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*Full paper*

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26<sup>th</sup> International Conference on Science and Technology Indicators | STI 2022

## “From Global Indicators to Local Applications”

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#STI22GRX

### Analysing Open Access publishing beyond Plan S: Motivations for publishing in Hybrid and Bronze OA formats<sup>1</sup>

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#### Introduction

One of the effects of Plan S, which launched in September 2018, is that special focus has been given to Gold and Green OA publishing, with the first being the preferred model (Brainard, 2021). Therefore, less attention is paid to publishing in Hybrid OA, in which authors choose to pay article processing charges (APC) to make their papers open in otherwise closed journals. Another relevant dimension – which is beyond the control of researchers, funders, and other stakeholders such as academic librarians – is Bronze OA: the opening of scholarly literature by publishers, without proper licensing, and without any expectations on the durability of that situation (Piwowar et al., 2018).

This study focuses on both Hybrid and Bronze OA publishing, two formats that have been less intensively studied lately. The main goal of the research is to unravel some of the potential underlying motivations behind authors' decision to cover APC costs in hybrid journals and for the publishers' selection of papers made open on their own accord. For that, we start from two main hypotheses: (i) Authors often choose hybrid journals because of their impact, which can be potentialized by papers being open; (ii) Publishers select papers with potential high-impact or that originate from reputable institutions and make them open to increase journal visibility and impact metrics.

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## Methods and Data

The study is based on the Web of Science (WoS) core collection data (Clarivate, 2022), specifically the in-house version developed at the Centre for Science and Technology Studies (CWTS). Publications from 2018 have been used for the research, as this would provide an adequate citation window running up to 2021. We used only articles, letters, and reviews in our analysis. The WoS Open Access status tags have been used for this research, as the current version of the database aggregates data from the Directory of Open Access Journals (DOAJ), a directory of OA journals, and Unpaywall, allowing for an extensive identification of OA types of publishing for each document.

Two basic principles for assigning an OA label to a WoS publication are sustainability and legality (Martín-Martín, Costas, Leeuwen, & López-Cózar, 2018). Sustainability means that it should be possible to reproduce the OA labelling from the various sources used repeatedly, in an open fashion, with a limited risk that the sources which were used will disappear behind a paywall or that publications previously reported as OA change their status to closed. The second aspect, legality, relates to the use of data sources that represent evidence of legal OA publishing, excluding illegal publishing in platforms such as Sci-Hub.

From DOAJ (2021) and Unpaywall data (Else, 2018), it is possible to distinguish between Gold, Hybrid, Green, and Bronze OA. Gold refers to publications in open journals, with a comprehensive identification being possible by combining data from both sources mentioned. As discussed, Hybrid OA is a form of publishing in which the authors of a publication pay APCs to open a single publication in an otherwise toll-access journal. Green OA is a form of publishing in which publications are made available in an openly accessible archive or repository, therefore contributing to the sustainability dimension of OA publishing. Finally, Bronze is associated to publications made freely accessible by publishers, without clear licenses on any type of re-use. Despite being a non-sustainable form of OA, for the sake of completeness, we have chosen to report Bronze OA as a separate category, as the format influences the overall perspective on OA publishing.

In the analyses conducted with the collected data, we apply indicators like (i) the number of publications in 2018; (ii) tcs, the total number of citations received by the selected publications (2018–2021); (iii) mcs, which is the mean citation score; (iv) mnscs, the mean normalized citation score, which compares actual versus expected impact taking field, age, and document type into account (Waltman et al., 2011); (v) jfis, the field-normalized journal impact, a measure solving most issues related to Journal Impact Factors (Leeuwen & Moed, 2002); (vi) Finally, we use the pp top 10%, which shows the presence of a set of publications among the top 10 % of the output within the field(s) to which the publications belong.

## Results and discussion

### *On the motivations of Open Access publishing*

Open Access publishing can be the result of a series of very distinct motivations such as gaining citation advantages; enforcing the overall perception that those results from public-funded projects should be freely accessible; or taking a stand against big publishers (especially relevant as a motivation to publish Green OA versions of closed papers). This paper focuses on the first one, the citation impact of those publications, as measured by indicators as mnscs and jfis.

From the above perspective, Table 1 displays the number of publications and the corresponding indicators, distinguishing between closed and the various types of Open Access. Additionally,

subsets of all journals containing hybrid and bronze publications in 2018 have been created and analysed, to allow for comparison between those more restricted sets with the whole universe of journals.

Table 1. Publications in 2018 in journals covered by WoS, according to OA types involved.

	Publications	Mean Citations	mncs	jfis	pp top 10%
<b>Closed</b>	986.515	8,44	0,87	0,90	8,2%
<b>Gold</b>	349.650	9,54	0,93	0,93	9,0%
<b>Green</b>	392.241	12,20	1,19	1,15	12,8%
<b>Hybrid</b>	95.104	14,51	1,49	1,31	17,3%
<b>Bronze</b>	131.587	13,87	1,36	1,33	15,5%
<b>Set with Hybrid OA</b>	1.138.266	11,15	1,12	1,12	11,6%
<b>Set with Bronze OA</b>	924.463	11,62	1,16	1,16	12,3%

The first remark from Table 1 is that OA publishing generates more citation impact when compared to publications in closed journals. The only form of OA publishing where the gain is not significantly higher compared to closed or toll-access journals is Gold OA. Although the mean citations (mcs) are somewhat higher for Gold OA compared to Closed publishing (mcs scores of 9,54 and 8,44, respectively), the mncs values for both types of scholarly publishing are similar (0,93 versus 0,87). The mcs and mncs values for Green, Hybrid, and Bronze OA are higher compared to those for both Closed and Gold OA publishing. Jfis values are also higher, indicating that the journals involved in these three types of OA publishing are among the highest impact journals within the WoS environment. Finally, visibility among the top 10% is also increased for these three types, compared with closed and Gold OA.

The sets of journals shown at the bottom of Table 1 also perform better than closed journals. If we compare those sets with the corresponding type of publication, the roles of the Hybrid and the Bronze OA papers are significant to boost the overall impact observed in their sets, with selected publications performing better in all four indicators displayed. For instance, the set with journals containing Hybrid OA reaches an mncs of 1,12 and a pp top 10% of 11,6%, while the Hybrid publications show a higher performance with 1,49 and 17,3%, respectively. The same type of gain is seen for Bronze OA.

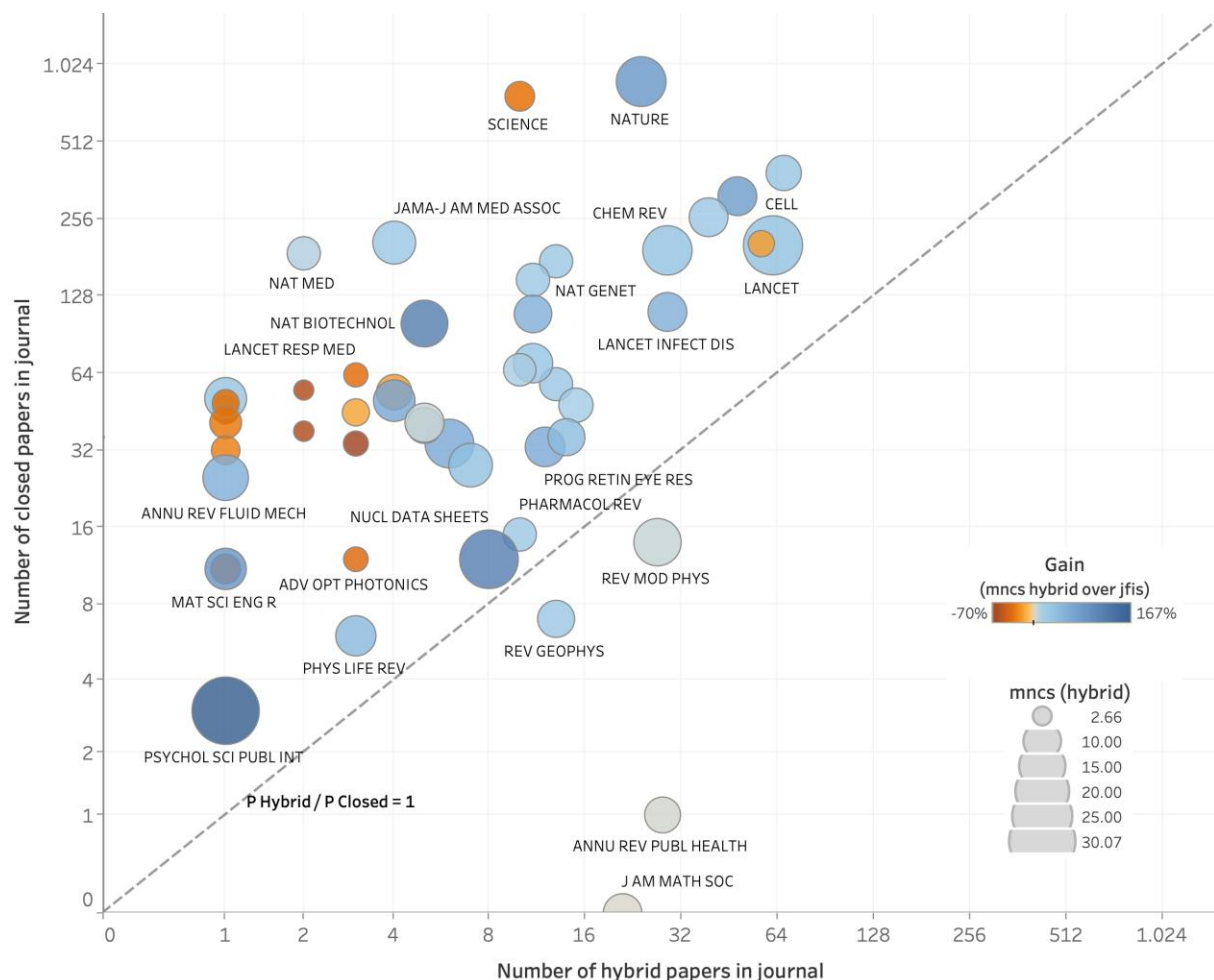
From the observed results, it seems reasonable to consider that researchers' and publishers' decisions to open publications as Hybrid or Bronze OA, respectively, are intentional and that they could be motivated by the overall higher impact of those types of publications. To confirm that, this study now focuses on those sets of Hybrid and Bronze journals, digging deeper into the data to assess if the observed results are not an outcome of their aggregation.

#### *Hybrid OA: The author's choice*

To investigate motivations behind authors' choices to pay APCs to open their publications in closed journals, Figure 1 shows the top 50 highest-ranking journals, according to jfis, with Hybrid OA in 2018. We assume jfis to emulate JIF, an indicator which influences choices in publication strategies and behaviour (Rushforth & Rijcke, 2015). As jfis is field-normalized, it can perform cross-field analyses, thus Figure 1 shows journals in a wide variety of fields. The axes display the number of closed and Hybrid publication in each journal. The marker size

indicates the mncs calculated for the Hybrid set of publications only, while the colours show the gain with that type of output, considering the Hybrid mncs in relation to the overall journal jfis.

Figure 1: Top 50 highest impact journals (based on jfis) with Hybrid OA output in 2018.



An interactive version of this image, covering up to 5000 journals, is available at <https://tabsoft.co/399gqTX>.

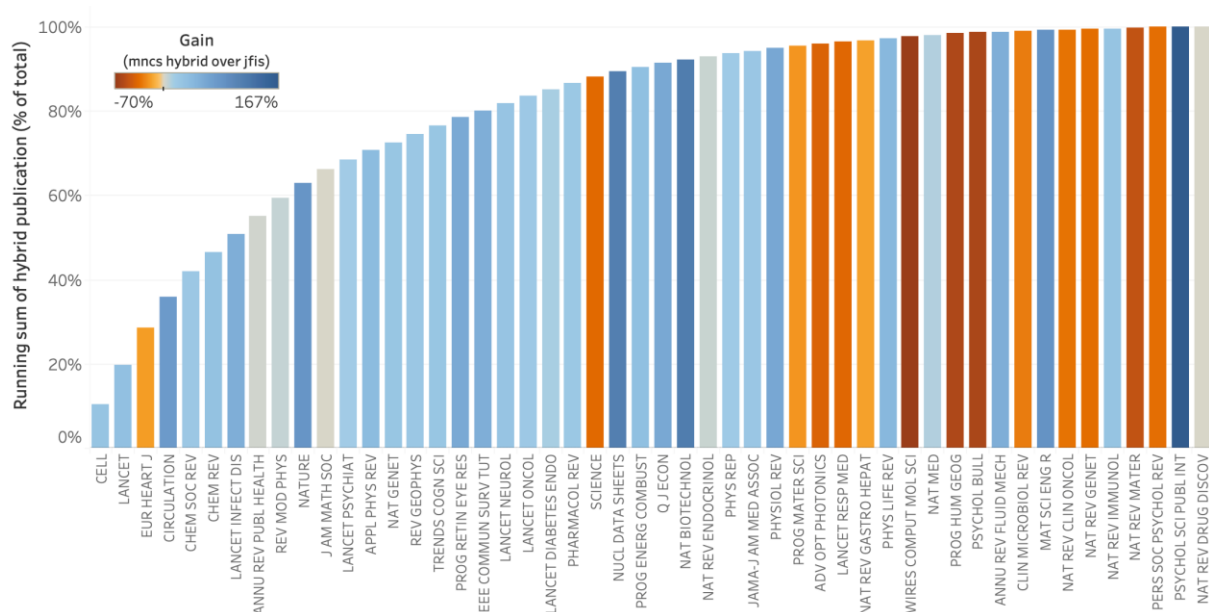
The dashed diagonal line displayed in Figure 1 represents the threshold in which the number of Hybrid papers is equal to the closed papers. Using that as a reference, we see only four out of the top 50 journals have a higher proportion of Hybrid OA. Little gain can be observed for those journals, that being an obvious consequence of their high relative number of Hybrid (reaching 100% in the case of the Journal of the American Mathematical Society). For around 25% of the journals, the Hybrid papers performed lower than the overall journal jfis, and that includes 'Science', with a jfis of 9,4 and an mncs for the hybrid papers of 5,8. In that case, we see only 10 papers were published as Hybrid, while 771 others were closed.

To analyse the effect of the number of Hybrid publications per journal as an indicator of the impact gain, Figure 2 shows the same set of journals displayed in Figure 1, but with a Pareto chart perspective. Journals are now ordered according to their contribution to the total number of Hybrid papers within the top 50 journals, with the colour scale highlighting the mncs gain of Hybrid over the overall journal jfis. As it can be seen, most journals with a higher volume of Hybrid papers benefit from their higher impact, as measured by mncs. Most of the journals with negative gain values, where Hybrid papers underperform closed ones, had few Hybrid papers



in the period (under five). With few papers, results become attached to individual performance rather than to an aggregate, more meaningful, observation.

Figure 2: Pareto chart of the top 50 highest impact journals (jfis-based) with Hybrid OA.



An interactive version of this image, covering up to 5000 journals, is available at <https://tabsoft.co/3ELeD3c>.

From an overall perspective, the data on the top 50 highest impact journals seem to confirm that making a paper Hybrid OA may help achieve results above those that would be expected for closed publishing in the same journal. Evidently, being open is not a guarantee of higher impact, as seen in those journals where the few available Hybrid papers underperformed their closed counterparts. Regardless, from an author's perspective, it is understandable why the Hybrid approach would be preferable to the closed one, should APC funds be available.

### *Bronze OA: The publishers' choice*

There are no clear standards about what motivates publishers' choices on what papers to make accessible as Bronze OA. However, some recent scenarios may shed some light on the possibilities. The first one has been clearly seen during the COVID-19 pandemic, as many publishers recognized the importance of knowledge dissemination, making studies on the coronavirus open. These were often made available as curated collections on dedicated websites<sup>2</sup> from Elsevier, Springer Nature, Wiley, and others. Publishers emphasize the free access to those studies, but they do not mention whether this openness will be permanent, hence the Bronze OA status. The publishers' responsive action increased the visibility of research, and that has been confirmed by a study showing that 37.6% of OA coronavirus publications in the Dimensions database were Bronze OA, and that those papers received the highest attention from the social media (Torres-Salinas, Robinson-Garcia, & Castillo-Valdivieso, 2020).

While there is value in opening relevant science that may help fight a pandemic, it is undeniable that openness in this case also serves as a tool for publishers to improve brand image. Thus, Bronze OA becomes part of a marketing strategy, which can also be seen when publishers make the work of Nobel Prize laureates open as soon as winners are announced every year. For

<sup>2</sup> <https://bit.ly/3rODfTm> (Elsevier), <https://bit.ly/3rZzZEI> (Springer Nature), and <https://bit.ly/3s4GhTF> (Wiley).

instance, Elsevier publishes a yearly advertising webpage to celebrate the achievement of laureates who once published in their journals<sup>3</sup>.

In this marketing perspective, we argue that publishers may also make papers from “higher-ranking” institutions open, aiming to profit from the reputation of authors’ affiliations. Figure 3 shows a tentative look into this situation, listing the top 20 institutions with the most Bronze OA publications in 2018. For each university, the total number of Open Access publications is included, together with a colour scale detailing the different types of output. The pp top 10% is also shown for the overall publication output. Institutions are listed in descending order of relative number of Bronze OA.

Figure 3: Institutions with the highest percentage of Bronze OA output in 2018, and their overall OA production.

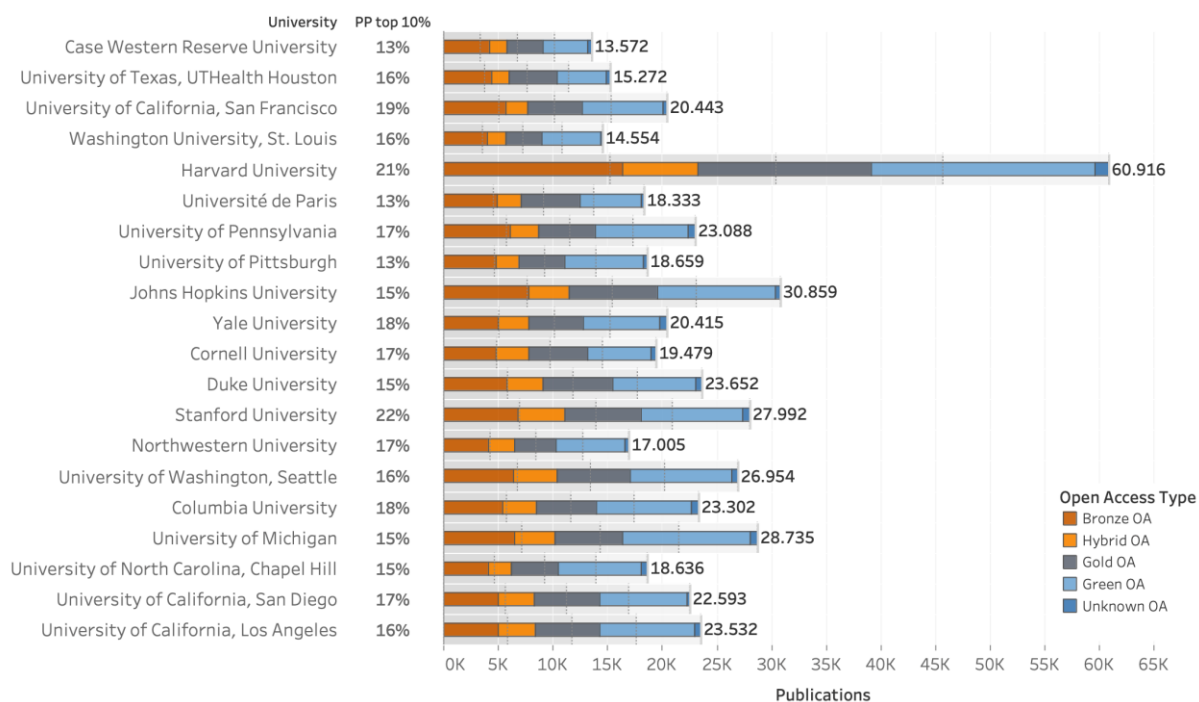


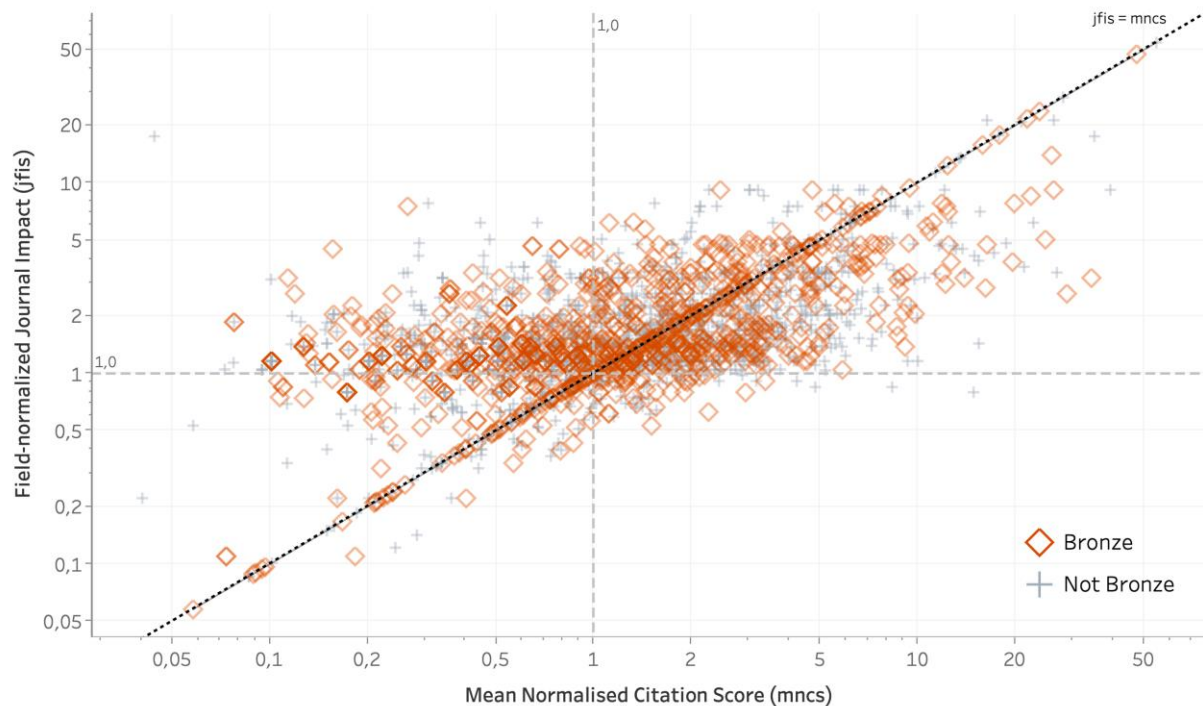
Figure 3 reveals the ratio of publications of the top 20 universities with the most Bronze OA ranges from 21% (University of California, Los Angeles) to 31% (Case Western Reserve University), thus a significant part of the otherwise closed or toll-access output from those institutions is made accessible. Out of the 20 universities listed, only Université de Paris is not US-based. Furthermore, all institutions achieved a pp top 10% above the database average of 10%. All this seems to suggest that the publisher selection of publications to be made Bronze OA is not random, and that affiliations may be taken into consideration.

Besides the university perspective, another potential analysis relates to a probable perception from publishers that citations accumulated by papers they choose to make open could boost journal citation impact. Figure 4 displays a surprising overview of such a perspective, by comparing the mncs and jfis of individual papers, and highlighting the Bronze publications for journals with between 20% and 50% of Bronze OA. This proportion was applied as a filter after several iterations of the analysis have shown higher or lower rates of Bronze publications did not allow for a comparative analysis of the paper distribution.

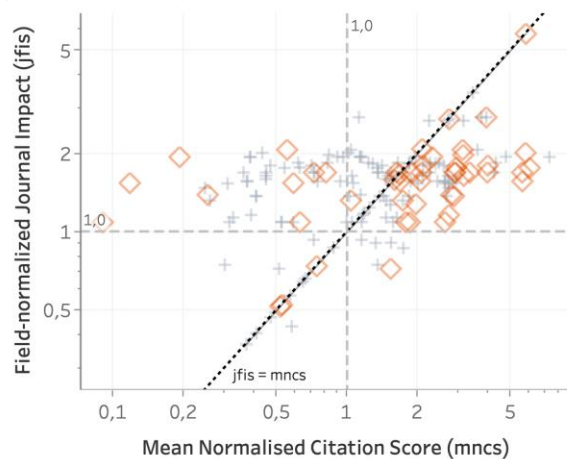
<sup>3</sup> <https://bit.ly/3y2q1X2> (2019), <https://bit.ly/3OJebHp> (2020), and <https://bit.ly/3Mua3Jc> (2021).

Figure 4: Analysis of paper mncs vs jfis for journals with bronze publications in 2018

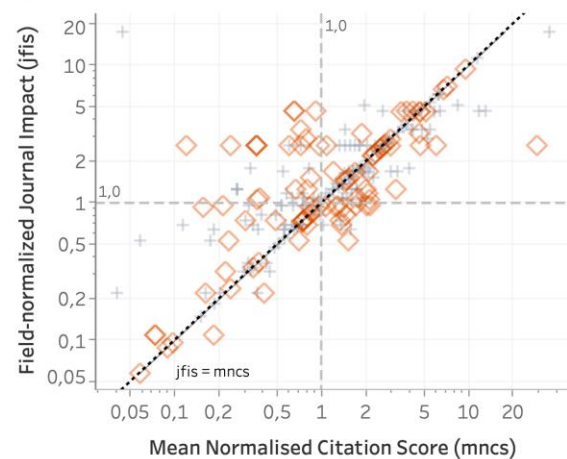
(a) top 10 journals (jfis based)



(b) journal with expected profile



(c) median journal



An interactive version of this image, with 50 journals to explore, is available at <https://tabsoft.co/3Kmlvp5>.

Considering the hypothesis that publishers would choose which papers to open aiming to boost journal citation impact, Figure 4b would represent an expected distribution of papers, displaying a higher number of Bronze OA to the right of the dashed diagonal line (where mncs would be higher than jfis). However, that is not the result observed for most journals, as the most common profile is similar to the one displayed in Figure 4c, showing a distribution with no clear tendency seen towards overperforming Bronze OA. This profile belongs to the



Molecular Biology and Evolution journal, a member of the top 10 journals (ranked by jfis) which are shown together in Figure 4a.

## Conclusions

Recently, the discussion of OA publishing has been dominated by the consideration of potential effects of Plan-S on scholarly publishing. Part of the debate centred on the academic freedom and autonomy of researchers to self-select in which journals they publish their findings, as journals labelled as Hybrid under Plan-S are no longer eligible for publishing (except in cases where publishers agree to transformative agreements on their portfolios). The publisher's own choices on opening publications, through Bronze OA, is also in need of further debate. With that in mind, this study made a first attempt to understand motivations behind Hybrid and Bronze choices, especially in face of Plan-S restrictions.

From the Hybrid OA perspective, we have seen that part of the motivation for authors publishing in this format may come from potential citation advantages of open publications. Some closed journals have a high impact on their own and an Open Access paper in them may potentialize the desired results for that specific publication. While there is no guarantee that a Hybrid paper will outperform the overall paper in a journal, in this case, APC costs can be considered an investment aimed at more than openness.

For the Bronze OA, it is clear that a sense of responsibility to share relevant knowledge with society influences publishers' choices to open publications. However, a marketing benefit is also evident, whether as an unintended benefit or a driving force. That could be seen in the high proportion of Bronze OA papers made open for authors affiliated with renowned institutions, with above-average publication impact measures, such as Harvard, Stanford, Yale and more.

Regarding the hypothesis that publishers could use a high-impact potential as a factor to decide whether to make a publication Bronze OA, further analyses seem to be necessary. Multiple iterations of exploration led to a selection of 50 top performing journals (jfis based), with a balanced representation of Bronze papers for analysis. Most of those journals, whose Bronze OA profiles can be explored individually at <https://tabsoft.co/3Kmlvp5>, seem to contradict the expectation that Bronze papers would outperform other publications and help boost journal's citation impact. An alternative perspective that is being explored for a future study is a longitudinal analysis, where the observed citation impact of a paper before being made Bronze OA and its performance afterwards can bring a different perspective of whether citations motivate Bronze decisions.

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