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THE ECONOMICS OF SCHOLARLY PUBLICATIONS AND THE INFORMATION SUPERHIGHWAY

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THE ECONOMICS OF SCHOLAR PUBLICATIONS

AND THE INFORMATION SUPERHIGHWAY

by

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Abstract

This article examines the basic economics of scholarly publications, especially technical journals, and applies this model to the consequences of low-cost electronic publication. The article discusses the demand for scholarly publication: dissemination of new information to students, other researchers and professional users outside the educational community; reputation development by scholars and research institutions; and the evaluation of research personnel by peers and superiors. The key supply feature of scholarly publication is that some uses are public goods, and others have strong economies of scale. Electronic publication reduces duplication and storage costs, but does not have much of an effect on fixed costs, and so is a minor technological change purely from the perspective of costs. However, electronic publication is a major change in two respects: it radically alters the relative costs of enhancements to straight textual material, and so may change the content of publications, and it dramatically reduces the cost of unauthorized duplication. The article focuses on the latter problem, and explores some of its possible consequences.

The Economics of Scholarly Publications and the Information Superhighway

Electronic technology offers many interesting opportunities for lowering the costs, increasing the variety, and speeding the dissemination of scholarly publications. Unfortunately, electronic publication also presents some new problems, and aggravates others. Specifically, because electronic duplication is much cheaper than duplication of hard copies, in the absence of effective methods for preventing unauthorized use electronic distribution can reduce the economic viability of scholarly publications, and lead to less, rather than more, effective dissemination of new knowledge. The purpose of this essay is briefly to describe the economics of scholarly publication and how it may be affected by electronic distribution.[1]

The structure of the essay is as follows. First, a basic model of demand and supply in markets for scholarly publication is developed, including the entry process for new publishers of books and journals. Next, the effect of illegal duplication on this market is explored. Then, the economic and technical characteristics of electronic publication are examined, including their likely effect on the market that has developed using traditional technology. Finally, some conclusions are offered about the likely effect of new technology on scholarly publication, the dissemination of research, and university libraries.

I. The Sources of Demand

Scholarly publications serve several distinct uses, each of which in some measure creates of demand for scholarly books and journals.

One function of scholarly publications is the dissemination of information, ranging from fundamental new concepts to cleverly organized aggregations of old data. Scholars frequently minimize the importance of this use of scholarly publications because, by the time scholarly works are published, they are often outdated as representations of the current research frontier. Research scholars tend to rely primarily on preprints, seminars and conference for information about the latest advancements in scholarly knowledge.

Nevertheless, dissemination through publication is very important for practitioners and students. In scholarly fields with extensive practical uses, such as science, engineering, finance and law, scholarly publications are relied upon extensively in industry and government to guide applications. For these users, whether a publication contains results at today's frontier of knowledge is not valued as highly as among research scholars. Scholarly publications are also useful in educating students. As in more applied research, most education is not focused on the current frontier of research, even at the graduate level. Consequently, scholarly publications are intensively used for advanced undergraduate and graduate education. Furthermore, even if scholars rarely use publications to learn about new developments in their research specialties, they do use them to keep abreast of developments in other fields.

Another function of scholarly publication is as a tool for evaluating researchers. The advantage of scholarly publication is that the prepublication review process and subsequent citations (as an indicator of impact) are important sources of information about scholarly standing. In addition, the hierarchy of journals also generates signals about the quality of scholarly work that facilitates dissemination and evaluation. The scholarly publication process is used as a screening

mechanism to enable researchers to allocate their searching and reading time more efficiently.

Both of these factors cause scholarly publications to have an economic value. Scholars derive value from a more efficient process for evaluating and disseminating their work, universities derive value from the improvements in their evaluation process that are made possible by scholarly publications, and students, other scholars, and participants in the private economy derive benefit from the dissemination functions of scholarly publications. But *all* of these sources of value have public goods properties: that is, to an individual, the benefits of the process do not depend fully on whether a subscription is actually purchased. For example, scholars and universities derive the benefits of evaluation and prestige that flow from the dissemination of a publication, regardless of whether either buy it. One employee of a high-technology firm can make use of an engineering journal that was bought by another employee, or by a nearby library.

Because of this "public good" feature of scholarly publication, each beneficiary has some incentive to "free ride" -- not to pay a "fair share" of the costs of scholarly publications. As a result, the effective demand for scholarly journals -- the actual response in the market to the introduction of a publication of a given quality that is offered at a given price -- is likely to be an underestimate of the true economic benefits, as measured by the aggregate maximum willingness to pay.

The preceding argument supports the tentative conclusion that scholarly publication is likely to be undersupplied, a conclusion that is at variance with the commonly held opinion that many scholarly publications have little or no value. (The conclusion is tentative because assessing the efficiency of scholarly publication requires consideration of costs, which are examined in the next section.) The contrary argument runs something like this. First, most scholarly publications are

simply not read by more than a handful of people, and are never again cited by anyone other than the author, who presumably did not need to have the work published in order to know about it and to cite it.[2] Second, many people express the belief that scholars place too much emphasis on research and not enough on teaching, university service, being good citizens, parents, and spouses, etc. Third, because scholars do not bear the full cost of publication, they can be expected to overuse it.

These arguments are incomplete. Some of the purposes of scholarly publication do not depend on attracting readers. In particular, the signal "published, not cited" is different than "published, cited" and "failed to be published." In addition, the likely impact of a scholarly work can not be perfectly anticipated in the review process. If peer assessments of submitted manuscripts are subject to significant random error, the expected number of readers and citations can be positive at the time of publication, even if, ex post, the median number of readers and citations is zero. If scholars knew in advance which of their works were unimportant, or if peer review were perfect, a reduction in publication could be accomplished with zero social cost; however, with imperfect ex ante assessments, if one observed a circumstance in which all publications were widely read and cited, the number of publications would assuredly be too few.

Finally, whereas scholars do not bear the full cost of publication (although in the sciences they frequently bear a part of it), publishers do -- and find it worthwhile. Moreover, the cost of publication represents a relatively small fraction of the social cost of producing and disseminating research. Scholars, their employers and other sponsors of research bear a very large fraction of the total costs of scholarly work in terms of the opportunity costs of the time spent undertaking the research and writing the manuscript.

Of course, a comprehensive assessment of the extent of scholarly publications requires consideration of costs and the mechanics of the market for scholarly publications. But with respect to the efficiency of the scope of scholarly publications, two important facts are important. First, many specialized journals that are infrequently cited pass a market test, especially in technical fields. Moreover, in technical fields, a significant share of this market is accounted for by libraries and employees of government and industrial laboratories. Second, judging from such factors as citations and appearances on reading lists, the best articles in secondary journals and books from secondary publishers have substantially more impact than the worst publications from the most prestigious sources, supporting the view that ex ante assessments of the significance of scholarly works are subject to substantial uncertainty. Hence, the notion that a reduction in the number of scholarly publications would eliminate only the least valuable material is clearly optimistic.

II. The Supply of Scholarly Publications

Like all information products, the supply of scholarly publications can be separated conceptually into two distinct components: (1) the production of the basic information product (in this case, the edited, formatted and composited publication); and (2) the duplication and dissemination of this product (in traditional technology, printing and shipping). In addition, the supplier undertakes marketing costs.

The first component is called the "first-copy costs." Among the first-copy costs are the work of the author in producing a manuscript and the work of editorial personnel in evaluating it and preparing it for publication. For scholarly publications, the first-copy costs include all of the

research by the scholar plus refereeing and editing.

The most important feature of information products is that the magnitude of first-copy costs is independent of the second stage costs. That is, the cost of the content of the publication is independent of how many copies are produced. To a rough approximation, then, the costs of an information product can be decomposed into a linear function:

(1) $$C = F + mq,$$

where C is total cost, F is the first-copy cost, m is the cost of producing and distributing one more copy of the published product (the marginal cost of a copy), and q is the number of copies that are produced and distributed. This simple representation has only two important complications that need to be noted, but that subsequently will be ignored to simplify the argument.

First, for most publications, the number of copies produced exceeds the number of copies that are distributed. The cause of excess production is uncertainty about final demand. For reasons that are explained below, the price of a publication is usually substantially higher than the marginal cost of production. Consequently, the publisher will print one more copy if the probability of selling it is reasonably high but less than one. Hence, the optimal printing run is usually higher than the expected number of sales. This phenomenon adds complexity to the conceptual model of the supply of information products, but does not really affect the core conclusions.

Second, marketing costs do not fit neatly into either first-copy costs or duplication and dissemination costs. Indeed, marketing costs have elements of both. Some aspects of marketing are

like first-copy costs: preparing the promotional material. Other aspects are more directly related to the quantity sold in that the intensity of advertising is positively related to the number of copies sold. Hence, both F and m in (1) contain marketing elements.

The most important implication for all information products that is derived from this generic characterization of costs is that for a publication to be economically viable, the price of a copy must exceed the marginal cost of production. That is, total revenues must generally not fall below total costs in order for a publisher to survive in the market. Hence, if P is the price of the publication, it must be true that:

$$P \geq F/q + m. \tag{2}$$

This basic formula is somewhat more complicated if the publication sells advertising, but not greatly so. Typically, advertising rates depend on the size of the ad, the location of the ad in the publication, and the circulation of the publication, so that the price on the left-hand side of (2) can be decomposed into two elements, the subscription price and the advertising prices for each size and location of ad. Thus, if there are k types of ads, P can b rewritten as:

$$P = P_s + P_1Q_1 + ... + P_kQ_k, \tag{3}$$

where the first term on the right-hand side of (3) represents the price charged to consumers, the remaining P's represent the prices per subscriber for various types of ads, and the Q's represent the

number of ads that are sold. This complication does not alter the basic fact that the revenues per copy from all sources must exceed the marginal cost of producing one more unit.

One important reality about all products that have this kind of cost function (including broadcasting and all other information products) is that the most efficient pricing system is not consistent with the financial viability of the product for a private producer.[3] Neither subscriptions nor advertising can be priced at marginal cost; together they must generate enough revenues to cover the first-copy costs (F in equations (1) and (2)) if the publication is to be financially viable. By setting price above marginal cost, however, some potential subscribers must be excluded who otherwise could be provided an incremental copy of the publication at a price that exceeded its marginal cost. The necessity to exclude such subscribers in order to cover total costs constitutes a fundamental efficiency problem for all private markets for information. This problem can only be solved by subsidy.

Another important implication of this general cost function is that the price of a publication, all else equal, is likely to increase if circulation falls. A drop in circulation is likely to cause a drop in advertising revenues but a less than proportionate drop in costs because the first-copy costs must still be covered. Hence, subscription revenues per subscriber must cover a higher fraction of total costs. While the actual pricing effect depends on the precise way in which demand for the publication declines, the most common case is that a fall in demand leaves the publication with buyers who value it most highly, and have less price-sensitive (less elastic) demand, in which case the price will increase (or, in some cases, the material will not be published).

Scholarly publication differs from commercial publication in a number of important ways.

Most importantly, scholarly publications are not expected to cover the parts of the first-copy costs that represent the effort of the author. Research and writing costs are paid by the author's employer and, in some cases, a grantor or even the author. Although book publishers usually pay royalties, on average these are very small compared to the first-copy costs of research and manuscript preparation, and are not the primary source of the author's motivation to publish. In addition, some scholarly publishers are subsidized by universities, professional associations and foundations. Hence, the costs that they must cover may be less than the fixed and marginal costs of publication and distribution.

In many cases, scholarly publications impose charges on the author. One form is a submission fee, and another is a page charge. In addition, some scholarly publications require that manuscripts be submitted in machine-readable form, or that tables and figures be submitted in a form that is ready for photo-offset printing. These requirements are equivalent to a publication charge in that they shift some of the first-copy costs to the author. Thus, the simple formula in (2) requires further amendment for some journals to take into account these other forms of revenues.

Entry and exit of publications is determined by whether the maximum feasible incremental revenues from a publication enable it to cover its total costs. Imagine that all scholarly publication were controlled a by a monopolist.[4] In considering whether to publish one more book or to add one more scholarly journal, the monopolist would inquire whether the increment to revenues would exceed the increment to costs arising from the additional publication. In making this calculation, the monopolist would consider whether the new publication caused some customers to switch from another publication. The monopolist would "count" only those revenues of a new publication that

were generated by a net increase in purchases; it would ignore revenues that represented a substitution of the new for the old. By contrast, a second firm contemplating a new publication would count as incremental any revenue that shifted from another publisher. The decline in revenues and, hence, profits suffered by the first publisher would be irrelevant to the assessment of the desirability of an additional publication by the second publisher. This basic logic is the basis for a conceptual understanding of the process that determines the number of scholarly books and journals that are published. To some extent, publications within a given discipline or field of research are substitutes. An increase in total publications will reduce the sales and average revenues of publications in the field.

The markets for journals are especially interesting in their dynamics. Initially, journals were few in number and generally covered entire disciplines, reflecting the relatively small demand that supported the market. As time progressed, more scholars sought publication, and rejection rates increased. The established journals experienced increased circulation and revenues. In practice, the initial monopoly suppliers -- usually, professional associations and university presses -- could have responded by expanding the number of journals, but typically they did not. Instead, they increased rejection rates to improve the quality of their publications. In some cases the initial publishers used the increased profits from journals to subsidize other activities of professional associations. Consequently, excess demand for new publications grew, broadening the process of assessment of scholars and allowing easier and broader dissemination of work that was thought to have value but was rejected by the established journals.

Initially, entry took the form of more general purpose journals, but the reputation and first-in

advantage of the established general disciplinary journals prevented entrants from achieving circulation that was equivalent to their competitors. Eventually, entry began to take the form of specialized journals, largely because of the character of demand. Individuals and corporate laboratories, contemplating the choice between the fifth or sixth best general purpose journal (with relatively few articles in the special field most relevant to the subscriber) and a specialized journal in the relevant field, would tend to pick the latter. Likewise, authors, while preferring the prestige of a top-ranking general purpose journal, sought to target their other publications in journals that would be read by the most people in their fields, rather than skimmed or skipped by a general audience. Hence, for journals of lesser quality, specialization came to be dominant. The phenomenon has come to be called "journal proliferation," referring to the tendency for new journals to come into the market to serve narrower and narrower specialties as research volume increased.

The effect of journal entry is to reduce average circulation among older journals, since each journal derives some of its subscribers from individuals and institutions that cancel other subscriptions in order to free funds to buy the newcomer. And, as circulation declines, the average cost of older journals increases. Moreover, in the case of all but the general circulation journals, the remaining demand for the older journals typically becomes less price sensitive (less elastic). Each specialized journal increasingly relies on a subscriber base of narrow specialists for whom the journal represents the best way to reach other similar specialists among journals lacking the prestige of the leading general journals. Hence, as more journals enter, prices for established journals generally increase.

By the late 1980s, the process had created literally thousands of journals with relatively low

circulation, numbering a few hundred subscribers.[5] For example, imagine a journal that does not require an especially fancy publication process (e.g., no color photos, or complex figures). If the journal publishes about 150 pages per issue, it will face a marginal cost of printing and distribution in the range of $2 to $4 per issue, or, for four issues per year, of $8 to $16. Its first-copy costs will be in the range of $50,000 to $100,000, depending on whether the editor and referees are paid, and on the extent of copy editing and proof reading. If it has a circulation of 400 (roughly the median for scholarly journals), the first-copy costs per subscriber will be between $125 and $250; Hence, its subscription price must be far in excess of marginal costs in order for the journal to survive. Note that in this example, a fall in circulation has very little effect on costs, and so mainly causes an increase in the minimum viable price for the journal.

In addition, because the gap between minimum viable price and marginal cost is so large, the market for low-circulation journals is likely to be highly inefficient, with many potential subscribers excluded. Publishers deal with this problem to some extent by attempting to discriminate between individual and institutional subscribers. Frequently, individual subscriptions are as little as ten percent of the institutional price, and frequently are in the range of one-fourth to one-third. But even so, individual prices are usually substantially above marginal costs. In addition, the high institutional price causes institutional libraries to be far smaller than would be socially optimal. Of course, for publications in science and engineering, this inefficiency ripples throughout the entire economy, for it means that education, applied research and development, and direct diffusion to the production of goods and services will proceed at a slower rate than otherwise would be the case.

The phenomenon of declining average circulation and rising prices has placed increasing

pressure on general purpose libraries, such as libraries at universities and colleges. The combined effect of more journals and, due to declining average circulation, higher prices led to rapidly rising costs of maintaining a comprehensive library of scholarly journals. Many commentators interpreted these developments as representing monopolistic practices publishers.[6] First, the price increases were said to represent monopoly pricing. Second, journal proliferation was explained by the practice of publishers inducing undeserved subscriptions by paying leading scholars to lend their names to unimportant new journals as editors.

In practice, neither explanation is a fully consistent explanation. Journals may have market power, but there is no reason to believe that it has increased, and in any case declining average circulation of journals is sufficient to explain the pricing phenomenon. Likewise, the identification of a journal with a famous scholar is undoubtedly beneficial for its initial marketing, but if it did not contain material that was useful for dissemination purposes (and did not generate citations), it would not generate permanent subscribers. Industry would not subscribe, and universities would not face resistance to canceling subscriptions, if neither faculty nor students wanted access to it. This, identification with a famous scholar might shift high-quality articles among journals, but it can not explain the increase in the total number of financially viable publications. The latter is due to the increase in the number of useful publications, which in turn reflects the persistent rise in the number of researchers and real expenditures on scholarly research.

Libraries have responded to price increases and journal proliferation by cutting back on subscriptions and placing greater reliance on interlibrary loan. For any single library, this strategy makes sense if a journal is not frequently used. For a few dollars, a request for a journal can be

satisfied by interlibrary loan, and a faculty member or student can legally photocopy the desired article. If such a request occurs only a few times a year, the library can save several hundreds of dollars in subscription costs (plus a few more in journal storage costs) for an outlay of tens of dollars in the interlibrary loan process.

Unfortunately, for all libraries taken together, this process probably does not reduce total costs, and may even increase them. The reason is that only a very small part of the costs of a journal are related to the marginal cost of adding one more subscriber. The savings to the publisher is not the hundreds of dollars for the subscription, but the few dollars in printing and distributing one more copy. Hence, the total effect of interlibrary loan on all libraries is to raise their aggregate costs by increasing journal prices and causing libraries to incur the added costs of interlibrary loan (including additional photocopying). For publications that are used with some frequency, the savings from lower distribution costs are not likely to offset that additional costs of interlibrary loan. Consequently, the perfectly rational strategy for each library is collectively irrational: it reduces the quality of library services and has no significant effect on costs (and may increase them).

III. Illegal Copying

The economics of illegal copying of scholarly publications fits nicely into the supply and demand model presented in the preceding discussion. The cost of illegal duplication is the sum of the direct cost of producing a copy (c), the fine for being caught (f) times the probability of detection (p), and the psychic disutility from engaging in illegal behavior (d).[7] Hence, a person will engage in illegal copying rather than acquiring a personal copy if:

(4) $P > c + pf + d.$

The extent of illegal duplication will change if any of these factors changes.[8] Assume for purposes of discussion that two of these factors are fixed: the fine for illegal copying and the personal distaste for illegal activity. This assumption enables us to focus on the effects of events that might affect the other elements of (4).

Clearly, the trend in rising journal prices can be expected to increase illegal copying. If (4) is not satisfied only because P is slightly too low, and increase in P will cause a change in behavior, from subscribing to copying illegally. Hence, the fall in average circulation from journal proliferation eventually leads to a further fall in average circulation because the proportion of users who gain access through illegal copying increases. Because libraries are more likely than individuals to be caught and fined if they copy illegally, price increases are likely to cause the proportion of subscriptions accounted for by institutions to increase. This process further increases the cost of general purpose research libraries, and intensifies the gap between the individual and collective rationality of sharing arrangements between libraries.

In similar fashion, a fall in the real price or an increase in the quality of copying also increases illegal duplication. Here the most important technological events that have taken place to date are the invention and subsequent improvement of photocopying. Prior to photocopies, illegal duplication required a form of publication. Although illegal publication could be of somewhat lower quality, the main saving was to avoid the editorial and marketing costs, and in the case of books royalties to authors. The illegal duplicator still had to pay for preparing the material for publication,

then printing and distributing it. Because the duplicator did not offer much in cost saving, illegal duplication of scholarly works was rare.

The introduction of photocopying vastly reduced the costs of duplication by eliminating the first-copy costs of the process. It also vastly increased the problem of detecting illegal copying, so reduced pf as well as c in (4). Subsequently, falling real costs of photocopying due to technological progress further increased the incentive to engage in illegal copying. Because the cost of photocopying includes the time of the person who does the copying, the vastly faster photocopiers that were introduced in the 1980s made illegal duplication more attractive. Thus, technological progress in photocopying constitutes a separate factor that drives down average circulation and increases subscription prices for libraries, much in the same fashion as does interlibrary loan.

Duplication of publications by even the most efficient photocopiers is usually inefficient. Its inefficiency depends on the relationship between m and c. In general, photocopying costs (including the time of the photocopier) are greater than the marginal cost of printing and distributing one more copy. But for the vast majority of scholarly journals, the reader usually does not want to read everything. If the reader places little or no value on most of the contents of a journal, copying a few desired items can be cheaper than paying even the marginal distribution cost for a copy of the journal. Consider the example above of a journal that costs, say, $3 per issue to print and to distribute (not counting first-copy costs). Suppose that the cost of photocopying is $.10 per page for the photocopier plus ten seconds per page in the time of the person doing the duplicating. If this person earns $15 per hour, this adds about 4 cents per page for copying. Then, photocopying an entire 120 page journal would cost $10 for photocopying plus $5 in employee costs, or $15, which

is far more than the marginal cost of one more issue of the journal. But photocopying one six page article costs $.60 in photocopying plus one minute of employee time (another $.25). Thus, if a scholar wants to read one short article per issue, it is cheaper in total social costs to photocopy the article than to print one more copy of the entire journal.

Of course, publishers are unlikely to make some arrangement with a scholar to permit this can of efficient duplication. A publisher would have no incentive to make such an arrangement unless it could recover some of the first-copy costs from users of this type. In attempting to set a price above the actual costs of duplication, the publisher would drive the cost of legal duplication too high in relation to the cost of illegal duplication, at least for users with a small disutility for illegal duplication. In addition, the cost of negotiating separate deals to allow copying could well exceed the cost saving from user photocopying. Hence, in a manner parallel to the fundamental inefficiency of average-cost pricing for all information products, efficient user duplication is likely to be impossible to achieve legally.

IV. The Consequences of New Information Technology

A common belief among library administrators and other potential users of electronic media for the distribution of scholarly publications is that the information superhighway offers prospects for solving the problems of escalating journal publication costs. In the framework of the analysis presented here, this belief is almost certainly incorrect.

The only source of cost savings from electronic distribution of scholarly publication is in the cost of storing and accessing publications. Electronic distribution will still need to cover the same

first-copy costs associated with reviewing manuscripts and editing he final product. Whereas computer technology has reduced first-copy costs, these savings do not depend on how the publications is distributed. A recent study (Bowen 1995) estimates that storage costs are about $2 per year per book or journal, and that reshelving hard copies after use costs about another $1. When added to the few dollars of printing and distributing hard copies, these savings are substantial compared to institutional subscription prices only for journals that are rather extensively used. Most likely, for most journals and books, the savings arising from electronic publication, at best, would equal one year's rise in the average cost of publications.

In addition, electronic publication reduces the cost of illegal duplication, for it avoids the cost of photocopying. If a reader wants a hard copy of an article, printing and electronic file and photocopying hard copy have about the same costs; however, the costs of storing illegal copies electronically is low, so these costs can be avoided if a hard copy is not needed.

An interesting issue arises with respect to the ease of detection of electronic copying. At present, methods for protecting software are not very secure, but they become more so in the future, in which detection might be easier than it is now for either photocopying or pirating software. But once a user has access to a legal electronic copy, willful duplication for others is almost impossible to detect unless the copy is stored on the hardware of a computer that is connected to a public network. Legal access can be gained by a single legal electronic subscription or by a hard copy subscription and a scanner. My tentative conclusion is that electronic duplication is potentially as important an innovation as photocopying in terms of its effects on illegal copying. If so, it will cause legal subscriptions to decline and, consequently, institutional subscription prices to increase. Hence,

electronic publication will add to, not subtract from, the financial problems of libraries and the inefficiency of the distribution process among institutions, where illegal acquisition and copying is easier to detect and is subject to harsher penalties.

In addition, electronic publishing will certainly increase the range of feasible methods of producing scholarly product. For example, it will vastly reduce the cost of including data sets, full motion video, and nonlinear textual material. All of these are likely to be valuable additions from the perspective of disseminating scholarly information. But they are also likely to increase the first-copy costs of publications by making publications longer and more complex. If so, electronic publication will increase, not reduce, the financial pressures on libraries and the inefficiencies arising from the pricing structure of scholarly publications.

Even without illegal duplication, electronic distribution threatens publishers. Many scholars already post preliminary versions of their publications on the World Wide Web. Potential readers can make use of the screening and classification features of he publication process by simply consulting the advertising material of the publishers, listing recent books and the contents of journals. After using this material, readers can then bypass the publisher by downloading the manuscript from the author's Web site, and perfectly legally bypass the publication process -- and the payment of a share of the editorial costs of the publisher.

A common reaction to these problems is simply that groups of scholars can band together to publish "approved" lists of manuscripts that are available on the Internet, thereby avoiding the needs for journals altogether. Whereas such groups, whether informally organized or a formal board of editors, may well emerge, they will not change the fundamental problem. This concept amounts to

a proposal to shift the first-copy costs to groups of volunteer scholars, and it will succeed only if the editorial inputs of publishers (such as copy editing and marketing) are of little value, and if the inputs of scholarly editors (such as providing in-depth refereeing and detailed suggestions for improvement) either are also of little value or will be supplied without remuneration. None of these requirements seems particularly plausible, for if they were, journals would already have eliminated the services of little value and/or moved to rely exclusively on volunteer services.[9]

V. Conclusions

The preceding analysis leads to several important conclusions.

The first is that in the absence of relatively secure methods for preventing unauthorized access and duplication, publishers are not likely to embrace electronic publication of existing scholarly products because it offers little prospective cost saving but a considerable threat in terms of increased illegal duplication. The ripest prospects for electronic distribution are either new types of publications that make use of the new technical capabilities of digital communication or historical documents that have little future market value. Even so, journals, especially, are in trouble, as scholars place working papers on the Internet and make them freely available. Internet access is likely to be used to some degree as a substitute for the purchase of final publications by business and libraries, which will further erode average circulation of journals.

Second, the financial problems of major libraries are unlikely to be ameliorated by electronic technology. Libraries can capture savings in storage and circulation costs by shifting to electronic copies, but these are small for all but the most heavily circulated publications. And, working in the

opposite direction, electronic publication is likely to increase the institutional price for legal access because few individuals will subscribe as more engage in illegal copying.

Third, because electronic publication will lead to more illegal duplication and innovations that take advantage of the quality-enhancing capabilities of electronic media, ratio of first-copy costs to total costs of scholarly publications will rise. As a result, the prices of publications will also increase, so that the inefficiencies of the scholarly publication market -- in particular, undercirculation to institutional subscribers -- will get worse.

Fourth, from a societal perspective, electronic publication and more widespread circulation should be encouraged. The best means for accomplishing this objective is subsidization of the fixed cost of publication, so that publishers would need to rely on subscriptions only to recover distribution costs. Unfortunately, subsidies are not easy to implement: how would the subsidizing institution determine whether a publication deserved a subsidy? Most likely, any system for allocating subsidies would depend on some sort of peer review process to evaluate publications, and would therefore be likely to erect barriers to entry of new journals.

In the context of the underlying market for scholarly publications, electronic technology raises many interesting and formidable problems. While electronic media offer exciting new prospects for expanding the form of publication, and can offer some real cost savings, they may aggravate the economic problems that have already arisen in scholarly publication.

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Notes

1. The economics of scholarly publications is a special case of the economics of information. See, for example, Owen (1975) and Noll, Peck, and McGowan (1973). For an explanation of the economics of information products for noneconomists, see Noll (1993).

2. For example, the top ten percent of scholarly journals in economics account for 88% of all citations, and 74% of economics journals have never received a single citation in any of the top eleven journals. See Pencavel (1992).

3. The following argument closely parallels the economics of pay television. See Spence and Owen (1977).

4. The discussion that follows was first developed with respect to competition in broadcasting by Peter O. Steiner. For a recent comprehensive statement of this approach to understanding competition in the media, see Owen and Wildman (1992).

5. The basic facts about prices, costs and circulation reported here are based on my research in collaboration with Lisa L. Cameron and W. Edward Steinmueller. A summary of the information about prices and circulation is contained in Noll and Steinmueller (1992). A more detailed econometric study is in preparation. In addition, see Marks, Nielsen, Petersen, and Wagner (1991).

6. For example, see Association of Research Libraries (1989); Selsky, (1988); Tuttle (1990); and Hamaker and Tagler (1988).

7. There is good evidence that the distaste for extensive illegal duplication is significant. For example, some very popular and profitable computer software is distributed as "shareware." That is, the software is given away for free on computer bulletin boards or on published articles, or is sold at roughly the cost of duplication on diskettes. Users are then asked to pay the license fee (usually in the range of $25 to $100) only if, after testing the program, they decide to use it permanently. Because enforcement of the intellectual property rights in shareware is essentially impossible, these payments are voluntary, yet a very large number of people pay them. See Takeyama (1994a).

8. Some copiers would never subscribe because they value the publication at less than P, but more than the cost of illegal copying. These people do not harm the publisher by illegally copying the material. In the case of scholarly publications, some illegal copying actually can enhance the value of the publication to the publisher if it increases citation, and hence the reputation and visibility, of the publication (Takeyama 1994b). This effect can be important for journals, where cumulative past citations are likely to affect the demand for subscriptions.

9. Margaret Jane Radin, in commenting on an earlier version of this paper, pointed out that the vast majority of law reviews are edited almost entirely by uncompensated students. She also observed that, judging from the results, this example is not one that other disciplines should rush to follow.