Peters, Isabella; Biesenbender, Kristin

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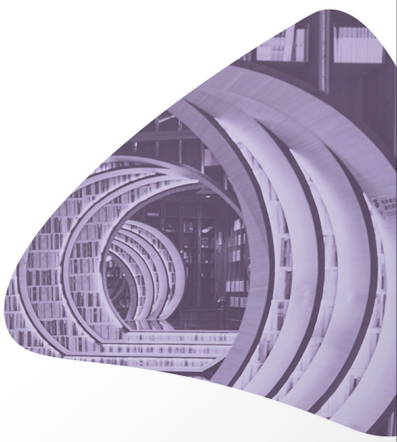

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Wissenschaftliches Publizieren im digitalen Wandel

Yuliya Fadeeva, Simone Franz, Torsten Kahlert, Dario Kampkaspar, Melanie Seltmann, Timo Steyer, Niels-Oliver Walkowski (Hrsg.)

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Same Same but Different – Effects of the Open Access Transformation on the Scholarly Publication and Reputation System

Isabella Peters & Kristin Biesenbender

Introduction and background

The *Budapest Open Access Initiative* and the subsequent *Berlin Declaration* (2003) set themselves the goal of enabling free access to scholarly knowledge. *Open Access* (OA) allows users to read and process scholarly literature free of charge[1]. A distinction is made between gold OA and green OA, whereby the gold route refers to the publication of an article in an original OA journal and the green route to open self-archiving of the article (Mounce 2013). Since starting those initiatives, more than 21,000 OA journals and other publication outlets have emerged that offer OA publishing[2]. Also, more than 1,100 scientific institutions and funding organizations have established mandates that recommend or require OA publishing[3] – the most prominent of which was certainly the European Commission's call for all publications produced with EU funding to be published OA by 2020[4].

Presumably, it is these mandates as well as expanded OA publication options and intensive educational work that have led to a significant increase in the proportion of OA publications in recent years: from approx. 16% gold OA in 2012 (Laakso and Björk 2012), to about 50% in 2019 (Huang et al. 2024) and 45% in 2018 in Germany (Hobert et al. 2021) and now 66% for publications from Germany from the last 5 years[5].

Despite this fact and although mandates were assumed to work well as an incentive for OA publishing (Harnad 2011), the OA option is often not the decisive criterion in the choice of the publication venue (Dallmeier-Tiessen et al. 2011). Also, the authors of scholarly publications are often still reluctant to publish OA (Rowley et al. 2017). An important reason for this reluctance can be found in the reward system of science. Since the introduction of the peer review process with the first scholarly journals in the 17th century, the acquisition of reputation in many disciplines has been closely linked to successful publication in peer-reviewed journals with a high *impact factor* (IF)[6]. However, although numerous OA journals now have an IF and thus offer a genuine alternative to strategic publishing in the traditional format, authors feel often unsettled by the

1 https://www.budapestopenaccessinitiative.org/
2 https://doaj.org/
3 https://roarmap.eprints.org/
4 https://research-and-innovation.ec.europa.eu/strategy/strategy-research-and-innovation/our-digital-future/open-science/open-access_en
5 As reported by the Open Access Monitor: https://open-access-monitor.de/
6 For example: Nature Publishing Group: Author Insights 2014 (doi: 10.6084/m9.figshare.1204999.v4); Taylor & Francis: Open Access Survey (URL: tandfonline.com/openaccess/opensurvey)

OA option. The IF does not yet seem to provide enough of an incentive to publish OA. In addition, most journals nowadays are owned by publishers, which determine access to scholarly products and which have developed complex digital business models, often requiring the author to pay for the OA publication (so-called *article processing charges*, APC). So, another type of paywalls were established, besides those that already exist for readers. The emergence of often science-led, digital repositories for preprints broadens the range of publishing options and provides an alternative to traditional and OA publishers – which results in even more factors contributing to the researchers' uncertainty and reluctance towards OA publishing.

Although it seems that the transition to OA and gaining a reputation in academia are almost incompatible, the number of citations for each article and accumulated for the authors is the next adjusting screw in the scholarly incentive system. But empirical evidence shows contradictory results for OA publications. The majority of studies can demonstrate an *Open Access Citation Advantage* (OACA) on the number of citations[7]: OA publications are cited more frequently (a fact mostly independent from the OA colors and preprint publishing). This effect has also been shown in non-traditional publication environments: OA publications are shared more frequently on social media platforms and therefore have higher altmetric values (Van Noorden 2012; Wang et al. 2015). This effect was anticipated even before the OA initiatives had started: "maximizing [...] research impact by maximizing user access to [...] research output" (Harnad and Brody 2004). However, other studies have concluded that it is not just the free accessibility of publications that increases their citation frequency (Swan 2010), but that additional factors influence the variable "citation". Further theses have been put forward on the characteristics of OA publications (above all Harnad 2011), which should explain why their citation counts are positively affected, but which can also describe why publications are being made fully available as OA by authors (i.e. OA motivations). Given that scholarly publishing and the scholarly reward system take place within different global and societal ecosystems with varying constraints and demands coming from outside academia (as was the case during the COVID-19 pandemic), it seems obvious to also consider the extent to which external shocks and interventions to the scholarly system influence researchers' OA behavior.

The aim of this paper is to briefly summarize effects that are associated with and result in the OACA and which were drawn from existing literature[8]. We will contrast them with the findings from a 5-years-research-project (i.e. OASE) which systematically studied those effects across various disciplines (amongst others life sciences, social sciences, economics, marine science). To complete the picture on the challenging relationship between the OA transformation and the acquisition of scholarly reputation, we will report project results that shed light on the perception and motivations of researchers to publish and cite OA publications. The paper will be concluded with lessons learned-like observations as well as directions for future research.

7 http://sparceurope.org/what-we-do/open-access/sparc-europe-open-access-resources/open-access-citation-advantage-service-oaca

8 Such as http://opcit.eprints.org/oacitation-biblio.html

Project OASE

The project "OASE – Structural and author-specific factors influencing the impact of OA publications from various disciplines" was funded by the German *Ministry for Research and Education* (BMBF) and ran from March 2018 until July 2023[9].

The aim of OASE was to describe the transformation process from traditional to OA publishing in a mixed methods approach to better understand existing publication strategies and conflicts in connection with OA. In the project, structural and author-specific factors influencing the impact of OA publications were investigated systematically, longitudinally and comprehensively. Traditional and altmetric, i.e. social media-based, indicators were used to test the validity of popular theses on why OA positively affects the impact of publications. Quantitative and qualitative surveys added to the understanding of if and how researchers use OA in their publishing practices and to gain reputation. The OASE project focused on the most relevant OACA-theses and influencing factors discussed in the literature and aimed to validate these theses, quantify effects and show causal relationships as well as answer novel questions (especially on the role of authors in OA publishing). Through the comprehensive analysis of OA publications, their characteristics, the citing and cited publications and the temporal and disciplinary comparison, further influencing factors and effects could be localized, described and classified. The project evolved around the central research question: What is the 'genuine' OA effect (i.e. accessibility) on bibliometric indicators and to what extent does it occur in different constellations of structural and author-specific features of the publication published as OA?

Where previously only smaller case studies researched the OA effect, OASE was able to gain comprehensive insights into how OA affects the citation and publication behavior of researchers. It also shed light on the overarching structural, discipline- and author-specific mechanisms and dependencies influencing how researchers deal with OA publications. This was achieved through large-scale cross-disciplinary and cross-impact research studies. During the COVID-19 pandemic, the influence of this external shock on scholarly publication and citation behavior, especially regarding the use of and attitudes towards preprints as a form of green OA, was also investigated, as well as further interventions to the scholarly publishing system, such as publishing boycotts and *transformative publishing agreements* like DEAL (Haucap, Moshgbar, and Schmal 2021).

9 https://www.zbw.eu/de/forschung/web-science/oase

Comparison of popular theses on the open access citation advantage with OASE results

In the following we will briefly discuss the results of the OASE project[10] against the background of popular theses about the reasons for the positive relationship between OA and bibliometric and altmetric indicators.

General Open-Access-Effect: This effect attributes the increase in citation counts and altmetrics, incl. downloads, of publications solely to the free accessibility of publications published digitally as OA (i.e. gold, green including preprints) and is the most popular mentioned reason (amongst others: Davis et al. 2008; Fu and Hughey 2019; Harnad and Brody 2004; Huang et al. 2024; Langham-Putrow, Bakker, and Riegelman 2021; Lawrence 2001). OASE conducted two studies on this effect, where one has confirmed this effect and the other has partially confirmed it. In Fraser et al. (2020) it was found that journal articles deposited on a preprint server had sizably higher citation and altmetric counts compared to non-deposited articles whereas in Fraser et al. (2022) respondents of a survey disagreed on whether publishing preprints actually has a positive effect on citations and/or altmetrics.

Early-Access-/ Early-View-Effect: Proponents of this effect argue that it is the earlier availability of publications that increases their citation counts (amongst others: Kurtz et al. 2005; Kurtz and Henneken 2007; Moed 2007; Swan 2010). Our study on preprints in the life sciences was able to confirm this effect for citations and altmetrics (Fraser et al. 2020) as well as a study on COVID-19 preprints (Biesenbender, Toepfer, and Peters 2024). This effect was also mentioned by researchers in a focus group interview, who agreed that depositing preprints has benefits in terms of online dissemination and increase of citation rates (Biesenbender et al. 2024).

Self-Selection-Effect or Quality Bias (author-driven): This effect suggests that authors are more likely to make their high-quality publications available via OA and that these are the publications that would accumulate a lot of citations anyway (amongst others: Dallmeier-Tiessen et al. 2011; Eysenbach 2006; Swan 2010). Two of our studies could only partially confirm this effect. In Fraser et al. (2022) we have shown that researchers publish preprints to make their research results better known and to disseminate them more quickly, although the results of an OASE-survey do not indicate that researchers consciously reinforce these effects by selecting certain publications. It is the first author who decides which form of OA is used for the publication. Focus group interviews revealed that both researchers from the Global South and from the Global North emphasized the importance of peer-reviewed research articles - preferably in high impact journals - for career development, while the relevance and usefulness of preprints in this regard was controversially discussed (Biesenbender et al. 2024).

Quality-Effect (publication-driven): This effect assumes that because of their inherently outstanding quality good publications are more likely to benefit from OA because they are more citable than other publications (amongst others: Gargouri et al.

10 We would like to refer the readers to the full texts of the publications if interested in more details of the studies we have conducted. A summary of the OASE results are also published in this brochure (in German): https://www.zbw.eu/fileadmin/pdf/forschung/open-access-effekte-kernergebnisse.pdf

2010; Moed 2007; Swan 2010). Conversely, OA publications of poor quality (e.g., publication in the lowest citation quintile or in journals with low IF) do not receive more citations (McCabe and Snyder 2014). Brierley et al. (2022) reported that preprints as well as peer-reviewed and published publications do not differ significantly from each other (e.g., in the number of tables, figures, qualitative changes in the conclusions) which may serve as an indication for the validity of this effect.

Feedback-Effect: This effect considers the pre-publication of research results (i.e. preprinting as a type of green OA) as the main driver for an increase in the quality of the final publication because in this way it can receive early feedback from the readers. After that the "Quality-Effect (publication-driven)" will appear (Eysenbach 2006). The OASE studies were not able to confirm this assumption. As mentioned before, preprints as well as peer-reviewed and published publications do not differ significantly from each other (Brierley et al. 2022). Furthermore, in online surveys supplemented by focus group interviews (Fraser, Mayr, and Peters 2022; Biesenbender et al. 2024) we found that the greatest incentive to publish preprints is to be able to share findings quickly, followed by the motivation to raise awareness to research results. The weakest incentive is the possible reception of feedback, although most of the survey respondents still agree with this reason.

Popularity-Effect: This effect links social media-based altmetrics to the OACA arguing that altmetrics can amplify the citation advantage because they draw additional attention to the publication itself (Mounce 2013). OASE has conducted three studies to investigate this phenomenon and arrived at a similar tendency. Although the respondents of the survey confirmed that they publish preprints to raise the profile of their research, we found less consensus on whether preprint publication actually has a positive impact on citation rates and/or altmetrics (Biesenbender, Toepfer, and Peters 2024; Fraser, Mayr, and Peters 2022). However, it was also found that altmetrics depend on the OA type and the respective social media platforms (Fraser et al. 2019a) and that OA articles and articles with preprints have higher altmetrics (Fraser et al. 2020).

Formal-Publication-Effect: That authors are more likely to cite the gold OA version than the green OA version is summarized in this effect (amongst others: Bautista-Puig et al. 2020; Harnad 2001). The OASE-research on this effect showed the most controversial findings of the project. On the one hand, we found that researchers predominantly only cite preprints if no journal publication is available (Biesenbender et al. 2024) and that in most research fields, journal flipping from closed access to gold OA leads to more published articles and citations for the journal (Momeni et al. 2021b). On the other hand, we could show that publications published via bronze OA and green OA receive the highest altmetric values (Fraser et al. 2019b). The same holds for preprints during the COVID-19 pandemic: preprints were cited more frequently during the pandemic (Biesenbender and Peters 2023; Lemke, Biesenbender, and Peters 2024) and COVID-19 preprints also received increased attention (especially) at the beginning of the pandemic, gaining more abstract views, more downloads, more citations, more tweets, more press mentions, and more mentions in blogs and on Wikipedia (Fraser et al. 2021).

Platform-Effect/ Pathway-Effect: This effect argues that the publication venue, and therefore the OA-color, affects citation counts. This results in green OA implement-

ed through preprint repositories having the most positive effect (Haucap, Moshgbar, and Schmal 2021; Hobert et al. 2021; Huang et al. 2024; Young and Brandes 2020). Our study confirmed this effect and revealed that bronze OA (i.e. articles made free-to-read on the publisher website) and green OA publications receive the highest altmetric values (Fraser et al. 2019b). Furthermore, OASE found that journals which flip to an OA publishing model will increase the number of published articles as well as their journal and article citation indicators (Momeni et al. 2021b).

Resources-Effect: Established authors on higher career levels (later in career) and with job security at prestigious, well-resourced institutions are more likely to pay the APCs charged by journals – and those are also the authors who are more likely to publish highly cited papers (Olejniczak and Wilson 2020). In our research we could also observe a higher percentage of highly cited papers for corresponding authors from countries with higher income levels. The ratio of highly cited articles among all countries for gold and hybrid OA models was higher than in other models. Also, this ratio was higher for gold OA articles and indicated the better citation impact of articles published in gold OA journals. The only exception we found is for countries with low income levels, with more highly cited papers in the hybrid OA model. Compared to closed access journals, journals in hybrid closed access had more highly cited articles, except for countries with a high income level (Momeni et al. 2023).

Diversity-Effect/ Interdisciplinarity-Effect: It was shown that citations to OA publications (gold, green including preprints) stem from more diverse researchers (from a wider range of locations, institutions, and fields of research), which opens room for more citations (Huang et al. 2024; Young and Brandes 2020). Also, more diverse communities publish in those journals that flipped from closed access to gold OA (Bautista-Puig et al. 2020). Our research arrived at similar conclusions. Lemke, Biesenbender, and Peters (2024) found that less OA-affine authors cite larger proportions of closed access literature, while the shares of citations for all other OA status types increase along with the authors' OA-affinity. Also, we could show that publications published on two preprint repositories (i.e. *bioRxiv* and *medRxiv*) are responsible for the largest share of citations of preprints, while *Elsevier* publications are the most numerous among documents citing non-preprints.

OASE findings on open access publication behavior

In line with the findings of previous studies, the OASE project has confirmed the existence of a general OA-effect and an early-access-effect (Fraser et al. 2020; Fraser, Mayr, and Peters 2022). However, researchers do not acknowledge this as a decisive factor in their publication decisions (Biesenbender et al. 2024). Thus, the researchers do not deliberately remove their publications from behind the paywall. OASE has further revealed that there are – may we say: still – major uncertainties on the side of researchers with regard to OA publishing: the lack of awareness of preprints, uncertainty about compliance with the *Ingelfinger rule*, according to which previously published articles may not be published again, the lack of quality control for preprints and concerns about "predatory

publishing" by OA publishers. Those uncertainties are the biggest hurdles to publishing preprints (Biesenbender, Toepfer, and Peters 2024; Fraser, Mayr, and Peters 2022). It is interesting to note that the "perceived quality" of a preprint or article plays a greater role in the decision to publish or cite OA than the proven quality, which is almost the same for preprints and published articles (Brierley et al. 2022). Additionally, focus group interviews have clearly shown that the IF of journals usually guides the decision of where to publish (Biesenbender et al. 2024). This is especially important for early-career researchers who aim at establishing scholarly reputation and advancing their academic careers.

The decision to publish preprints is largely motivated by the researchers' interest in the rapid dissemination of their research findings and by the aim of raising the profile of their own research. However, this motivation is mostly characterized by the level of experience with preprint and OA publications and by the academic age of the researchers (Momeni et al. 2023). Overall, researchers seem to be more motivated to publish preprints at the beginning of their careers to increase the visibility of their research and receive feedback, while researchers at the end of their careers are more focused on prioritizing their scientific findings (Biesenbender, Toepfer, and Peters 2024; Fraser, Mayr, and Peters 2022). Also, OA publication behavior is strongly influenced by author characteristics. For example, women publish more frequently in gold OA journals than men (Momeni et al. 2023) and researchers from the Global South were more likely to agree that they make their publication decisions on the basis of mandates and that mandates could change publication behavior towards OA (Biesenbender et al. 2024).

How authors react to the demands of peers wanting to get access to publications is described as the "Demand-Effect" by Wren (2005). The author argues that publications are green OA because readers consider them to be of high quality, so they ask the authors to receive them for free and authors respond to this demand. In OASE we have not found this reason, since the majority of respondents of our survey does not seem to actively select the publications to be published as preprints with regard to their quality, novelty or significance (Fraser, Mayr, and Peters 2022). Conversely, it was argued that there is no "Community-Effect": The size of the discipline does not influence the willingness to publish OA (Harnad 1997; Khalili and Singh 2012). OASE arrived at similar results with the majority of respondents from a survey stating that the benefits of preprints will be slow to change publishing behavior in their disciplines (Biesenbender et al. 2024) as well as that researchers' publication behavior, and also preprint publication behavior, appears to be strongly influenced by disciplinary norms and practices (Biesenbender, Toepfer, and Peters 2024).

In several of the OASE-studies, we could show that the general OA publication and citation behavior of researchers from various disciplines is - in the long term - largely unaffected and independent of external interventions to the academic system, such as mandates or policies on OA publishing, the COVID-19 pandemic, the design of APCs or the role of transformative agreements such as DEAL. Although survey respondents from the Global South emphasized that mandates could change publishing behavior towards OA (Biesenbender et al. 2024), researchers decide where to publish (gold or green OA) largely without considering the OA policies and/or mandates of their institutions and

funding organizations and tend to rather be guided by disciplinary norms (Biesenbender, Toepfer, and Peters 2024; Fraser, Mayr, and Peters 2022). This confirms previous findings by Rowley et al. (2017), but also contradicts a previously reported "Mandate-Policy-Effect", where institutional mandates lead to a significant increase in the share of OA publications, especially when OA publishing is linked to the institutional reward system (Harnad 1997; Khalili and Singh 2012).

The reduction or exemption of APCs has a clearer effect on the OA publication behavior of researchers from low- and lower-middle-income regions. While the exemption of APCs (typically in low-income countries) leads to a high proportion of gold OA publications, researchers who only receive an APC discount publish much fewer articles in gold OA journals than researchers from other countries (Momeni et al. 2023; 2021a). This illustrates the significant influence of APC design on the motivation to publish OA, as well as the effect on the diversity of a journal's authorship.

Although the COVID-19 pandemic has led to many researchers publishing a preprint for the first time, resulting in a large increase in publication output in the subject-specific repositories (especially in the life sciences; e.g. Biesenbender and Peters 2023; Biesenbender, Toepfer, and Peters 2023; Fraser et al. 2021), a lasting change in preprint publication behavior has not yet been observed - especially not for disciplines in which preprint publishing is not yet common practice (Biesenbender, Toepfer, and Peters 2024).

In 2014, a union of German research organizations established "Projekt DEAL", a national-level project to negotiate licensing agreements with large scientific publishers. Negotiations between DEAL and Elsevier began in 2016, and broke down without a successful agreement in 2018. During this time, around 200 German research institutions canceled their license agreements with Elsevier, leading Elsevier to restrict journal access at those institutions. This boycott led to fewer publications in Elsevier journals - but Elsevier articles were not cited less frequently and the lack of this publication venue did not lead to an increase in (green) OA publications (Fraser et al. 2023).

Conclusions and future work

We have set out to describe the relationship between the OA transformation and the scholarly reputation system by studying the OA citation advantage with regard to structural as well as author-specific factors and different disciplines. Also, we have investigated how researchers decide on their OA publication strategies and in how far those are affected by interventions from inside and outside academia, i.e. publishing mandates and the COVID-19 pandemic.

The effects and impacts of OA on citations and publication decisions present themselves as a complex network of different influencing factors (i.e. author-specific, discipline-specific, systemic, external shocks, etc.) and cannot be reduced to only one effect or one influencing factor. After 5 years of OASE it still seems to be unclear what the genuine OA effect (i.e. free accessibility) is based on and how strong it is depending on which influencing factor surrounding OA publishing.

However, the studies conducted in OASE have consistently shown that OA publishing always influences publication output (i.e. number of articles published in journals; Momeni et al. 2021b; 2019) and its reception, i.e. subsequent citation counts or attention generated on social media platforms (Fraser et al. 2019a; 2019b). Controversial findings evolved around the Formal-Publication-Effect and the various OA colors: while researchers were more likely to cite a gold OA version than a green OA version of a publication (Momeni et al. 2019; Biesenbender et al. 2024), during the COVID-19 pandemic bronze OA publications and green OA publications received the highest altmetric values and preprints were cited more often (Biesenbender and Peters 2023; Lemke, Biesenbender, and Peters 2024; Fraser et al. 2021; 2019b). Whether this result can only be attributed to the exceptional situation of a short-term global health crisis or whether it is rather linked to the different OA types should be examined in further research.

In contrast to earlier studies the OASE research could not confirm the positive influence of OA mandates or policies on researchers' decisions to publish OA. Instead OA and/or preprint mandates and policies from institutions and funders were not seen as important for decision-making in the publishing process, which is surprising given the science policy efforts in this area (Biesenbender, Toepfer, and Peters 2024). Also, the publication behavior, and along with it preprint publishing, appears to be more influenced by disciplinary norms and practices than by external shocks such as the COVID-19 pandemic.

Nevertheless, external interventions do affect the OA publication and citation behavior. Four OASE-studies investigated this effect and arrived at (partially) confirming and contradicting results. Firstly, Fraser et al. (2021) and Biesenbender et al. (2023) found a "COVID-19 shock" for preprints which influenced the importance and spread of preprints in the life sciences - in the form of increased citations and altmetric indicators. Secondly, the DEAL agreement influenced the publication and citation behavior of German academics during the Elsevier boycott (Fraser et al. 2023). And thirdly, authors who are entitled to an exemption from APCs publish more in gold OA journals than others (Momeni et al. 2023). How researchers adapt to those and to other external interventions is another avenue for future research.

The OASE research also highlighted the need for further research into the connection of OA publishing and acquisition of scholarly reputation. On the one hand, the OASE studies once again underlined that author-specific aspects have a major influence on OA publishing behavior, e.g. academic age, gender, origin, etc. (Momeni et al. 2023; Biesenbender et al. 2024). But it is also the IF which (still) drives publication strategies most. This raises the question of how to change the research evaluation system so that advantages of OA publishing (e.g., gaining more citations, but also reaching a more diverse audience of readers) become of higher value to authors. Furthermore, with regard to questions of inclusion, diversity and equal treatment of researchers in the scholarly publication and reputation system, these findings must be taken into account and research in this area must be expanded in order to be able to assess the scope of these influencing factors.

On the other hand, the design of the OA publishing system by publishers, e.g. APC models and transformative agreements, and the investigation of its influence on the pub-

lication behavior of researchers opens up scope for numerous in-depth research questions (Biesenbender, Toepfer, and Peters 2024; Fraser et al. 2023). The predominant question is how to facilitate open access to research for the benefit of all stakeholders without merely replacing one paywall for readers with another paywall for authors. The (still existing) close connection between the publication and reputation or evaluation system in the sciences and humanities makes a critical examination of this connection imperative (Biesenbender and Peters 2022a).

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