Publication Fees in Open Access Publishing: Sources of Funding and Factors Influencing Choice of Journal

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Open access (OA) journals distribute their content at no charge and use other means of funding the publication process. Publication fees or article-processing charges (APC)s have become the predominant means for funding professional OA publishing. We surveyed 1,038 authors who recently published articles in 74 OA journals that charge APCs stratified into seven discipline categories. Authors were asked about the source of funding for the APC, factors influencing their choice of a journal and past history publishing in OA and subscription journals. Additional information about the journal and the authors' country were obtained from the journal website. A total of 429 (41%) authors from 69 journals completed the survey. There were large differences in the source of funding among disciplines. Journals with impact factors charged higher APCs as did journals from disciplines where grant funding is plentiful. Fit, quality, and speed of publication were the most important factors in the authors' choice of a journal. OA was less important but a significant factor for many authors in their choice of a journal to publish. These findings are consistent with other research on OA publishing and suggest that OA publishing funded through APCs is likely to continue to grow.

Introduction

Scientific publishing has undergone two major paradigm shifts. The invention of the printing press revolutionized scholarly publishing, making possible the dissemination of monographs on a much wider scale than was previously possible. In 1665, the Royal Society of London started publishing the Philosophical Transactions, which is generally regarded as the original scientific journal (Guédon, 2001). The second shift occurred only recently with the emergence of the World Wide Web, which in a very short time has changed the dominant dissemination medium for scientific journal articles from paper to electronic (Tenopir & King, 2000). As a result, scientists today mostly retrieve peer-reviewed journal articles from web resources, although many still prefer to print out the full texts of interesting articles and read and annotate them on paper.

Because of the move from print publishing to predominantly electronic publications, accessible through bundled university licenses, most scientists have rapid access to a much greater variety of scholarly journals and articles than before (Ware & Mabe, 2009). Yet much of the potential of the web is still left untapped, because of the fact that the business model of scientific publishing has continued to be based on selling content to subscribers, which increasingly tend to be libraries, particularly for electronic versions. Although this model was required in the print production era due to the incremental cost of printing and shipping each copy of a journal, it is no longer an absolute necessity in the web environment. In the web environment, there is no marginal cost for providing e-access to the content, because publishing costs are more and more concentrated to what Tenopir and King (2000) have labeled first-copy costs. Increasingly, scientists and publishers have consequently started to question the limited access subscription model and have created new ways of funding scientific journals that allow the content of these journals to be freely accessible. The label open access (OA) is nowadays used to describe such journals.

In OA, the scholarly journal is seen as service provider to authors who wish to get maximal dissemination for their research results. Implicitly, journals have traditionally had

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this function as well. Why else would scholars have been willing to barter away the fruits of their labor for no monetary compensation and even sign very restrictive copyright transfer agreements? With OA, this function of providing services to the authors becomes much more explicit.

From around 1993 to 2009, the number of OA journals has rapidly risen from a few dozen to more than 5,000 (Laakso et al., 2011). In the early years, most OA journals were funded by individual scholars or groups of scholars who did not charge authors for publishing. This model worked for small journals publishing a few articles per year but didn't scale well to bigger journals. In addition, a number of well-established society journals decided to make the electronic versions of their articles freely available, sometimes with a delay. Portals such as Highwire Press (predominantly used by American society journals) and Scielo (society journals from Latin American countries) have been instrumental in this transition. Starting from around 2000, a number of professional OA publishers has entered the market using article-processing charges (APCs) as their main source of income. BioMed Central and the Public Library of Science are the two earliest and best known of these OA publishers; however, the number of professional OA publishers using the APC funding model has been growing rapidly over the last decade.

Article processing or publishing charges are not new to scholarly publishing. Many journals have charged authors publication fees for decades. These fees are still quite common in subscription journals for unusually long articles and/or the inclusion of color illustrations. But only now, with electronic-only OA journals, are APCs becoming the central revenue mechanism for funding the publishing operations.

Starting around 2004 a number of established publishers, led by Springer and Oxford University Press (Bird, 2008), has started testing the willingness of scientific authors to pay such charges for individual articles published in otherwise subscription journals. Such an arrangement is now possible in over 2,000 of what are commonly called "hybrid" journals. This model has, however, not become popular, with an overall acceptance rate of only around 2% (Dallmeier-Tiessen et al., 2010). The lack of acceptance of this model is likely because of the generally high level of the payments (usually around 3,000 U.S. dollars [USD]), which even exceeds the APC levied by most professional OA journals, and the fact that paying the fee is optional, to making the article freely available, and not a condition for being published per se.

Because an increasing number of highly reputed publishers (Springer, Nature Publishing Group, Sage, and Royal Society) are now launching APC-funded OA journals, the reaction of potential authors to pay such charges will be very important in deciding if and how rapidly scientific publishing will move towards the OA model. Authors "vote" with their manuscripts, and only by getting a sufficient inflow of good quality submissions can OA journals become successful.

Scientific authors when choosing where to submit their manuscripts are making choices in the same way that consumers choose any other commodity, that is, they evaluate the costs and benefits for a particular journal compared with other options. In the past, the cost element of a submission has been obscured by the fact that submissions have appeared to be "gratis" to authors. On the other hand, the economic value of good articles is considerable for the publisher, and what has in fact happened is that the authors have exchanged their manuscripts for the peer review, dissemination, and "branding" services provided to them by the publisher. With APC-funded OA journals, authors will be forced to consider even closer the value they get from a particular journal, especially because there are usually both non-OA and OA alternatives available for each manuscript at hand. All other things being equal, OA journals need to be able to offer additional advantages such as accessibility, rapid publication, better topical fit, and/or the likelihood of more citations to offset and exceed the negative cost of the APC.

Aims of This Study

The goals of this study are as follows:

- Identify the sources of the funding that the researcher/scholars are using to fund APC in different disciplines.
- Determine the factors influencing authors' choice of the journal in which they published.
- Find the maximum APC the authors are willing to pay to publish an article in a desired journal.
- Describe the authors in terms of publication experience, discipline, and country to better understand how these factors influence the funding of APCs and the authors' choice of journals in which to publish their research.

Previous Research

There are two previous research tracks that are of relevance for this study. The first track concerns research on how authors in general evaluate scientific journals and how they decide on where to submit. The second track has focused on how scholars evaluate OA journals as potential outlets for their own work.

There are thousands of studies where scientific journals in particular disciplines have been ranked according to their scientific quality or prestige. Nisonger (1999) found 178 published rankings in library information systems alone. Most of the ranking studies have been based on subjective opinions of scientists in the discipline at hand, sometimes based on very broad surveys and sometimes on the opinions of select groups of leading scientists. Since the 1970s, these survey rankings have been supplemented by the citation count-based journal impact factors published by the Institute for Scientific Information (ISI). Despite some controversial issues relating to the use of impact factors as a proxy for quality (Anon, 2008), they have become a very influential factor in determining author submission choices. Impact factors are used by university administrations, research funders, ministries of education, and other decision-making bodies as a cost effective way of comparing applicants for posts, research grant applicants, as well as the output of research groups and whole universities.

There have been fewer studies that have looked in more detail into the range of criteria scholars use when deciding

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where to submit their manuscripts. Ziobrowski and Gibler (2000), for instance, studied how authors in the field of real estate chose where to submit manuscripts by sending out questionnaires to authors who, in the previous six years, had published in three leading journals in the field. They ranked 16 predefined criteria according to a 5-point Likert scale. The highest average score was 4.31 (author's perception of journal quality) and the lowest 2.01 (editor knows the author). Based on a factor analysis, they reduced the criteria to four major ones: fair and efficient editorial process, probability of publication, quality and ranking for promotion, and tenure (by the employing institution).

Swan and Brown (1999, 2004) have carried out a number of broad surveys of author preferences. According to their results, the two most important factors affecting the submission decision are the readership and the quality of the journal. Readership is not simply a matter of the number of readers. To academics, it is often more important to reach the colleagues in the same discipline, so that the results can make "a contribution" and hopefully be cited, and the absolute numbers of readers are less important.

Coupé (2004) has also highlighted the fact that authors, if they behave rationally, also take into account the risk of rejection, which differs a lot between journals, and what that might entail in terms of delays in getting published.

Nicholas et al. (2005) have made a survey of the knowledge of and attitudes towards OA of authors who have published articles in ISI-indexed journals. Of the 3,787 authors who answered the web questionnaire (3.5% response rate), two-thirds knew about OA and of these 11% had ever published an article in an OA journal. The survey results provide a good overview of senior academics' attitudes towards OA publishing in the early days, and highlight, for instance, the regional differences, where around 30% of authors from Asia and South America had published in OA journals.

Schroter Tite, and Smith (2006) have empirically studied medical journal authors' perceptions of OA journals, using both interview and survey techniques. They found that the factors of importance for deciding on where to submit were impact factor, reputation, readership, speed of publication, and the quality of the peer review system. They also asked questions about the willingness to pay APCs and found that the journal quality was the decisive factor.

Björk and Holmström (2006) have proposed a framework ("net value of submission") for the factors authors take into account when choosing where to submit. The model includes 29 factors that are aggregated into four groups: infrastructure, readership, prestige, and performance. One of the 29 factors is the level of a possible article processing charge, one of the few negative factors in overall balance of factors. This model has later been tested on journals in three different scientific disciplines (Björk & Öörni, 2009).

Overall, previous research seems to indicate that the "openness" of a journal is only a minor consideration for most authors when they decide where to submit. Perceived quality and a good topical fit for the manuscript are much more important.

Methodology

Sampling

Our goal was to draw a sample of authors that broadly reflected scholars/researchers who have recently published articles in OA journals that charge APCs. The Directory of Open Access Journals (DOAJ) served as a source for locating journals from which to sample authors. The DOAJ is widely accepted as the most comprehensive database of OA journals, with over 6,500 listed.

Journals were stratified into seven discipline clusters by grouping subsets of the 17 discipline categories used by the DOAJ. Each cluster included disciplines that we believe to have similar academic cultures and availability of support.

1. Health Sciences, Biology, and Life Sciences
2. Education, Social Sciences, Law, and Political Science
3. History and Archaeology, Arts and Architecture, Languages, and Literatures
4. Technology, Engineering, Mathematic and Statistics, Computer Science
5. Business and Economics
6. Chemistry, Earth Sciences, Physics, and Astronomy
7. Agriculture and Forestry

We attempted to select 15 journals from each discipline cluster listed above. Where possible, we selected 5 of the 15 journals in each cluster from those with impact factors listed in the Journal Citation Reports for 2009 (JCR, 2009). We identified journals in the DOAJ with impact factors using a list developed by Wouter Gerritsma.[1] The journals we selected were limited to those that published in English, charged APCs, and listed the corresponding author's e-mail address. Approximately a fifth of the journals in the DOAJ charge APCs and those tend to be concentrated in the scientific, technical, and medical (STM) fields. The majority of these journals is published by few large commercial OA publishers. This limited our ability to get a broad sample of journals that charge APCs across the seven discipline clusters.

We first attempted to select five journals in the JCR 2009 from each cluster. We used a systematic random sampling approach in the STM disciplines where a high percentage of journals charged APCs. In the other clusters, we identified as many journals as we could find that had impact factors.

We then used the DOAJ website to identify the rest of the journals. We attempted to use a systematic random sampling approach, however this did not turn out to be practical. The DOAJ metadata, at the time that we drew the sample of journals, did not include whether a journal charged APCs. This required us to confirm that a selected journal charged APCs by searching the journal website, which was very time consuming. To make the selection process feasible, we limited our selection process to commercially published OA journals. We did include a few non-commercial journals that charged APCs. In some of the seven discipline clusters listed

[1] http://wowter.net/2011/01/06/the-impact-factor-of-open-access-journals/

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above, we were unable to identify 15 journals that charged APCs. In those clusters, we included all journals we could locate that charged APCs.

Each journal selected served as a subcluster for sampling authors. Where possible, we sampled from each selected journal the corresponding authors from 15 articles published in 2010. We started with the most recently published article and worked backward by date of publication until 15 articles were identified. When authors had published multiple articles, they were included only once and an additional author was selected. If there were less than 15 articles published in 2010 for a given journal, we continued to work backward, selecting additional authors who published articles in 2009. In a few cases where journals had been launched in 2010, we included authors who published articles in 2011.

A total of 1,038 corresponding authors who had published articles in 74 journals were asked to participate in the survey.

Data Collection

The survey was developed by the lead author based on the research questions outlined above, with the goal of keeping the instrument as short as possible to help increase the response rate. The instrument was reviewed by a number of people with expertise in OA publishing. (A copy of the survey can be viewed at http://www.openaccesspublishing.org/apc/survey.example.html) Each author was sent an e-mail request to participate in the web-based survey. (A copy of the e-mail used to solicit authors can be viewed at http://www.openaccesspublishing.org/apc/survey.request.example.html) Authors who failed to respond within approximately a week were sent a second e-mail request.

Additional data were collected from the journal website and the DOAJ. The data elements included the journal publisher, ISSN, amount of the APC, and discipline of the journal based on what was listed in the DOAJ. For a subset of the journals, the APC was based on the number of pages published. In those cases, we calculated the actual APC based on the number of pages in the article that the author published in that journal.

For each article, we collected the title, corresponding author's country, their name, e-mail address, and either the digital object identifier (DOI) or uniform resource locator (URL) of the article. These data were merged with the survey responses.

The survey and other data collection procedures were piloted with 123 authors from four journals in medical education. No changes were made in the instrument or procedures for the main study. As such, data from the pilot were included in the analyses.[2] The statistical significance of the relationship among variables in Tables 2–6 (below) was assessed using Fisher's exact test.

[2]We included all articles published in 2010 in the pilot. One journal, BMC Medical Education, had approximately 100 articles in 2010. We decided that the advantage of a larger sample size gained by including all the data from these authors outweighed the potential biasing effect.

TABLE 1. Articles published over the last 5 years in different types of journals.

Number of articles published	Subscription journals	OA journals w/o APC	OA journals with APC
0	14%	51%	17%
1–5	36%	38%	74%
6–10	22%	6%	6%
11–20	14%	3%	2%
21–30	7%	1%	1%
30–40	4%	0%	1%
Above 40	3%	1%	0%

Note. Percentages are based on 429 respondents.

The study protocol was reviewed by the Biomedical and Health Institutional Review Board of the Michigan State University Human Research Protection Program and deemed to be "Exempt" (IRB # x10-1223). All currency amounts are listed in USD.

Results

Description the Respondents

A total of 429 or just over 41% of the authors responded to the request to complete the survey. They were located in 65 countries and published articles in 69 journals from 23 publishers. A total of 111 or approximately 26% of the authors had published articles in journals that had impact factors listed in the JCR 2009. A total of 266 or approximately 62% of the authors were from countries where the annual per capita Gross National Product (GNP) was greater than $25,000 per year in 2008. These included countries in North America, Western Europe, Japan, Australia, and New Zealand. The tables that list the author's country, journal in which they published, and the publishers are shown in the Appendix.

Although the response rate of 41% was less than we hoped, it is considerably higher than many of the studies in this area, for example, Nichols et al. (2005b) and Dallmeier-Tiessen et al. (2010). Additionally, a broad range of authors in terms of discipline, location, and the size of the APC paid responded to the survey.

Table 1 provides a breakdown of the total number of articles published over the last 5 years in (a) subscription journals, (b) OA journals that do not charge APCs, and (c) journals that do charge APCs. The table is based on three questions in the survey, which ask to indicate the number of articles published over the last 5 years in each of the above-mentioned categories. The authors were asked: "If there were a journal in which you had a strong desire to publish, what would be the maximum APC you would be willing to pay?" The responses ranged from $0 to $5,000 USD, with an average amount of $649 and a standard deviation of $749. We suspect that many of the authors interpreted the question to mean how much of their own personal funds they would be willing to pay rather than as intended, how much they would

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TABLE 2. Article processing charges by discipline categories.

	APC category				
	<500	501–1000	1001–2000	2001–3000	Number
Agriculture and Forestry	71%	29%			7
Business and Economics	71%	29%			7
Chemistry, Earth Sciences, Physics, and Astronomy	10%	50%	40%		10
Education, Social Sciences, Law, and Political Science	13%	67%	20%		15
Health Sciences, Biology, and Life Sciences	7%	14%	50%	29%	14
History and Archaeology, Arts and Architecture, Languages, and Literatures			100.0%		1
Technology, Engineering, Mathematic and Statistics, Computer Science	27%	53%	20%		15

Note. APC = article-processing charges.
APC categories are in US Dollars (USD).
The percentages in each cell are for the number (given in the last column) of journals that discipline category.
Statistical significance (Fisher's exact) $p < 0.0001$.

TABLE 3. Analysis APC by JCR 2009.

	APC category				
	<500	501–1000	1001–2000	2001–3000	Number
JCR 2009					
No	35%	50%	13%	2%	48
Yes	5%	24%	57%	14%	21

Note. APC = article-processing charges. JCR 2009 = Journal Citation Report of 2009.
The percentages in each cell are for the number (given in the last column) of journals included/not included in the JCR 2009.
APC categories are in US Dollars (USD).
Statistical significance (Fisher's exact) $p < 0.0001$.

be willing to pay from any funds available, for example a grant or institutional funds. Our concern stemmed from the fact that approximately 20% of the responses were under $100, far lower than most APCs. In addition, in over half the cases, the amount the author indicated was lower than the actual APC they paid to publish the article from which we obtain their name and email address as the corresponding author. For this reason we have not pursued further analysis of this question.

Journal APC Cost Analysis

As noted above, the respondents were published in 69 journals. Tables 2 and 3 break down the journals' APC by discipline and whether or not the journal was listed in the JCR 2009. Please note that the unit of analysis for these tables is the journal, rather than the author. For those journals where the APC was based on the number of pages published, we averaged the APC across the sample of responding authors publishing in the particular journal.

Source of APC

Tables 4–6 breakdown the source of funding for the APC by discipline category, the GNP of the author's country, and size of the APC categorized, respectively. The respondents were given an opportunity to provide written comments concerning the sources that were used for paying the APC. Five authors indicated they did not pay an APC. In tracking down the reason, we found that one of the journals was launched in 2010 and did not start charging APCs until 2011. We inadvertently selected another journal for which the publisher charged APCs for some of their journals but not that particular journal. Nine respondents indicated they used multiple sources to pay these fees. In six cases, this involved a mix of personal funds and some other source of institutional funding. We did not find any other comments that were notable or consistent enough to describe.

Choice of Journal

Figure 1 summarized the authors' rating of six factors influencing their choice of a journal in which to publish. The respondents were also given an opportunity to provide written comments concerning choice of a journal in which to publish. Ten of the comments indicated they chose the journal because they had difficulty getting their manuscript published in other journals. In five of these comments the authors felt the journal they eventually published was more willing to accept unusual or non-standard approaches to research/scholarship or presentation formats.

In 12 of the comments the author indicated a relatively low APC was an important factor in selecting the journal. Four respondents made comments that in general APCs were too high particularly for authors without funding. In addition,

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TABLE 4. Source of funding by discipline category.

	Source of Funding						
	Grant or contract	National funding (OA policy)	Institutional funding (OA policy)	Discretionary funds (institutional)	Personal funds	Fee waived	Other	Number
Agriculture and Forestry	23%	4%	15%	4%	35%	13%	7%	48
Business and Economics	10%	4%	4%	23%	46%	10%	2%	48
Chemistry, Earth Sciences, Physics, and Astronomy	30%	9%	17%	11%	24%	9%	3%	47
Education, Social Sciences, Law, and Political Science	17%	2%	17%	21%	19%	17%	6%	110
Health Sciences, Biology, and Life Sciences	46%	4%	10%	20%	8%	8%	5%	77
History and Archaeology, Arts and Architecture, Languages, and Literatures	20%	20%				40%	20%	5
Technology, Engineering, Mathematic and Statistics, Computer Science	24%	5%	10%	32%	15%	14%	1%	88

Note. OA = open access.
Statistical significance (Fisher's exact) $p < 0.001$. The percentages in each cell are for the number (given in the last column) of authors who published articles in that discipline category.

TABLE 5. Source of funding by authors' country GNP category.

	Per capital GNP	
	Over $25,000 USD	Under $25,000 USD
Grant/contract	31%	16%
National funding (OA policy)	5%	3%
Institutional funding (OA policy)	10%	16%
Discretionary funds (institutional)	26%	10%
Personal funds	11%	39%
Fee waived	12%	3%
Other	5%	3%
Number	262	159

Note. GNP = Gross National Product; OA = open access.

Statistical significance (Fisher's exact) $p < 0.001$. The percentages in each cell are for the number (given in the bottom row) of authors who published articles in that discipline category.

TABLE 6. Source of funding by size of APC in USD.

	Size of APC in USD			
	<500	501–1000	1001–2000	2001–3000
Grant/contract	17%	23%	30%	67%
National funding (OA policy)	4%	4%	4%	14%
Institutional funding (OA policy)	8%	12%	17%	7%
Discretionary funds (institutional)	17%	20%	24%	7%
Personal funds	35%	26%	6%	
Fee waived	17%	12%	11%	7%
Other	3%	3%	8%	
Number	109	167	132	15

Note. APC = article-processing charges; USD = US dollars; OA = open access.

The percentages in each cell are for the number (given in the bottom row) of authors who published articles in that discipline category.

Statistical significance (Fisher's exact) $p < 0.001$.

three authors replied back to the email request to participate in the survey indicating they felt that high APCs were a hardship or unfair. Eleven respondents indicated that the journal's quality, impact or the ability to disseminate to a particular audience was an important factor in selecting the journal. Ten respondents indicated the quality of the service they received from the publisher such as the speed of the review/publication process or responsiveness to their questions was an important factor in choosing the particular journal. Four respondents indicated the ability to publish color figures, multimedia or lack of page length limitations were important factors in their choice of a journal.

Discussion

Our survey confirmed the results of previous studies concerning what factors authors take into consideration when choosing where to submit a manuscript. The three most

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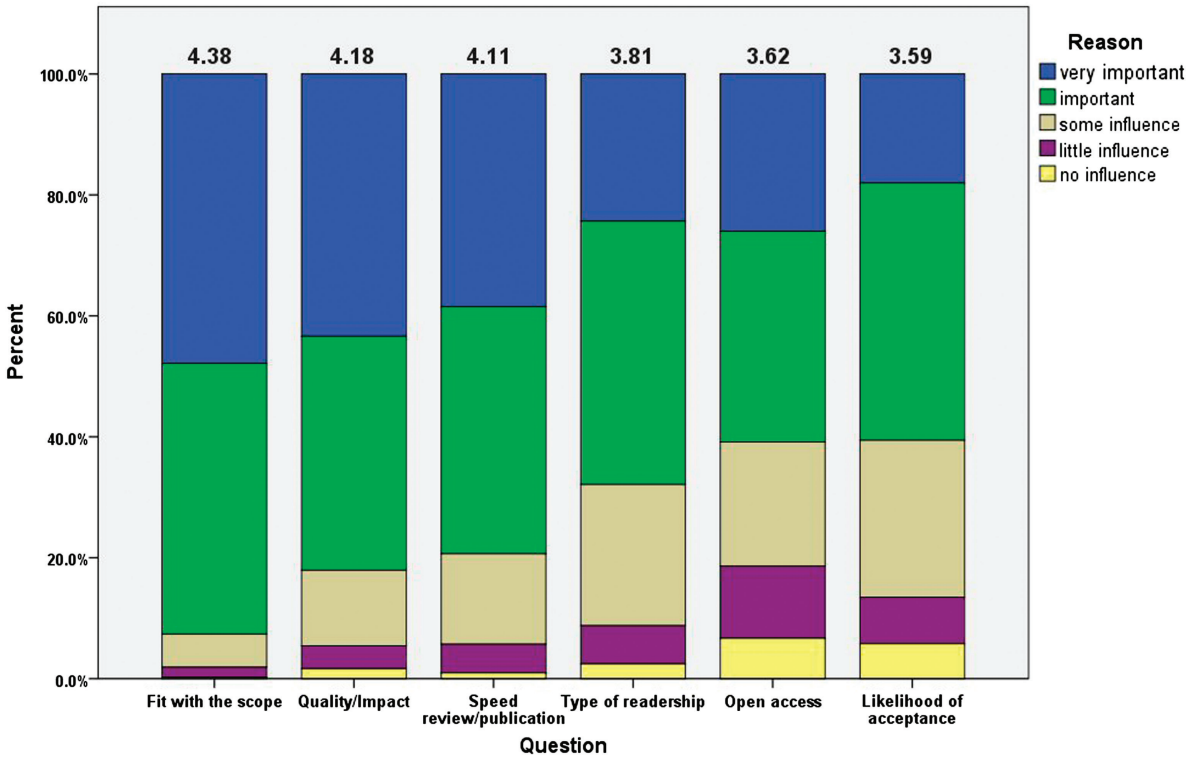

Note. Numbers above the bar indicate mean rating on 1–5 scale.

FIG. 1. Factors influencing the choice of a journal rated by importance. [Color figure can be viewed in the online version, which is available at wileyonlinelibrary.com.]

important factors were the fit of the article within the subject area of the journal, the scientific quality of the journal in some cases as measured by the impact factor, and the speed of review and publication. The OA status of the journal was slightly less important, although 60% of the respondents judged this very important of important. One has to bear in mind that this survey was specifically targeted at authors who have recently submitted to and published in an OA journal, in contrast to most earlier studies.

Three journals from the list used in our study can be used to illustrate the role of these factors in the author submission choice. The Journal of Medical Internet Research belongs to a wider group of electronic-only OA journals, often founded in the late 1990s, which focus on the different aspects of the use of the web and thus offers a natural outlet for "papers" in that domain. PLoS Biology in its turn was, from the start, designed to be a top-quality journal and is in fact the number one journal in its subject area, as measured by the impact factor. The service offering of PLoS One has been, from the start, to provide a very rapid publication cycle combined with the wide dissemination and high-quality standards of the publisher in question.

A frequently heard argument against APC-funded journals is that they place authors in different positions depending on their possibilities to obtain the funding needed to pay the fee. We found two main factors influencing the financing possibilities: first, the research discipline and, second, the country of origin of the author. Among our respondents, grant financing of APCs is more common in the bio and physical sciences than in the social sciences and humanities. Our results also show that research grants or institutional funds dominate as financing mechanism for journals charging higher APCs, whereas personal funds play a much bigger role in the lower APC brackets (below $1,000). Personal funds are also much more used by authors from lower income countries.

Nicholas and Rowlands (2005) were somewhat surprised to find that only a minority of the respondents in their study associated OA publishing with a payment model. This could be explained by the fact that OA journals charging APCs were still very rare at the time of the survey in January 2004.

In Swan and Brown's (2004) survey, those authors who had previously published in OA journals reported if and how they had paid a possible APC. Thirty-six percent of the authors had not paid a fee at all, and for 19%, the fee had been waived by the publisher. Twenty-five percent had paid the fee from their research grant, 8% from departmental funds, and 9% from other institutional funds. In 4% of cases, the fee was paid by the author (Swan & Brown, 2004). Their results indicate a lower degree of direct author funding. One has to bear in mind that their study was done several years ago and that authors' views on OA and preferences may have changed in the meantime.

Our results can also be compared with results from the European Commission-funded SOAP project, which has been carried out in parallel with this study (Dallmeier-Tiessen et al., 2011). Our study differs in a number of

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important ways from the SOAP survey, which used massive e-mailing to authors who had published with some of the participating publishers. The survey focused on their attitudes towards OA. The response rate was just over 2.5% of the roughly 1,500,000 researcher/scholars who received the e-mail. Those respondents who had published in an OA journal answered additional questions. The distribution of the means of financing the APCs roughly corresponded to our results. An important question concerned the ease of obtaining the needed funding, and their study showed substantial differences between disciplines with researchers from the physical sciences, who had the least amount of difficulty, and researchers in the social sciences and humanities, who claimed the highest level of difficulty.

Although journals tend to justify the specific levels of their APC with their costs per published paper (supply side), equally important is the authors' willingness to pay the APC of a particular journal (demand side). A comparison of the journals included in the study (Table 3) reveals that the level of the APC charged is strongly related to the objective or perceived quality of the journal. Seventy-one percent of journals with an ISI-impact factor charged more than 1,000 USD, whereas the corresponding figure was 15% for journals without an impact factor. The journals charging the highest APC also have the highest impact factors (Plos Biology APC = $2,900, impact factor = 12.9; Nucleid Acids Research APC = $2,770, impact factor = 7.4).

Scientific journal publishing is in a state of change, with OA journals rapidly increasing their market share. Most of this growth is occurring in established or newly founded journals using APCs to fund the operation. For the last few years, this growth has, according to Laakso et al. (2011), been more or less a linear at round 30%, but the big question is if this new service model, after an initial pioneering stage, is reaching the steep incline of the classical adoption curve of innovations. Author attitudes towards paying the required APCs and their ability to obtain funding, balanced against the quality of the service they experience, will determine what the peer-reviewed journal looks like in the future.

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References

Bird, C. (2008). Oxford Journals' adventures in open access. Learned Publishing, 21(3), 200-208. doi:10.1087/095315108X288910

Björk, B.-C., & Holmström, J. (2006). Benchmarking scientific journals from the submitting author's viewpoint. Learned Publishing, 19(2), 147–155.

Björk, B.-C., & Öörni, A. (2009). A method for comparing scholarly journals as service providers to authors. Serials Review, 35(2) 62–69.

Dallmeier-Tiessen, S., Goerner, B., Darby, R., Hyppoelae, J., Igo-Kemenes, P., Kahn, D., . . . van der Stelt, W. (2010). Open access publishing - Models and attributes. Retrieved from http://edoc.mpg.de/478647

Dallmeier-Tiessen, S., Darby, R., Goerner, B., Hyppoelae, J., Igo-Kemenes, P., Kahn, D., . . . van der Stelt, W. (2011). Highlights from the SOAP project survey. What scientists think about open access publishing. Working paper, arXiv, 28.1.2011 Retrieved from http://arxiv.org/abs/1101.5260v2

Guédon, J.C. (2001). In Oldenburg's long shadow: Librarians, research scientists, publishers, and the control of scientific publishing. Proceedings of the 138th Membership Meeting of the Association of Research Libraries. Washington, DC: Association of Research Libraries. Retrieved from http://www.arl.org/resources/pubs/mmproceedings/138guedon.shtml

Laakso, M., Welling, P., Bukvova, H., Nyman, L., Björk, B.-C., & Hedlund, T. (2011). The development of open access journal publishing from 1993 to 2009. PLoS ONE 6(6) e20961. doi:10.1371/journal.pone.0020961

Nicholas, D., & Huntington, P., & Rowland, I. (2005). Open access journal publishing. The views of some of the world's senior authors. Journal of Documentation, 61(4), 497–519.

Nicholas, D., & Rowlands, I. (2005). Open access publishing: The evidence from the authors (guest editorial). The Journal of Academic Librarianship, 31(3), 179–181.

Nisonger, T. (1999). JASIS and library and information science journal rankings: A review and analysis of the last half-century, Journal of the American Society for Information Science, 50(11), 1004–1019.

Schroter, S., Tite, L., & Smith, R. (2006). Open Access publishing and author-pays business models: A survey of authors' knowledge and perceptions, Journal of the Royal Medical Society, 99(3), 141–148.

Swan, A., & Brown, S. (1999). What authors want – The ALPSP research study on the motivations and concerns of contributors to learned journals. ALPSP. Retrieved from http://www.alpsp.org/ngen_public/article.asp?id=200&did=47&aid=356&st=&oaid= −1

Swan, A., & Brown, S. (2004). Authors and open access publishing. Learned Publishing 17, 219–224.

Tenopir, C., & King, D. (2000). Towards electronic Journals – Realities for scientists, librarians and publishers. Washington, D.C: Special Libraries Association.

Ware, M., & Mabe, M. (2009). The STM report – An overview of scientific and scholarly journals publishing. International Association of Scientific, Technical and Medical Publishers (pp. 68). Retrieved from http://www.stm-assoc.org/2009_10_13_MWC_STM_Report.pdf

Ziobrowski, A.J., & Gibler, K.M. (2000). Factors academic real estate authors consider when choosing where to submit a manuscript for publication. Journal of Real Estate Practice and Education, 3(1), 43–54.

Appendix

Publisher

	Frequency	Percent		Frequency	Percent
Academic Journals	34	7.9	MDPI AG Open Access Publishing	43	10.0
Aston Journals	13	3.0	Nature Publishing Group	3	0.7
Bentham Open	27	6.3	Neoplasia Press	5	1.2
BioMed Central	81	18.9	Open Journals Publishing	28	6.5
Canadian Center of Science and Education	7	1.6	Oxford Journals	2	0.5
Co-Action Publishing	23	5.4	Public Library of Science	13	3.0
Dove Press	4	0.9	SAGE-Hindawi Access to Research	3	0.7
European Journals, Inc.	6	1.4	Sciedu Press	19	4.4
Friends Science Publishers	6	1.4	The Optical Society	3	0.7
Gunther Eysenbach	8	1.9	University of Lampung	1	0.2
Hindawi Publishing Corporation	91	21.2	Wiley-Blackwell	4	0.9
Libertas Academica	5	1.2	Total	429	100.0

Country

	Frequency	Percent		Frequency	Percent
Australia	10	2.3	Malaysia	11	2.6
Austria	3	0.7	Mexico	5	1.2
Bangladesh	1	0.2	Netherlands	5	1.2
Belgium	2	0.5	New Zealand	1	0.2
Botswana	1	0.2	Nigeria	16	3.7
Brazil	10	2.3	North Ireland	1	0.2
Brunei	1	0.2	Norway	2	0.5
Bulgaria	1	0.2	Pakistan	4	0.9
Cameroon	2	0.5	Peru	1	0.2
Canada	18	4.2	Portugal	6	1.4
Chile	1	0.2	Qatar	1	0.2
China	24	5.6	Republic of Korea	3	0.7
Cyprus	2	0.5	Russia	2	0.5
Czech Republic	1	0.2	Saudi Arabia	2	0.5
Denmark	5	1.2	Scotland	1	0.2
Egypt	1	0.2	Serbia	2	0.5
Ethiopa	1	0.2	South Africa	28	6.5
Finland	7	1.6	Spain	11	2.6
France	2	0.5	Sweden	10	2.3
Germany	13	3.0	Switzerland	1	0.2
Ghana	2	0.5	Taiwan	7	1.6
Greece	7	1.6	Tanzania	1	0.2
Hungary	1	0.2	Thailand	3	0.7
Inda	1	0.2	The Netherlands	3	0.7
India	9	2.1	Tunisia	1	0.2
Indonesia	2	0.5	Turkey	10	2.3
Iran	6	1.4	Uganda	2	0.5
Isreal	5	1.2	UK	21	4.9
Italy	17	4.0	USA	98	22.8
Japan	8	1.9	Vietnam	1	0.2
Jordan	1	0.2	Total Valid Responses	427	99.5
Korea	1	0.2	Missing	2	0.5
Kuwait	1	0.2	Total	429	100.0

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Journal

	Frequency	Percent		Frequency	Percent
Acta Crystallography: Structure Reports Online	4	0.9	International Research Journal of Finance and Economics	6	1.4
Advances in Civil Engineering	7	1.6	Journal of Aesthetics & Culture	5	1.2
Advances in Materials Science and Engineering	6	1.4	Journal of Agricultural Science	7	1.6
Advances in Medical Education and Practice	4	0.9	Journal of Automated Methods and Management in Chemistry	1	0.2
Advances in Physical Chemistry	5	1.2	Journal of Biomedicine and Biotechnology	4	0.9
Advances in Software Engineering	7	1.6	Journal of Cheminformatic	5	1.2
African Journal of Agricultural Research Journal	9	2.1	Journal of Management and Strategy	11	2.6
African Journal of Business Management	5	1.2	Journal of Medical Internet Research	8	1.9
African Journal of Political Science and International Relations	5	1.2	Journal of Public Administration and Policy Research	6	1.4
Algorithms	5	1.2	Jurnal Tanah Tropika	1	0.2
Applied Computational Intelligence and Soft Computing	8	1.9	Life Sciences and Medicine Research	9	2.1
Bioinorganic Chemistry and Applications	6	1.4	Mathematical Problems in Engineering	4	0.9
BMC Biology	5	1.2	Medical Education Online	7	1.6
BMC Biotechnology	5	1.2	Molecules	3	0.7
BMC Medical Education	41	9.6	Neoplasia: An International Journal for Oncology Research	5	1.2
BMC Public Health	7	1.6	Nucleic Acids Research	2	0.5
Business and Economics Journal	4	0.9	Nursing Research and Practice	4	0.9
Cardiology Research and Practice	3	0.7	Open Medical Education Journal	3	0.7
Cell Death and Disease	3	0.7	Optics Express	3	0.7
Chemistry Central Journal	7	1.6	PLoS Biology	5	1.2
Clinical Medicine : Pediatrics	5	1.2	PLoS ONE	8	1.9
Discrete Dynamics in Nature and Society	7	1.6	Remote Sensing	9	2.1
Economics Research International	5	1.2	SA Journal of Human Resource Management	8	1.9
Education Research International	6	1.4	SA Journal of Industrial Psychology	6	1.4
Energies	6	1.4	Sensors	9	2.1
Forest	6	1.4	South African Journal of Information Management	8	1.9
Global Health Action	11	2.6	The Journal of Geography and Regional Planning	4	0.9
Globalization and Health	4	0.9	The Open Anthropology Journal	4	0.9
International Journal of Agriculture and Biology	6	1.4	The Open Behavioral Science Journal	1	0.2
International Journal of Agronomy	10	2.3	The Open Business Journal	10	2.3
International Journal of Antennas and Propagation	4	0.9	The Open Construction & Building Technology Journal	9	2.1
International Journal of Dentistry	5	1.2	Verbum et Ecclesia	6	1.4
International Journal of Financial Research	8	1.9	Water	5	1.2
International Journal of Health Geographics	7	1.6	Total	429	100.0
International Journal of Physical Sciences	5	1.2			
International Journal of Quality, Statistics, and Reliability	2	0.5			

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