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JEL Codes: L11, L82.

**Keywords: Academic publishing, Open access, Two-sided markets,
Certification.**



Academic publishing and open access.

What does economics teach us? *

Catherine Bobtcheff[†] Bernard Caillaud[‡] Raphaël Lévy[§]

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Abstract

We review the literature on the academic publishing sector with a particular focus on the questions raised by open access. Dwelling on insights from the literatures on two-sided markets and certification, we discuss the various options to promote open access as well as possible policies to regulate the publishing market.

Keywords: academic publishing, open access, two-sided markets, certification.

JEL classification: L11, L82.

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1 Introduction

Access to the work of peers is crucial to the progress of knowledge and, as such, constitutes a cornerstone of scientific research. Since the 17th century, specialized journals have been the vector of dissemination of knowledge among researchers. While the ongoing revolution brought by information and communication technologies leads to a qualitative leap in dissemination opportunities, many researchers are concerned that “*free access to scientific information has become the challenge of the 21st century*” (Jokic, Mervar and Mateljan (2018), Pisoschi and Pisoschi (2016)). The international scientific community as well as public authorities have actually questioned the economic model in place since the 19th century. Such a model is based on low - even zero - submission and publication fees on the one hand, and high subscription fees on the other hand.

Raw figures are striking: subscription fees for academic journals, especially those published by for-profit publishers, have increased at a dizzying speed over the last few decades (a price explosion referred to as the *serials crisis*). Between 1986 and 2010, fees increased three times faster than consumer prices (House of Commons, 2013). In economics, they have increased by a factor of nine for the five most prestigious not-for-profit journals between 1985 and 2016, and by more than 20 for the five most prestigious for-profit journals.¹ This explosion of fees strains the budgets of university libraries and research centres and led the most fragile and poorly funded of them (but also, recently, more important and prestigious institutions such as Caltech, the University of Maryland, University of Konstanz, Université de Montréal) to let some subscriptions lapse. This reduces access by academics and other users of research, including the general public, to certain publications. Given that scientific knowledge is a public good, even this partial exclusion may involve significant welfare losses.

Beside these exclusion concerns, the increase in fees also raises the question of the efficient use of public funds. Indeed, fees are taken from budgets allocated to higher education and research that could easily be reallocated to a more productive use. In Europe, these budgets are publicly financed and thus require tax revenues which possibly create distortions for the rest of the economy. In other words, given the current constraints on public spending, the presence of high markups in the academic publishing industry may raise political problems: on the one hand, large surpluses obtained by publishers could be reallocated to fund activities more essential to research, equipment or more permanent research jobs; on the other hand, most publishers are not even domestic firms.

In response to this situation, a few isolated attempts to promote open access – that is free dissemination of academic research – emerged in the biomedical domain in the

¹McCabe and Snyder (2018) documents that, in 1985, the mean subscription fee was worth 199 USD for for-profits journals compared to 52 USD for non-profits journals; in 2016, average fees had increased to 4,134 USD for for-profits and 479 USD for non-profits journals.

1990s, followed by several international initiatives since the beginning of the 2000s. Most notably, “An Open Letter to Scientific Publishers” in 2001 gave birth two years later to the Public Library of Science and the launch of the first open access PLOS journal, as well as major international statements in 2003-2004.² Overall, open access has expanded swiftly. Using a database of more than 67 million articles and excluding access via social media, Piwowar *et al.* (2018) establishes that the fraction of articles in open access reached 45% in 2015.³ In parallel to this evolution, there has also been a sharp increase in the number of articles illegally circulated: many academic social media networks disseminate articles in open access in violation of copyright legislation – Jamali (2017) estimates that 50% of articles are concerned by such practices – and the shadow library website Sci-Hub is estimated to offer for free 95% of all scholarly publications with issued DOI numbers.

The status quo is thus largely questioned and the existing model is likely to change to respond to the growing concerns of the academic community and to technological advances. To better understand the prospects of the academic publishing sector, the objective of this paper is to offer an economist’s view based on a critical synthesis of the extant literature on the subject. Academic journals serve four main functions: dissemination of knowledge, certification, establishing scientific priority, and archiving. In this paper, we focus more specifically on dissemination and certification, noting that dissemination may encompass publication, various features of access provision (e.g., search engine) and archiving, while certification includes both ascertaining truth and importance of scientific articles and attribution of credit to scientists.⁴ We thus develop an analysis of the academic publishing sector using the frameworks of the economics of platforms (Section 2) and the economics of certification (Section 3). We then review the different regimes of open access in the light of these theoretical insights (Section 4).

2 Academic publishing as a two-sided market

In this section, we focus on the role of academic journals as vectors of dissemination of knowledge. Our analysis is based on the insights drawn from the literature on platforms. Academic journals play an important role in preparing articles, making them available for reading, preserving them and keeping them available in the long term. As such, scientific journals are platforms that bring together authors and readers. The theory of platforms or two-sided markets is thus particularly useful to understand pricing in academic publishing,

²See the statements made in Budapest (Budapest Open Access Initiative, 2002), Bethesda (Bethesda Statement on Open Access Publishing, 2003) and Berlin (Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities, 2003).

³Over an earlier period, Archambault *et al.* (2014) proposes slightly different figures but reaches the same conclusion of a strong expansion.

⁴Notice that Gans (2017) suggests that unbundling some of the tasks traditionally performed by journals would result in less publisher market power.

and the likely impact of switching from the traditional model to open access.⁵

2.1 Cross-group externalities

The dissemination of knowledge is an intermediation service: journals connect authors, who want to be read, to readers, who seek access to state-of-the-art research.⁶ The value of this intermediation service for authors increases with the circulation of the journal: authors benefit from being read, often cited and widely recognized. This improves their career prospects and salaries, and the impact of their research in their own discipline and beyond.⁷ From the readers' perspective, this intermediation service is all the more valuable as a journal offers a wider, more diversified and more relevant range of articles. Therefore, there are cross-group externalities. That is, the participation of one group has an impact on the value created for the other group: an author publishing in a journal increases the benefits from reading that journal, and, by subscribing to a journal, a reader increases the value for authors to publish there. As usual, the existence of such externalities is a potential source of market failure.

With such cross-group externalities, the efficient allocation is characterized by a unique dissemination platform with Pigouvian implicit prices. First, all readers must have access to all articles so as to maximize cross externalities and avoid search costs or switching costs across different platforms. Second, the implicit prices (submission / publication fees or access fees) must be equal to marginal (publication or dissemination) costs corrected by a term that captures the extent of cross-group externalities. Specifically, the price paid by authors (resp. readers), i.e. submission and publication fees (resp. access fees), should decrease with the benefit that the presence of an extra author (reader) generates on the whole population of readers (authors).

The magnitude of these cross-group externalities is debatable. For the population of researchers publishing articles, the value of one additional reader seems small, so that the Pigouvian price for readers should be close to the marginal cost of granting access.⁸ As this cost is quite small with online access, the optimal access fees for readers should be close to null, i.e. open access should be approximately optimal. For readers, the value of accessing one additional article is also limited on average, although reading some pioneering papers may sometimes be critical in the emergence of an idea or of a discovery. The global impact on a large readership may however be non-negligible so that the

⁵See, for instance, Armstrong (2006), Caillaud and Jullien (2001) and (2003), and Rochet and Tirole (2003) and (2006) for basic contributions on the theory of platforms.

⁶Notice that authors and readers are often the same agents playing different roles at different times.

⁷Asthana and Balsam (2017) estimates that the increase in annual salary for a top tier publication in an accounting journal to be 5,609 USD and that the present value of a top tier publication to exceed 145,000 USD for an assistant professor.

⁸Impact factors and related indices are a very coarse measure of readership that plays a role in determining the quality of a publication, but the marginal effect of one additional reader seems trivial.

Pigouvian price for submitting a paper may be significantly below the marginal cost of handling the submission. Again, this cost has been much reduced with online submission; although it remains non-negligible, the externality correction may drive the optimal author fees close to zero as well. So, efficiency should not require large departure from free services on both sides.

The actual market structure in the academic publication industry is characterized by much concentration. There are thus two sources of inefficiency: market power and the imperfect internalization of cross-group externalities in dissemination. In what follows, we highlight how the market performs both in terms of pricing and in terms of efficiency under different market structures.

2.2 Inter-group price discrimination

One feature emerging from the literature on two-sided markets is that the pricing structure, i.e., how total fees are split between authors and readers, matters. In fact, the traditional academic publishing market is characterized by a highly imbalanced price structure, which can be described as follows:

- Authors pay submission fees that are typically lower than the sum of the production, administrative and reviewing costs of the article.⁹ The editorial cost of handling submissions and the reviewing costs are often small since referee service is provided by the research community for a trivial compensation, but submission fees are arguably even smaller and equal to zero in most disciplines (except in economics, finance and accounting).
- Authors do not have to pay any extra publication fee when their work is accepted, formatted and prepared for final publication (whether in electronic or printed form). These processes involve nontrivial costs, although they also have been greatly reduced thanks to digital technologies.
- Authors waive the copyright attached to the article being published, which implies that one given article can be published in one outlet only.
- Potential readers in the academic community have access to research articles via the library of their institutions (be it physical or virtual). In this case, they do not face any budget constraint nor access limit. Therefore, they may not be aware of, and certainly not sensitive to, the cost of access.

⁹As Larivière *et al.* (2015) explains, “*fixed or first-copy costs [that] comprise manuscript preparation, selection and reviewing as well as copy-editing and layout, writing of editorials, marketing, and salaries and rent (...) are estimated to range between 20 USD and 40 USD per page.*”

- University and research libraries subscribe to academic journals, often through contractual agreements that cover several journals published by the same publishing company (agreements called ‘Big Deals’). These contracts involve high subscription fees for libraries. When negotiated with for-profit publishers, they also involve sophisticated pricing, based on observed access and usage (number of downloads); in addition, fees result from bilateral negotiations. Overall, a lot of price discrimination is going on (nonlinear pricing, personalized pricing).¹⁰
- Readers outside the academic community, e.g., companies, industrial development laboratories, professional training organizations, and citizens, must pay sizable subscription fees to publishers or to intermediary distributors, although individual readers often get a lower rate than academic institutions.

The relations and payments between these different players in the traditional (reader-pays) model are depicted in Figure 1.

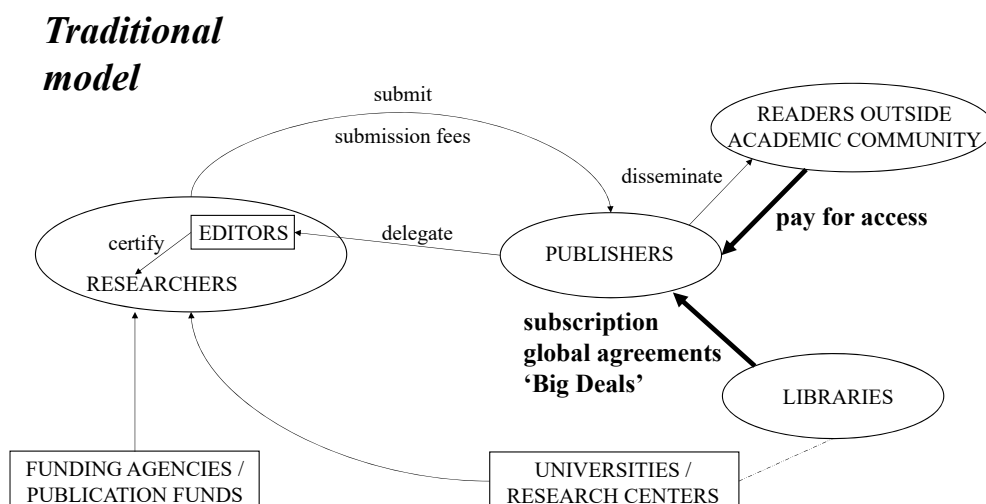


Figure 1: The traditional model.

The literature on scientific publishing and open access was naturally inspired by the

¹⁰On how for-profit publishers exploit their monopoly market power through price discrimination, see the pioneer work by Bergstrom and Bergstrom (2004, 2006), Bergstrom *et al.* (2014), Edlin and Rubinfeld (2004, 2005).

canonical two-sided platform model.¹¹ Given the degree of concentration in the academic publishing market, it is useful to consider as a first approach the case of a monopolistic journal. Such an approach is justified by the vision that there is a single best diffusion medium for a given article, either because it is the only journal on some niche, or because it is the only one offering articles of a certain quality. The analysis of the monopoly model delivers a clear result: the pricing applied to each group – authors and readers – is determined by a markup (or markdown) above marginal cost. This margin has two components.

- The first component reflects the price elasticity of demand of each group. When demand is inelastic, publishers can impose larger prices; this is the typical aspect of monopoly pricing. University libraries are captive because they cannot deprive researchers and students from access to knowledge, and are thus quite price-insensitive.
- The second component reflects the strength of cross-group externalities. The margin made on authors is lower the larger the marginal benefit of an extra article for readers (and conversely). Indeed, a publisher reduces submission or publication fees in order to attract more authors, and it captures a large share of the value that these authors generate for readers through subscription fees. It is worth noting that, compared to the distortion (from marginal cost) in efficient pricing discussed in the previous subsection, only the impact on the marginal readers matters for a profit-maximizing journal while efficiency is concerned with the impact on the average reader.¹²

As mentioned, inefficiency results from two sources: the classical inefficiency related to market power and the imperfect internalization of cross-group externalities. Even though cross-group externalities are taken into account by a monopolistic publisher, they are not perfectly internalized, i.e. not as much as efficiency would require, and both sources of inefficiency compound.

In order to evaluate whether this model provides an adequate description of the academic publishing sector, it is interesting to appreciate which side of the market is the best source of income for a journal with monopoly power. Typically, this is the side of the market that benefits more from the presence of the other, that is, the side that benefits from the larger cross-group externality. In theory, the optimal pricing might be highly asymmetric in that a group can be subsidized (for instance, by getting the service free of charge). This is the case when the value that the presence of this group creates for the other group is both large in itself and significantly larger than the reverse externality.

In the case of scientific publishing, it seems difficult to conceive that one effect could outweigh the other so radically as to rationalize the highly imbalanced pricing structure

¹¹Armstrong (2015), Jeon and Rochet (2010) and articles by McCabe and Snyder (2005) and (2018).

¹²See Weyl (2010) for a discussion in the context of the economics of platforms of the general effect emphasized in Spence (1975).

we typically observe in traditional academic publishing (insignificant submission fees and sizable subscription fees). To justify the major markdown on submission/publication fees, one would have to consider that attracting an additional author/article would bring a considerable benefit to readers compared to the benefit of a wider readership for authors. One may doubt that an extra article published has such a large value for readers. Indeed, many readers will have read a draft or working paper version of the article, seen it presented in a lecture or conference, or heard colleagues talk about it.¹³ So, the model of a monopolistic platform does not seem to capture in a compelling way the pricing structure that we typically observe in the academic publishing market.

To capture the imbalanced pricing structure we observe, one needs to consider the competitive dimension of the environment. At the international level, there are a few large scientific publishing houses that operate on a commercial basis (Elsevier, Wiley, Blackwell, Springer, Kluwer, Taylor and Francis, Lippincott), as well as significant not-for-profit academic publishers, often attached to a professional society or a public institution associated to the research community (for instance, the two largest university presses in the world are Oxford University Press and Cambridge University Press). There are also a few small, local scientific publishing houses. In a given discipline and with a certain reputation for quality, there are several competing publishers, even though the number of players is low. Models of oligopolistic competition between two-sided platforms therefore seem better suited to describe the industry.

These imperfect platform competition models call for another assumption regarding whether agents can use several platforms, i.e., can “*multi-home*” or not. While it is clear that an article can be published in only one journal (exclusive use by authors, as stipulated by copyright laws, also called “*single-homing*”), readers have possibly access to several platforms, and university libraries typically subscribe to several of them. Competition among journals under the assumption of exclusive use by authors but multiple use by readers corresponds to a variation of the model known as “*competitive bottleneck*”.¹⁴

2.3 Imperfect competition: the *competitive bottleneck* model

The analysis of the competitive bottleneck model leads to the more realistic prediction of highly asymmetric prices between publication and access, contrary to the monopoly journal model discussed above. The results can be summarised as follows.

¹³Some path-breaking articles generate considerable externalities on readers and on future research, and attracting those articles with small or zero submission fees might make sense. This introduces a dimension of quality in research articles, with publication serving as a means of certification, an issue discussed at length in the next section. Let us simply notice at this stage that the externality on readers is limited *on average*, which is what matters if journals are unable to ex ante identify (a fortiori, to price discriminate) such path-breaking papers.

¹⁴See Armstrong (2006) on the general model, Armstrong (2015) on its adaptation to the world of academic publishing, and McCabe and Snyder (2007) on a similar model with open access.

- When an article is accepted, monopoly power over readers' access to that article is transferred to the journal, via copyrights. Accordingly, a profit-maximizing journal will exploit this monopoly power by charging readers high fees for access.
- In order to enjoy the monopoly rent associated with the publication of an article, publishers have an incentive to attract authors. As they compete to attract authors, journals are ready to lower publication fees in exchange for higher subscription profits.
- This leads to significant subscription fees on the one hand and to exacerbated competition to attract authors on the other hand. As a result, submission and publication fees are below marginal cost, possibly even free of charge.

Compared to the efficiency benchmark, high subscription fees induce major inefficiencies in the dissemination of knowledge (exclusion of readers and of university libraries, cost of public funds). Of course, below-cost publication fees increase the authors' incentives to publish their work, but this markdown on publication fees does not correspond (or at least is hard to compare) to the efficient markdown discussed previously. So, overall cross externalities are not correctly taken into account in the competitive bottleneck equilibrium.

When competition becomes more intense in the competitive bottleneck model, journals have to fight even more fiercely to attract authors; once prices paid by authors cannot be further reduced, journals would have to give up part of readers' profits in order to maintain some readership, e.g. by lowering subscription fees. This is what one would typically expect with poorly differentiated and numerous journals. Free entry in the competitive bottleneck model would lead to more intense competition and an erosion of the rents generated on the reader side, at least as long as entrants can survive and compete (McCabe and Snyder, 2007), which should bring the market closer to efficiency. The important publisher profits we observe, as well as the persistence of incumbent players, thus suggest the presence of important barriers to entry.

2.4 Barriers to entry

The first type of barriers to entry comes from reputation and existing catalogs. On the one hand, a few reputable journals have developed expertise to convene editorial boards that make their certification stamp particularly attractive to authors. On the other hand, these journals often have been around for long and libraries will have a strong demand not only to access current issues of the journal, but also to have access to its existing catalog. These two features make it particularly difficult for potential entrants to challenge these journals' market power.

In a competitive bottleneck, barriers to entry also arise from cross-group participation externalities. To attract good authors, a new outlet must convince authors that it will manage to attract many readers, which in turn depends on whether sufficiently many good authors publish there (a *chicken-and-egg* problem). Therefore, the market entry of a new platform is not immediately accompanied by a reorientation of submissions to this journal because authors often prefer to wait to see whether it will attract some readership. Relatedly, readers are reluctant to subscribe to a new journal that they suspect is not yet popular enough among authors to attract the best articles.

In addition to network externalities, another barrier to entry arises from the widespread practice of bundling by incumbent publishers, in the form of the so-called “Big Deal” contracts.¹⁵ Commercial publishers own several journals that cater to different readers or propose a range of differentiated journals; moreover, they propose both printed versions and electronic versions of the same outlet. Commercial publishers have engaged in negotiations with their main clients, university libraries, so as to offer a bundle of journals and versions. These enormous contracts deter libraries from substituting one new independent journal to one journal included in these contracts; as they drain the libraries budget resources, they also make it very costly to subscribe to a new independent journal in addition to the Big Deals. It has then become much more difficult for small independent publishers to enter with a reader-pays regime (i.e., charge libraries).

Finally, a large part of new entrants in the publishing market have actually been new journals created by large incumbent multi-journal publishers. The emergence of these new journals arguably stems from a brand proliferation strategy designed to deter entry by potential independent entrants. This brand proliferation strategy complements the bundling strategy, since incumbent could of course include new journals in the Big Deal (multi-journal) contracts.

Independent publishers therefore have to circumvent several entry barriers. One natural and interesting question is whether entrants have incentives to enter with a new business model and offer open access to readers, or to conform to the dominant business model in the market (reader-pays). Entry using an open access model has occurred successfully in many disciplines since the late 90s, often by non-profit publishers (e.g. PLOS journals), but our theoretical understanding of how an equilibrium looks like in a market where some incumbent journals charge readers and others (entrants) charge authors remains an open question for future research.¹⁶

¹⁵See Edlin and Rubinfeld (2004) and (2005), and Bergstrom *et al.* (2014).

¹⁶Note that McCabe and Snyder (2018) study price competition between open access and traditional journals in a specific environment where journals cannot ex ante commit to the prices paid by readers.

2.5 Departing from the competitive bottleneck model

Increased competition on the publishing market could thus come from more entry, but also from changes in the market structure allowing to move away from the competitive bottleneck environment. One such policy would be to relax copyright law for academic publications, as suggested by Shavell (2010). Authors could then use private or institutional repositories for their articles, in their published version or perhaps under their pre-acceptation form and after an embargo period following the first publication.¹⁷ De facto, authors would then *multi-home* and publishing platforms would then compete under two-sided multi-homing against these repositories, leading to lower fees.¹⁸ An even more radical way to relax copyright law would be to allow authors to submit and publish a given paper in different journals. This extreme scenario raises additional concerns: it could create confusion, e.g. in citations, it would feature duplication and search costs across many publication platforms, and a free rider problem would likely kick in in such a market as each platform would rely on other platforms' refereeing process to select papers.

In this context, generalized open access appears as a way to move away from the competitive bottleneck environment without a change in the copyright legislation. Indeed, with free access for readers, publishers could only earn profits by charging submission and publication fees to authors and the market would look like a traditional *one-sided* market: author charges would not depend on the extent of cross-group externalities with readers. Therefore, publication platforms would compete mainly through prices to attract authors, which would drive publication fees towards marginal costs and improve efficiency. In relation to Section 2.4, notice also that a switch to open access would also likely facilitate entry. Indeed, there would be fewer barriers to entry than in the competitive bottleneck market where network effects require entrants be able to modify the beliefs about whether other players will switch. With easier entry, the dominant position of large incumbent publishers will be more easily contested than in the traditional reader-pays model.

Notice, however, that we should expect publishers to respond to a possible intensification of competition (be it driven by a switch to open access, entry, or laxer copyright legislation). A typical response would be to increase differentiation in order to restore market power. Such differentiation strategies could be related to topics (niches), quality, or ancillary services (e.g., performing search engine, reader-friendly rendition and navigation,...). Notice in this respect that the specific sequential top-down submission process reinforces the returns to differentiation by raising the market power of upper-tier journals

¹⁷This is discussed further down in Subsection 4.2.3 on green open access.

¹⁸Notice that even if competition leads publishers to increase author surplus in the competitive bottleneck model, it does not seem reasonable to expect publishers to spontaneously relinquish their copyrights to attract more authors. Indeed, since copyright is precisely the source of market power vis-à-vis readers, their rents would then vanish.

and lowering the perceived quality of lower-tier journals.¹⁹

In Section 2, we have outlined the cross-group externalities related to the role of journals as intermediaries between authors and readers, and focused on their impact in terms of pricing and dissemination. Yet, we have so far neglected issues related to the quality and diversity of articles, and the role of certification played by journals, which we now turn to.

3 Certification and quality

While it seems clear that open access is a vector of greater knowledge dissemination, it is important to understand the interplay between the pricing model of journals and the proper execution of their certification mission. A general property of two-sided markets is that the identity of the payer has an impact on efficiency because of cross-group externalities between the two sides of the market. But the identity of the payer can also have an impact on the incentives for the journals to be more or less selective on quality.

3.1 Journal business model and selectivity

While the literature on open access unanimously recognizes the certification role of scientific journals, most papers take the level of certification as fixed and exogenous and thus independent of the pricing structure. Only two papers clearly raise the question of the relationship between the level of certification (certified minimum quality) and the identity of the payer: Jeon and Rochet (2010), and McCabe and Snyder (2005). They take complementary perspectives: McCabe and Snyder see the level of certification as fixed, and establish that less selective journals are most likely to switch to open access. Indeed, as the degree of selectivity rises, authors are less prone to submitting their articles, knowing that there is a greater chance of rejection; conversely, reader demand grows when they expect to find high-quality articles. The two effects compound to produce a greater incentive to charge readers. In contrast, Jeon and Rochet compare the selectivity level chosen by an open access journal and a traditional one. They show that the quality level chosen in the traditional model is too high: since publication costs are covered by readers who are willing to pay more when the quality increases, the journal has an incentive to increase quality. However, such an increase is excessive because it does not take into account the social cost associated to the non-dissemination of articles that remain unpublished because of the higher selectivity. Conversely, in open access, revenues come from authors, hence an incentive to be less selective to boost submissions.

Accordingly, journals are too selective in the traditional model and insufficiently selective under open access. As regards dissemination, there may be more readers in either

¹⁹See, e.g., Fahri, Lerner and Tirole (2013).

regime. Indeed, open access boosts readership holding quality fixed. But since the average quality is inferior under open access than in the traditional model, fewer readers might be attracted, so that the net effect on readership can go either way. More generally, in terms of welfare, it is not a priori obvious that under-provision of quality is the main concern. The social cost of rejecting high-quality papers that fall below the bar because a journal is highly selective may be large. When quality becomes endogenous, an excessive selectivity also induces authors to inefficiently increase quality along alternative dimensions. For instance, authors may be tempted to write longer and less focused papers, to work on numerous extensions and tests of robustness in response to reviewers or to second-guess their objections, and such overshooting efforts may carry inefficiencies.²⁰ More generally, the tendency of not-for-profit organisations to offer an excessive level of quality is well documented, for example in hospitals or in the culture sector (see Newhouse (1970), Feldstein (1971), Baumol and Bowen (1993)). Since academic journals are often non-for-profit, over-provision of quality might be a concern there as well.

Notice, however, that an inefficient choice of quality by journals becomes less problematic when there is competition among journals. With a monopolistic journal, the social cost of quality over-provision is that some articles that should optimally be published are rejected. In the presence of competition between vertically differentiated outlets, the fact that better journals are perhaps too selective creates less damage because articles that are rejected from these outlets will likely be published in some other journal of similar or slightly lower ranking. In this regard, the coexistence of different business models in the market (reader-pays or open access) could result in a richer quality ladder, hence in smaller welfare losses associated with inefficient quality choices.

3.2 Business model and the credibility of certification

We have just seen that journals are likely to choose different levels of quality depending on their price structures. Another key question is whether, holding the stated quality target fixed, journals actually have equally strong incentives to stick to their targets under different price regimes (open access or reader-pays). One of the potential issues with the way certification is modelled in the existing literature is that all the studies assume that a journal can commit in a credible manner to publish only articles above a certain quality. This is a frequent assumption in the literature on certification which is usually justified by reputational motives. For example, readers of a given journal expect to find articles of a certain quality and if the journal publishes an article of lower quality, then readers might turn away from the journal, possibly for good. Thus, publishers could apparently

²⁰Ellison (2002) notably documents a sharp increase in paper length between 1970 and 1990 across all disciplines. Notice though that there has been a movement towards shorter articles. See, for instance, <https://www.econometricsociety.org/statement-editors-econometrica-quantitative-economics-and-theoretical-economics>.

legitimately argue that they have no actual interest in lowering quality, even if doing so would substantially increase their current income. There is certainly some force to this argument, and it is indeed desirable that reputation be such a driver of quality. Nonetheless, the argument is not sufficient in itself, as suggested by the example of rating agencies, which resumed their activities even though their credibility was seriously impaired after the 2008 financial crisis. In any case, it is crucial to assess, from a theoretical viewpoint, whether the argument that reputation is a credible commitment mechanism is equally valid regardless of the identity of the payer.

This is one of the questions raised by Bouvard and Lévy (2018). In their paper, a certification agency that commits to a level of quality will always supply as much information as possible, because transactions between buyers and sellers are more efficient when all available information is shared. When it cannot commit, reputational concerns lead the agency to provide as much information as possible if buyers pay, since the latter want the best information possible. However, if sellers pay, then the agency will sometimes prefer to have a reputation for some laxity (or inaccuracy) since that can increase the demand of sellers with bad products, who see in that laxity a greater probability of being certified, and hence to sell. This suggests that it is far from obvious that journals can commit to a level of quality as easily if authors are the source of revenue as if readers are: in an author-pays regimes, journals might accordingly tend to be laxer in implementing their own quality standards.

In this regard, the evolution of corporate ratings business is useful to appreciate some questions raised by open access. In the 1970s, the pricing system of rating agencies has shifted from an investor-pays to a issuer-pays regime. The reason for this radical change was the invention of the photocopier which made it possible to disseminate reports at zero cost and therefore almost impossible to charge investors for a report they could get for free from another investor (free-riding problem).²¹ Following the 2008 financial crisis, many commentators pointed the finger at this economic model in which rating agencies' income mainly came from security issuers. Indeed, it is in their interest to have the highest possible rating, which gives agencies little incentive to be strict when grading.²²

In the publishing market, several warnings (see, for example, House of Commons, 2004) have been made about the risk of collusion between publishers and authors, in line with these concerns: if publication fees are paid by authors, then journals will have an

²¹If the link between the current movement towards open access and the advent of the Internet seems obvious because the spectacular reduction in distribution costs to readers makes the significant profits less justifiable, then it is interesting to note that the Internet also changes the academic market by allowing authors to disseminate their research articles themselves for free (we might speak of market disintermediation). See also the related discussion on green open access in Section 4.2.3.

²²This reputation problem arises because issuers pay for the rating, not because the fees are contingent on the rating itself (i.e. the fact that an AAA issuer pays the agency more), although this clearly exacerbates the problem.

interest in accepting more articles at the expense of quality.²³ It seems likely, then, that in an open access world, journals have an incentive to accept more papers. This lower selectivity due to the inability to commit would thus reinforce the low selectivity already established by Jeon and Rochet (see Section 3.1) under commitment.

There is a potential difference between traditional certification agencies and academic journals, namely that the selection process is delegated to editors (and then to referees) in academia. Allegedly, this might create an extra layer of agency issue; indeed, if getting editors to implement the minimal quality target is costly to publishers, they may want to distort the minimal quality level compared to what they would otherwise do to lower this extra incentive cost. However, this incentive problem is orthogonal to the fact that a journal is open access or not, so it seems unlikely that this feature of the editorial process could qualitatively overturn the insight that quality is ultimately likely to be lower under open access.²⁴

As we highlighted in the previous section, a good model for understanding how the academic publishing market works is an imperfectly competitive model. Yet, most studies of certification treat certification agencies as a monopolies. The theoretical results of the impact of competition among agencies are mixed: competition can increase or decrease incentives for certifiers to provide high-quality information. Empirically, many studies show that competition among certifiers is not always beneficial (see Dranove and Jin, 2010). However, the market for academic publishing works as a competitive bottleneck: authors can publish their articles in only one journal, while readers can read multiple journals. Then competition among certifiers generates a fierce struggle to attract authors. In this context, such competition risks being beneficial if they fight to attract the best authors, but detrimental if the struggle is over articles of average or mediocre quality.²⁵

Finally, in the context of certification, the identity of the payer can also change authors' publication strategies. Comparing situations in which buyers or sellers pay for certification, Stahl and Strausz (2017) shows that certification plays a different role depending on whether it is solicited by a seller or by a buyer. The buyers purchase certification to be assured that they will not pay an excessive price for a bad-quality good. The sellers can seek, via certification, to send a signal that they are confident of obtaining a certification because they know that they hold a high-quality product. This model is not obviously

²³McCabe and Snyder (2005) argues that the collusion problem can be avoided by an appropriate division between submission fees and publication fees.

²⁴Another remark pertaining to this agency issue is that, if the conflict of interest between editors (or referees) and publishers is that editors want to be more selective than publishers (e.g., to sustain a reputation that they care about quality), then an easy way to discipline editors is to require to publish a given fixed amount of papers per year. Since the number of accepted papers is perfectly observable, getting editors to implement a minimal quality policy should not involve large agency rents.

²⁵In Bouvard and Lévy (2018), competition is positive because demand is driven by high-quality sellers, without whom low-quality sellers would have no interest in being certified. However, we can envision alternative scenarios in which certifiers primarily seek to attract low-quality sellers.

applicable to the academic publishing market, because authors cannot sell their articles directly to readers but are obliged to use an intermediary (the journal), while Stahl and Strausz's argument rests on the fact that certification is optional, and therefore informative. It seems important, nevertheless, to retain the idea that the decision to submit an article to a given journal contains potentially valuable information on the intrinsic quality of the article. This informational content is larger if the journal is selective and the submission fees high. Accordingly, journals can use submission fees to screen submissions: an author who believes he is very unlikely to have his paper accepted at a journal might give it a try if submission is free or cheap but is likely to be deterred from submitting if the submission fee is sufficiently large and publication odds are too small.²⁶

4 Policy perspectives

In the previous sections, we have investigated the possible welfare impact of a switch to open access in light of the theory. In this section, we adopt a more practical perspective. We first report evidence from the literature aiming at evaluating empirically the impact of open access on dissemination. We then discuss the various ways available in practice to increase open access, including a transition scenario.

4.1 Impact of open access on dissemination

A substantial empirical literature has sought to establish a link between dissemination (measured by the number of citations) and open access. While there is a clear positive correlation between open access and the number of citations, it is difficult to establish a causal link because of a possible selection effect: articles published in open access may well be more cited because they are of higher quality on average (for whatever reason), and not because of their free circulation. Until the mid-2000s, empirical studies did not take this selection effect into account, which led to massively overestimate the impact of open access on citations. More recent papers try to control for this selection effect and mostly conclude for a rather limited effect of open access on citations.

Gaulé and Maystre (2011) uses as an instrument the timing of submission during the year, noting that at the end of the year authors are more likely to have left-over budgets to consume. This plausibly exogenous source of variation thus impacts the willingness to pay to publish. Based on this instrument, their analysis suggests the absence of causality between open access and citations. Using data from journals in ecology, botany, multidisciplinary sciences and biology between 1996 and 2004, McCabe and Snyder (2014) estimates that the shift from the traditional system to open access has increased article

²⁶Notice that another way to screen is by playing on response time to process the submission (Muller-Itten, 2021).

citations by 8%. This increase is chiefly concentrated on articles published in the best journals. Articles published in lower-quality journals were cited less often than they were before the change. They explain this phenomenon by competition to capture readers' attention. Using the same dataset, McCabe and Snyder (2021) shows both theoretically and empirically that posting a free version of an article on the journal's website has a monotonic effect over the quality spectrum: negative for the least cited articles and positive for the most cited. For low-quality articles, carefully reading the paper makes it possible to realize that the information conveyed in the summary was incomplete and that the results of the paper are less relevant than initially thought. This explains the negative effect of open access for such articles.

Mueller-Langer and Watt (2018) investigates the case of applied mathematics and economics journals between 2006 and 2012 and exploits an agreement between Springer and several universities that offers free access to authors at those institutions. The analysis of this natural experiment eliminates any selection effect for authors attached to the universities enrolled in the agreement. Mueller-Langer and Watt did not find that authors in this "treatment group" had more citations when there are pre- or post-publication versions available in open access (the last draft of the article before it is published, or the version published after an embargo period, for example), when the authors are affiliated to one of the best 500 universities, or when authors who cite the articles have unlimited access to articles via their institutions. But they found that when pre- or post-publications are not available, the shift to open access had a positive effect on the number of citations.

4.2 New models for academic publishing

According to Section 2, publishers are unlikely to spontaneously switch to an economic model based on open access. Significant changes in the market will thus stem either from stronger cooperation between researchers and institutions to increase their bargaining power vis-à-vis publishing houses, or from regulation. In this respect, there have been important changes in public policy. On September 4, 2018, an international consortium of public and private research funding organisations, with the support of the European Commission and the European Research Council (ERC), announced the launch of cOAlition S, an initiative to promote open access.²⁷ This initiative revolves around Plan S, which notably imposes that, "*with effect from 2021, all scholarly publications on the results from research funded by public or private grants provided by national, regional and international research councils and funding bodies, must be published in Open Access Journals, on Open Access Platforms, or made immediately available through Open Access Repositories without embargo*".

Still, the definition of open access is sometimes blurred as to whether an open access

²⁷See <https://www.coalition-s.org>.

article is simply one that can be read for free, or whether it can also be kept and reused, in accordance with the Budapest Open Access Initiative (*free to read and free to reuse*). Among articles in open access, there are also different degrees of openness: the whole journal might be available for free; or access to the journal might be costly but some articles available free of charge. In what follows, we try to clarify and discuss the various options considered by public authorities to increase dissemination and better regulate the market of academic publishing.²⁸ Of course, several policy objectives may be pursued (e.g., efficiency, dissemination, curbing market power, quality of publications, limiting the cost of public funds), each of them potentially warranting different types of policies or regulation.

4.2.1 Gold open access

One of the most debated options is the gold regime whereby access is completely free.

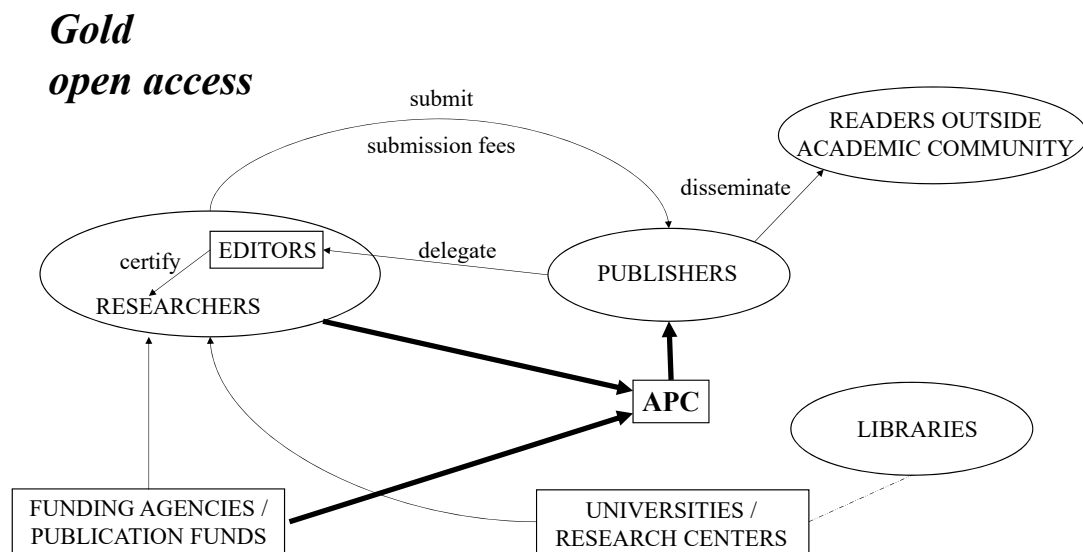


Figure 2: The gold regime.

In gold open access journals, authors pay Article Processing Charges (APC) upon acceptance.²⁹ For instance, the APC for a research article amounts to 2100 USD in PLOS Climate, PLOS Global Public Health and PLOS Water, to 5500 USD in PLOS

²⁸See also the discussion in Armstrong (2021).

²⁹See Figure 2 for an illustration of the organisation of payments.

Biology and to 6300 USD in PLOS Medicine. According to Blanchard *et al.* (2022), in 2013, the average APC paid by French-based authors for articles in gold journals amounted to 1395 EUR. In 2020, it had increased to 1745 EUR. These APC should be distinguished from possible submission fees that are paid at the submission stage, i.e., before an editorial decision is made.³⁰ The absence of fees on the reader side brings the market close to a “one-sided” oligopolistic model (see Section 2.5). The externalities generated on the reader side cannot be captured by publishers as in the reader-pays model. The price chosen on the author side is then determined by the classic trade-off between extracting a part of the author’s surplus through high APC and attracting sufficiently many submissions. Two possible welfare issues arise in such a context. First, the exclusion concern moves from readers to authors. In particular, young researchers with potentially limited financial support and for whom publications in high-quality journals is key to have access to research funds or to promotion could particularly suffer in a generalized gold access regime.³¹ Such exclusion concerns feature among the reasons why the European Research Council decided to withdraw its support to cOAlition S in 2020.³² Second, as Armstrong (2015) stresses, publication fees are most often paid by the institution to which the author is affiliated. Since authors are often unaware of the actual cost paid by their institutions, they are little price-sensitive, which tends to increase markups. Observe that a general shift to gold open access would impose a reshuffling of library funds to publication funds. Smith *et al.* (2016) suggests that, under a gold regime, APC may increase rapidly unless there are controls to limit market power.³³ To keep APC affordable, it is important to make sure that competition for authors is sufficiently intense. That can be accomplished by making authors accountable for the amounts they spend on APC, e.g., by granting them discretionary funds that they directly control (research budgets). This would increase their price sensitivity and significantly reduce publication fees.

In terms of quality, publishers will possibly face conflicts of interest under the gold regime given that their income comes from authors (see Section 3.2). We might also note, like Armstrong (2015), that the gold open access could alter the refereeing and dissemination process specific to academic publishing. This process benefits not only authors, but also readers who thus have access to articles of better quality. More generally, if readers stop paying, publishing companies might cut their efforts to supply high-quality service to readers (ease of access, rendition, reliability of the archiving service...), which

³⁰Such submission fees are common notably in economics, finance and accounting.

³¹Note that some economics journals propose a waiver for authors from low-income countries where research funds are typically very limited.

³²<https://erc.europa.eu/news/erc-scientific-council-calls-open-access-plans-respect-researchers-needs>

³³In particular, Smith *et al.* (2016) estimates that, “for the most research-intensive North American research institutions, the total cost to publish in a fully article processing charge-funded journal market will exceed current library journal budgets”.

may also damage quality.

4.2.2 Hybrid open access

Several publishers have recently started to offer authors the option of publishing at their own expense: authors of accepted articles can decide to pay APC and then retain their copyright and make their article freely accessible. Such a regime is said to be hybrid, since it is a mix between the reader-pays and author-pays regimes where authors self-select into the regime they prefer. The introduction of this hybrid regime appeared as a response of publishers to the growing pressure of public authorities and organisations towards more open access (McCabe, Snyder and Fagin, 2013). While Springer was the first major publisher to offer the hybrid option on a large scale in 2004, the volume of articles published as hybrid open access has increased dramatically since then (Laakso and Björk (2016), Piwowar *et al.* (2018)): according to Jubb *et al.* (2015), around 50% of all journals across the world had adopted the hybrid model in 2015.

One of the main criticisms of this hybrid option is the potential “double dipping” problem, that is, the fact that access is charged twice: through the subscription price and through APC. An important concern is that the total publication fees are larger in the hybrid regime. This might actually be an unintended consequence of regulation. Indeed, as Laakso and Björk (2016) observes, “*(c)hoosing the hybrid option is for many authors an easy option for complying with OA mandates set by funders and universities, policies which are increasingly common*”. In lots of instances, the hybrid formula is the only way to make sure an article is open access. Authors who have to comply to such an open access regulation thus have a very inelastic demand for the option, which most likely explains why APC are much larger in the hybrid regime than in the gold regime.³⁴ Smith *et al.* (2016) observes that the price paid for publication in a full OA journal amounts to 1865 USD on average whereas this amount reaches 2887 USD in a hybrid journal. Using the data from 23 UK university libraries, Pinfield *et al.* (2016) notes that “*hybrid subscription/OA journals are consistently more expensive than fully OA journals*”.³⁵

Arguably authors may also want to pay for the option in order that their article be more read and, henceforth, more cited. As we explained in Section 4.1, whether open access increases or reduces citations is still a debated question in the empirical literature. Gaulé and Maystre (2011) finds that “*authors of higher quality papers are more likely to choose open access in hybrid journals which offer an open access option*”. The same conclusion is reached by Besancenot and Vranceanu (2017), that proposes a theoretical model where authors of the best quality articles disproportionately select the expensive

³⁴In economics, the hybrid option amounts to 4,600 USD for *Econometrica*, 2,500 USD for the *Journal of Political Economy*, 6,977 USD for the *Quarterly Journal of Economics* and 4,535 USD for the *Review of Economic Studies*, while in pure (gold) open access journal like *Quantitative Economics* or *Theoretical Economics*, APC are 10 USD per page.

³⁵See Mittermaier (2015) and Björk and Solomon (2015) for instance.

option of making their articles copyright free. This is, in effect, a way for authors to signal the high quality of their papers because authors of good articles get a larger payoff from being read, and have thus stronger incentives to increase their readership by paying to grant free access to readers.³⁶

4.2.3 Green open access

The green regime (or partial open access) in which a so-called inferior version of the published article is publicly available for free gets around some of the problems created by the reader-pays and gold open access models.³⁷

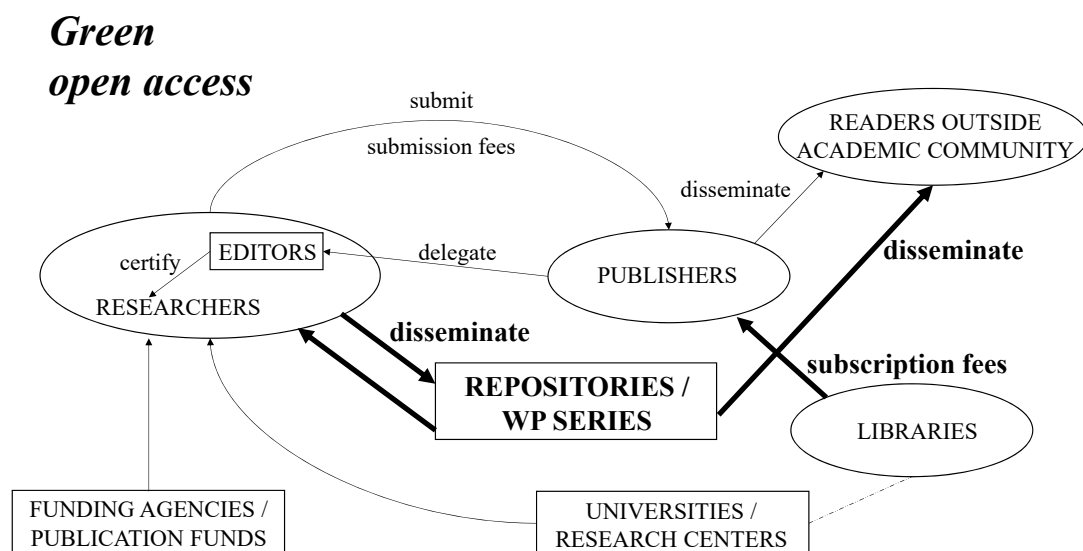


Figure 3: The green regime.

By inferior version, one may refer to an earlier version (e.g., the last working paper version of an article before publication) or the published version itself made available after an embargo period of a few months. The coexistence of the published version and the (free) inferior version creates vertical competition between the two. Journals must then set subscription prices lower than in the traditional system if they want libraries to

³⁶Note that this argument may be disputed in that the primary source of heterogeneity between authors' willingness to pay has much more to do with the availability of research money than with the quality of papers. So one may think that the exercise of the option signals the abundance of research money rather than quality.

³⁷See Figure 3.

subscribe. While libraries would always prefer to have access to the superior version of any article, their demand becomes more elastic due to the availability of the inferior version (if the price is too high, libraries can fall back on the inferior version). As a result, journals must cut subscription prices while access is wider thanks to the availability of the inferior version. Of course, the closer the two versions of the article the less journals can charge readers, which limits publishers' income. The two versions must be distinct enough so that journals cover their costs but also remain close enough to reduce publishers' margins and maintain the readers' interest (Armstrong, 2015).

As mentioned in Section. 4.1, Mueller-Lang and Watt (2018) shows that the impact of open access on dissemination is small in the presence of preprints and post-publications. Green access thus seems a good substitute for open access: it allows to limit the exclusion of authors and readers while preserving free access to high-quality articles. In sum, it appears that encouraging researchers to systematically publish different versions of their papers (on their web pages, or on archive repositories) would definitely contribute to the reduction of publishers' market power, and, as such, possibly constitutes a powerful policy lever.³⁸

4.2.4 Diamond open access

Diamond open access refers to a regime where there are no fees, either for readers or authors. Journals operating under this regime are mostly financed through institutions or charities with subsidies or donations.³⁹ In Europe, for instance, research activities are largely based on public funding. Public authorities can negotiate general agreements with publishers that cover both submission and access. Part of the funding could take the form of a fixed payment based on usage predictions. Such general agreements already exist for institutions of a certain size, such as the CNRS and the Max Planck Institute, and for groups of institutions.⁴⁰ This avoids inefficiently excluding readers and authors by making payments non-contingent. A residual cost could be kept in order to avoid bogus submissions and to optimize cross-group externalities.

Notice that, while the intervention of public authorities in a general agreement may influence negotiations with publishers to reduce its financial burden, such comprehensive agreements in the public research sector cannot solve the problem of high fees outside these agreements (e.g., access to science for the general public).

³⁸See also Dewatripont et al. (2006).

³⁹See Figure 4.

⁴⁰For instance, the transformative agreement between Springer Nature and the Max Planck Digital Library enables authors affiliated with participating institutions to publish at no cost their articles accepted for publication in Nature and Nature-branded journals in open access.

Diamond open access

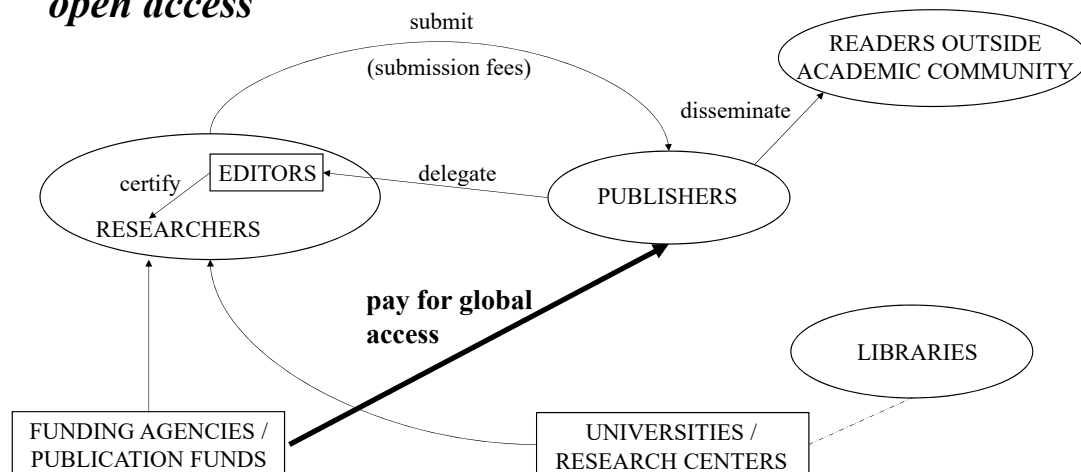


Figure 4: The diamond model.

4.3 Transition

Research essentially has a public good nature. Research outputs produced in a given part of the world benefit to the global research community. This interdependence calls for cooperation in the design of institutions that allow a better dissemination of knowledge. In the negotiations with publishing houses, there is some coordination going on between European players, and it will likely increase. However, coordination with other research players is out of reach as of now, even if some call for such coordination (for instance, Schimmer *et al.* (2015) and Shavell (2010) advocate that the copyright system be abandoned for academic publications). Assessing the efficiency of a proactive negotiation by European authorities requires thinking about the impact of Europe's policy choices on other regions (e.g., the potential ripple effect).

In the reader-pays model in which journals are funded at the international level by subscription fees, negotiating an open access policy in Europe necessarily has complex global consequences. Since other regions of the world will not accept to subsidise European research, the negotiation must be accompanied by an agreement on an alternative financing model in Europe – through APC for instance. A distortion in the incentives to publish between Europe and the rest of the world would follow, which would modify the relative weight of academic publications and lead to cross-subsidies between different

regions of the world. For instance, a European open access article entirely financed by his author would be read by his American colleague, who would publish at no cost an article that the European researcher would have to pay to read. European research would probably be read and cited more often, but at the cost of American research being subsidized by European research. A solution might be to condition access on reader location. Free access to articles written by European researchers who paid APC could be possible only for European readers using the URL of their institutions. However, this might not be sufficient. Indeed, the coexistence of several publication regimes makes the negotiation more opaque because it involves multiple tariffs that are largely private, rather than a simple subscription fee. As a result, it becomes possible for publishers to double charge for the publication of an article written by Europeans and read at a large cost outside Europe. The significance of submission fees and library subscription fees reinforces this fear.

5 Conclusion

In this paper, we have discussed some of the main characteristics of academic publishing, presented the various possible forms of open access, and analyzed their impact on the different players of the academic market (readers, authors, libraries, research institutions). We chose to leave aside some topics relevant to academic publishing but not directly related to the transition to open access like the negotiation of global agreements.⁴¹

While the gold regime seems the most natural way to achieve open access, a generalized switch to open access may also have undesired consequences: projections indeed suggest that a massive move towards the gold regime would generate an explosion in the amount of APC unless there are controls to limit market power.⁴² Beside the sharp increase in APC, the shift to gold open access may create conflicts of interest for publishers given that their income comes from authors and may alter the quality of publications. The green regime, by introducing competition between the journal's version of an article and a free public version, seems an efficient way to reduce market power while expanding access. In this light, a potentially powerful and harmless policy would be to systematically encourage authors to post a working paper version of their works in public repositories or on their webpages.

Finally, let us stress that the movement in favour of open science arises in a much broader context where scientific publishing itself is being questioned following the publication in 2005 of Ioannidis' article "Why most published research findings are false". As a

⁴¹Jeon and Menicucci (2017) notably raises the important question of the optimality of building library alliances in the face of publishers' market power.

⁴²In an extreme scenario where 90% of all articles by France-based corresponding authors would be gold open access and 10% diamond open access, Blanchard *et al.* (2022) shows that the total amount of APC would be multiplied by 5.6 between 2020 and 2030.

reaction, several journals have introduced policies intended to systematically monitor the reproducibility of published research. This welcome development raises a number of questions related to open access. On the one hand, the reproducibility process is costly and hence might increase fees for authors in an open access world; on the other hand, one may wonder whether journals would have the same incentive to invest in high reproducibility standards if authors pay as if readers pay.

Overall, the various axes of regulation of the academic publishing market (dissemination, certification, reproducibility, not to mention questions of scientific fraud) are all intertwined, and it is important to approach these issues using a global perspective.

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