Open Access and Academic Journal Quality

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Scholars and librarians have grown increasingly dissatisfied with the market for academic journals. New technologies might be expected to lower journals’ production and distribution costs, and for these reduced costs to factor into reduced prices; but library subscription prices remain high (Theodore Bergstrom, 2001) and indeed have continued to rise faster than inflation (McCabe, 2002). This dissatisfaction has led to the proposal of a new business model for academic journals, open access. In contrast to a traditional journal, which generates most of its revenue with subscription fees, an open-access journal makes its articles freely available on the Internet, generating revenue with author fees. As of October 2004, the Directory of Open Access Journals (www.doaj.org) listed over 1,300 open-access journals across academic fields. Perhaps the most famous of these are the biomedical journals published by the Public Library of Science, founded by Nobel-prize-winning biologist Harold Varmus to compete against the top-tier journals in the field. These journals charge substantial author fees, $1,500 per accepted paper.¹

The fee structure of journals has important consequences for social welfare. Subscription prices have risen to the point that libraries have begun to cancel significant titles, potentially harming scholars in their roles both as readers and authors. Research-funding institutions such as the U.S. National Institutes of Health and the Wellcome Trust have considered policies ranging from increasing the amount that is budgeted in grants for author fees to requiring that funded authors publish in open-access journals.

Much of the previous theoretical work on academic journals (see e.g., Doh-Shin Jeon and Domenico Menicucci, 2003; McCabe, 2004) cannot be used to study open access because it only considers one side of the market, library subscriptions, and does not endogenize author fees on the other side of the market. In an earlier paper (McCabe and Snyder, 2004a), we constructed a two-sided-market model with bilateral externalities (readers obtain benefits from reading, and authors obtain benefits from being read). We showed that a commercial journal is more likely to adopt open access the lower its market power, the lower its marginal cost of serving readers, and the greater are author benefits relative to reader benefits. The last result holds because, if authors have relatively high benefits per reader, the journal will try to recruit more readers by lowering subscription fees, thus increasing the revenue that can be extracted from authors. We proved a series of “anything is possible” results, providing cases in which even a monopoly journal would adopt open access in equilibrium and other examples in which open access is not socially efficient even if the marginal cost of serving readers were zero.

In the present paper, we extend our previous model to allow articles and journals to vary in quality. Good articles provide a reader benefit; bad articles do not. Readers cannot tell the quality of articles prior to reading them, and reading an article requires an effort cost. Journals’ quality differences emerge endogenously through the talent of their editors, where more talented editors can distinguish between good and bad articles with more precision. High-quality journals thus publish more good articles. This extension is useful because it allows for a more realistic depiction of journals. It also allows us to answer new questions of policy relevance about open access. First, should we

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expect to see open access being more likely to emerge at the high-quality or low-quality end of the journal spectrum? Harold Varmus suggested that open access should emerge at the high end: “The most important thing is that we, as publishers of open access journals, want our journals to be high quality. It is the only way we are going to succeed” (House of Commons, 2004 p. 80). The House of Commons Science and Technology Committee concluded otherwise: “There is a risk that some parts of the market would be able to produce journals quickly, at high volume and with reduced quality control and still succeed in terms of profit, if not reputation. Such journals would cater for those academics for whom reputation and impact were less important factors than publication itself” (House of Commons, 2004 p. 80). Second, should we expect open-access journals to lower their quality standards in order to boost revenue from author fees? Such is the attack often leveled against open access by commercial publishers, for example the CEO of Elsevier: “If you are receiving potential payment for every article submitted there is an inherent conflict of interest that could threaten the quality of the peer review system” (House of Commons, 2004 p. 81).

I. Model

There are three sorts of agents in the model: a unit mass of authors, a unit mass of readers, and a single commercial (i.e., profit-maximizing) journal. Authors submit articles of varying quality to the journal. The journal (more precisely, the journal’s editor; the two labels will be used interchangeably here) judges the quality of the submitted articles and accepts a subset. Accepted articles are bundled together in an issue and distributed to readers. Each author is endowed with a single article. Authors obtain a benefit $b_a \geq 0$ per reader, derived in part from the fact that having more readers increases the article’s impact and chances of being cited and thus improves the author’s career prospects. The analysis is considerably simplified without much loss of insight with the assumption that all authors have the same benefit $b_a$. Articles are of random quality. A fraction $\gamma \in [0, 1]$ of them are “good” and $1 - \gamma$ are “bad.” Readers only obtain a benefit from reading good articles. Since there will be a cost per article of reading, readers will prefer journals that have a high percentage of good articles. To simplify the model, assume authors do not know their own article’s quality prior to submission.\(^2\)

The editor can only imperfectly determine an article’s quality, depending on his talent, $t \in [0, 1]$. The editor can perfectly identify good articles as being good. With probability $t$, he correctly identifies a bad article as being bad. With probability $1 - t$, he mistakenly judges a bad article to be good. Assume that $t$ is public information.

Readers obtain no benefit from reading bad articles. Reader $k$ obtains benefit $b_{rk} \geq 0$ per good article read. Assume $b_{rk}$ is a random variable with cumulative distribution function $F$ and density $f$. Reading an article requires effort, which costs the reader $p - 0$. Hence the reader wishes to avoid reading bad articles, which provide no benefit but are costly to read. The reader cannot determine the quality of an article prior to reading it.

Let $c_s \geq 0$ be the journal’s cost of handling a submitted article up through and including the process of judging its quality, reflecting the cost of referees’ and editor’s time and any administrative costs of processing the author’s account. Let $c_a \geq 0$ be the cost of processing an accepted article, reflecting copyediting, typesetting, and administrative expenses. The cost of distributing the articles to a single reader includes a fixed cost $c_r \geq 0$ for the bundle of articles in the journal (reflecting the cost of servicing the reader’s account and any fixed shipping and handling costs) plus a variable cost $c$ per article (reflecting remaining variable shipping costs, including the cost of bandwidth in the case of Internet distribution).

The journal charges submission fee $p_s$ and, conditional on acceptance, accepted-paper fee

\(^2\) This assumption is consistent with a number of other recent papers involving quality certification by an intermediary (Josh Lerner and Jean Tirole, 2004; Alan Morrison and Lucy White, 2004). It serves to simplify the analysis by abstracting from complicated signaling behavior by informed authors. Lerner and Tirole show that adding upstream private information does not alter their basic analysis (their Proposition 4).
The journal charges subscription fee $p_\text{r}$ to readers for the bundle of articles in the journal. We will constrain prices $p_\text{s}$, $p_\text{a}$, and $p_\text{r}$ to be nonnegative. Assume that an article’s quality cannot be verified ex post, so in particular, the journal’s pricing scheme cannot be conditioned on realized quality (although in equilibrium fees will depend on editorial talent).

The timing of the model is as follows. First, the journal chooses prices. Then authors and readers simultaneously make their submission and subscription decisions. Finally, the journal decides which articles to accept or reject. We will look for a subgame-perfect, rational-expectations equilibrium in which outcomes on any subgame involving the infinitesimal players (authors and/or readers) is a strong Nash equilibrium (Robert Aumann, 1959).

II. Will High-Quality Journals Adopt Open Access?

Taking the case of a monopoly commercial journal, we will perform the comparative-statics exercise of examining the effect of a change in the editor’s talent $t$ on the equilibrium subscription price with the goal of determining whether a high- or low-quality journal would be more likely to adopt open access.

In this section, we will maintain the assumption that the editor can commit to a policy of only accepting articles believed to be good. Under this editorial policy, the probability of acceptance, denoted $\alpha$, is $\alpha = \gamma + (1 - \gamma)(1 - t)$. Journal profit is

$$\text{(1)} \quad p_\text{s}n_\text{s} + \alpha p_\text{a}n_\text{a} + p_\text{r}n_\text{r} - TC(n_\text{s}, n_\text{r})$$

where $TC(n_\text{s}, n_\text{r})$ is the total cost function, $\text{(2)} \quad TC(n_\text{s}, n_\text{r}) = n_\text{s}c_\text{s} + \alpha n_\text{a}c_\text{s} + n_\text{r}c_\text{r} + \alpha n_\text{a}n_\text{r}c.$

Aggregate author demand is inelastic because authors are homogeneous. The number of submissions is positive, equal to the unit mass of authors, if and only if net author surplus,

$$\text{(3)} \quad \alpha(n_\text{r}b_\text{a} - p_\text{s}) - p_\text{s}$$

is nonnegative. Reader $k$’s expected net surplus from subscribing to the journal is

$$\text{(4)} \quad \gamma n_\text{r}b_\text{rk} - \alpha n_\text{r}p - p_\text{r}.$$

Reader $k$ will subscribe to the journal if expression (4) is nonnegative, implying that aggregate reader demand is

$$\text{(5)} \quad n_\text{r} = 1 - F\left(\frac{p_\text{r} + \alpha n_\text{r}p}{\gamma n_\text{a}}\right).$$

Conditional on the level of the total expected payment from an author to the journal $p_\text{s} + \alpha p_\text{a}$, the particular division into subscription fee $p_\text{s}$ and acceptance fee $p_\text{a}$ is irrelevant. (This division will become relevant in the next section.) Without loss of generality, we will set the equilibrium submission fee, $p_\text{s}^*$, to 0. Then the equilibrium acceptance fee will be the highest value subject to author demand being positive. From equation (3), the equilibrium acceptance fee and author demand satisfy $p_\text{a}^* = n_\text{r}b_\text{a}$ and $n_\text{a}^* = 1$. The equilibrium subscription fee maximizes journal profit, which upon substituting $p_\text{s} = n_\text{r}b_\text{a}$ and $n_\text{a} = 1$, as well as equations (2) and (5) into (1), becomes

$$\text{(6)} \quad \Pi(p_\text{r}) = (\alpha b_\text{a} + p_\text{r} - c_\text{r} - \alpha c)$$

$$\times \left[1 - F\left(\frac{p_\text{r} + \alpha p}{\gamma}\right)\right] - c_\text{s} - \alpha c_\text{s}.$$

Applying the implicit function rule to equation (6) yields the following proposition.

**PROPOSITION 1.** Assume $b_\text{a} > \rho + c$. Assume the second-order condition from maximization of profit in equation (6) holds. The equilibrium subscription fee $p_\text{s}^*$ charged by a commercial
Proposition 1 states that, under the specified conditions, the subscription fee is increasing in editorial talent, implying that if a high-quality journal adopts open access in equilibrium, a lower-quality journal would also. Hence, under the conditions of the proposition, a low-quality journal would be more likely to adopt open access. The intuition for the result is that as journal quality (equivalently, editorial talent) increases, authors suffer a direct loss and readers enjoy a direct benefit. The direct loss to an author is that his article is published with lower probability since his article may be bad, and bad papers are more likely to be rejected. The direct benefit to a reader is that his cost of reading the journal falls because the journal contains fewer bad articles. The journal optimally responds to the relative changes in surpluses by reducing author fees and increasing reader fees.

Some caveats regarding Proposition 1 are in order. The result can be reversed (thus, high-quality journals can be more likely to adopt open access) if the conditions underlying the proposition do not hold. Furthermore, as shown in McCabe and Snyder (2004b), the results for nonprofit journals are less clear-cut. As discussed in the Introduction, many other supply and demand parameters enter into the decision to adopt open access besides journal quality.

As noted in the Introduction, critics of open access suggest that open access may lead to a corruption of the editorial process. Because an open-access journal obtains its revenue from authors rather than readers, it may have to charge high author fees to be viable. Once high author fees are in place, the journal may have an incentive to publish many articles to boost revenue, lowering editorial standards if need be.

To address this issue of possible “overpublishing” by open-access journals, we will examine a model in which the journal cannot commit to abide by the editorial standard of accepting only those articles believed to be good. Rather, the journal makes its editorial decision after pricing, submission, and subscription decisions have been sunk. A commercial journal would then make the acceptance/rejection decision solely to maximize ex post profit. To make the commitment problem as stark as possible, we maintain a static model, abstracting from any long-run concerns for reputation that might mitigate the commitment problem.

The next proposition states that, even in this stark model, the commitment problem has no bite: the journal can obtain the same profit as the journal that can commit by setting \( p^* = \frac{a \cdot (n + c)}{1 - y} \), \( p^* = n^* \gamma c + c^* \), and \( p^* = \gamma r \).

As opposed to the case in the previous section in which the journal could commit to an editorial policy (a case in which there were a whole range of combinations of submission and acceptance fees that could provide an optimum for the journal), when the journal cannot commit to an
editorial policy, the division of author fees into submission and acceptance fees is crucial. The acceptance fee is optimally set to the marginal cost of an additional acceptance $n^*c_a + c_a$: a higher fee and it will “overpublish”; a lower fee and it will “underpublish.”

The normative lesson from Proposition 2 is that a journal should design its author-fee schedule with care. The proposition suggests merits of reducing the acceptance fee to the marginal cost of accepting an article, extracting further author surplus by raising the submission fee. The author-fee schedules of some prominent open-access journals do not appear to conform to this normative lesson. The Public Library of Science journals mentioned in the Introduction charge $1,500 acceptance fees and no submission fees. It may be the case that these journals are confident that a desire to maintain a long-run reputation is sufficient to mitigate the “overpublishing” problem. Still, there would appear to be little loss, and the potential gain in the commitment to quality standards from having more balance between submission and acceptance fees. The Berkeley Electronic Press economics journals (not open-access journals, but online journals that charge relatively high author fees) have a fee schedule that is closer to that suggested by Proposition 2. These journals charge a $350 submission fee (or an agreement to referee two papers) and no acceptance fees. Given these journals do little copyediting after accepting articles and have a fairly automated system of posting articles online, it is plausible to suppose the parameters $c_a$ and $c$ are near zero for these journals, so that an acceptance fee near zero is plausibly close to their marginal cost of accepting an article.

IV. Conclusion

In this paper, we constructed a simple model of journal quality. Authors submit articles of unknown quality to a journal. The quality of the journal is related to the talent of the editor in distinguishing bad from good articles. High-quality articles are valuable to readers because they contain fewer bad articles that are costly to read but provide no benefit. The journal can potentially charge fees to both sides of the market, authors and readers, and can further subdivide author fees into submission and acceptance fees. In Section II, we highlighted some effects that would lead low-quality journals to adopt open access more readily than high-quality journals. In Section III, we evaluated the claim that open access, because it involves author fees, may degrade quality as journals publish more, lower-quality articles to boost revenue. We showed that a judicious division of author fees into submission and acceptance fees would mitigate this problem.

REFERENCES


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