Replication: Hybrid Open Access in Transformative Agreements

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Abstract

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1 Introduction

This study aims to demonstrate the suitability of open scholarly data sources for assessing the impact of transformative agreements on hybrid open access. To achieve this, a replication study was conducted by comparing results from hoaddata, an openly available and continuously updated dataset on hybrid open access uptake based on Crossref, OpenAlex, and the cOAlition S Journal Checker Tool, with the established bibliometric databases Web of Science and Scopus.

This study focuses on the coverage of hybrid journal portfolios included in transformative agreements between 2019 and 2023. Special attention is given to potential differences in open access uptake by country when comparing first-author affiliation data to corresponding authorships. This is crucial because the lack of publicly available invoicing data corresponding to authorships plays an essential role in determining whether an open-access article is supported through transformative agreements. Data on corresponding authorships have been available on the Web of Science and Scopus for much longer than in open databases such as OpenAlex, where this information is still being roled out at the time of writing. Because of this weakness, open approaches such as hoaddata and related research use first-authorship data instead.

By conducting a large-scale comparative analysis, this study aims to

1. Determine the strengths and weaknesses of using open data sources in monitoring the impact of transformative agreements on hybrid open access publishing.
2. Assess the coverage and accuracy of open data sources compared with established bibliometric databases.
3. Evaluate the reliability of first author affiliation data as a proxy for corresponding authorship in the context of open access uptake analysis.

2 Background – Evidence base to measure the effects of transformative agreements

2.1 Anforderungen an das Monitoring

- esac guidelines
- gemeinsamkeiten und unterschiede zu apc (listenpreise, tatsächliche zahlungen, zentrales invoicing, rabatte, waivers)
- insitutionen covern cas, jedoch kann es zu unterschiedlichen verrechnugnsformen führen (antielig mit förderer, splitting innerhaklbd er einrichtung)

2.2 Bibliometrische Evidenzen

- allgmeeiner uptake
- wachstum apcs
- wachstum verträge (konsortien, forschung)
- konsequenzen

3 Data and methods

This study aims to demonstrate the suitability of open scholarly data sources for assessing the impact of transformative agreements on hybrid open access. As shown in Figure 1, the methodology involved comparing hoaddata, an openly available collection of open research information on hybrid open access, with the bibliometric databases Web of Science and Scopus. This section introduces the initial data sources followed by a presentation of the necessary pre-processing steps to obtain eligible articles from transformative agreements by using author roles (first and corresponding) and harmonised affiliation data.

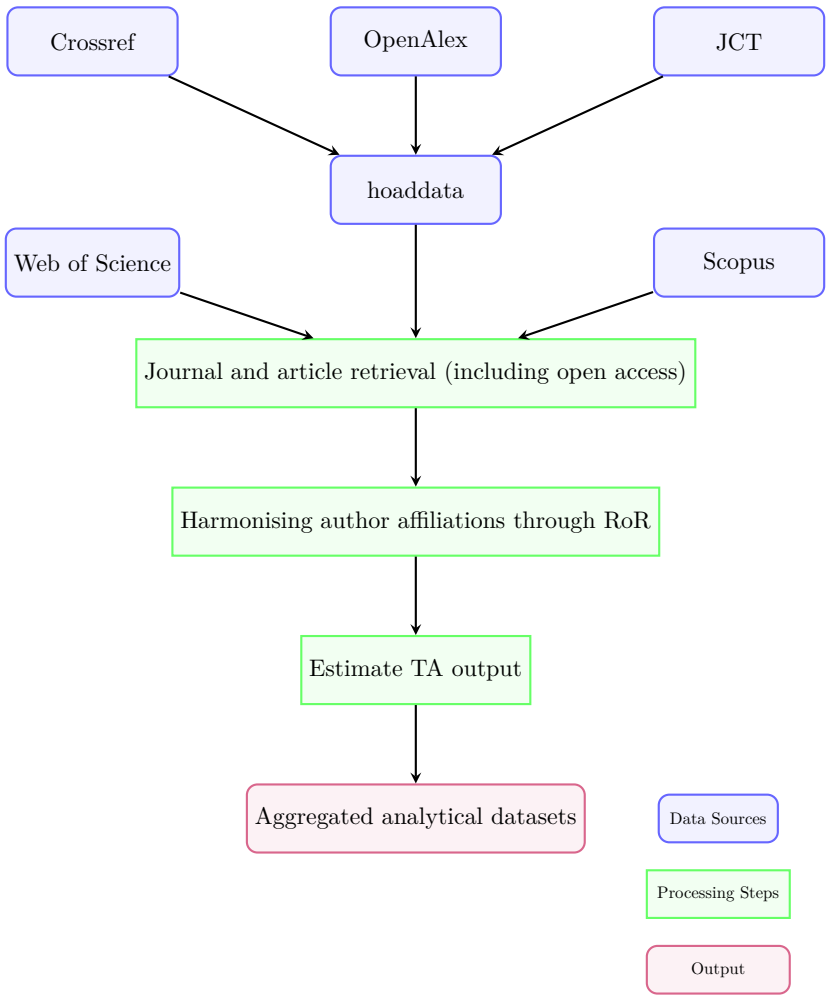


Figure 1. Data processing workflow for comparing hybrid open access uptake across bibliometric data sources. The workflow shows how data from different sources (Crossref, OpenAlex, JCT, Web of Science, and Scopus) is processed and matched using ROR identifiers to enable comparative analysis. TA = Transformative Agreement

3.1 Data sources

hoaddata. hoaddata, developed and maintained by the author to support open access monitoring and research (Jahn, 2025), is an R data package collecting information on hybrid open

access uptake from multiple openly available data sources. It combines article-level metadata from Crossref and OpenAlex with transformative agreement information from the cOAlition S Journal Checker Tool (JCT), which links journal and institutional data to agreements in the ESAC registry.

As discussed elsewhere (Jahn, 2025), hoaddata uses a unified dataset of historic JCT snapshots since July 2021, which were enriched with ISSN variants linked to an ISSN-L and associated ROR-IDs representing university hospitals or institutes of large research organisations, according to OpenAlex' institution entity. A comprehensive exclusion of fully open access journals using multiple journal lists (DOAJ, OpenAlex, Bielefeld) was performed to identify hybrid journals. hoaddata relies on Crossref for obtaining journal publication volume and open access status through Creative Commons licence information relative to the published version ("version of record"). Because of limited affiliation metadata in Crossref (Eck & Waltman, 2022), hoaddata sources first-author affiliations from OpenAlex.

hoaddata follows good practices for computational reproducibility using R (Marwick et al., 2018). The package, which includes data, code, a test suite and documentation, is openly available on GitHub. To ensure computational reproducibility while aggregating the data, a GitHub Actions continuous integration and delivery (CI/CD) workflow interfaces with the SUB Göttingen's open scholarly data warehouse based on Google BigQuery, which provides high-performant programmatic access to monthly snapshots of Crossref and OpenAlex. The workflow has run regularly to fetch updates from these data sources since 2022. The package version used in this study is 0.3, containing data from the Crossref 2024-08 dump provided to Crossref Metadata Plus subscribers and the OpenAlex 2024-08-29 monthly dump. This version including the computation log is available on GitHub (https://github.com/subugoe/hoaddata/releases/tag/v.0.3).

Web of Science. Clarivate Analytics' Web of Science (WoS) is a well-established proprietary bibliometric database consisting of several collections (Birkle et al., 2020). The collections considered in this study were the Science Citation Index Expanded (SCIE), the Social Sciences Citation Index (SSCI) and the Arts & Humanities Citation Index (AHCI), collectively referred to as Web of Science Primary (WoS Primary).

The WoS Primary provides important data points for analysing open access: author affiliations and roles, differentiation of journal articles into document types representing different types of journal contributions, such as original articles or reviews, and open access status information derived from OurResearch's Unpaywall, the same provider as Openalex. However, it lacks information about journals and articles under transformative agreements.

For programmatic access to article-level data, this study used the database of the Kompetenznetzwerk Bibliometrie (KB) in Germany. The KB processes raw XML data provided by Clarivate Analytics, which is provided as an in-house PostgreSQL database under a uniform schema. To support reproducibility, KB maintains annual snapshots of the database. Accordingly, this study

used the annual snapshot from April 2024 (wos_b_202404), which is considered to cover almost the entire previous publication year (Schmidt et al., 2024).

Scopus. Elsevier's Scopus, launched in 2004, is another widely used proprietary bibliometric database for measuring research (Baas et al., 2020). Similar to the Web of Science, Scopus is selective with regard to the journals it indexes. However, its coverage is substantially more extensive than that of the Web of Science collections considered in this study (Singh et al., 2021; Visser et al., 2021). With detailed metadata about article types, open access status information derived from Unpaywall, author roles, and disambiguated affiliations, Scopus also contains important data to assess open access uptake, although no direct information regarding transformative agreements was available at the time of the study.

This study used the Scopus annual snapshot of April 2024 as provided by the KB (scp_b_202404). The same KB curation effort was applied to the Scopus raw data as for the Web of Science (Schmidt et al., 2024).

3.2 Data processing steps

Determining hybrid journal publication volume. The hoaddata package (v.0.3) provided an enriched and unified list of hybrid journals in transformative agreements according to the JCT, covering agreements active from July 2021 to July 2024 according to the ESAC registry.

Article metadata were retrieved from each database using all ISSN variants linked to an ISSN-L. The metadata included DOIs, publication dates, article types, open access information as well as author roles and institutional affiliations. Publication years were determined using the earliest known date of publication in a journal. articles in hoaddata, this corresponded to Crossref's issued date. For Web of Science and Scopus, the earliest publication date was used where available, with Scopus dates specifically determined by the KB through version tracking of the raw data.

Many transformative agreements typically cover only certain types of journal articles, in particular original research articles including reviews. Because of limited information on these document types in open scholarly data (Haupka et al., 2024), hoaddata used an extended version of Unpaywall's paratext recognition approach to exclude non-scholarly content (Piwowar et al., 2018). To exclude conference supplements, which are also often not covered by transformative agreements, only articles published in regular issues, indicated by numerical pagination, were considered. For Web of Science and Scopus, their established document type classifications were used to identify original research articles and reviews, referred to as core articles throughout this study.

Identifying open access articles in hybrid journals. Published articles were considered hybrid open access when they were made freely available under a Creative Commons license on publishers' platforms. While hoaddata sourced this information from Crossref license metadata, Web of Science and Scopus relied on Unpaywall. Unpaywall supplements Crossref metadata by parsing

publisher websites directly, addressing cases where publishers do not provide machine-readable Creative Commons license information (Piwowar et al., 2018). This additional parsing remains necessary despite transformative agreement workflows requiring license information during DOI registration (Geschuhn & Stone, 2017). Both Web of Science and Scopus defined hybrid open access consistently as content available under Creative Commons licenses on publisher platforms, distinguishing it from bronze open access that lack such explicit license information.

Harmonising author affiliations across databases. Author affiliations were retrieved for both first and, if available, corresponding authors across all databases to prepare the linking between articles and institutions covered by transformative agreements. To handle different address variants, database-specific affiliation identifiers were used: ROR-IDs from OpenAlex for hoaddata, affiliation enhanced names for Web of Science, and Scopus Affiliation Identifiers for Scopus. Additionally, ISO country codes were retrieved for each author's address to compile country-level statistics. These country codes for Web of Science and Scopus were provided by the KB.

Because neither Web of Science nor Scopus support ROR IDs—the institution identifier used by the JCT—a two-step matching process was implemented to harmonise affiliation data. First, 2,782,540 articles from 6,457 institutions with ROR-IDs in the JCT data since 2017 (according to hoaddata) were processed to map first authors' ROR-IDs to corresponding proprietary affiliation identifier in Web of Science and Scopus using DOI matching. Then, an algorithm selected the most frequent ROR ID and proprietary identifier pairs to handle multiple affiliations and organisational hierarchy differences.

This process linked 6,375 ROR IDs to 4,894 Scopus Affiliation IDs, and 6,034 ROR IDs to 4,894 enhanced affiliation strings in the Web of Science. Quality evaluation through random sampling of 50 pairs revealed an error rate of 22% for Web of Science (11 mismatches) and 6% for Scopus (3 mismatches). Upon inspection, these mismatches primarily occurred with less-represented institutions having only a few publications, introduced through multiple affiliations of single authors. The difference between databases suggests that Scopus's affiliation control aligns more closely with ROR than that of the Web of Science.

Estimating open access in hybrid journals covered by transformative agreements. Based on these matching tables, articles eligible under transformative agreements could also be retrieved from Web of Science and Scopus, although they did not contain the ROR IDs used by the JCT. The estimation of eligible articles followed Jahn (2025) and included a matching of both journals and participating institutions according to the Transformative Agreement Data dump for each of the data sources examined. The matching also took into account the duration of agreements according to the ESAC registry, with only those matches where an agreement was actually in place being considered for subsequent analysis.

3.3 Data records

As a result of the comprehensive data processing described above, datasets on open access in hybrid journals included in transformative agreements were aggregated for each database at country and journal level by year. Table 1 provides a general overview of the coverage between 2019 and 2023 per database. It shows that the majority of hybrid journals published at least one original research article or review marked as core during the five-year period. These journals formed the basis for the subsequent aggregation of publication metrics.

Table 1

Coverage of hybrid journals in transformative agreements 2019-23.

	HOAD	**Web of Science**	**Scopus**
Hybrid journal metrics			
Active journals	12,890	8,655	11,888
Active journals (core)	12,888	8,655	11,878
Active journals (core) with OA	11,348	8,392	11,313
Publication metrics			
Total published articles	9,740,015	8,616,053	8,117,644
Core articles	8,158,425	6,708,083	7,317,703
Digital Object Identifier (DOI) coverage			
Articles with DOI	9,740,015	7,713,796	8,105,112
Core articles with DOI	8,158,425	6,695,661	7,314,327
Open Access (OA) metrics			
OA articles	998,699	1,112,758	974,099
Core OA articles	969,817	1,019,784	922,578
Core articles with affiliation data			
First author articles	7,242,542	6,294,855	7,232,017
Corresponding author articles	5,534,207	6,291,441	6,898,487

While hoaddata only covers articles with a DOI, Scopus and Web of Science publication metrics were aggregated using the database identifier. A subsequent comparison of DOI coverage shows that non-core articles in Web of Science often lacked a DOI. This was particularly the case for meeting abstracts, which are notably prevalent in Health Sciences journals (Melero-Fuentes et al., 2025) and are not indexed by Scopus (Donner, 2017). Open access indicators were aggregated by DOI, as Unpaywall only collects information on open access status for articles with a DOI. A closer look at the core articles with affiliation data reveals a lack of data on corresponding authors in the case of OpenAlex,

the affiliation data source used by hoaddata, compared to Web of Science and Scopus. Only about two-thirds of the articles examined provided corresponding author affiliations. For first authors, the proportion was 89%. Therefore, only first author data for hoaddata were considered in the following analysis.

4 Results

First, I will present a coverage analysis. Then, I investigate hybrid open access uptake using the same methods for each database and the compare results against each other in order to assess the suitablility of the biblioemtric databases to examine transofrmative agreements.

4.1 Coverage comparision

Overview. Figure 2 presents the coverage of hybrid journals included in transformative agreements, visualising the intersections of journals and articles across the examined databases as an UpSet graph (Krassowski, 2020; Lex et al., 2014). The analysis included hybrid journals that published at least one open access article between 2019 and 2023, based on open access status information from each database. Only original research articles and reviews were considered in the analysis.

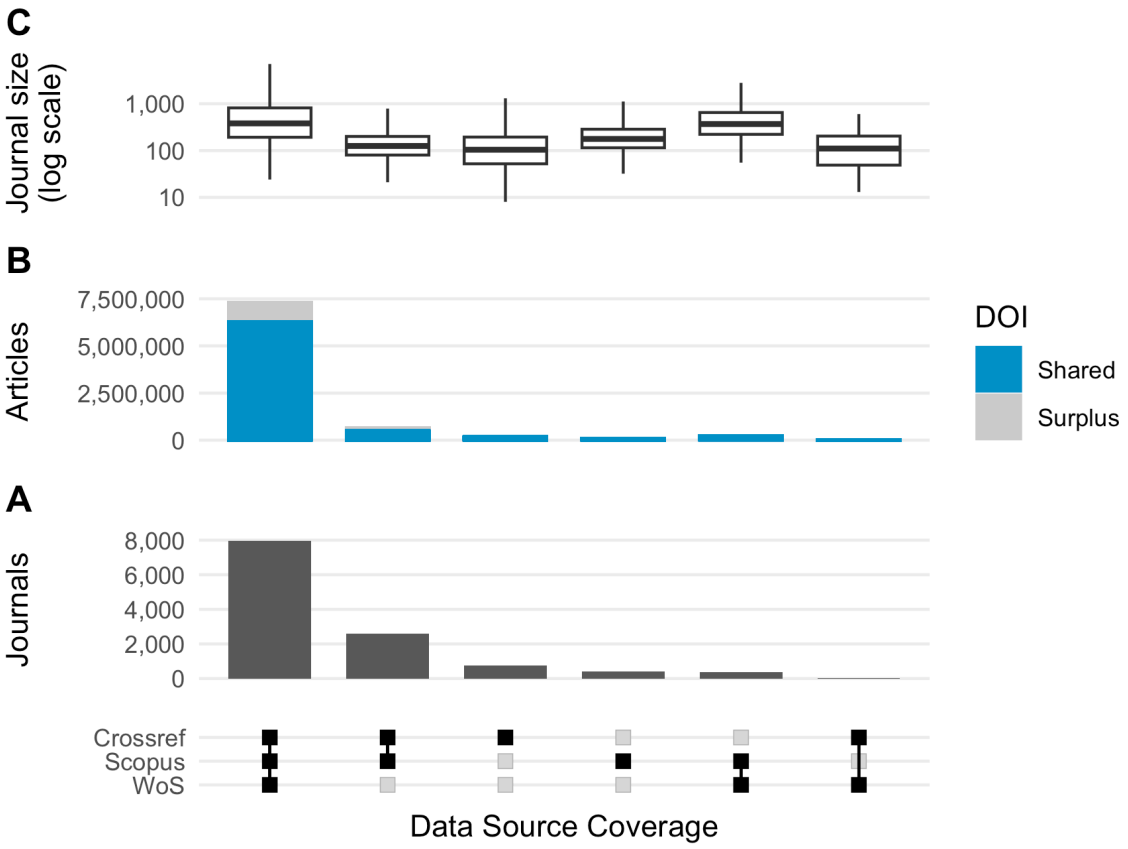


Figure 2. Upset graph

Journal coverage analysis revealed that 66% (n = 7,970) of hybrid journals included in

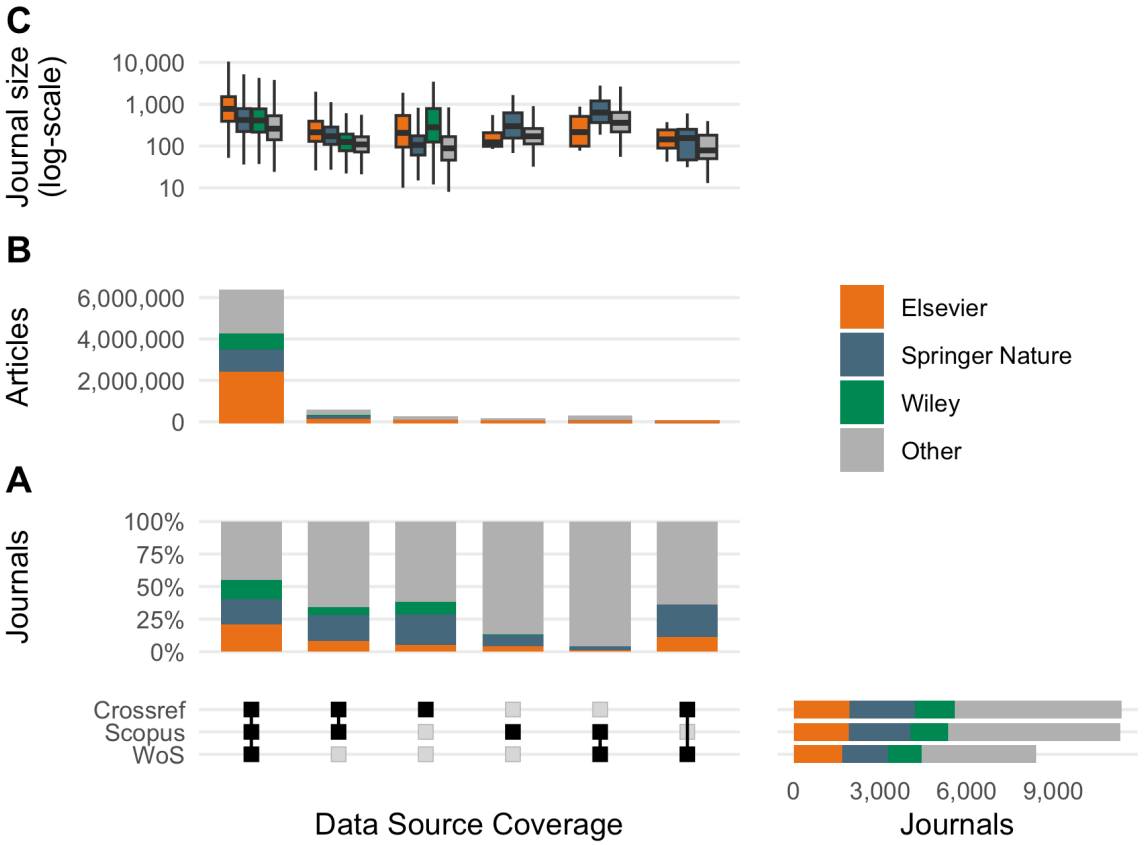
transformative agreements were indexed in all three databases (Figure 2A). The second-largest set consisted of journals indexed in both hoaddata and Scopus, comprising 21% (n = 2,595) of hybrid journals. Notably, 6% (n = 739) of journals were exclusively contained in hoaadata, while 6% (n = 748) were only found in the proprietory database Scopus. Of these, 354 were also available in the Web of Science. Upon inspection, this group of hybrid journals included only in the proprietary data sources mainly represents hybrid journals for which no open access evidence could be retrieved from Crossref, which served as the open access evidence source for hoaddata.

In terms of article coverage, Figure 2B shows the total publication volume per combination in terms of DOI availability. The largest set of hybrid journals, which includes all three data sources, also contains the largest number of articles. In total, these journals recorded 6,289,687 overlapping articles, represented by the blue bar. They represent 94% of core articles with DOI indexed in the Web of Science sample, and 86% in Scopus. Another 657,697 articles were exclusive to both Scopus and hoaddata. Exclusively in hoaddata were 177,110 articles, and exclusively in the proprietary databases were 325,194 articles.

Figure 2B also shows DOIs that were only available via hoaddata (grey area). In case of hybrid ournals covered by all three data sources, 1,023,882 DOIs were only present in hoaddata. After validation at the DOI level using the KB databases and manual inspection, the main reasons for missing DOI coverage in the proprietary database were insufficient classification of journal content as original research articles and reviews in hoaddata. Particulalry, letters and editorials could not be fully detected. Paratext recognition failed in 37% of DOIs to identify non-scientific content such as front matters or reviewer lists, which are generally not indexed by Scopus and Web of Science. To a lesser extent, differences in publication and indexing dates were a reason for non-overlapping DOIs.

Using overlapping DOIs, the publication volume between 2019 and 2023 was also calculated for each journal. Figure 2C shows the distribution for each combination. It shows that there is a large spread across the journals covered by all three data sources. Furthermore, journals in this set published more on average than journals covered by only one or two data sources. In particular, the journals covered exclusively by hoaddata are substantially smaller than those covered by all three sources. Upon inspection, these are often newly launched journals, which explains the relatively low five-year publication volume.

Coverage by publisher portfolio. Figre shows the coverage of hybrid journals in transformative agreements by publisher portfolio according to the ESAC registry.



discussion

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