

The ‘Must Stock’ Challenge in Academic Publishing: Pricing Implications of Transformative Agreements*

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The high relevance of top-notch academic journals turns them into ‘must stock’ products that assign its often commercial owners with extraordinary market power. Intended to tackle this, university consortia around the globe negotiate so-called ‘transformative agreements’ with many publishing houses. It shall pave the way towards standard open-access publishing. While several contract designs exist, the ‘publish-and-read’ (PAR) scheme is the one that comes closest to the ideal of an entirely open access environment: Publishers are paid a fixed case-by-case rate for each publication, which includes a fee for their extensive libraries. In turn, all subscription payments are waived. I theoretically derive that this contract design benefits the included publishers regardless of whether the number of publications in these publishers’ journals grows or declines. Consequently, widespread PAR contracts are likely to raise entry barriers for new (open-access) competitors even further. Intending to lower costs for the universities, their libraries, and, ultimately, the taxpayers, this PAR fee contract design of transformative agreements might cause the opposite.

JEL Codes: D43, D86, L14, L86, L12

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1 Introduction

“Universities and research institutions have been spending more and more money each year on journals as the scientific publishing market’s oligopolistic structure prevents competition and price transparency. . . . As many institutions are no longer able to afford an adequate supply of key literature, informal channels of exchange and piracy platforms are emerging, gradually undermining the authority of the scholarly publishing system.”^a

^aStatement of the DEAL consortium: <https://deal-konsortium.de/en/about-deal/rationale-and-objectives>, last checked June 27, 2023.

The criticism of the academic publishing market from the ‘DEAL’ consortium, which unites most German research institutions, is harsh. It negotiated so-called ‘transformative agreements’ (TAs) with Springer Nature, Wiley, and recently Elsevier, the three most prominent academic publishers, to tackle the leading publishers’ price increases and market power. Institutions without such contracts pay both subscription fees to access a publisher’s journal portfolio and publication fees for publishing papers with open access. Transformative agreements can take different forms. Closest to the envisioned fully open access environment are contracts based on a single ‘publish-and-read’ (PAR) fee: Affiliated institutions only pay a fixed fee per article published in an eligible journal with open access included by default. This is the ‘publish’ part. The PAR fee also encompasses a ‘read’ part that covers access to the publisher’s portfolio of past publications. In turn, subscription fees are waived (Hinchliffe, 2019).

This setting raises the economic question of how these contracts work, how the incumbent publishers may benefit from them, and how new market entrants without such an agreement may be affected. Generally, transformative agreements are on the rise. While only in 2020 some 100,000 articles had been published under some TA, it grew exponentially to some 600,000 in 2022 and nearly 900,000 publications in 2023.¹ While this development is often seen as evidence of change in the publishing market, it remains an open question whether this is a change for the better.

¹See the data from the ESAC Initiative, <https://esac-initiative.org/market-watch/#TAs>, last checked March 5, 2024. These numbers encompass all types of transformative agreements.

In this paper, I study how publishers that concluded such transformative agreements may adjust their PAR pricing in response to an exogenous change in the number of publications in their journals. It could be caused, e.g., by a shift away from a publisher due to requirements by third-party funding, public boycotts, or generally changing publishing preferences of academics. I theoretically demonstrate that established publishers with many papers behind subscription paywalls may exploit the ‘must stock’ dilemma in academic publishing: Universities must provide their researchers with at least the leading journals of every discipline. Even though intended to cause the opposite, the design of transformative agreements may actually increase prices in a market shifting towards open access. Furthermore, it may raise barriers to market entry, which will perpetuate the ruling position of the incumbent commercial publishers. Given the significance of the academic publishing market, examining these contracts from an industrial economics perspective is essential but has yet to be addressed.

The academic publishing market is considerably large. It has a size of some 19bn GBP or 21.5bn EUR annually, which ranks it between the music and the movie industry (Buranyi, 2017).² The five leading publishers own or manage more than 12,000 journals, leading to a market share of more than 40% among the largest 100 publishers (Nishikawa-Pacher, 2022). The revenue generated by the first two German DEAL contracts is also considerable. The publish-and-read fee to be paid by the universities amounts to 2,750 EUR per article.³ Based on an expected amount of 19,000 annual publications in both Springer Nature and Wiley journals (Schmal, 2024), this accumulates to annual payments of 50.25 million EUR.

Through its crucial role in disseminating novel knowledge, the academic publishing market ties in with science, innovation, and, ultimately, economic growth. The high

²GBP-EUR conversion using the exchange rate from the publication day of the article, June 27, 2017), see <https://www.exchangerates.org.uk/EUR-GBP-spot-exchange-rates-history-2017.html>.

³Note that the renewed contract with Wiley (2024-2028) is based on a staggered PAR fee with three tiers, 3150, 2700, and 2200 EUR, see <https://deal-konsortium.de/en/agreements/wiley>. The second contract with Springer Nature (also 2024-2028) still has a single PAR fee, now 2600 EUR with optional inflation upward adjustment, see <https://deal-konsortium.de/en/agreements/springer-nature>.

relevance of academic journals for the work and career of researchers turns the portfolios of large publishers into ‘must stock’ products (Choné & Linnemer, 2016), which endows their owners with high market power. In one way or another, universities need to provide them to their researchers by purchasing subscriptions, which are often sold as digital access to large bundles of journals (Bergstrom et al., 2014).⁴

It enables the leading commercial publishers to extract enormous rents from the scientific community (Larivière et al., 2015). Besides a fixed effort to maintain the server infrastructure, they face hardly any marginal costs of granting access to their repositories (Bergstrom et al., 2014), a common phenomenon in digital markets (Waldfogel, 2017). Researchers also contribute the content for free – they voluntarily write the articles, peer-review their colleagues, and serve on editorial boards (Puehringer et al., 2021).

In this paper, I study particularly the case of competition between an established publisher with a transformative agreement and a fully open-access publisher, as many stakeholders are dissatisfied with the large commercial incumbent publishing firms and hope for more competition, preferably from fully open-access providers. Furthermore, I apply my model under the assumption of fixed library budgets. Rising costs for providing scientific literature is a pressing issue for many mid-tier universities and even for leading institutions (Larivière et al., 2015).

By doing so, this paper contributes to the economic analysis of science. The economic implications of open access have been discussed by, e.g., Armstrong (2015) and McCabe and Snyder (2005). Somewhat related is also the analysis of Armstrong (2021) of the so-called ‘Plan S’ that shall encourage researchers to publish their work under open access but only takes the perspective of the scientists. Bergstrom (2001), Jeon and Rochet (2010), and Haucap et al. (2021) have pointed out the exaggerated economic position of journals – and, by that, implicitly their publishers – as they can be considered two-sided platforms (see, e.g., McCabe & Snyder, 2004), which come along

⁴One may get copies from print versions stored in libraries that are still available after a subscription cancellation, but it no longer applies to publications since a subscription has ended.

with the monopolization tendencies of network structures. While Haucap et al. (2021) and Schmal (2024) empirically study the transformative ‘DEAL’ agreements in Germany, they do not elaborate in detail on the economic implications for the publishers. McCabe et al. (2013) did the latter but compared subscription-based to open-access publishing in general and unrelated to transformative agreements.

Discussions on these kinds of contracts are topical in information and library sciences. They often focus on the extent to which these agreements help to foster open access (see, e.g., Bansode & Pujar, 2022; Borrego et al., 2021; Farley et al., 2021; Moskovkin et al., 2022). Björk (2017) already predicted that the general transition towards a fully open-access publishing landscape would not challenge the strong position of the large commercial publishers. A recent study by Jahn (2024) finds that transformative agreements preserve the dominant position of the ‘big 3,’ Elsevier, Springer Nature, and Wiley. The results correspond with the Butler et al. (2023), who identify the ‘big 3’ as the largest benefactors of open access fees regarding revenues, whereas TAs are the strongest driver of open access income for Elsevier and Wiley. Shu and Larivière (2024), among others, discuss the publishing fees for open access articles as a form of “knowledge tax” and also find the publisher monopoly to prevail also with large scale open access adoption. The present paper is the first to model publisher behavior in a transformative agreement theoretically. It reveals notable economic effects that are likely to be unintended – and up to now overlooked – by the proponents of transformative agreements.

The remainder of this paper is structured as follows. In Section 2, I sketch the institutional setting of the academic publishing market in more detail. Section 3 presents a parsimonious model to formalize the analysis, Section 4 elaborates on how an incumbent publisher with a TA would optimally set the PAR fee and the economic implications based on the optimal fee setting. Furthermore, I formalize the competition issue of the market entry of a fully open-access publisher. In Section 5, I discuss the policy implications of the findings above. Section 6 concludes.

2 Institutional Environment

In the world of postal mail and printing presses, academic journals relied on a subscription model. Researchers would publish their work free of costs (ignoring potential submission fees) and universities would subscribe to the journals to get printed copies they can store in their libraries to be available to their researchers. With the widespread roll-out of the internet, academic publishers could not only use an additional distribution channel for their journals but also the idea of open access emerged, namely that “literature is digital, online, free of charge, and free of most copyright and licensing restrictions” (Suber, 2012, p. 4). Without access restrictions, such as paywalls, the established business model of publishers by selling subscriptions does not work anymore. While in this system, publishing is free and reading is costly, open access upends this. Now, reading is free but, in turn, publishing becomes costly to ensure that the publishers are still able to generate revenues.⁵

This led to a coexistence of two business models, the continuing presence of restricted access journals that require a subscription, nowadays mostly organized via institutional online access to large journal portfolios such as ‘sciencedirect’ hosting all Elsevier journals or the ‘Wiley Online Library.’ On the other hand, there exist fully open access publishers such as the Public Library of Science (PLOS) or the Multidisciplinary Publishing Institute (MDPI) that host solely open access journals, which charge an ‘article processing charge’ (APC) as publishing fee. The large established publishers such as Elsevier, Springer Nature, or Wiley also run several fully open access journals that do not require any subscription in parallel to their subscription-based journal portfolio, for example *Nature Communications* run by Springer Nature.

Between the two business models, the incumbent publishers installed the so-called ‘hybrid open access,’ which allows authors to purchase open access for their own paper published in a journal requiring a subscription such that everyone can read only this

⁵There is the exemption of the so-called diamond open access, which is also explained in more detail in Section 5, where neither reading nor publishing is priced. This is only possible by third-party funding that covers the costs of running journals under such a scheme.

particular article in the journal for free (Laakso & Björk, 2016). Financially, this is highly beneficial for the publishers as it allows for ‘double dipping’ as they can charge fees for a published article twice: They get the APC revenue from publishing an article under an open-access license and still sell subscriptions to the journal (Sotudeh & Estakhr, 2018). Furthermore, the leading commercial publishers began to sell the subscriptions to their journals in large bundles (Bergstrom et al., 2014) and exerted the market power of their flagship journals (Dewatripont et al., 2007), which has been also found to be the case for the price setting of open access publishing fees (Budzinski et al., 2020; Zhang et al., 2021).

Even though open access to publications appears to be the main target of transformative agreements and not changing the market environment, this has not been the case in Germany, at least initially. Looking at older versions of the website of the ‘DEAL project,’ the first paragraph on the aim of the project states: *“The intention is also to bring about significant change to the status quo in relation to negotiations, content and pricing in the process. The effects of a consortium agreement at the national level should relieve the financial burden on individual institutions and bring wide-scale, lasting improvements in access to scholarly literature for academics. An open access component is also planned.”*⁶ It was only later that the consortium shifted its (communicated) attention towards fostering open access.

Thus, transformative agreements are, at least partially, meant to tackle the market power and resulting pricing behavior of the large commercial publishers. The present paper theoretically demonstrates that the particular design of the central ‘publish-and-read’ fee in the medium- and long-run may not lead to this expected outcome.

The necessity to subscribe to the publishers’ journal portfolios in the first place is rooted in their core role of academic libraries as literature providers for faculty and students (Puehringer et al., 2021; Klain Gabbay & Shoham, 2019; Hoppenfeld &

⁶See, for example, the copy of the project’s website from December 19, 2018 stored in the web archive: <https://web.archive.org/web/20181219162543/https://www.projekt-deal.de/about-deal/>, scraped on December 19, 2018, last checked July 27, 2023.

Smith, 2014). For obvious reasons, they need to provide at least the leading journals of each discipline, which turns them into ‘must stock’ goods. An objection to the ‘must stock’ proposition is the existence of predatory repositories, such as ‘sci-hub,’ that infringe copyrights to provide peer-reviewed research for free. Relying on such loopholes undermines the publishing system as a whole, according to Himmelstein et al. (2018), or may even strengthen the subscription-based system (Strielkowski, 2017) as in the entertainment industry, which open-access advocates do not intend. Last, official bodies like universities are not entitled to officially refer to predatory repositories and condemn these bypaths, as the initial quote shows. Legal repositories storing primarily working paper versions, such as *SSRN* or *arXiv*, are also no realistic alternative, as preprints may change substantially throughout the review process. Also, not all disciplines share their work ahead of publication.

3 Model

The novelty of transformative agreements is the change in the revenue structure. With established subscription fees, the publisher’s revenue consists of fixed lump-sum payments from university libraries to access a publisher’s current and past publications repository. There might be a variable element depending on the number of students enrolled or the overall number of readers from one institution. However, it is independent of the publication behavior of a university’s researchers. Transformative agreements now abolish the subscription fees and replace them with a – on first sight – payment structure fully independent of the publisher’s repository of published papers. Now, a publisher is paid a fixed fee *for every published article*, which I call ϕ . This fee is meant to cover the costs of publishing the particular article for which it has been paid (the ‘publish’ component). It also includes a portion to cover access to the publisher’s portfolio (the ‘read’ component). Even though the publish-and-read (PAR) fee ϕ is a single payment that is not decomposed further, one can analytically interpret it as a

compound of two parts as follows:⁷

$$\phi = \alpha\pi + (1 - \alpha)\rho. \quad (1)$$

Here, π represents the ‘publish’ part, ρ the ‘read’ part, and $\alpha \in [0, 1]$ describes a weighting parameter, i.e., to which extent the publisher emphasizes the publishing costs or the reading costs, respectively. Important for the relevance of ρ is that the publisher with the transformative agreement (TA) continues to publish papers from institutions without such a contract with restricted access that requires a subscription. Only in this case, the publisher can exploit the fact that it possesses a stock of important ‘must stock’ publications for which a reading access is preferable or even necessary.

Before looking at the profit maximization of the publisher, it is worthwhile considering the PAR fee ϕ further. Even though ϕ is negotiated as one fixed amount, for example, in the contracts between the publishers Springer Nature, Wiley, and the German research institutions, an internal decomposition is likely and reasonable, i.e., a separation into two distinct components that add up to one fee. Here, I assume a free adjustment of ϕ , which is a substantial simplification of the actual bargaining situation. Nevertheless, it allows an understanding of the underlying dynamics of these contracts in combination with the ‘must stock’ issue caused by incumbent publishers with many publications with access restrictions. Hence, when setting the optimal value for ϕ , the publisher considers the number of publications N for the ‘publish’ part as a higher demand should, *ceteris paribus*, lead to a higher π . The decisive variable in this analysis is N because, based on the reformed payment model under the transformative agreements, the number of publications is the only source of revenue for the publishers.

Second, and important for the analysis, the relative importance of the publish and

⁷ Even though there exists no proof that publishers analytically decompose the prize in the described way, there exists suggestive evidence from the publishers themselves, see, e.g., the criticism from Elsevier that transformative agreements do not acknowledge the value of the stock of research provided by the publisher: <https://www.deutschlandfunk.de/konflikt-zwischen-hochschul-en-und-elsevier-100.html>. Michael Bøddeker interviewed Hannfried von Hindenburg (Elsevier representative), published on August 8, 2018. Last checked June 26, 2023.

the ‘read’ part is likely to depend on the number of publications N as well. Consider the two corner solutions of zero publications and zero interest in the publisher’s repository. In both cases, adjusting the weighting parameter α is reasonable so that either π or ρ cancels out. Therefore, I propose that both π and α are functions of N . This leads to a refinement of eq. 1 as follows:

$$\phi = \phi(\pi, \rho, \alpha) = \alpha(N)\pi(N) + (1 - \alpha(N))\rho. \quad (2)$$

The assumption of the weighting parameter α as a function of the number of publications N is crucial for my model as it determines the optimal analytic weighting of the ‘publish’ and the ‘read’ part. It follows straightaway from the initial decomposition of ϕ since $\phi \stackrel{!}{=} \pi + \rho$ also implies a weighting and the α only makes this weighting obvious and flexibilizes it. Last, formulating α as a function of the number of publications N endogenizes the exogenous weighting parameter since it can now react to the only parameter that can be varied exogenously, namely the number of publications within the journals covered by a transformative agreement.

I assume the ‘publish part’ function $\pi(N)$ of the PAR fee ϕ to be a twice differentiable, concave function as prices are arguably increasing with the relevance of a publisher captured by the number of publications, but the price cannot infinitely grow. In theory, the fee paid per paper could also decrease as there is fixed cost degression. However, Budzinski et al. (2020) and Borrego (2023) show that there exist additional exogenous confounders such as reputation that affect (APC) publication fees of journals. Therefore, it is unlikely that publishers negotiating a TA abstain from this consideration when calculating their PAR fee. The number of publications does not directly affect reputation, but, of course, high demand signals researchers’ interest in the journals of the publisher.

I assume the same behavior for $\alpha(N)$. For the sake of simplicity, I assume the publisher can set take-it-or-leave-it (TIOLI) prices without any bargaining. Even though

this is not entirely realistic, it helps to highlight the ‘must stock’ problem. Furthermore, the conditions of transformative agreements are usually fixed over several years. For analytic simplicity, I abstract from that friction in my analysis. However, the underlying mechanics are the same.

What is particularly special about the institutional environment is that even though π and ρ can be set autonomously by the publisher, creating a demand function is somewhat difficult because buyers and users of the service (publication) differ. Plenty of stakeholders such as university councils, university libraries, legislators, funding agencies, and science functionaries participate directly or indirectly in price negotiations and product design, for example, what kinds of access they demand. In contrast, the core users of academic publications (both reading and publishing), namely the researchers, have a rather small to no say in how the publication system is designed, how much is paid from whom to whom, and so on.

While the researchers create revenue through publishing their papers, universities or their libraries somewhat independently negotiate with the publishers and buy the publication service as well as access to a publisher’s publication portfolio. Thus, it is difficult to construct a demand function in a common way. As an alternative, I examine what happens with the optimal setting of the fee ϕ in response to a change in the number of publications N and, as a consequence, how this affects the publisher’s profit under a transformative agreement given that there continue to exist publications from institutions not covered by such a contract. I define the profit function of a publisher under a transformative agreement as follows:⁸

$$\Pi_i = N(\phi - c) - F \tag{3}$$

Revenue is generated by the number of published papers N multiplied by the price it charges for each publication, the publish-and-read fee ϕ . The variable c shall capture

⁸For the sake of simplicity, I truncate the i subscripts at the parameters N , ϕ , c , and F here. Furthermore, I abstract from revenue generated by submission fees because there is no plausible argument why they should change due to the switch to a transformative agreement.

the variable costs for each publication and F represents fixed costs. Regarding a publisher's cost structure, the marginal costs of providing access to a paper do not depend on the number of publications, which I call N . With no loss of generality, I assume the costs of maintaining the digital repository of papers as a fixed amount F as well, given that in the digital age, variable costs of server usage are negligibly low. Second, I assume linear costs c for every paper published. Important to note is that for the profit function I only consider the revenues from the market in which the publisher concluded the transformative agreement, i.e., I abstract from subscription revenues generated in other countries, for example. Replacing ϕ in the publisher's profit function with the adjusted version provided in eq. (2) leads to:

$$\Pi_i = N(\alpha(N)\pi(N) + (1 - \alpha(N))\rho - c) - F \quad (4)$$

I use this profit function in subsection 4.2 to compute the optimal reaction of a monopolistic TA publisher to an exogenous change in the number of publications N . Optimally, I would base my analysis on a maximization problem of the publisher. Given that the PAR fee is fixed across journals and not paid based on the demand for published articles researchers want to read, but on the number of publications, the publisher can only react to changes in the publication behavior of scientists at institutions with transformative agreements. In the German case of the 'DEAL' contracts with Wiley and Springer Nature, even the initial setting of the PAR fee was rather fixed. As reported by Kupferschmidt (2019), the first German 'DEAL' contracts with Springer and Wiley were meant to be budget neutral, i.e., the PAR fee was based on the aggregated previous subscription costs of the participating institutions and divided by the number of expected publications. This resulted in a fee of 2,750 EUR per article. Thus, the publishers could not freely bargain the PAR fee here. Subsequently, they would have to adjust it based on this starting value, which is exactly what I model in the subsequent section on comparative statics.

4 Pricing Considerations of the TA Publisher

In this section, I evaluate the optimal firm behavior in response to a change in publications. Just as explained, I assume ϕ to be already in equilibrium, i.e., in default of a clear demand function, I do not compute the optimal price of ϕ but the optimal reaction to an exogenous change in publications from the researchers.

4.1 Optimal setting of the PAR fee

The core elements of this model are, due to the design of transformative publish-and-read agreements, the exogenous number of publications N , and, of course, the PAR fee $\phi(\pi, \rho, \alpha)$, in which its components are functions of the publications by themselves. Hence, the TA publisher adjusts ϕ in reaction to a change in publications as follows:

$$\frac{\partial \phi}{\partial N} = \frac{\partial \pi}{\partial N} \alpha(N) + \frac{\partial \alpha}{\partial N} \pi(N) - \frac{\partial \alpha}{\partial N} \rho \quad (5)$$

The derivative in eq. (5) consists of three parts. First, there is, for obvious reasons, the adjustment of the analytical publishing part of the fee, which is positive given the increased demand for journal space in the publisher's outlets. Second, there is an internal adjustment of the weighting between the 'publish' and the 'read' part captured by the parameter α . For every shift in the number of publications, not only is there a reason to increase the 'publish' fee π but also the weight of it in the composition of ϕ , i.e., $\frac{\partial \alpha}{\partial N} \geq 0$ must hold given that the 'read' part marginally loses its relevance as a contributor to the publisher's revenue.

It is easy to see that the modeling of ϕ as $\phi = \alpha(N)\pi(N) + (1 - \alpha(N))\rho$ always leads to a corner solution of $\alpha \in \{0, 1\}$. To study the effects of changes in the publication behavior of researchers on the profits generated by such a transformative agreement, one, therefore, needs a case distinction: Either the publication fee exceeds the library access fee ($\pi > \rho$) or vice versa ($\pi < \rho$). Technically, I abstain from the fringe case of $\pi = \rho$ as any adjustment in α between the two components of ϕ would be profit

neutral.

Figure 1 plots how ϕ is set as a function of $\pi(N)$ and ρ . The horizontal line captures ρ as it is – by assumption – independent of the number of publications N in the publisher’s journals. $\pi(N)$ increases in N as higher demand for journal space should increase its price. The plot highlights the functioning of this pricing. As long as $\pi(N) > \rho$ holds, the publication fee ϕ entirely consists of the publishing part (i.e., $\alpha = 1$). Once it switches to $\rho > \pi(N)$, the publisher focuses on its portfolio of past publications and uses this as pricing, i.e., $\phi = \rho$ and $\alpha = 0$. Hence, eq. (1) essentially becomes $\phi = \max\{\pi(N), \rho\}$, which the red line captures in the plot.

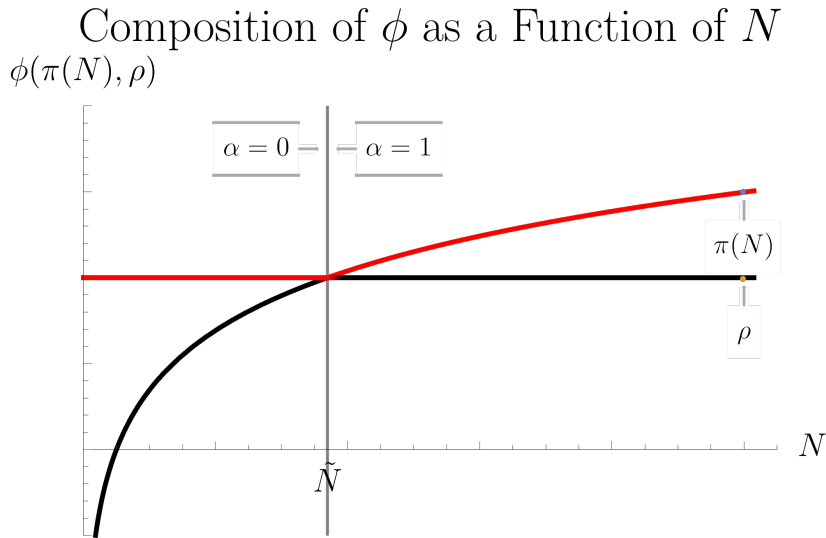


Figure 1: Optimal price setting of the PAR fee as a function of N

It is a trivial insight that the derivative of ϕ becomes 0 for all $N < \tilde{N}$, where α switches as $\frac{\partial \alpha}{\partial N} = 0$ for $\alpha = 1$. In contrast, $\frac{\partial \phi}{\partial N}$ becomes $\frac{\partial \pi}{\partial N}$ for $\pi(N) > \rho$, as in this case $\alpha = 1$ holds, such that only the ‘publish’ function pi matters for ϕ . Both is illustrated in Figure 1. It implies that the publisher has a ‘safety net’ for starkly decreasing interest in its journals (as a publication outlet) but can benefit from growing interest in them. This unilaterally beneficial fee setting for the publisher under a transformative agreement can be summarized as done in the following Proposition 1.

Proposition 1. *A publisher with a transformative agreement that possesses a portfolio*

of publications behind paywalls can monetize this portfolio by assigning the ‘read’ part ρ of the publish-and-read fee ϕ a higher emphasis in case the number of publications under the transformative agreement N fall below a certain threshold \tilde{N} , i.e.,

$$\phi^* = \begin{cases} \pi(N) & \text{if } N > \tilde{N} \rightarrow \alpha = 1 \\ \rho & \text{if } N \leq \tilde{N} \rightarrow \alpha = 0 \end{cases}$$

Even though the fee decreases in decreasing demand, this is stopped once \tilde{N} is reached due to the switch to relying entirely on the ‘must stock’ requirement embodied by the publisher’s restricted-access publications. ■

This pattern becomes even more pronounced once one replaces the definition of ρ as a constant with a function of N . Given the nature of supply and demand, assuming a concave function of the publishing part $\pi(N)$ is reasonable. However, no actual price can be inferred for the journal portfolio that is in the hands of such a publisher. First, the price is *per se* no function of publications as the interest in the library is not related to publishing new papers. It might be indirectly the case via the reputation built in the past. However, the reputation remains, at least in the short-run, the same regardless of the number of new publications. Second, a price based on paper requests or downloads is conceivable. But reading is not separately reimbursed anymore due to the design of the agreements based on the single publish-and-read fee.

Nevertheless, the concave shape of the pricing function of the publication part of the transformative publication fee suggests a reverse function modeling for the ‘read’ part from the publisher’s perspective. In particular, a convex function with the properties $\frac{\partial \rho(N)}{\partial N} < 0$ and $\frac{\partial^2 \rho(N)}{\partial N^2} \geq 0$ maximizes the publisher’s marginal revenue as it holds for ϕ that $-\frac{\partial \phi}{\partial N} > 0 \quad \forall \rho(N) > \pi(N)$. Figure 2 illustrates this.

With such a specification, the marginal revenue from a paper may actually *increase* even if the number of publications of this publisher diminishes. It is because of one reason: The TA publisher possesses monopoly power over the access to its journals,

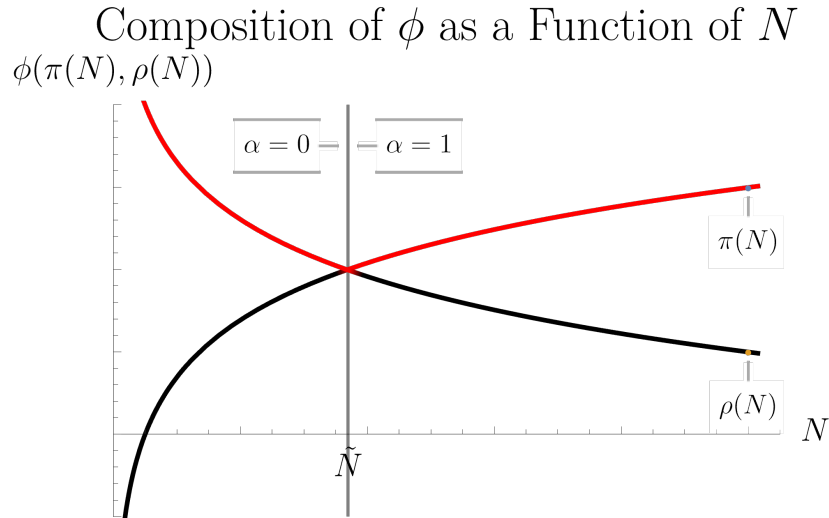


Figure 2: Optimal price setting of the PAR fee as a function of N with $\rho(N)$

especially to the leading outlets, for which access must be gained by the universities. Take the publisher Elsevier as an example. It hosts, among many others, the *Journal of Development Economics*, the *Journal of International Economics*, and the *Journal of Monetary Economics*. As long as researchers from universities without such TAs continue to publish in these journals without open-access, a stream of novel and, most likely, necessary research must be provided by the other universities to its researchers. Getting cut off from this body of research would be a significant problem for any research institution.

A prominent example is Germany, as the country’s universities and Elsevier parted ways over a dispute on how to model a joint transformative agreement. Consequently, researchers in Germany have no direct access to Elsevier anymore (Fraser et al., 2023; Schmal et al., 2023). Even though this may pose an objection to the put-forward argument of journals being a ‘must stock’ product, the way the German institutions deal with this cut-off strengthens the proposition.

In Germany, nowadays, exist hardly any subscription-based or transformative contracts with Elsevier.⁹ However, most universities offer its staff to order Elsevier publica-

⁹One notable exception is the transformative agreement between the minor Brandenburg University of Technology and Elsevier, see <https://www.b-tu.de/en/news/article/19647-open-access-publizieren-mit-elsevier> (published January 17, 2022, last checked June 26, 2023), which is, to the

tions for them on a case-by-case basis.¹⁰ Here, one can see that the German universities cannot fully overcome the ‘must stock’ challenge, but in turn, pay high amounts per article. According to the University of Cologne, it is approximately 35 EUR, to access *one* particular paper. Thus, the ‘must stock *per se*’ problem has been turned into a ‘must stock *per request*’ for Elsevier. This case underlines the central assumption of this paper and questions to which extent a hard exit from a leading incumbent publisher might be a viable alternative to the negotiation of a transformative agreement.

4.2 Profit of a monopolistic publisher

The specific dynamics of the publish-and-read fee outlined above directly affect a TA publisher’s profit. In this subsection, I examine the reaction of a single monopolistic publisher with a transformative agreement to a change in the number of publications in its journals, i.e., how the already outlined adjustment of the PAR fee ϕ affects the publisher’s profit. To do that, I compute the partial derivative of the publisher’s profit function, as shown in eq. (4), by N .

$$\frac{\partial \Pi_i}{\partial N} = (\phi - c) \tag{6}$$

$$\frac{\partial \Pi_i}{\partial N} = \underbrace{\alpha\pi(N) + (1 - \alpha(N))\rho - c}_{I} + N \left(\underbrace{\alpha(N)}_{II} \frac{\partial \pi}{\partial N} + \underbrace{\frac{\partial \alpha}{\partial N}(\pi(N) - \rho)}_{III} \right) \tag{7}$$

The upper equation (6) shows the ‘naive’ derivative of the simplistic profit function shown in eq. 3. Here, the publisher is a pure price taker, which implies a simple change in revenue minus costs, $\phi - c$.

Things get more involved once one considers the publisher under a transformative agreement not as a price taker anymore but as sensitive to changes in publications,

best of my knowledge, the only TA between Elsevier and a German institution.

¹⁰See, e.g., the offer to order Elsevier publications by the Heinrich Heine University Düsseldorf, <https://www.ulb.hhu.de/en/digital-and-on-site-services/loans-and-requests/translate-to-english-elsevier-aufsatzbestellung> (last checked June 26, 2023), the University of Cologne, https://www.ub.uni-koeln.de/res/forms/article_elsevier/index_eng.html (last checked June 26, 2023), or the University of Mannheim, <https://www.bib.uni-mannheim.de/en/research/sources/elsevier-journals-form/> (last checked June 26, 2023).

i.e., switching from constant terms for ϕ to $\phi(\pi, \rho, \alpha)$, i.e., to a function of π , ρ , and α , which again are functions of N . The lower equation (7) shows the respective derivative. It consists of three crucial parts. *I* essentially captures $\phi - c$ based on the definition of ϕ in eq. (2). Hence, this is equivalent to the plain derivative in eq. (6). Nevertheless, the two additional parts, *II* and *III*, contain two additional fee shifters. The first one – in *II* – is the change in the price of the ‘publish’ part due to the higher demand, i.e., $\frac{\partial \pi}{\partial N}$, which is weakly positive. This is because higher demand weakly increases ϕ for all publications.

Part *III* shows the adjustment of the weighting parameter $\alpha(N)$, which, in practice, only comes into play when switching from 0 to 1 or vice versa, given its character of a step function. Even though, in theory, the partial derivative is positive, and α could take any real value in the interval $[0, 1]$. Furthermore, part *III* contains the difference between the ‘publish’ and the ‘read’ part. Overall, the two demand shifters in the parts *II* and *III* are multiplied by the number of publications N .

Based on that step function, the TA publisher’s marginal profit depends on the relationship between $\rho(N)$ and $\pi(N)$. The case distinction of Proposition 2 below depicts this. Due to the concave ‘publish’ function and the linear or even convex ‘read’ function, a transformative agreement also implies a comparatively comfortable situation for these established publishers. In case the number of publications increases (given $\pi(N) > \rho(N)$), the partial monopoly situation allows to adjust of the general price per publication, which implies an increase that exceeds $\phi - c$, which would be the additional revenue without a price adjustment. On the other hand, a significant decrease in the number of publications triggers the publisher’s emphasis on the ‘must stock’ character of its existing publication portfolio. Hence, the decrease in marginal revenue gets tempered by $\frac{\partial \rho}{\partial N}$, which becomes positive for a decrease in N . Based on that, I state the following proposition:

Proposition 2. *The functional form of the optimal publish-and-read fee ϕ allows a TA publisher to increase its profit under increasing demand for publishing in its journals if*

$\alpha = 1$. Under decreasing demand, the decrease in its profit is dampened once it reaches the state of $\alpha = 0$. The partial derivative of the profit function by N illustrates this:

$$\frac{\partial \Pi}{\partial N} = \begin{cases} \pi(N) - c + N \frac{\partial \pi}{\partial N} > \phi & \text{if } \alpha = 0 \rightarrow \pi(N) > \rho(N) \\ \rho(N) - c + N \frac{\partial \rho}{\partial N} < \phi & \text{if } \alpha = 1 \rightarrow \pi(N) < \rho(N) \end{cases}$$

Once the threshold \tilde{N} is reached at which α switches to $\alpha = 0$, the publisher is better off exploiting the ‘must stock’ character of its restricted-access publications. This can reduce the continued decrease in revenue caused by a decline in TA publications. ■

Figure 3 shows how the profit function could look given the assumptions of a concave publish and a convex read part of the transformative publication fee ϕ . One can see that switching from $\alpha = 1$ to $\alpha = 0$ leads to a significant change in profits as the convexity of the read function $\rho(N)$ leads to an increase in the marginal and the overall profit. Of course, this cannot be sustained for very low values of N as the decrease in the actual number of TA publications at some point outweighs the increase in ρ .

Sketched Profit Function of the Publisher $\Pi(\pi, \rho, N)$

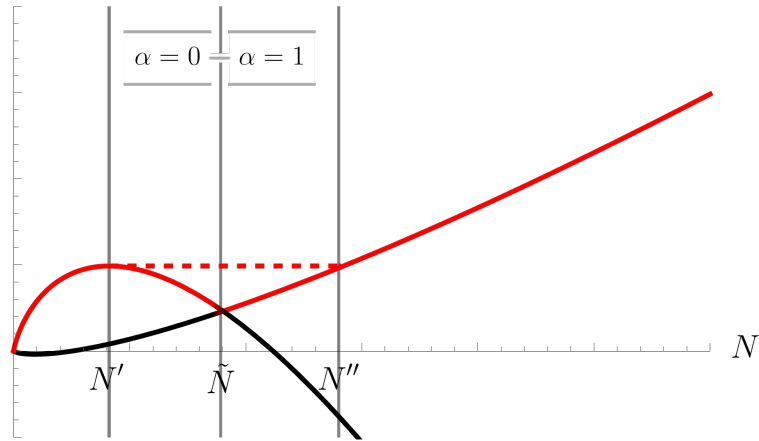


Figure 3: Profits as a function of N with $\rho(N)$

Nevertheless, this situation may get worse from the perspective of the university libraries. As the publisher wants to maximize profits, they likely set the profits based

on the value of ϕ that maximizes its profit as described by the red dashed line in Figure 3. In particular, it is reasonable for the publisher to entirely focus on its stock of papers much earlier and may sell this as the main asset when negotiating such transformative agreements. It stabilizes the publisher's profits in the interval $N \in [N', N'']$ with $N' \leq \tilde{N} \leq N''$ even though the number of publications is in decline. It emphasizes the prominent role of the existing repository of publications, as long as the TA publisher continues to publish papers requiring subscriptions from other countries or institutions without a transformative agreement.

One objection to the bargaining power of the incumbent publishers with a transformative agreement is that the relevance of the average publication diminishes over time. Hence, the older the stock of papers of a TA publisher, the less its power in negotiations. But the bargaining power remains strong as long as the inflow of restricted-access publications does not diminish.

4.3 Competition with a full open access publisher

After considering solely the situation of one publisher with a large stock of paywalled publications and a transformative agreement in place, now, I add a fully open-access publisher as competitor. The latter has, by definition, no stock of publications requiring subscriptions and cannot build any as every paper is published open access immediately. This scenario comes close to reality as there are, on the one hand, the large established publishing houses such as Elsevier, Springer Nature, and Wiley as well as new market participants such as 'Frontiers,' the 'Public Library of Science' (PLOS), or the 'Multidisciplinary Digital Publishing Institute' (MDPI) that dedicated themselves solely to open access publishing from the beginning on.¹¹

Consider now the case of an incumbent publisher with a TA and a fully open access publisher, for which I use the subscript OA, even though a TA publisher also

¹¹I set aside at that point the debate on whether some of the full open access publishers are so-called 'predatory' publishers that publish work regardless of its quality, see, e.g., Beall (2013), Bohannon (2013), and Kendall (2021).

publishes at least the publications made under the TA as open access. Given that the whole market in my model is covered by these two publishers, the total number of publications \bar{N} consists of

$$\bar{N} = N_{TA} + N_{OA}. \quad (8)$$

Second and crucial to the point I want to make is the assumption of the budget of the university libraries being fixed.¹² Hence, a library's budget B is composed as

$$B = \phi_{TA}N_{TA} + \phi_{OA}N_{OA}, \quad (9)$$

where ϕ becomes ϕ_{TA} as the publication fee of the TA publisher as defined in eq. (2) beforehand. Accordingly, ϕ_{OA} is the article publishing fee charged by the open access publisher and consists, by construction, only of a 'publish' part as there exists no repository of restricted-access publications for which a university could be charged. Hence, $\phi_{OA} = \pi_{OA}(N)$. While journals may be able to charge a higher *submission* fee at the beginning of the review process of a paper in response to a higher reputation, I set this aside in this computation. Further, I propose for the 'publish' functions that $\pi_{TA}(N_{TA}) \geq \pi_{OA}(N_{OA})$, because of the fact that the incumbent TA publisher might have some first mover advantage, e.g., due to its grown reputation. Again, I assume a twice-differentiable concave function with $\frac{\partial \phi_{OA}(N)}{\partial N} > 0$ and $\frac{\partial^2 \phi_{OA}(N)}{\partial N^2} \leq 0$. Also, I assume the slope of the 'publish' part function to be the same for both publishers, i.e., $\frac{\partial \pi_{TA}(N)}{\partial N} = \frac{\partial \pi_{OA}(N)}{\partial N}$. This is, of course, a simplification but a less severe constriction than assuming $\pi_{TA}(N) = \pi_{OA}(N)$. Furthermore, it is reasonable to assume that both publishers can *change* their fees in the same way in response to a change in demand. While differences in market power usually affect prices (Budzinski et al., 2020), it is reasonable to assume that it only shifts the 'publish part' function upwards and does

¹²This is not unrealistic because even well-endowed institutions such as Harvard University stated its incapability to pay for the expensive journal subscriptions, see, e.g., Sample (2012).

not change the functional form of the first derivative.

Equipped with these prerequisites, I look at how the market changes if the *relative* amount of publications shifts from one publisher to the other. This is because of the omnipresent calls to transform the academic publishing market. I assume that under the status quo, the TA publisher is in the $\pi(N) > \rho(N)$ case, i.e., it sets $\alpha = 1$ and focuses solely on the ‘publish’ part. The first case of a shift from the OA to the TA publisher is straightforward and not worth a closer examination. An increase in N_{TA} implies a growth in $\pi(N)$, by that, a growth in ϕ and a decrease in $\hat{\phi}$ as the demand for the OA publisher diminishes accordingly.

The changes are more involved for the opposite – and from many stakeholders desired – case: What happens when researchers shift from the incumbent TA publishers to the new fully open-access market participants?

For the sake of tractability, I assume a fixed number of publications. Notwithstanding the the long-run growth in academic output (Bornmann et al., 2021), the assumption of a fixed amount eases the understanding of a shift in market shares, which captures relative variation. Constant growth in N is easily conceivable, though, and would not change the results qualitatively. Given the nature of a fixed number of publications \bar{N} , $\Delta N_{OA} = -\Delta N_{TA}$ must hold. Then, the partial derivative of B by N_{OA} becomes

$$\frac{\partial B}{\partial N_{OA}} = \underbrace{\frac{\partial \phi_{OA}}{\partial N_{OA}} N_{OA}}_I - \underbrace{\frac{\partial \phi}{\partial N_{TA}} N_{TA}}_{II} + \underbrace{\phi_{OA} - \phi_{TA}}_{III} \stackrel{!}{=} 0. \quad (10)$$

I separate the above equation into three parts. Part *I* describes the change in the OA publisher’s fee ϕ_{OA} weighted by the number of publications as each change in the fee applies to all publications, not only to the marginal publication. *II* describes the ‘counterpart’ for the TA publisher. Under the assumption of a fixed amount of publications \bar{N} , a marginal shift towards the OA publisher implies a marginal negative shift away from the TA publisher. Accordingly, *II* describes the change in the fee

ϕ_{TA} of the TA publisher weighted by the remaining TA publications N_{TA} . Last, *III* describes the marginal change in the budget by switching one marginal publication from the TA to the OA publisher.

The derivative is set equal to zero as the budget shall not grow since I want to show how the relative growth of the full OA publisher affects the fee it can charge under the restriction of the presence of a TA publisher. Accordingly, rearranging leads to:

$$\underbrace{\frac{\partial \phi_{OA}}{\partial N_{OA}} N_{OA}}_I = \underbrace{\frac{\partial \phi_{TA}}{\partial N_{TA}} N_{TA}}_{II} - \underbrace{(\phi_{OA} - \phi_{TA})}_{III}, \quad (11)$$

where the Latin indices of the square brackets below the equation correspond to those in eq. (10). Now, it is worth evaluating which sign the LHS of eq. (11) takes under the condition of a fixed library budget B . Naturally, it should be positive, given the increasing demand for publications from the OA publisher. However, it depends on the change in the TA publisher's pricing. In particular, it is crucial in which area of the ϕ_{TA} composition curve the TA publisher finds itself. For $\alpha = 1$, only the publish part matters, i.e., $\frac{\partial \phi_{TA}}{\partial N_{TA}} > 0$. Hence, given the previously stated assumption of $\frac{\partial \pi_{TA}(N)}{\partial N} = \frac{\partial \pi_{OA}(N)}{\partial N}$, it must hold that $\phi_{TA} \geq \phi_{OA}$ as $\pi_{TA}(N) \geq \hat{\pi}_{OA}(N)$ since it is only supposed to vary in the intercept and, by assumption, the intercept of the TA publisher weakly exceeds the one of the fully OA publisher. Of course, this is an important restriction. However, I consider it reasonable given that the leading publishers Elsevier, Springer Nature, and Wiley are all hybrid TA publishers and arguably possess more market power than new market entrants.

Thus, given a sufficiently high demand for TA publications ($\alpha = 1$), $II > 0$ holds as for an increase in N_{TA} , the fee ϕ_{TA} of the TA publisher increases – and decreases for a decline in N_{TA} . Even though the sign of *III* is not entirely clear, it has not much impact on the sign of the overall RHS as the fee differential for *one* publication is unlikely to exceed the change multiplied by all publications of a publisher.¹³

¹³Take, as an example, the case that the TA publisher accepts 100,000 publications in a given time period and that the marginal change amounts to 1 unit of money. Then, it is unlikely that the

The setting differs once the regime switches to $\alpha = 0$. Under this condition, the TA publisher fully focuses on its journal repository when setting the price for $\rho(N) = \phi_{TA}$. Thus, the fee for each TA publication does not react if ρ is fixed (i.e., $\rho(N_{TA}) = \rho$) or even increases in case it is a function of the number of publications, i.e., $\rho(N_{TA})$. One can already infer conceptually that a *decrease* in publications triggering an *increase* in the TA fee ϕ_{TA} puts pressure on the fee ϕ_{OA} of the OA publisher that cannot monetarize an existing portfolio of must stock publications. This is confirmed analytically. Again, one has to look at the RHS of eq. (11). Part *II* becomes under the assumption of $\alpha = 0$ the following:

$$\frac{\partial \phi_{TA}}{\partial N_{TA}} N_{TA} \begin{cases} = 0 & \text{if } \alpha = 0 \wedge \frac{\partial \rho(N_{TA})}{\partial N_{TA}} = 0 \text{ (fixed } \rho) \\ < 0 & \text{if } \alpha = 0 \wedge \frac{\partial \rho(N_{TA})}{\partial N_{TA}} < 0 \text{ (convex } \rho \text{ function)} \end{cases} \quad (12)$$

Crucially, the case distinction for the incumbent publisher with a transformative agreement also affects the fully open-access publisher, which leads to the following Proposition 3 below.

Proposition 3. *The change in the fee chargeable by the fully open-access publisher depends not only on the demand for its own journals but also on the demand for publishing in the outlets of a publisher with a transformative agreement.*

$$\frac{\partial \phi_{OA}}{\partial N_{OA}} N_{OA} \begin{cases} > 0 & \text{if } \alpha = 1 \\ \approx 0 & \text{if } \alpha = 0 \wedge \frac{\partial \rho(N_{TA})}{\partial N_{TA}} = 0 \\ < 0 & \text{if } \alpha = 0 \wedge \frac{\partial \rho(N_{TA})}{\partial N_{TA}} < 0 \end{cases}$$

A fully open-access publisher does not necessarily benefit from publication growth in its own journals when it operates in a market environment with an incumbent TA publisher that continues to publish restricted-access publications. ■

Due to part *III*, $\frac{\partial \phi_{OA}}{\partial N_{OA}} N_{OA} \approx 0$ holds for a fixed ρ as the small differential in

difference in publication fees $\Delta\phi$ exceeds this change.

publication fees between OA and TA publisher for the marginal publication is not necessarily equal to zero but may differ slightly. Nevertheless, the main takeaway of Proposition 3 is that, under the condition of $\alpha = 0$, i.e., a rather ‘weak’ TA publisher in terms of articles published, the change in the fee ϕ_{OA} of the full open-access publisher becomes weakly negative even if the demand for fully open-access publications actually *increases*. It is due to the ‘must stock’ problem the university libraries encounter with transformative publishers that still own a large stock of publications from the past and continue to publish papers behind paywalls. As a consequence, under the regime of fixed library budgets, the library needs to push down the publication fee of the fully open-access publisher.¹⁴

5 Policy Implications

The academic publishing market as a whole is in motion. Transformative agreements are only one tool that academic libraries use to address two issues at once, namely the extremely high rents extracted by the incumbent publishers from the libraries while providing only a bare minimum of actual effort. Second, the TAs shall path the way to more open-access publications, i.e., publications that do not require any subscription or institutional affiliation but are freely available to anyone with internet access.

The previous analysis has shown that the cost issue is more entangled than presumably expected. In particular, the centerpiece of a transformative agreement, the single publish-and-read fee, in this paper called ϕ , may be utilized by the TA publishers to compensate for changes in the publication behavior by the researchers. Put differently, the given setting became a ‘win-win’ situation for a TA publisher as high demand for publications justifies an increase in the PAR fee. Reversely, the publisher may not lower the fee proportionally in response to a decrease in demand as long as the publisher’s repository still contains sufficiently many papers in which researchers

¹⁴This scenario currently holds, but, of course, only as long as not all countries/institutions around the globe have closed transformative agreements, which would turn the TA into an OA publisher.

of the TA institutions are interested. In this case, the publisher can exert the market power from the ‘must stock’ character of many journals that still require subscriptions to access them.

Based on that fundamental problem, the design of transformative agreements will not overcome the competition challenges embodied by this particular market. If at all, TAs even increase the barriers to entry. Therefore, librarians, politicians, and institutions should focus on fostering competition instead of attempting to change the market via the incumbent firms.

Schmal (2023) could already show that new journals on the market suffer from an overall citation disadvantage – even if they publish all their papers fully open access, simply because of their necessary lack of accumulated reputation. Nevertheless, this disadvantage may be mitigated or even entirely wiped out if all authors of a publication are from Western institutions, which also close the vast majority of transformative agreements. Instead of doing this, these universities, colleges, and institutes could encourage or even make it mandatory for their researchers to publish in novel or non-profit outlets, such as society-run journals.

One, of course, needs to acknowledge the predominant ‘publish or perish’ doctrine in academia (see, e.g., van Dalen, 2021; Heckman & Moktan, 2020; Graber & Wälde, 2008), which may conflict with the sketched idea. To overcome this, one could assign a non-zero weighting factor to whether a paper has been published as open access and at what kind of publisher. Another approach could be related to third-party funding. The funding authorities could foster competition by making a specific publication type compulsory. Other than for ‘usual’ publications, winning a grant is often already a well-respected sign (van den Besselaar & Sandström, 2015), which might support a researcher’s career so that publication restrictions may have less impact. This comes with its own challenges and may lead to potentially unintended behavioral responses of the grant-receiving researchers, but it could be worth considering to break up the status quo.

First and foremost, however, the open access community could adjust the existing ‘color’ scheme for open-access publications in journals of specific publishers. The publishing community has designated colors to distinguish (and value) different types of open access, as shown in Table 1. Up to now, the differences only address types of access and the costs related to the different models. It does not address what kind of publishers offer them. Large publishers offer hybrid open access and plenty of fully open-access journals.

OA ‘Color’	Description
Diamond	Full open-access is the only publishing option in such a journal, i.e., every publication is by default published with open access. These journals are by definition unable to charge subscription fees and also do not charge any publication fees, but rely on external funding
Gold	Full open-access is the only publishing option in such a journal, i.e., every publication is by default published with open access. These journals cannot charge subscription fees, such that they generate revenues based on publication fees
Green	Secondary publication of papers in subscription-based journals in freely accessible repositories or on private websites, either as a preprint or as published versions but only after a retention period of several months or years
Bronze	Free (partial) access to subscription-based journals, but subject to the publisher’s policies, e.g., voluntary open access to archives of subscription-based journals.
Black	Illegal open access via predatory repositories, e.g., ‘sci-hub.’
Hybrid	Full open access to specific papers within a generally subscription-based journal

Source: <https://openeconomics.zbw.eu/en/knowledgebase/the-meaning-of-the-different-types-and-colours-of-open-access/>. Last checked: May 30, 2023.

Table 1: Types of open access by type or color

The latter may appear not so much as a hurdle to competition as fully open-access journals do *not* contribute to the stock of journals and papers with restricted access, which a sizable hybrid publisher can misuse to negotiate higher publish-and-read fees as derived in this paper. However, it still perpetuates the market position of the large incumbents, which also endows them with considerable political influence and makes them the first address to be approached by library consortia and policymakers.

Instead of additional colors, librarians should consider introducing ‘shades’ as an additional layer of differentiation. For example, a publication in a fully open-access

journal hosted by one of the big three publishers Elsevier, Springer Nature, or Wiley could be labeled ‘light gold OA’ or ‘light diamond OA’ to distinguish it from the standard types. Alternatively, one could vary between ‘light’ and ‘dark.’

This suggestion does not overcome the fundamental pricing challenge of transformative agreements. At least, it would support fully open-access publishers as they could better distinguish themselves from their hybrid competitors. Furthermore, grants could then require to not only publish in a specific color but also specify the shade of it. In general, library consortia and funding agencies should reconsider whether they solely focus on fostering open access – which, of course, happens with these contracts – or whether they also consider competition implications. If so, transformative agreements are likely to be the wrong path to it.

6 Conclusion

Transformative agreements continue to be concluded between academic institutions and publishers around the globe. Their main goal is to substantially increase open-access publications to reduce the necessity of (expensive) journal subscriptions. At the same time, the payment streams shall be transformed from paying for subscriptions to paying for the free availability of a paper. In addition, it is at least an implicit aim to reduce the money paid by universities or their libraries to academic publishers.

However, the present analysis has shown that transformative agreements centered around one single ‘publish-and-read’ fee that comes along with a decoupling of the access to a TA publisher’s existing portfolio and the payment for it may carbonize publishers’ profits for a long time if not extend them. The results show that the mechanics of such transformative agreements raise entry barriers for new competing publishers, given the limited availability of additional funds to university libraries. Using contracts to lock out competitors is not new (Aghion & Bolton, 1987), but up to this aspect has been missing in the discourse on transformative agreements.

During the first round of negotiations between the German ‘DEAL’ consortium and Elsevier that ultimately failed, the publisher’s officials made claims that went directly into the direction of the present paper: *“[The German institutions] want to pay for about six percent of the global research output. . . . That is, they want to pay for what the German authors publish. However, at the same time, they want free access to the remaining 94 percent of the worldwide content. . . . Then they want to increase the number of institutions – about a third of German universities at the moment that we supply – they want to increase that to all institutions and all universities without paying extra. Then they want access to almost all the journals that Elsevier offers, and they would like to have all that at a price lower than the total amount that German universities have been paying. That is their idea, which, you can imagine, is relatively difficult, . . . ”*¹⁵ While arguing from a different position, the publisher emphasizes that it publishes much research with restricted access and that German institutions should pay for it. Hence, they do not emphasize the ‘publish’ but the ‘read’ part in the negotiations for the fixed fee, which justifies the analytic decomposition applied in the sketched model.

Furthermore, the first DEAL agreement of Springer Nature already contains a contract clause that reflects the ‘insurance’ character of the DEAL agreements and the corresponding focus on the ‘read part.’ §2.2 of the contract states: “In deviation from the principle in the foregoing sections, the Parties agree to an adjustment of total PAR Fees in certain cases: The Parties agree to certain minimum and maximum amounts related to the total PAR Fees.”¹⁶ Put differently, there exists an upper and a lower cap on the payments. The former protects the universities from overly high payments due to a sudden jump of papers published in Springer Nature journals – equivalent to

¹⁵Translated interview with the Elsevier representative Hannfried von Hindenburg, 08.08.2018, see footnote ⁷ for details. The original quote in German is shown in the appendix. Note that a second attempt to negotiate a transformative agreement between Elsevier and the German DEAL consortium was successful. It began on 1 September 2023 and lasts until 31 December 2029, see <https://deal-konsortium.de/en/agreements/elsevier>.

¹⁶See the ‘Publish and Read Agreement – Projekt DEAL and Springer Nature – January 2020,’ available under <https://hdl.handle.net/21.11116/0000-0005-A8EA-6>.

subscription fees that usually also do not react rapidly to changes in the relevance of the covered journals. But the latter, the lower cap, essentially protected the publisher so that it can still expect certain revenue levels even if the interest of researchers publishing in the eligible outlets diminishes. While the spread of both caps broadens year by year (the lower one decreases, the upper increases), it is a notable confirmation of the problem laid out in this paper. Essentially, the lower cap implies a higher emphasis on the ‘read part’ as in case there are too few publications, revenue is stable for the publisher, which also implies a theoretically increasing ‘actual’ PAR fee, i.e., the fee that results from the lower cap being paid divided by the number of publications.

Overall, its insights raise questions about how ‘transformative’ such agreements are. Other than intended, they may strengthen the position of the incumbent publishers instead of opening the market to new entrants and further straining library budgets. The crucial point in overcoming the status quo is fostering competition rather than open access at any cost. While the publish-and-read fee, by definition, solely pays for the publication, it appears to be slightly shortsighted to interpret this literally because, economically, an analytic decomposition is not only conceivable but also done, as the previous statement of the Elsevier representative proves. Thus, transformative agreements may ‘transform’ payment streams but less so the oligopoly structures in the market.

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Appendix

The McCabe and Snyder (2005) publisher revenue model

McCabe and Snyder (2005) present in their work on academic publishing models already a stylized model how to formulate a publisher's profit function depending on the business model it chooses. I relate their work to the case of transformative agreements.

As outlined by McCabe and Snyder (2005), the profit function of a journal looks as follows: $\pi = p_s n_a + \alpha p_a n_a + p_r n_r - c(n_a, n_r)$. Besides the cost part $c(n_a, n_r)$, it consists of three revenue-generating components, namely the reading/subscription fees (p_r) and the number of readers (n_r), submission fees (p_s) and the number of submissions (n_a), and, last, the publication fees (p_a) and the number of accepted papers for which their respective authors have to pay for. Here, McCabe and Snyder (2005) normalize the number of submissions to the number of authors n_a and weight the acceptance of a submission with the parameter α (not to be confused with α I use in my model). It leads to a total number of publications αn_a , for which $0 \leq \alpha n_a \leq n_a$ holds. For a subscription-based model, this profit function collapses to $\pi_{subs} = p_s n_a + p_r n_r - c(n_a, n_r)$ as it cannot charge any publication fees aside from the submission fees to be paid at the beginning of the review process. For hybrid journals that offer costly open access within a subscription-based journal, all three revenue streams apply, which also raises the issue of 'double dipping,' i.e., the publisher gets paid twice for a research article, for the subscription and making a paper open access (Sotudeh & Estakhr, 2018). Last, fully open-access journals can only charge publication fees, which excludes them from the revenue part $p_r n_r$. As said beforehand, I abstract from submission fees in my model.

What happens under a transformative agreement to the profit function sketched by McCabe and Snyder (2005)? In an environment with a single buyer, there are no subscription fees anymore.¹⁷ Hence, the number of readers/subscribers (n_r) does not play anymore, and the price for reading (p_r) must be captured by the number of publications since fixed subscription fees are canceled as well. This leads to the analytic decomposition of the PAR fee into a publish and a read part.

¹⁷In reality, there exists, of course, the case that transformative agreements only apply to specific consortia while other institutions still pay subscription fees for the same journals. In theory, cross-subsidization could be assumed, but as transformative agreements become widespread, it is unlikely that publishers do not extract profits also from these contracts.

Transcript of parts of the interview with Elsevier representative Hannfried von Hindenburg

The following statement was made by Hannfried von Hindenburg, representing the publisher Elsevier, in an interview with the public German radio station ‘Deutschlandfunk’ on August 8, 2018. The full answer is presented. The text in italics is the excerpt translated into English and cited in the conclusion.

Hindenburg: “Es ist eine Frage des Geldes, aber das hat auch Herr Professor Ziegler in seinem Interview mit Ihnen angedeutet, das ist nicht nur eine Frage des Geldes, sondern auch, was man sich unter einer Einigung vorstellt. Stellen wir uns mal Folgendes vor beziehungsweise nicht nur vorstellen, sondern es ist so, dass die HRK [Hochschulrektorenkonferenz] Projekt DEAL folgende Vorstellung hat, wie eine Einigung aussehen soll: *Sie wollen, dass sie, die deutschen Universitäten, für ungefähr sechs Prozent des weltweiten Gesamtvolumens bezahlen. Sechs Prozent, das ist der deutsche Ausstoß. Das heißt, sie wollen das bezahlen, was die deutschen Autoren veröffentlichen. Gleichzeitig aber wollen sie freien Zugang zu den verbleibenden 94 Prozent aus den weltweiten Inhalten, nicht aus Deutschland. Die wollen sie auch noch erhalten. Dann wollen sie die Zahl der Institutionen – ungefähr sind es ein Drittel von deutschen Universitäten gegenwärtig, die wir beliefern –, das wollen sie erhöhen auf alle Institutionen und alle Universitäten, ohne extra dafür zu bezahlen, und dann wollen sie den Zugang zu fast allen Zeitschriften, die Elsevier anbietet, und all das möchten sie gerne zu einem Preis haben, der geringer ist als die Gesamtsumme, die die deutschen Universitäten bisher bezahlen. Das ist deren Vorstellung, und das, können Sie sich vorstellen, ist eine relativ schwierige Vorstellung, und darüber muss man sich über eine Weile unterhalten. Das haben wir natürlich auch schon getan, aber was wir vorgeschlagen haben, ist, dass man sich stückweise dieser Einigung, die wir natürlich beide wollen, annähert und zunächst mal sich über die Rahmenbedingungen einigt, und das war eben, die Rahmenbedingungen waren, wir unterstützen Open Access, wir wollen diese Transformation in Deutschland beschleunigen, das machen wir zusammen, und dabei gleichzeitig bringen wir auch die Universitäten, die die Verträge gekündigt hatten mit uns, bringen wir die vorübergehend wieder an Verträge heran, bis dann eine nationale Lizenz an Ort und Stelle ist.”*

Source: Konflikt zwischen Hochschulen und Elsevier: “Wissenschaftsbetrieb wird dadurch erheblich behindert” – Hannfried von Hindenburg im Gespräch mit Michael Böddeker; Deutschlandfunk, 08.08.2018. URL: <https://www.deutschlandfunk.de/konflikt-zwischen-hochschulen-und-elsevier-100.html>. Engl.: Michael Böddeker interviewed Hannfried von Hindenburg (Elsevier representative), published on August 8, 2018. Last checked June 26, 2023.