Plan S: An Economist's Perspective

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August 2021

Abstract

Many scholarly journals charge high prices to research libraries and generate high profits. Open access regulation, in its various forms, can mitigate this problem. This essay examines one particular policy, "Plan S", which aims broadly to require regulated authors to publish their research in open access journals, which among other drawbacks of the policy greatly limits their publishing options.

Keywords: Scholarly journals, open access, two-sided markets, regulation, Plan S.

1 Introduction

In this essay I discuss the scholarly journal market, including forms of market failure the market might suffer in the absence of regulation. The market failure most prominent in current debates involves the excessive prices that some publishers charge readers for access to their articles, especially within the STEM disciplines. Various kinds of open access regulation have been proposed to mitigate this problem. One recent proposal is known enigmatically as "Plan S", the many and changing details of which will be explained later, and in this essay I discuss the pros and cons of this plan alongside other potential regulatory policies. I will use an economist's perspective, both in terms of using economic tools to discuss this particular market and in terms of a focus on how Plan S would be likely to impact the economics discipline.

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A useful perspective on the scholarly journal market is that it is a "two-sided" market, providing value to readers (who gain access to articles they wish to read) and to authors (who gain exposure for their work to readers).[1] Journals incur costs when providing their services, and these costs are usually met from charges levied on one or both sides of the market. For this essay, the two principal purposes of a journal are (i) to disseminate an author's work to potential readers and (ii) to certify various attributes of that work.

In more detail, purpose (i) involves the journal making available its content to those readers—and only those readers—permitted to consume its content. With the advent of online journal access, the costs associated with dissemination to subscribers have fallen drastically in recent years. Authors care (some more than others) about the size of their journal's readership, but plausibly care mostly that their scientific peers have access to their work (either in its final journal form or as a working paper if available) rather than the wider public. Nevertheless, there can be much value in the wider population gaining access to up-to-date scholarly material, at the time of writing perhaps most notably in the area of health.

Purpose (ii) is to certify that the article's content is novel, correct, concerns certain specialist topics, and it may also signal how important and/or interesting the article is. Certification is valuable for both sides of the market, although for different reasons. For readers, (ii) helps them to discover the content they will likely want to consult, from out of the vast pool of available content.[2] Given that reading a paper involves a sunk cost, a reader benefits from *ex ante* information about a paper's quality and topic before deciding whether or not to read it. For an author, on the other hand, (ii) provides a useful signal of the quality of her work, including to people who may *not* actually want or be able to read it. The quality of an author's publications collected in her CV, as judged by various committees, determine the hiring, promotion, and research funding decisions which are so crucial for her career. This certification function is particularly important for more junior researchers, who have not yet built up a widely perceived reputation. Many junior researchers would be willing to pay much money out of their own pocket to place a paper

[1] Early contributions to the theory of two-sided markets include Caillaud and Jullien (2003), Rochet and Tirole (2003) and Armstrong (2006). See Rysman (2009) for an early overview of two-sided markets.

[2] The economics subject repository *RePEc* currently hosts around three million research items, including articles from around 3,500 journals.

in a prestigious journal.[3] The costs associated with certification (e.g., paying the journal's editors and, sometimes, its referees) have not fallen nearly as much over recent years as those of dissemination. Moreover, as the internet makes various kinds of self-dissemination by authors so easy and discoverable, purpose (ii) is nowadays arguably the more important of these two roles.

As mentioned, a journal usually covers its costs by charging one or both sides of the market.[4] An open access journal makes all of its content free to readers at the time of publication. Such journals usually cover their costs by charging authors or their institutions to publish their work. Thus, anyone can read the 2020 article "Open access publishers: the new players" in *PLOS ONE* for free, but its authors have paid around $1749 (at current prices) to publish there. Within my own economics discipline, only a few well-known journals currently are open access. (Perhaps the three best-known economics journals which are open access are the *Journal of Economic Perspectives*, *Quantitative Economics* and *Theoretical Economics*.) In particular, none of the so-called "top 5" economics journals—*American Economic Review*, *Econometrica*, *Journal of Political Economy*, *Quarterly Journal of Economics*, and *Review of Economic Studies*—are currently open access. For better or worse, the ability to publish articles in top 5 journals is an important route to career success for academic economists.[5] Some journals do not supply credible certification at all, and publish almost anything in return for a fee from the author. These journals often position themselves as "open access", although they have minimal readership and could not generate much subscription revenue if they tried. Part of the author demand for these "predatory" journals is to fool those evaluation committees that are ignorant about which journals are discriminating about the articles they publish and which are not.[6]

At the other extreme, a subscription-only (or "closed") journal sells all its content to readers (usually libraries in universities and other research institutions). Subscription journals often allow authors to publish their work without charge, so that authors have

[3] Attema *et al.* (2014) provide graphic evidence of the extent to which an author would go to place an article in a top journal.

[4] A number of journals currently have neither reader nor author fees (sometimes this is referred to as diamond or platinum open access). Presumably, these journals operate with funding from institutions or charities, and/or by editors and reviewers donating their time.

[5] See Heckman and Moktan (2020) for extensive discussion on this point.

[6] See Bagues *et al.* (2019) for evidence of this effect.

free access to the journal's subscribers. A few and declining number of economics journals follow this funding model, and do not allow their authors to pay for open access to their articles. So far as I understand, for instance, it is not currently possible for an author to make her article open access in the *American Economic Review*, although the author is permitted immediately to post the published article on her personal website.

However, a great many journals obtain revenue from both sides of the market. Historically, since costs (especially for dissemination) used to be far higher, journals had difficulties covering their costs, and many of them levied fees both for subscribing and for publishing. However, in recent years a more subtle form of two-sided pricing has emerged, whereby a so-call hybrid journal offers access to some of its content only to subscribers, but offers authors an option to pay to make their article immediately open access to all readers. Apparently the first hybrid journal was the *Florida Entomologist*, which adopted this funding model in 1998. (See Walker, 1998, for an account of this innovation, and an insightful early discussion of open access issues in general.) For instance, *Managerial and Decision Economics* currently offers online institutional subscription in the US in 2021 for $3,561, and authors can make their individual article free to all readers by paying $2,500. Unless they face strong regulatory encouragement, however, relatively few authors will choose to spend their own money, or money from their limited research budgets, on making their work open access in their chosen journal. For instance, in 2018 just 6 out of the 132 articles published that year in the *Economic Journal* were open access. A variant of the hybrid approach are the so-called "read and publish" deals offered by publishers to institutions. When a university strikes such a deal with a publisher, its students and researchers have access to that publisher's journals and its researchers are able to publish their articles with open access in that publisher's journals.[7] Another variant is the so-called "mirror" journal, where what is in effect the same journal (with the same editorial board and acceptance standards) is split into two—for instance, Elsevier's *Water Research* and *Water Research X*—one of which is subscription and one of which is open access, and once her paper has been accepted the author can decide in which of the two to publish (paying a publication

[7] More precisely, researchers can publish their articles with open access in a subset of that publisher's journals, often that publisher's set of hybrid journals. (Open access journals are often excluded, as they involve no subscription element for the institution.)

fee for the open access outlet).[8]

A snapshot of the balance between subscription and open access content in a major publisher's set of journals can be found in Elsevier's 2020 Annual Report. There, the company states that in 2020 it published 2,650 journals, of which around 500 were open access journals and around 1,900 were hybrid journals. It published around 560,000 articles, of which around 81,000 (or nearly 15%) were open access. The company had revenues of £2,692m, of which 76% came from subscriptions. Putting these figures together show that the company obtained average revenue per subscription article equal to about £4,270.[9] Its author charges for open access vary widely across journals, from near zero to nearly £8,000 for a premier science journal such as *Cell*. However, the bulk of author charges lie in the range £1,800 to £3,000.[10]

A final important way in which publishers differ is the extent to which they permit authors to disseminate the accepted versions of their published papers. Some publishers only permit an author to post the accepted version online after a lengthy embargo period, while others allow authors immediately to post the final version online (either on their personal webpage or in specified repositories). Interestingly, Elsevier, which is sometimes the target of open access activists' ire for its high subscription prices, has had since 2004 a very liberal policy towards self-dissemination, and it allows an author to post the accepted version on her webpage or on *SSRN* or *RePEc* immediately on publication.[11] (Oxford University Press, by contrast, has an embargo period of 24 months for most of its economics journals before an accepted version of a published article could be uploaded to *RePEc*.) In practice, though, it is hard to prevent authors from uploading the accepted version of their paper to a repository: an economics paper, for instance, will typically have been through several rounds of revision before being accepted, and it would take much effort from the

[8] Mirror journals seem to be rare in economics. An exception is the *Journal of Public Economics Plus* (whose parent journal is the *Journal of Public Economics*). However, this journal charges a submission rather than a publication fee, and so a submitting author must decide in advance whether to publish in the open access version. At the time of writing this journal has published just one article.

[9] See pages 14 and 16 of *RELX Annual Report and Financial Statements 2020*.

[10] See the spreadsheet of author fees available from https://www.elsevier.com/about/policies/pricing. An interesting feature is that for Elsevier's mirror journals (all marked with an "X" as with *Water Research* previously mentioned), it is cheaper for authors to publish in the open access journal than to buy open access in the hybrid journal, perhaps reflecting the opportunity cost of foregone subscription revenue when an author buys open access in a hybrid journal.

[11] The social science repository *SSRN* is owned by Elsevier.

publisher to determine which precise versions have been posted online.

An important issue, and one central to the open access debate, is whether or not an unregulated journal market will implement an appropriate balance of charges across the two sides of the market. In particular, a frequent claim is that many publishers, left free to do so, charge libraries too much to subscribe to their journals. In the next section I explore why it is indeed likely that journals will levy high subscription charges rather than high author charges. But taking this skewed pricing pattern as given for now, it is clear that high subscription charges have an adverse impact on both distributional and efficiency aims. Even if libraries are just willing to pay them, high subscription charges have a welfare cost if a dollar of library budget is worth more in welfare terms than a dollar of publisher profit, as is plausibly the case when research libraries are ultimately financed from costly public funds. It is inefficient to exclude interested readers and libraries when it costs next to nothing to serve them. It may also be costly in political terms to exclude readers, if those who pay for public research through their taxes are denied timely access to its final product.

Related to this is the observation that scientific publishing can be highly profitable. As the UK's House of Commons (2004, page 5) put it, "There is mounting concern that the financial benefits from the Government's substantial investment in research are being diverted to an excessive degree into the pockets of publishers' shareholders." In the year 2020, for instance, Elsevier made profit of £1021m on revenues of £2692m, a profit margin of about 38%.[12] It is not just the most commercially minded publishers which benefit from subscription fees. Many learned societies devoted to their respective disciplines have their activities funded in large part by journal subscriptions, and several universities obtain significant revenues from their university presses. Scientific publishing is highly concentrated, according to traditional measures. For instance, Larivière *et al.* (2015, page 4) document how five publishers together supply about half the articles, half the journals, and half the citations, and this is true both for both natural and medical sciences (combined) and for social sciences and humanities (combined). While this degree of concentration may play a role in driving up prices and profits in the absence of regulation, in the next section I argue that a more fundamental source of market power is the monopoly nature of each

[12] See page 7 of *RELX Annual Report and Financial Statements 2020.*

individual article.

Open access regulations are intended to combat high subscription charges.[13] Varying standards of "purity" for open access exist. When the published journal article is freely available to all readers at the time of publication, this is usually termed "gold" open access for that article. Plan S, discussed in more detail in section 3, originally proposed a strong version of this, which is that an article be published in an open access journal rather than merely made open access within a hybrid journal, i.e., alongside other articles that are also freely available.

Stopping short of gold open access are various kinds of "near" open access. These include publishing in a journal which has a short delay, or embargo, after publication before the article is made freely available. For instance, *PNAS* makes its content freely available six months after publication (and even this delay can be circumvented if the author pays for immediate open access). Second, an author might post online the accepted version of her paper (and publishes in a journal which permits this), in which case readers have free access to a close substitute for the published article. (This is usually known as "green" open access.) In the economics discipline, the culture is such that almost all published articles are freely available online in working paper form, although in other disciplines it is rarer, or even forbidden, to post working papers online prior to publication. Third, many journals, usually non-profit journals, charge "low" but not zero subscription fees. The top 5 economics journals arguably all fall into this category.[14] In the economics discipline, this combination of a working paper culture along with relatively inexpensive journals (at least at the top end) has meant that discussions and controversies about open access have been muted relative to those within other subject areas.

Finally, there are various kinds of illegal open access, where published work is disseminated in violation of the publisher's copyright requirements. As mentioned, authors might

[13] Note that there is always "open access" for the certification role of journals: one need not subscribe to the *American Economic Review* to discover that a particular article and author has been published there.

[14] In 2021, institutional online subscription charges in the US were \$950 for the *AER* (which includes subscriptions to seven other journals from the *American Economic Association*), \$826 for *Econometrica*, \$552 to \$1300 for the *JPE* (where the charge depends on the size of the institution), \$680 for the *QJE*, and \$724 for *Review of Economic Studies.* (Some of these journals require submitting authors to be members of an associated society and/or charge a modest submission fee.) These charges are significantly lower than that for *Managerial and Decision Economics*, say.

post the accepted version of the published article online before a required embargo period, or even post the published version online. It is hard for published to monitor and enforce all such violations. There are also "pirate" websites, most notably *Sci-Hub*, which allow readers to download published articles that the website has somehow managed to obtain.

2 Some Economics of Open Access Regulation

Open access regulation requires designated authors—for instance, those whose research was funded from a specific source—to make their research open access in a specified manner, such as in a "gold" form or in some "near open access" form. To understand the impact of different forms of open access regulation, it is conceptually useful to distinguish between the dissemination and certification functions of journals.[15] For the initial discussion I focus on the dissemination purpose of a journal, and subsequently add the extra complexities which arise from their certification purpose.

Without regulatory intervention, the typical pattern of pricing in the commercial journal market is that subscribers pay high fees to access a journal's content, while authors pay little or nothing to publish, i.e., to access the journal's subscribers.[16] What is the asymmetry between the two sides of the market which induces this skewed pricing, whereby authors are offered a "bargain" funded from "ripoff" charges levied on subscribers? The crucial issue is that the peer-review process ensures an article is only published in a single journal and is differentiated from other published articles, and so readers need to subscribe to several journals if they wish to see a wide range of content. (In the jargon of two-sided markets, the asymmetry is that authors "single-home" while readers "multi-home".) Each published article thus constitutes a mini-monopoly, and a journal enjoys market power in providing access for readers to its articles. For this reason, a journal in the absence of regulation is able to set high subscription charges which need bear little relation to the cost of running the journal. Even a tiny publisher with a single journal could set a high

[15] Much material in this section has been taken from Armstrong (2015, section 2). In particular, the numerical examples which follow are based on more fully-fledged and general models elaborated in the earlier paper.

[16] As already noted, many non-profit journals have modest subscription fees. See Bergstrom (2001) for an early discussion of the significant price differences between commercial and non-profit journals in the economics discipline.

subscription charge for access to its content.[17]

Because each article generates its own quantum of monopoly profit, a journal has strong incentives to attract articles to publish and so will wish to offer a generous deal to a suitably qualified author. An important and curious feature of the academic journal market, dating from its inception, is that publishers do not usually *pay* authors for their work. (Of course, an author may obtain financial reward for publications in prestigious journals, via job promotion and so on, but those rewards are financed from elsewhere. For some reason, academic books are different from journals and book authors are usually paid advances and royalties.) As a result, the most generous deal a publisher can offer is that an author can publish for free. Since authors are not paid, the often large revenues from selling subscriptions to institutions are not easily dissipated and publishers can enjoy supernormal profits. From this perspective, high subscription fees and excess publisher profits are due mostly to the monopoly nature of each individual article, alongside a constraint that monopoly subscription profits are not fully passed back to authors.[18]

This pattern of skewed pricing, with its "bargains and ripoffs", would be reversed in an alternative world in which readers each subscribed to a single journal, and authors had to place their work in multiple journals in order to reach a large readership. (This is akin to the old market for print newspapers, in which most people read a single newspaper and advertisers had to place their advert in multiple outlets to reach a desired number of eyeballs.) In such a world, it would be readers who would be courted by journals, and authors would pay high fees for access to a journal's captive subscribers.

The journal market is an instance of what I have elsewhere termed a "competitive bottleneck".[19] In such a market, there are competing platforms which intermediate the interaction between two sides. For perhaps exogenous or institutional reasons, one side

[17] This point was put nicely by Suber (2012, p.39): "toll-access journals compete for authors much more than they compete for subscribers. If you need an article published in a certain journal, then you need access to that journal. This is one reason why free and expensive journals can coexist in the same field, even at the same level of quality. The free journals don't drive the expensive journals out of business or even drive down their prices."

[18] Some authors particularly value their work being seen widely, and would be attracted to a journal which has a low subscription price. Shavell (2010) studies a model where authors differ in the value they place on readership, and in an unregulated market journals differ in the mix of author fees and subscription fees they charge. (In his model authors can be paid by journals, and in equilibrium some authors choose to be paid in return for disseminating to a smaller audience.)

[19] See Armstrong (2002, section 3.1, and 2006, section 5).

joins one platform exclusively (the single-homing side). The chosen platform can exploit the monopoly position it holds on this single-homing side by setting high prices to the other, multi-homing, side. Sometimes monopoly prices on the latter side are fully passed onto the single-homing side, in which case platforms are less likely to sustain excess profits. However, sometimes there are constraints which prevent full pass-through, for instance that the single-homing side cannot be *paid*, in which case the platforms may retain a portion of the monopoly profit, even when there is stiff competition between similar platforms. Other markets with competitive bottleneck features similar to scholarly publishing include credit cards (which consumers can often use for free if they pay the balance in full each month, while merchants pay high fees on each transaction), shopping malls (which consumers can enter for free, while retailers pay high rents for access to these consumers), online search engines (where people can search for free, but advertisers pay high prices to appear prominently in their search results), and call termination on telephone networks (where before the advent of regulation subscribers had a subsidized phone and their callers had to pay high charges to call them).

This competitive bottleneck logic can be illustrated in the following simple example. First, imagine (as John Lennon might say) a world without journals. Author A obtains a benefit of \$5 when reader R sees her article, while R gains benefit \$15 from reading A's article. It costs A some very small amount to deliver the article to R (say, the effort of posting the article online), and so she is willing to do this. The joint surplus from this exchange, which involves no monetary exchange, is therefore about \$20. Now introduce a group of homogenous journals, which for simplicity incur negligible costs for disseminating the article to R. Since by assumption only one journal is able to publish A's article, the journal which obtains the article will be able to sell it to R for \$15. If a payment to A is feasible, journals compete to offer the highest such payment, and the monopoly profit of \$15 from R is passed back to A. Thus, in this stylized model, the introduction of the journal market induces no significant efficiency gains, but operates to transfer surplus from readers to authors. However, if as is more realistic there is a constraint that A cannot be paid, journals will offer A free publication, A will choose a random journal, which will then sell the article to R for \$15. In this case, the combined surplus of A and R falls from about

\$20 to \$5 (all of which is enjoyed by A), the difference being siphoned off by journals.[20]

Provided there is sufficient competition between publishers in a given subject area and quality tier, a "gold" open access regime, in which a regulated author must publish her article in a journal which make the article freely available at the time of publication, entirely overcomes this problem of monopoly pricing by journals.[21] Journals would then usually have to cover their running costs by charging regulated authors a fee to publish their paper. Like more familiar "one-sided" markets, journals would then compete for custom from authors in terms of publication fee, turnaround time, value-added (or not) from the refereeing process, and so on, and there is a greater chance that only normal profits would be observed. As Brown *et al.* (2003, page 2) put it: "Open access would eliminate monopolies over essential published results, diminishing profit margins and creating a more efficient market for scientific publishing".

A gold regime has other attractions relative to alternative policies involving "near" open access. It is surely of some benefit to the reader to see the journal article itself (rather than the author's own pre-print as in a "green" open access regime): the format may be somewhat more attractive, pagination for detailed citation is stable, she automatically knows the name of the journal which published the paper, and she knows she has the final, peer-reviewed version. A subscription price which is precisely zero (rather than merely cheap) will reduce some journal costs, such as the selling costs associated with negotiating contracts with libraries. Relatedly, it is easier for regulators to ensure that authors are complying with gold open access obligations, rather than having to decide what counts

[20] This highly stylized example has historical parallels in the story of how Robert Maxwell exploited this competitive bottleneck aspect of publishing when he started numerous new journals for his Pergamon Press (later sold and incorporated into Elsevier). As in footnote 17, he believed that "we don't compete on sales, we compete on authors". He offered to publish the journals of scientific societies in return for a small fee to them. The editor of the *Journal of Neurochemistry* said Maxwell took over the journal after the editor was wooed with a lavish dinner and a cheque for a few thousand pounds. See Buranyi (2017) for these and many more details. Buranyi writes: "If a serious new journal appeared, scientists would simply request that their university library subscribe to that one as well. If Maxwell was creating three times as many journals as his competition, he would make three times more money. [...] And since there was no way to swap one journal for another, cheaper one, the result was, Maxwell continued, 'a perpetual financing machine'. Librarians were locked into a series of thousands of tiny monopolies. There were now more than a million scientific articles published a year, and they had to buy all of them at whatever price the publishers wanted."

[21] However, if the publishing market is relatively concentrated—and as discussed in section 1, the five largest publishers account for about half the market—there may be scope to raise author fees, not just subscription fees, above the competitive level.

as a "cheap enough" journal subscription or having to check that the author has indeed posted her accepted version in an appropriate online location.

Nevertheless, the gold policy essentially *reverses* the extreme skewness of pricing, moving from a situation where authors have free access to subscribers to one where readers have free access to articles. Thus the "paywall" is shifted from readers to authors. This opposite extreme pattern of bargains and ripoffs is unlikely to be the most efficient way for journals to cover their costs. First, there are sound public finance reasons why readers should contribute something to the cost of publishing. Taking a parochial perspective, many readers of journal articles written by authors in a relatively small country will be overseas, and it is not obvious that national taxes should be used to fund free access for these readers.[22] Many users of scientific research are in the industrial and corporate sector, and it is unclear why such users should free ride on a subsidized author-pays regime.[23]

Second, having to pay to publish will deter some authors at the margin from publishing at all. Of course, not publishing an article at all is even more harmful to potential readers than having to pay a high price for access. It may be that a regulated author has publication fees built into her grant, or her institution has a "read and publish" agreement with the publisher which allows her to publish with open access, in which case this is not an issue. However, if open access regulation succeeds in making publication fees widespread in the market, then unregulated authors will be impacted too. Even if many authors have access to funds which can be used to cover a publication fee, there will often be an opportunity cost when paying to publish a paper. Many scholars in the humanities and/or in poorer countries do not have research funds which cover publication fees. Indeed, a major drawback to a widespread move to an author-pays regime may be that scholars in poorer countries will not be able to adequately publicize their work to their peers in richer countries.

A "near" open access policy might require authors to publish in journals with a short

[22] One option here might be to offer open access only to those readers in the geographical area which funded the research, as suggested in 2017 by Elsevier in www.elsevier.com/connect/working-towards-a-transition-to-open-access.

[23] House of Commons (2004, paragraph 175) reports that Elsevier obtains 20% of its journal revenue from this sector, and quotes the Biochemical Society as saying "in the open-access world it would appear that the only real winners are going to be corporate pharmaceutical companies who would no longer have to pay to access information."

embargo period, in journals with low but not zero subscription charges, or require authors to post the accepted version of their published work online (and to publish in a journal which permits this). Such policies mitigate the problems of high subscription charges and excluded readers. When a somewhat inferior substitute is freely available (say, when content is released after a short embargo period or if authors post accepted versions online), then libraries have a valuable outside option, and publishers are forced to charge less if they wish to continue selling their subscriptions. Moreover, the wider public has free access to the inferior variant of the published article, while before they may have been excluded altogether. Nevertheless, if the inferior variant is not *too* close a substitute, publishers may still be able to extract sufficient revenue from libraries willing to pay for the premium published version to cover their costs, albeit with less to spare. Therefore, this "freemium" funding model can be consistent with authors continuing to publish without charge.

Note that even if a publisher permits an author to immediately post the accepted version of her published paper online, the evidence is that—beyond a few subjects, including economics, computer science and physics—many authors do not go to the trouble to do this, which is not surprising if their article is anyway being distributed to their desired audience by a journal. Thus the "green" route to open access requires a degree of compulsion on regulated authors to disseminate the accepted version of their articles. A beneficial by-product of "green" open access regulations may be to stimulate a working paper culture within a wider set of subject areas than is the case at present. Such a culture often enables speedier access to research compared to a system where readers must wait for the published article to arrive, and may also enable comments from readers (rather than just from editors and referees) to be fed into the article's final draft.

This discussion so far has focussed on the dissemination role of journals. Journals also add value to the raw content, for instance in terms of certifying quality, attractive formatting, providing feedback from referees to authors, and generally in "polishing" papers for publication. Some of this added value benefits readers. If a journal is not permitted to charge readers (or more generally faces an inflexible price cap on its subscription charges), as in the gold regime, it cannot appropriate the extra benefit it provides readers in the form of higher prices, and so will have less incentive to spend resources on such activities. Thus, we expect that an open access journal will provide expert feedback from referees

and editors and go through multiple rounds of revision only to the extent this is valued by its authors (including the indirect impact on boosting readership insofar as this is valued by authors), and the direct benefit of such activity on readers is ignored in the journal's calculus.

If we focus more specifically on the certification service, there is a downside to authors bearing the costs of processing papers, which is that some authors may be unwilling or unable to pay for certification. More selective journals are likely to charge higher author fees than less selective journals in a gold regime, since they follow a more rigorous and costly peer-review process. (By contrast, in the traditional subscription model, the extra costs of peer-review for a selective journal are covered by readers.) As such, some authors with good papers may be less willing or able to publish in selective journals. The result is that the quality signal in a journal's name becomes less precise, which harms readers and (good) authors.

This issue can be illustrated as follows.[24] An author has a paper which might be good or bad. Readers in aggregate are willing to pay $10,000 to read an article known to be good, and willing to pay nothing for an article known to be bad. An author knows the quality of her paper, while readers cannot directly observe quality without investing in the costly effort of reading. It costs a journal $2,000 to determine via peer review whether a paper is good or bad, but all other journal costs are zero. Journals come in two forms: a "discriminating" journal peer reviews all submitted papers (at the cost of $2,000 per paper) and publishes only good papers, while a "non-discriminating" journal will publish anything and incurs no costs. Because of its reputation, say, readers know whether a journal is discriminating or not. An author enjoys some intrinsic benefit from being seen to publish a good paper (if she has one), and if she has a bad paper she will not submit to a discriminating journal since she knows her paper will be rejected.

In an unregulated subscription-funded market, the outcome is that discriminating journals compete for good papers, a journal which attracts a good paper charges readers $10,000 to read the paper certified to be good, and since the certification cost of $2,000 is covered

[24] Jeon and Rochet (2010) study a related model, except there is just one journal in their framework. Like the example in the text, article quality is binary and known to authors in advance. They find that a subscription journal will never publish bad papers, while an open access journal will publish a proportion of bad papers. Thus, in their model a move to open access also dilutes the certification role of the journal.

by the subscription revenue, it allows an author to publish for free when she has a good paper.[25] Readers infer that a paper which appears in a non-discriminating journal is bad, and won't read it (even if it is free). By contrast, if the author must publish her article with open access in a journal, a discriminating journal will charge her $2,000 to publish if she has a good paper. If her intrinsic benefit from being seen to publish a good paper is greater than her opportunity cost of funding the $2,000 publication fee, the outcome is as before and good papers are all published in discriminating journals. However, if this benefit is below her opportunity cost (for instance, if she has limited research or personal funds), the author prefers to submit a good paper to a non-discriminating journal which charges her nothing.[26] In this case, a reader must consult a non-discriminating journal if she wants to see the article. If an uncertified article is relatively likely to be good (and this depends on the underlying fraction of good papers and the distribution of author benefits of being seen to have a good paper), it is worthwhile for readers to take the gamble of reading a paper in a non-discriminating journal, although they suffer the disutility of having to read some bad papers alongside the good ones. If an uncertified article is unlikely to be good, though, readers may have no incentive to read undiscriminating journals at all, and so these good papers will go unnoticed. Likewise, authors of good articles, such as those in poorer countries, may not gain the reputation they deserve if they are financially constrained to publish their work in lower-ranked outlets.

In sum, the demand for journal certification by authors may fall when authors must pay to publish. In a subscription-funded market, authors can usually submit and publish for free, and so an author has an incentive to place her article in the most discriminating journal willing to accept it. The result is that potential readers, as well as members of tenure and promotions committees, obtain a relatively precise signal of article quality from the journal in which a paper appears. In an author-pays regime, however, it becomes more expensive to publish a paper in a discriminating journal since the peer-review costs are higher. As a result, some authors with good papers may be constrained or choose to submit

[25] To implement this scheme, the journal could charge a submission fee of $2,000 which is refunded if the paper is judged to be good.

[26] For instance, within the PLOS group of open access journals, the highly selective *PLOS Biology* currently charges authors $4000 to publish, while the less selective *PLOS ONE* charges $1749. Some good biology papers will be published in the latter outlet when authors are financially constrained (or don't care enough about the incremental impact on their reputation).

to a less prestigious journal. For instance, authors with an already high reputation may reach their audience without the need for expensive journal certification.[27] Readers and committees then have a less precise signal of quality than before, and good papers may be lost amongst the mediocre.

As before, a near open access regime can overcome these dangers. If the regime is not "too near" to open access, a discriminating journal will be able to cover its costs (including its costs of peer review) out of its subscription income, and authors of good papers do not need to pay to have their article certified. As such, the policy may be compatible with authors continuing to publish in the most selective journal that will accept their paper, and the certification role of journals is maintained.

In summary, while "gold" open access mandates have their advantages, they come with a significant danger that some authors who have to pay to publish (either out of their own pocket or out of a limited research budget) might prefer not to submit to an expensive, selective journal, or even to any journal at all. Instead, regulations which allow authors to use some kind of "near" open access rather than "gold" open access, mitigates the problems caused by excessive journal subscriptions while avoiding these dangers.

3 Plan S

Until recently, policy debates around open access have focussed largely on which of the "gold" or the "green" routes to open access is more appropriate, assuming regulation of some form is needed. That is, whether the regulated author should be required to make the published article open access, or whether for instance she merely has to make the accepted version of the article available in some accessible way. In particular, regulation was at the individual article level: on what terms should a particular piece of research contained in an article be made available to readers?

For instance, the UK's periodic *Research Excellence Framework* (REF), which at the time of writing is about to evaluate departments in UK universities, has an open access

[27] Even without explicit fees for publishing in prestigious journals, there are often other costs authors incur to publish in these journals, including the need to go through many stages of revisions. As a result, there is evidence, at least within the economics discipline, that established scholars are choosing to publish less often in the top ranked journals. See Ellison (2011) for further discussion.

policy such that for a journal publication to be submitted to the current review, the article must either have appeared without embargo from the publisher itself (the gold route), or to use the green route the author's accepted version must be publicly available from a suitable repository no longer than 12 months after publication (or 24 months for humanities and social sciences). In essence, this makes most of the recent journal articles originating in the UK open access in some form, albeit with a very lengthy delay in many subjects. Although it is hard to get data at this point, I feel confident in predicting that a large majority of economics articles submitted to the current REF will follow the green rather than the gold route to comply with open access requirements.

Plan S is a different kind of regulation, which focusses less on the article than on the journal in which it is published. An explicit aim of the policy, at least initially, was to terminate subscription payments for journal content, and to move to a world in which only open access journals exist. The origins of the plan seem murky. The architect of Plan S, Robert-Jan Smits, the European Union's special envoy for open access, gave a conference presentation in July 2018 during which he announced a new radical plan to accelerate open access, the details of which he said would be clarified later in the year.[28] In this presentation he said that the plan's "S" stands for "speed, solution, science", and that he aimed to use the financial influence of research funders to put pressure on journals to change their funding model from a reader-pays to an author-pays regime.

These promised further details were published as a manifesto in September 2018 in Schiltz (2018), and Plan S was launched with the support of eleven European national funding bodies and the European Research Council (ERC) who would all follow its policies. Although Plan S seemed to many in the university world to come "out of the blue", Schiltz (2018, p.4) states that "Plan S was initiated by [Robert-Jan Smits] and further developed by the President of Science Europe [Marc Schiltz] and by a group of Heads of national funding organizations. It also drew on substantial input from the Scientific Council of the European Research Council." The manifesto is written in a kind of pious and dogmatic style: "Monetising the access to new and existing research results is profoundly at odds with the ethos of science. There is no longer any justification for this state of affairs to prevail and the subscription-based model of scientific publication, including its so-called

[28] The presentation can be viewed on YouTube by searching for "ESOF 2018".

'hybrid' variants, should therefore be terminated. [...] **no science should be locked behind paywalls!**" (Schiltz, 2018, p.1, with emphasis in the original).

The manifesto proposes one key principle and ten subsidiary principles. The key principle states that "After 1 January 2020 scientific publications on the results from research funded by public grants provided by national and European research councils and funding bodies, must be published in compliant Open Access Journals or on compliant Open Access Platforms".[29] Thus, within sixteen months of this announcement, the plan envisaged that all European grant-funded research would have to appear in open access journals.

Among the ten subsidiary principles, one suggests that for disciplines in which high quality open access journals do not yet exist "the Funders will in a coordinated way provide incentives to establish these and support them when appropriate", another suggests that "when Open Access publication fees are applied, their funding is standardized and capped (across Europe)", another states that funders will monitor and sanction non-compliance by authors, while another explicitly states that "the 'hybrid' model of publishing is not compliant". (It was later clarified that "mirror" journals would be considered to be hybrid journals, and so would not be compliant either.) Another principle suggests that open access will also be required for scholarly books and monographs, although the timeline needed to achieve this may be longer. It was not explained why it is harder to achieve open access for books, although one factor may be that authors would be unwilling to give up their royalties if their books had to be given away.

Clearly, unless very many subscription and hybrid journals "flip" to become open access, these policies would greatly restrict where researchers can publish their work. The manifesto (Schiltz, 2018, p.3) acknowledges that "researchers need to be given a maximum of freedom to choose the proper venue for publishing their results", but immediately goes on to warn that "researchers must realise that they are doing a gross disservice to the institution of science if they continue to report their outcomes in publications that will be locked behind paywalls".[30] The manifesto also gives a strong steer away from the certifi-

[29] The precise meaning of "open access platforms" is unclear, although www.coalition-s.org (which is the umbrella group of funders who support Plan S) says that "open access platforms are publishing platforms for the original publication of research outputs (such as Wellcome Open Research or Gates Open Research)." It certainly does not include subject repositories such as *RePEc*.

[30] In Enserink (2018), Schiltz is quoted as saying "The greater good of a well-functioning science system is more important than the right of individual researchers to decide where to submit their papers."

cation role of journals, saying that researchers who commit this "gross disservice" might prefer to publish in non-compliant journals due to a "misdirected reward system which puts emphasis on the wrong indicators (e.g., journal impact factors). We therefore commit to fundamentally revise the incentive and reward system of science."

There are several problems with Plan S as it was originally proposed in this manifesto, both in terms of its aims and in terms of its feasibility. As argued in the previous section, it is by no means clear that a monoculture of open access journals is the most efficient way for authors to disseminate and certify their work. For example, an environment with widely available working papers and inexpensive high-quality journals, as is arguably already the case in economics and some other disciplines, may work better than one where all journals are funded exclusively by author fees. Author fees might discourage some authors at the margin from publishing their work at all, which is even worse than science being "locked behind paywalls". Permitting green open access, whereby authors can post the accepted version of their paper online, might stimulate a working paper culture in a broader range of subject disciplines, which carries its own advantages.[31] No allowance is made for a journal being merely cheap rather than precisely free, as its content is nevertheless "locked behind paywalls".

In addition, the certification role of journals may well be diminished when subscription fees are prohibited. Indeed, as mentioned it is one of the subsidiary aims of Plan S to *lessen* this certification role, with its disdain for impact factors and the like, despite the efficiencies caused by certification (especially for junior scholars of high calibre). What the stated aim "to fundamentally revise the incentive and reward system of science" might actually mean in practice is clarified to some extent in the current set of Plan S principles, where principle 10 states that "The Funders commit that when assessing research outputs during funding decisions they will value the intrinsic merit of the work and not consider the publication channel, its impact factor (or other journal metrics), or the publisher".[32] How in practice a committee member asked to evaluate a grant application outside her

[31] Enserink (2018) quotes the open access scholar Peter Suber as saying that Plan S's downplaying of green open access was an "elementary mistake", and that by allowing researchers to make their work freely available while publishing in a "conventional, venerable" journal, green OA helps young scientists who need the cachet of publishing in top journals.

[32] See www.coalition-s.org/plan_s_principles for a description of the current ten principles.

own areas of expertise should grasp the "intrinsic merits" of the applicant's work is not explained. It is also hard to understand how this aim to diminish journal certification sits with another of the Plan S principles, which is that "the Funders will ensure jointly the establishment of robust criteria and requirements for the services that compliant high quality Open Access journals [...] must provide"; what does this notion of "high quality" mean?

The aim to standardize and cap publication fees is hard to interpret. Would they be standardized across disciplines, or only within the same subject area? (The latter seems the only reasonable policy, given the extent to which peer review costs differ across fields.) Would a more discriminating and selective journal be permitted to charge higher publication fees than a less discriminating journal, given that its peer review costs will be higher? If not, and if the cap is set below that of a highly discriminating journal, this may force such journals to become less discriminating and hence weaken further the precision of journal certification.

The share of world research funded by the initial supporters of Plan S is tiny.[33] This would not give major international journals a sufficient incentive to "flip" to an open access model, with the result that researchers with grants from Plan S funders would have a very restricted set of journals to consider for their work. In economics, for instance, none of the top 5 journals had any prospect of becoming open access, and so economists with grants from these funders would be unable to publish in the discipline's prime outlets. This would disadvantage the careers of good researchers who had grants from these sources, and also deter many of the best researchers from applying for grants from these sources. (Funders compete for good applicants, just as journals compete for good papers, and Plan S promises an excellent opportunity for non-Plan S funders to attract good researchers by offering them the freedom to publish where they wish.) Relatedly, it would be hard for a Plan S funded researcher to collaborate with other researchers who may not wish to be so constrained in where they could publish. The economics discipline is arguably already "dominated" by American scholars, and the reduced ability of European economists to publish in the best journals or to collaborate with American-based researchers would only

[33] https://deltathink.com/news-views-potential-impact-of-plan-s/ estimated that 3.3% of global research articles in 2017 was funded by these initial Plan S funders.

exacerbate this problem.

While the manifesto suggests that funders will somehow establish new high quality open access journals in disciplines where these do not yet exist, it hard to see how that could happen in reasonable time, if at all. Journal reputations are notoriously "sticky", and for reasons of coordination it is a difficult task to launch a new quality journal, and not a task for which funding bodies are well suited.[34] It is not clear that the academic world needs still more journals in any case.

Even if it were to be judged desirable, the main aim of Plan S to induce most journals to become open access would only be feasible if large numbers of funders from around the world signed up to its principles. In part, this becomes another issue of coordination: if a funder anticipates that few others will join the Plan S initiative, and hence that few journals will become open access, then that funder may be reluctant to join too, as doing so will unduly restrict where its funded research can be published. Soon after its launch, Robert-Jan Smits embarked on a campaign to enlist new funders to join the original eleven.[35] However, at the time of writing there are just eighteen national funders which are part of cOAlition S, i.e., which are aligned with the principles of Plan S.[36] These include only three from outside Europe (Jordan, South Africa and Zambia), and none from North America or Asia. (Important charitable funders based in the US, such as the Gates Foundation and the Howard Hughes Medical Institute, are also current supporters of Plan S.) An important original supporter, the ERC, withdrew from cOAlition S in 2020, writing that the requirement not to publish in non-compliant hybrid journals is "detrimental, especially for early career researchers, researchers working in countries with fewer alternative funding opportunities, [...]".[37]

Since the hoped-for bandwagon of support for Plan S did not occur, and if it was not to lose backers in addition to the ERC, its policies needed to be adjusted and weakened if they

[34] Bergstrom (2001) discusses this problem of coordination. He suggested (twenty years ago) that one promising way within the economics subject area to increase the share of low-cost, high-quality journals would be for the existing such journals and societies to expand their portfolio of associated journals, to leverage their existing reputation. In the time since this suggestion, the American Economic Association and the Econometric Society have each added several new "second tier" journals to their list.

[35] See https://www.nature.com/articles/d41586-018-06936-7, which quotes Smits as saying "By the end of the year [2018], if we don't have more funders and statements of support, we will miss the boat."

[36] See https://www.coalition-s.org/organisations/.

[37] See erc.europa.eu/news/erc-scientific-council-calls-open-access-plans-respect-researchers-needs.

were to remain workable for its supporting funders. The date for the start of the policy was moved back one year to January 2021. (It seems unclear whether this means that all publications arising from grants awarded after this date need to be compliant, or only publications from grants with funding calls made after this date need to be compliant.) Reference to standardized and capped author fees was removed. Publication in hybrid journals was permitted, provided that the journal "commits" to a path to become open access by means of a so-called transformative arrangement.[38] For instance, many Elsevier journals have become "transformative journals", as has *Nature* (albeit with a publication fee of 9,500 euros to obtain open access for an article). What the sanctions would be if a journal did not satisfy all of the transformative requirements over time are unclear. So far as I understand, none of the top 5 economics journals is currently a transformative journal. Finally, the "green" route to open access is permitted, but with very tight restrictions: the accepted version of the article must be deposited in a repository without an embargo period and be published with an liberal re-use license (such as "CC-BY"). Few publishers would agree to such terms, at least without payment of an author fee (which would not be covered by the funder).[39] In sum, although the Plan S requirements have become weaker than those in the original manifesto, they nevertheless impose significant restrictions on where a funded author can place her work, especially for those authors who cannot fund on their own the likely expensive "green" route to open access which is permitted under the policy.

[38] The details of what counts as a compliant journal change frequently, but currently the requirements include that the share of open access content in the journal rises by 5 percentage points each year, and the journal becomes fully open access when the share of open access content reaches 75% or by the end of 2024 (whichever is sooner). See https://www.coalition-s.org/addendum-to-the-coalition-s-guidance-on-the-implementation-of-plan-s/ for full details.

[39] So one way for a Plan S funder author to publish her paper in a non-compliant hybrid journal would be to pay for open access from the journal, which comes with an open license, and then, somewhat redundantly, deposit the article in a repository. However, the author would not have her publication fee covered by her grant in this case. Another possibility is that if the fraction of a journal's articles which come from Plan S funded authors is small, that journal may be willing to *selectively* grant these authors the ability, without charge, to deposit their accepted paper without embargo and with an approved re-use licence. This is currently the policy at the *Science* family of journals (see www.nature.com/articles/d41586-021-00103-1).

4 Conclusion

While the broadest aims of Plan S—to open up access to published research—are laudable, the plan itself had and has many deficiencies and could well be counter-productive. It does not appear to have been based on broad consultation, and several obvious drawbacks to the original manifesto were mitigated only after a good deal of criticism from researchers themselves. The timetable seems rushed, even with the current weaker policies. (Are all these transformative journals really going to be fully open access by the end of 2024?) The policy seemed to try to do too many things—induce widespread flipping to open access by journals, capping author fees, downplaying the certification role of journals—in too short a time and with too little support for this combination of policies. Lack of funding for author fees for open access in (non-compliant) hybrid journals perversely means that *fewer* gold open access articles might be published than would be the case with a policy which paid for hybrid open access. Crucially, Plan S required the same tough regulations for all disciplines, while in many subject areas beyond the STEM disciplines less drastic regulations requiring "near" open access would be more appropriate. At the current time the bold policy appears to have lost its initial momentum, and to have become a European-centric policy followed by a number of the region's national research funders, which will probably harm the career prospects of many researchers in those regions, and which has not transformed the publishing market into one populated mostly with open access journals.

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