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How research funders can finance APCs in full OA and hybrid journals

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ABSTRACT. Open access (OA) publishing is steadily growing in both full OA journals and hybrid journals where authors can pay to open up individual articles. Funding for article processing charges (APCs) is still a strong barrier for many authors, particularly for subscription journals where the hybrid option is expensive and an added extra feature after an article is accepted for publication. Many research funders in Europe have started or are considering mechanisms for paying APCs with earmarked funding in order to increase the uptake of OA. At the same time they are well aware that their actions may influence the way the OA market will develop in the near future. This article discusses a number of scenarios for ways in which funders could cover the cost of APCs, while encouraging the development of a competitive and transparent market for APC-funded OA scholarly publishing. We provide evidence that the current APC-funded full OA market is sensitive to journal prestige/impact. We present a value-based cap funding scheme which could help maintain transparency, bringing hybrid market pricing in line with the full OA market. We also consider a scenario that addresses hybrid 'double dipping' while limiting the cost of transitioning to full OA for research-intensive universities as well as cost-sharing as a mechanism for providing authors with an incentive for considering cost as well as value in choosing where to publish.

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Introduction

Open access (OA) scholarly publishing is currently evolving very rapidly, growing at about 30% a year based on article volume.[1] In 2013 the roughly 10,000 journals registered in the Directory of Open Access journals (DOAJ) published around half a million articles. The fastest-growing segment within fully OA (gold) journals consists of journals charging authors for publication, generally termed article processing charges (APCs). This market was pioneered by new publishers such as Biomed Central, Public Library of Science, and Hindawi. Currently established commercial and society publishers are rapidly launching full OA journals, acquiring existing gold OA publishers and in a few cases 'flipping' subscription journals to full OA. Simultaneously they have rapidly expanded the number of journals that offer a hybrid option for authors to make their specific articles OA via paying an APC, though uptake continues to remain low.

This paper is a summary of the key findings from a project commissioned by Jisc, Research Libraries UK, Research Councils UK, the Wellcome Trust, the Austrian Science Fund, the Luxembourg National Research Fund, and the Max Planck Institute for Gravitational Physics. The goal of the project was to analyze the developing market for OA APCs, and to explore the associated opportunities and risks. Towards that end we conducted an extensive literature review and interviewed 13 professionals including librarians, publishers, and personnel in research funding agencies. We surveyed the current APC-funded publishing market and conducted several small studies analyzing the growth and inflation in the market. We also evaluated strategies for maintaining a transparent, competitive, and reasonably priced APC-funded scholarly publishing market. The details of the study and a more extensive presentation of the findings are contained in the full project report.[2]

Facilitating a transparent, competitive,

the full OA market has so far thus been a competitive one

and reasonably priced OA market is particularly important in the UK due to the recent decision to provide earmarked funding for APCs triggered by the Finch report and the later policy decisions of the government and the research councils. One of the key questions of the study was how funders can create mechanisms where authors have to consider the APC price among other factors in choosing a journal in which to publish, thus putting competitive pressure on publishers to lower prices, or at least moderate the growth of the level of APCs. A review of the literature as well as our own research conducted as part of this project suggests author sensitivity to APC prices has worked reasonably well for full OA journals, resulting in prices averaging around US$1,000.[3] In contrast, high hybrid APCs have been largely set to around US$3,000, a level that we believe is inhibiting significant uptake of hybrid OA.[2]

The full OA market has so far thus been a competitive one in which new entrants, without the help of established prestige, have needed to create a niche for themselves by offering good 'value' for the price their APC. The leading companies have now been in business for around a decade and seem to be getting enough revenue at their current APC levels to be sustainable. Acquisitions by major subscription publishers of OA companies such as BMC and Frontiers are also indications that the business model is on a healthy track.

The hybrid OA market is fundamentally different from the full OA journal market. The hybrid option is low risk and inexpensive for publishers to set up. Since publishers are not dependent on the hybrid income stream, they do not have the same pressure to price the hybrid option at what most customers are willing to pay. Uptake of the hybrid option has averaged only 1–2%. Growth in hybrid articles in the last few years has mainly been in the number of journals for which the option

has become available rather than an increase in uptake among existing hybrid journals. By the end of 2013 the number of journals from major publishers offering this option has exceeded 8,000.[2]

Authors have often had to patch together the funding needed to pay for an APC (both full OA and hybrid) from a number of sources, which could include allowable cost allocations in project funding, institutional dedicated APC funds, general overhead money, and even personal funds.[4] This has meant that many authors have been sensitive to the price level.

Both the full OA and hybrid market demonstrate that the uptake of APC-funded OA is dependent on the price elasticity of the authors' willingness to pay certain levels of APC. A couple of studies give some indication of what level of APCs authors have been willing to pay and how they have funded the charges. The European SOAP study[5] found that for 28% grant money was used, in 55% of cases overhead funding from grants or the department was used, and in only 12% of cases the researcher paid himself (with 5% other). The results from a similar survey by Solomon and Björk[5] show approximately the same distribution with around 30% grant funding in industrialized countries. The picture is different for developing nations, where 39% of the funding came from personal funds. Both surveys also show that the authors' willingness to pay the charge rapidly decreased with rises in the price level.

The uptake levels of different hybrid OA journals also demonstrate how sensitive authors are to the price. Björk[6] has shown uptake levels of 2% or less for publishers charging around US$3,000. The few 'success stories' of hybrid journals that have achieved uptake levels of around 10% seem to be due to much lower APCs, discounts for society members, or other mechanisms for lowering APCs in combination with being high-impact journals. Also in the case of Springer most of the hybrid articles have come through bundled deals tying up APCs with normal subscription licenses for a few select universities and consortia.[7] There are also examples of highly priced hybrid journals achieving significant uptake levels, in particular *Nature Communications* with a 31% uptake[8] at a price level of US$4,800–5,200 (depending on the license). Significantly *Nature Communication* has an impact factor of over 10.

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In the last few years many research funders have defined OA policies requiring grantees to make the resulting publications OA either via the green or gold route. Currently 70% of UK medical charities either have such a policy or are planning to introduce one with the next year.[9] Funders such as the Wellcome Trust and the Austrian Research Fund have

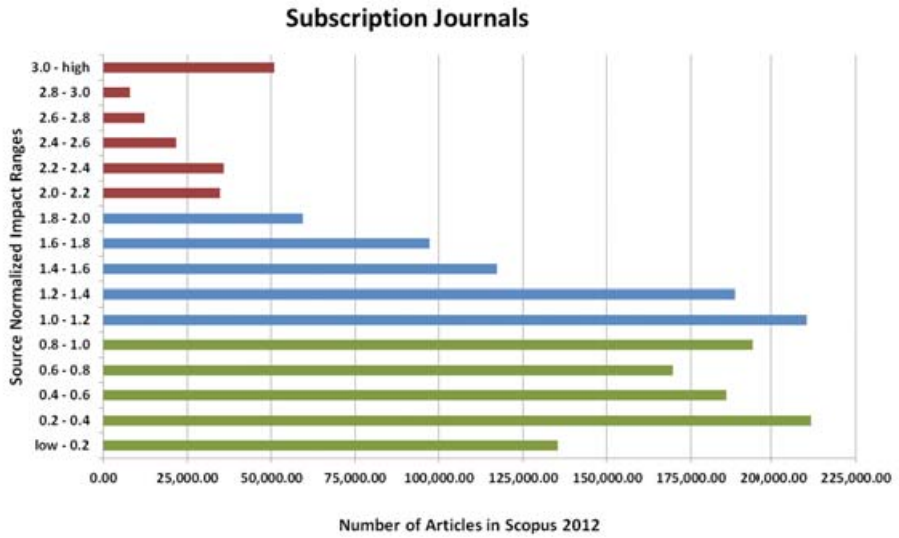

Figure 1. Distribution of SNIP levels for articles.

in addition established funds for paying their researchers' APCs, as a means of increasing OA uptake, by insulating authors from these costs. In a sense this parallels the role of subscriptions for journals provided via university-wide e-licenses. Pinfield and Middleton report on the extent to which UK universities have established centralized funds and mechanisms for the handling of APCs.[10] Only 13% of responding universities had such systems in 2011. According to the study, the mean cost paid through the institutional fund at the University of Nottingham in 2010–2011 was £1,216. This is more than £1,047, the average APC paid by the Wellcome Trust in 2012 for full OA journal articles, and clearly higher than the world average of £861 we found in our own investigation of high-quality established full OA journals.[2]

this makes it virtually impossible to verify whether double dipping is occurring with hybrid uptake rates of 1–2%

If earmarked APC funding starts to become widely available, for instance in university-wide funds or directly via central funders such as Wellcome Trust, the cost of the APC is likely to be far less of an issue for authors in choosing where to publish their research and hence pressure on publishers to reduce or moderate increases in APCs. Making decisions about rationing the use of this resource will then, in the case of budgetary restrictions, fall on the administrators of such funds. If prices remain high for lack of competition this will also impact on authors who do not have access to these sources of funding.

One key difference setting the hybrid market apart from the gold market is the risk of so-called 'double dipping' of subscription publishers collecting hybrid fees without adjusting their subscription fees for the articles that have already been funded through APCs. Overall most publishers offering hybrid OA have pledged that they do not engage in double-dipping and that they will reduce subscription prices proportionally as the uptake of the hybrid option increases.[11] The listed subscription prices of individual titles from the largest commercial publishers are somewhat misleading due to the dominance of bundled electronic licenses. Such big deals are multi-year contracts, which usually are the results of long negotiations as well as often covered by non-disclosure clauses. This makes it virtually impossible to verify whether double dipping is occurring with hybrid uptake rates of 1–2% for most publishers. Several of our interviewees supported this contention. The situation might change if hybrid uptake increases but at current uptake rates it is difficult to tell whether there has been any real reduction in subscription prices due to hybrid payments.

This dilemma has both a global facet and a local one. If research-intensive institutions pay hybrid APCs, they could be risking a substantial rise in their total costs for accessing the literature with the combination of subscriptions and APC payments. While true for both full OA and hybrid publication, it is potentially a much greater problem with hybrid publication given significantly higher APC levels and a far larger number of articles if uptake were to increase significantly. Several interviews conducted during the study showed the difficulties in getting agreements with publishers on these issues and the concern of librarians faced with limited budgets and the potential of a significant rise in costs of covering APCs without a concurrent drop in subscription fees.

The challenges of paying APC fees were raised in several interviews with both OA publishers and librarians. This involves dealing with difficult issues such as articles with authors from many institutions and countries, articles published outside the time limits of the grants they stemmed from, or without any external funding.

Library accounting systems are not currently designed to manage APC invoicing and payments. As such handling of APC payments has been extremely challenging and inefficient causing a great deal of frustration for both publishers and librarians. While intermediaries would seem to be a good solution for addressing these problems, neither the publishers nor librarians we interviewed seem to feel that efforts to date have been very effective. The lack of effective administrative and workflow structures for payments appears currently to be a serious impediment to a widescale conversion from subscription to APC-funded OA publication.[12,13]

The mechanisms of funding APCs and their consequences have been a major focus of the OA debate in the UK in the past couple of years. The Finch report[14] created quite a lot of discussion in the different OA camps supporting author self-archiving vs. OA journals or hybrid articles as the best means of achieving

open access to the literature. The report has been very influential on later developments in the UK. A key concern of the report is the balanced transition towards more OA:

> [I]t seems likely that the transition towards open access will accelerate in the next few years. The Group's aim is to support that process, but to ensure that policies are implemented in ways that do not disrupt the essential features of a high-quality and continuously-developing research publishing ecology, or the high performance and standing of the UK research community. (p. 55)

The report puts much emphasis on simplifying the mechanisms for funding APCs in both full OA and hybrid OA journals rather than supporting infrastructure for author self-archiving. It points out that in addition to the publication charges themselves, the transaction costs for handling the payments can be considerable both for publishers and the institutions of the authors.

The later House of Commons report[15] voices strong criticism of the Finch report and its follow-up in the form of the RCUK OA policy. It puts much more stress on green self-archiving as the preferred route to OA and is highly critical of the current policy. In particular it states: 'If RCUK and the Government continue to maintain their preference for gold, they should amend their policies so that APCs are only paid to publishers of pure gold rather than hybrid journals.'

Recently the Finch committee issued a review of progress one year after the original report,[16] based partly on written input from 25 stakeholders. One central observation was that few universities had added internal funding to the APC funds set up using the earmarked lump sums given to them by RCUK. The report also recommends that hybrid OA should be funded, although it highlights the problems involved in ensuring that the sum total of APC and subscription cost does not grow too much for research-intensive universities.

A further input into this discussion was provided by the UK government response to the House of Commons report.[17] A central position statement is:

> Government does not consider it appropriate for publishers to rely on retrospectively amortising their APC revenue to discount global subscription rates, as some now do. This may address 'double-dipping' in one sense, (no increase in total revenue to the publisher) but it does nothing to address the concerns of research intensive individual institutions, wherever they are located around the world. Such institutions paying APCs for gold OA publication in particular journals should see some related and proportional discount in their total subscription fees, with the same publisher, to avoid them disproportionately funding the translation to gold OA.

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The same message is also contained in the recent letter from the Minister for Universities and Science, David Willets, to Dame Janet Finch.[18]

Potential scenarios for gold and hybrid OA

The key objective of this project was to identify and appraise policy options that could potentially help ensure a competitive and transparent market for APC-funded scholarly publishing. Accordingly a series of scenarios reflecting policy options that funders might use to help achieve these goals were developed. The formulation of the scenarios are was influenced by the current rules governing the payment of APCs by funders such as the Wellcome Trust, Research Councils UK and the Austrian Science Fund.

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Given the differences in how the full OA and hybrid markets operate, the scenarios needed to address these two forms of APC-funded publication separately. In scenarios where funders are not willing to pay the full asking price of APCs, or only pay a portion of the asking price, universities and/or authors can always pay the difference from other funds, if they feel it worthwhile to publish in these journals. This introduces an incentive for authors and their institutions to consider price as one of the factors in choosing a journal to publish and we believe will help maintain transparency and competition in the APC market. It should be noted that requiring the university or author to pay a portion of the APC also adds complexity and overhead costs to the process of paying the APC and may limit the choice of journals for some authors who cannot obtain additional funding.

The scenarios were designed such that each contains a clear main principle. In reality, the situation is likely to be considerably more complex. It would, however, not be practical to try to assess a variety of options simultaneously. For the predicted effects to be achieved it is assumed for simplicity's sake that a number of influential funders worldwide adopt similar APC funding principles. Although this might not be realistic, a critical mass is needed to have significant influence on the uptake and pricing of APC-funded OA publishing as well as publisher policies. In practice developments could be slower and less clear-cut with funding agencies choosing different paths towards open access. In addition the APC-funded OA market is evolving very quickly in ways that would have been difficult to predict even a few years ago. We expect this trend to continue.

This paper focuses on the three combinations we felt most promising

We initially considered eight hybrid and four gold scenarios settling on three combinations that were felt to be the most feasible and likely to promote an effective market. More detail on the full set of scenarios is contained in the report. This paper focuses on the three combinations we felt most promising as well as the recommendations and concerns related to implementing these scenarios.

APCs are refunded at list prices, with mechanisms at the local level for hybrid articles to ensure increased APC expenditure results in savings in subscription costs for a specific institution

Since the full OA APC market is currently fairly competitive, transparent, and on average priced well under hybrid APCs we felt it would be reasonable to continue to pay list prices. Given that the APC market is changing rapidly and there is risk of price inflation this option would likely need to be re-evaluated fairly often until the market stabilizes.

In the case of hybrid articles this scenario could be appropriate provided that mechanisms are put in place to ensure a significant portion of the hybrid APCs are returned to the funding organization that pays for the hybrid access rather than globally through the reduction of subscription prices. That is, institutions paying hybrid APCs will be reimbursed through rebates to the funding organization on subscriptions paid to that publisher or by other similar means such as has been recently implemented by the Austrian Science Fund (FWF) and IOP Publishing.[19] With this scenario only journals from publishers willing to fulfil such criteria will be eligible. The administrative burden of negotiating contracts based on this scenario would be considerable. On the other hand such clauses could be negotiated as part of bundled contracts for electronic access as they came up for renewal but this would result in a slower adoption process.

This scenario would be most appropriate for research-intensive institutions that must purchase subscriptions as well as wishing to pay hybrid APCs for articles published by their researchers. This scenario would not increase transparency and would provide little pressure to reduce APCs but could provide a means stabilizing access costs for research-intensive institutions needing to provide subscription access to a broad base of the scholarly literature while wishing to provide funds so that their researchers can publish in hybrid journals. The scenario would help mitigate the excessive financial burden of paying both subscriptions and APCs as well as tendency for APC-funded OA in general to shift the financial burden of publication from less research-intensive universities to more research-intensive universities or organizations. The scenario is well in line with the policy of the UK government as expressed, for instance, in the recent letter of Minister Willets to Janet Finch, mentioned above.

Refunding full OA journal APCs at list prices is less problematic since that market currently is fairly competitive and prices are considerably lower than hybrid prices. As long as a majority of authors have some incentive to consider price, this is likely to continue. With an income stream from subscriptions, publishers of hybrid journals do not face the same financial risks that probably motivate OA publishers to keep their APC prices competitive.

APCs are funded according to multi-tier, value-based price caps

In this scenario (see Figure 1 above), a maximum price cap for an APC is set based on services or, as is modeled below, on citation rates as a proxy for value. In the model below we used a three-tier system of caps with maximum payments of US$1,000, US$2,000, and

Table 1. APCs of full OA journals indexed in Scopus[a]

Price cap (US$)	Average APC	Articles	Std. deviation
Cap of 1,000	809.92	29,628	657.37
Cap of 2,000	1,576.08	29,195	391.08
Cap of 3,000	2,466.89	2,258	828.54

[a]Based on 595 OA journals funded by APCs in Scopus. APC prices are from 2011.

US$3,000. The rationale for the model is that APCs would be tied to the value provided by the journal thus creating a level of transparency and limiting the amount of the APC a funder will pay based on value. Authors or their institutions could pay the full amount of an APC covering the additional about the cap from other sources if they so choose. We believe this model would encourage authors to consider price in their choice of a journal in which to publish. Our modeling of the effects of this scenario was based solely on using Source Normalized Impact per Paper (SNIP)[20] values as criteria for determining the caps. A problem with standard impact factors (IFs) is that the average IF levels are quite different for different scholarly disciplines, for instance typically much higher in biomedicine than in the social sciences or mathematics. They are thus most useful in comparing the relative scientific level of journals within disciplines, not across disciplines. Normal IF values could be used if journals within disciplines would first be ranked based on, say, the two-year IFs, after which the journals' relative ranking position would be used as a quality proxy. But extracting the data by hand from journal citation reports for a couple of hundred disciplines would be very labor intensive.

SNIP values, which are citation rates normalized to account for differences in citation patterns across disciplines, are better suited for our particular purpose. They are based on Scopus data and are freely available from the Journal M3trics Web site[17] developed through collaboration between Elsevier and the University of Leiden. The data set was formed using ISSNs to merge SNIPs obtained from the M3trics Web site, article counts from SCImago Journal Rank Web site,[21] and the DOAJ[22] to determine whether a journal was OA and funded by APCs. We used the latest data from these sources as of August 2013.

Using this database we constructed SNIP distribution curves for articles in subscription journals and OA journals funded by APCs (see Figure 1). Both curves have means and medians around 1, due to the normalization, but the subscription journal curve has a long decreasing tail of very high impact journals, which the APC-funded OA curve largely lacks. The large spike in the APC-funded distribution is due to *PLoS ONE*.

We were able to construct Table 1 using APC charges obtained from an earlier study.[3] The vast majority of articles from full OA journals would be funded below the cap.

The top limit, US$3,000, is one that only a small percentage of full OA journals exceed. Many of the very top quality journals, e.g. *PLoS Biology* and OUP's *Nucleic Acids Research*, charge just below US$3,000. From our prior research, US$1,200 is approximately the average APC charged by journals in either Scopus and or the JCR.

As can be seen in Table 1, the averages of full OA journals remain well below these caps. A statistical analysis shows that there is a moderate correlation between SNIP values and APC prices in the full OA market. The Pearson product moment correlation was 0.67.

Most current hybrid APC prices with prices typically in the US$3,000 range would be above the caps and this would put strong pressure on the publishers to reduce the prices if they want to rapidly increase the uptake.

Such a model raises the obvious concern that publishers would raise prices where possible to the maximum within the cap. For full OA journals we feel this is unlikely unless the scenario in this exact form was used very widely. As long as a significant number of authors must pay APCs from their own personal funds, limited discretionary funds, or grants with limited funds, we feel there would be adequate pressure to keep prices down in the gold market.

We chose to use SNIP citation rates in mod-

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eling the effects of these caps in this example because they were freely accessible, based on a well-accepted though controversial means of measuring the quality of a journal, and as shown are significantly related to the competitive pricing of full OA journals. Their use, however, would be controversial particularly since Scopus is owned by Elsevier, creating conflict of interest. We view the results above as an example of how this model might be applied. The California Digital Library (CDL) has used a similar approach including the use of SNIPs as a factor in valuing the journals in their collection.[23]

this multilevel price cap scenario represents a novel approach

In principle other measures of value such as type of license, availability of XML versions, high-quality peer review, fast review and publication, as well as potentially altmetrics could be used for measuring the value of services provided to authors, and these were discussed in the workshop of the steering group as an alternative to citation-based metrics. The problem with such solutions is, however, that they are very difficult to operationalize for thousands of full OA journals and close to 10,000 hybrid journals.

This multilevel price cap scenario represents a novel approach. Since earmarked funding for the full APC removes the incentive for authors to balance journal quality against price, this scenario would reintroduce a type of price elasticity at the funder level. We believe it could make the APC market function more like a normal market.

The funders cover a fixed percentage of the APCs above a maximum value whilst universities (or the authors) cover the remaining portion of the APC through other sources.

This scenario would be best combined with other scenarios, both gold and hybrid. By having the institution or researcher through other internal funding bear part of the cost of the APC, there would be an incentive for authors to consider the price of an APC as one of the factors when choosing a journal to publish in. The goal would be to provide an incentive for keeping the APC market competitive and reasonably priced.

This scenario reinforces the dependency of the uptake on the price level, but it inevitably leads to a more complex process of deciding on paying the APC and on the collection of the required money from different sources. It could also limit the choices for those authors who do not have access to discretionary funds from grants or other sources to cover their portion of the APC.

This might best be implemented by requiring authors or their institutions to cover a percentage of the cost of an APC above a particular value, making this scenario less of a burden for authors with limited funding and resulting in less administrative overhead. This might also be implemented in combination with value-based caps.

Summary of the various scenarios

None of these three scenarios is directly recommended as the best option. Individual funders and institutions have different requirements and different goals. An aspect which is very difficult to analyze is how widespread such policies will become and at what speed since different stakeholders have different perspectives and needs. We hope that all the discussed scenarios provide a useful input into the internal discussion of funding organizations as well as for a broader dialog with the different stakeholders in scholarly publishing.

Other issues in funding APC payments

APC-funded OA invites low quality and unscrupulous publishers. While most researchers are savvy enough to avoid these publishers, we suggest that in all scenarios journals meet minimum criteria in order to receive funding as a means of avoiding this problem. For full OA we propose requiring that journals be in the DOAJ and meet the organization's newly developed selection criteria.[24] The standards have been tightened and will eventually apply retrospectively to all journals in the DOAJ. While they are not perfect, the criteria helps ensure journals meet basic standards for a peer-reviewed scholarly journal, will be implemented by a well-known and widely respected organization, and will be easily verified.

The DOAJ cannot serve this purpose for hybrid journals. Another option would be inclusion in at least one major comprehensive citation index, such as Web of Science or Scopus, or subject-based index, such as PubMed, ERIC, or PsycINFO. Most legitimate

hybrid journals would meet this criterion. In some countries funders could additionally allow certain nationally based indexes or other accrediting organizations such as SciELO in Latin America. We also strongly suggest publishers should meet the Principles of Transparency and Best Practice in Scholarly Publishing proposed by COPE, the DOAJ, OASPA, and WAME.[25] We also feel in the interest of maintaining a transparent and competitive market for publishing services, at a minimum, the average APC paid to the publisher for a specific journal should be provided to the funder. This information should not, for instance, be hidden behind non-disclosure clauses.

Another important area that needs to be addressed is payment systems for APCs. Certain issues, such as standard rules for handling authors from multiple institutions or when research is funded by multiple sources, need to be worked out. In our interviews with librarians and publishers, they indicated the mechanics and processes for handling APC payments have been extremely challenging and inefficient, causing a great deal of frustration for both publishers and librarians. While intermediaries would seem to be a good solution for addressing these problems, neither publishers nor librarians (including those interviewed for this study) seem to feel that intermediaries operating to date have been very effective.[26] The lack of effective administrative and workflow structures for payments appears currently to be a serious impediment to a wide-scale conversion from subscription to APC-funded OA publication.

Conclusions

Both the literature and the empirical data we collected during the study highlight that the APC-funded full open access and the hybrid OA market are significantly different. The full OA market has had over 10 years to develop and is a relatively normal economic market where publishers have to compete for 'customers' via a combination of quality, innovative services, and price. Although some researchers have their APCs fully covered and probably do not consider price in their choice of a journal, there is evidence from a variety of sources that APC price is a consideration for many researchers and this is likely working to moderate APC prices in the market.

The key strategic issue for stakeholders such as research funders is to ensure the APC market is kept innovative and competitively priced. Traditional publishers are now rapidly entering this market, increasing the possibility that APCs will be bundled with subscription prices which could reduce transparency and competitiveness. If funders provide 'earmarked' APC funding at list price, this could further erode price competition. A further risk is that the market would evolve in the same direction as the subscription market, with a few large publishers gaining a competitive advantage via bundled 'big deals' combining subscription and prepaid APCs.

there is clear evidence the hybrid market is dysfunctional

There is clear evidence the hybrid market is dysfunctional. Although growing. there is little price differentiation among journals based on quality, discipline, or the services provided. Elsevier and Sage were the lone exceptions of the major publishers we reviewed. Sage prices their hybrid APC differently for social science and STM journals. Elsevier has begun to price their hybrid APCs individually. Prices, however, on average are considerably higher than in the full OA market. Uptake of the hybrid option remains low and publishers do not have as strong an incentive as full OA publishers to increase uptake via moderate pricing, since they already receive enough revenue from the journals both to fully cover their costs and incur in many cases a high level of profits.

Since the vast majority of subscription journals now offer the option, hybrid OA has the potential for rapidly increasing the share of articles that are OA upon publication. If a large number of funding agencies were to provide earmarked funds for covering hybrid APCs, this could happen quickly. Unless market forces or some other means are used to reduce hybrid APCs to more competitive levels, and there is commensurate reduction in subscription fees as hybrid uptake increases, this would result is a dramatic rise in the cost of publication.

Several publishers have pledged that they will reduce subscription prices in the same proportion as the increase in hybrid APC revenue, so that customers pay only for the non-OA content. While this in principle sounds reasonable it is extremely difficult to verify

that publishers are actually following this in practice or even know exactly how to do so. Reductions in the list prices of individual titles are almost meaningless since most subscription revenue comes from multi-year bundled contracts, the details of which are often are hidden behind non-disclosure agreements. In any case reductions following from average uptake levels of 1–2% for major publishers would be so small that they would be lost in the negotiation margins for big deal e-licenses.

An additional concern is that research-intensive universities, and universities in countries such as the UK where earmarked money for funding hybrid APCs will be provided on a large scale, could end up funding a high percentage of the APCs, whereas subscription prices would be lowered only at the global level, providing little benefit to these universities and countries. This has led to a number of proposed mechanisms that would lower subscription costs for individual universities or consortia in direct proportion to the hybrid APCs paid by them. Early experience indicates that such agreements may be difficult both to negotiate and implement in practice,[27] though the agreement between the FWF and IOP indicate such agreements may be feasible.[16]

it is also important to note that implementing changes to a complex publishing ecology can be extremely challenging

It is also important to note that implementing changes to a complex publishing ecology can be extremely challenging. The history of the publishing agreements between the Max Planck Institutes (as well as a number of universities) and Springer around 2007 is instructive. These agreements provided subscription access to Springer journals and allowed researchers covered by the agreements to publish articles as hybrid OA in Springer's Open Choice journals at no additional cost. While these agreements were attempts in good faith both by Springer and the sponsoring institutions to implement a programme to provide hybrid OA options for authors, they were ultimately not successful and were terminated after a few years. Even though there was no additional cost to publish OA, the uptake of the hybrid option by Max Planck authors was extremely low due to a variety of factors that involved changes in workflows, communication to authors and confusion about the program.[28]

We evaluated a number of alternative scenarios for APC-funding policies with the goal of helping maintain a transparent and competitive APC market for full OA and increase the transparency and competitiveness of the hybrid market, settling on three combined scenarios were felt to be potentially the most promising. These are not mutually exclusive and could be combined in different ways. While there are many other options, including the innovative approach taken in the Sponsoring Consortium for Open Access Publishing in Particle Physics (SCOAP3), we feel the three scenarios were the most promising for widescale adoption.

An aspect which is very difficult to analyze is how rapidly funders will start to adopt APC policies and how widespread they will become, since different stakeholders have varying perspectives and needs. None of these three scenarios is as such recommended as the best option but they could be combined and adapted to cater to different requirements and goals of different organizations.

In addition to providing direct funding for the APCs (or part of them) there are ways in which funders could support alternative types of OA such as directly supporting OA journals that do not charge fees, as has been done with the journal eLife. While this was not the focus of our study, we feel work in this area is needed and could provide a valuable alternative means of funding OA publishing.

We hope that this study provides useful input into the internal discussions of funding organizations as well as for a broader dialog with the different stakeholders in scholarly publishing, both in terms of the new background data on current developments and the proposed alternative solutions.

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