Library Periodicals Expenses Comparison of Non-Subscription Costs of Print and Electronic Formats on a Life-Cycle Basis

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Abstract

What are the implications of the transition to electronic periodicals on non-subscription library expenditures, such as those required to select, accession, catalog and provide ongoing access and services? New data on staff activities and costs were collected from eleven US academic libraries, and a life-cycle analysis was utilized to study the longer-term cost implications of the transition. We find that, on a per-title basis, the non-subscription costs of the electronic format are consistently and substantially lower than those of the print format. We conclude by considering the implications of the transition to electronic formats—and the consequent favorable cost differentials—on long-term preservation.

Introduction

Many academic and research libraries are in the midst of what may ultimately be seen as a transition of formats for various parts of their collection, from print to electronic. One of today's challenges in providing for the long-term availability of research literature is the need for an acceptable archiving solution for electronic publications. A number of efforts are currently underway to develop such a solution, including work at the Library of Congress, JSTOR, Stanford University, and elsewhere. In designing its business plan, JSTOR's Electronic-Archiving Initiative, with which some of the authors of this article are associated, wanted to learn more about the transition to electronic journals. The study presented here represents part of this effort to learn what effects the transition will have on the higher education community's ability to ensure the long-term availability of electronic publications[1].

For a number of years, it has been noted by observers of library economics that there may be significant cost advantages to moving away from print collections and towards electronic collections[2]. In addition to greater accessibility and searchability, potential cost reduction has been an important motivation for those who envisioned a more electronic future. One set of potential cost differentials comes from subscription costs, and there is a growing literature on the business models and resultant prices that have arisen for electronic periodicals, providing evidence for how libraries' subscription and license costs are changing[3]. But what we will call non-subscription costs, such as staff time, binding costs, and capital expenditures for space, are also important. There has been relatively little formal consideration of how these non-subscription costs may vary with the changing format. This study has therefore sought to examine the changing non-subscription cost structure in the transition towards electronic periodicals[4].

There is good reason to believe that these non-subscription costs vary significantly between the two formats, since processes differ so greatly. Some of the activities unique to the print format are shelving and re-shelving, binding, and long-term stack storage. The electronic format also has processes specific to it, such as negotiations, licensing, and establishing and maintaining access to the resources. In addition, activities that may appear to be similar for both formats, such as collections development, check-in, cataloging, reference, and user instruction, in fact vary significantly in their specific requirements and costs. Finally, a number of the activities for print collections (including binding and maintaining adequate storage conditions) contribute to the long-term preservation and access of these materials—or "archiving"; but there are no equivalent expenditures as yet for the electronic

format. Since these non-subscription activities differ so significantly between the two formats, the cost and shape of these activities may have important effects on the transition from print to electronic formats. For further consideration of how the processes appear to differ between the two formats, please see the more detailed version of this study[5].

Our work is not the first to explore how costs change as periodicals are increasingly delivered in electronic format. The most significant work previously undertaken with regard to how periodicals costs vary between print and electronic formats is by Carol Hansen Montgomery, under whose leadership the Drexel University library system has radically shifted its periodicals collecting away from the print format to electronic[6]. Our effort has collected data from more libraries and focused its attention somewhat differently. We focus strictly on non-subscription costs, thereby excluding the actual costs of the subscription or license. We also set aside measures of "value," such as those derived from the level of usage. In addition, we make use of a life-cycle model for data analysis, similar to the original life-cycle work that was conducted by the British Library, allowing us to compare over time the costs of the format choice[7].

We believe that the cost comparison on the life-cycle basis can permit libraries to become better informed about how a transition from print to electronic periodicals may impact their costs. At the same time, one should keep in mind—as we have tried to do in this study—that there are limitations to the available data. Nevertheless, we hope that this study will be viewed as a contribution towards informing discussion of the choices facing libraries and academia in this time of transition.

Data Collection

Our dataset includes data related to the non-subscription costs of periodicals from eleven academic libraries. Drexel University agreed to permit its mostly pre-existing data to be utilized within a modified methodological approach. In addition, King was independently organizing a somewhat similar study at the University of Pittsburgh, which agreed to permit the use of its data in this study. From the remaining nine libraries, we collected data directly[8].

In recruiting library participants, we sought a diverse group of institutions in terms of size, affiliation, and degree of commitment to electronic resources. For the purposes of comparative analysis, we have categorized these institutions, based on their Carnegie Classifications, as small, medium, and large, as shown in Table 1.

Table 1. Size Categorization of Participating Libraries

Small	Medium	Large
Bryn Mawr College	George Mason University	Cornell University
Franklin & Marshall College	Drexel University	New York University
Suffolk University	Western Carolina University	University of Pittsburgh
Williams College		Yale University

A number of the participating institutions are relatively decentralized. Professional schools often administer their own libraries, and all of the large institutions have more than a dozen library locations on campus(es). Consequently, several participants chose to collect data only for certain collections, avoiding some of the school or departmental libraries, as indicated in Table 2.

As a result, some of the large medical, science, and law collections are excluded from the study. Many of their periodicals are very lengthy in terms of issues and pages per year. One known implication of excluding these collections from the study is to reduce the average cost of binding and storage space for the print collections. This is important and will lead us—especially in the life-cycle analysis—to underestimate the print costs for Cornell, NYU, Pitt, and Yale[9]. Science collections may also behave differently in other ways that would have implications for circulation and reference services in the print format, and across the board for electronic. We have no reason to believe that this would have any meaningful implications for the cost comparison in either direction. It is perhaps also worth pointing out that all the collections included in this study of the participating libraries are open-

Table 2. Periodicals Collections under Examination at Each Participating Library

Participant	Print Subscriptions in Collections Examination as a % ofInstitutional Total	Comments
Bryn Mawr	100%	
F & M	100%	
Suffolk	45%	Includes the Mildred F. Sawyer Library, the main facility, but excludes the law library.
Williams	95%	Excludes several departmental libraries.
Drexel	100%	
George Mason	73%	Includes all libraries except law.
Western Carolina	100%	
Cornell	66%	Includes these Ithaca libraries: Africana, Annex, Engineering, Fine Arts, Hotel, Management, Mathematics, Music, Olin/Kroch/ Uris, Physical Science. Excludes law and medicine, among others.
NYU	62%	Bobst Library only for print holdings categories; Bobst, Courant, Institute for Fine Arts, and Real Estate Institute for electronic. Excludes law and medicine, among others.
Pitt	85%	Includes 5 campuses and 19 complete departmental libraries. Medical (health sciences) and law libraries are excluded.Yale51%Sterling Memorial Library only, includes major humanities and area studies collections. Excludes sciences, law and medicine, among others.

stack[10]. Finally, with one exception (noted in Table 2), the collections under examination at each institution were identical for both print and electronic formats.

Data collection took place during the first half of 2003. Staff contacts at each library[11]. gathered institutional statistics and spearheaded the distribution of activity logs to all library staff who spend any amount of time on periodicals-related activities. The activity logs required staff to report the proportion of time they devoted within a specified time period to each of 15 periodicals-related categories, segmented by holdings category—for a total of 60 possible activities. With one category excluded (explained below), 14 categories of data that are included in this report are:

- *Collections Development*
- *Negotiations and Licensing*
- *Subscription Processing, Routine Renewal, and Termination*
- *Receipt and Check-in*
- *Routing of Issues and/or Tables of Contents*
- *Cataloging*
- *Linking Services*
- *Physical Processing*
- *Stacks Maintenance (including current issues areas)*
- *Circulation*
- *Reference and Research*
- *User Instruction*
- *Preservation*
- *Other*

Some cost categories are not included, but we do

not believe their absence to have meaningfully affected our results. Most importantly, we excluded from our analysis the costs of electronic infrastructure and support. We did not exclude these costs without careful consideration. One problem raised by these costs is that they are very difficult to allocate directly to periodicals in general and to print or electronic periodicals more specifically. Although most of the libraries in this study were therefore unable to allocate these costs directly, it was possible to develop estimates for several schools—Drexel, George Mason, and Pitt. In these cases, including the electronic infrastructure costs does not meaningfully impact our findings, although they tend to increase the relative cost of the electronic format somewhat. Because we could not develop estimates for all the participating libraries, however, we elected to exclude the electronic infrastructure costs from all the data that we present across the board. More information on the electronic infrastructure costs for these three schools is reported in our forthcoming report from the Council on Library and Information Resources (CLIR). In addition to this cost area, we did not attempt to collect data on interlibrary lending and borrowing[12].

For the space occupied by periodicals, it was very difficult for the majority of the libraries, with their mature library buildings, to calculate the actual costs of the space. We therefore estimate a conservative standard for the cost of space and impose it across the board, identifying one cost for current issues and another for backfiles[13]. For backfiles, we use the construction cost of a high-density off-campus storage facility, which we have estimated at $2.50 per volume in today's dollars[14]. For current issues, we use the construction cost of an on-campus library facility, estimated at $100 per square foot[15]. In both cases, the cost of space was amortized over a 25-year period.

Data Overview

To give a sense of the scale of the libraries participating in the study, we provide an overview of the size of the periodicals collections in Figure 1. The small and medium size libraries have very large electronic collections relative to their print collections. We then, in Figure 2, show the total cost, across all holdings categories, of non-subscription periodicals operations at each of the library participants. As the figures show, there are major differences both within and across our size categorizations.

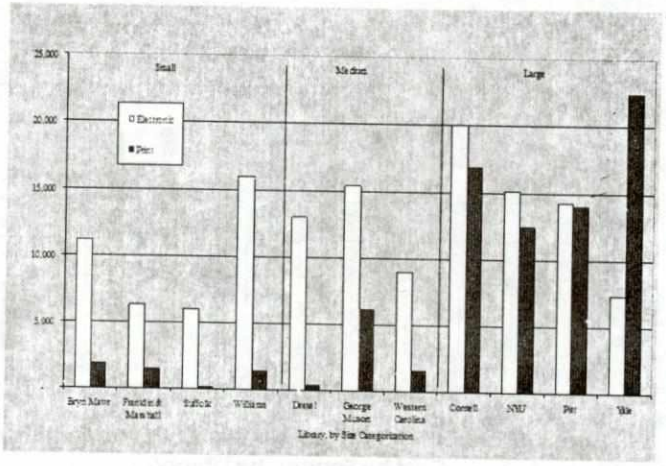


Figure 1. Number of Periodical Titles, by Format, by Library

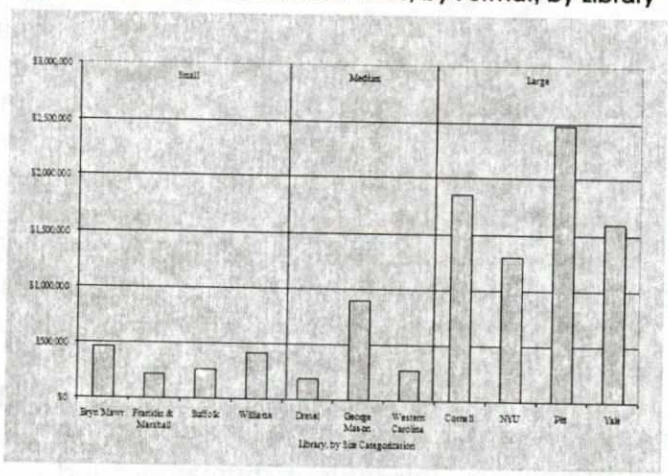


Figure 2. Total Annual Non-Subscription Periodicals Cost, by Library

There are several explanations for differences in the scale of costs. Differences in the size and composition of the holdings of the various collections, along with services provided and patterns of usage, are probably the most important of these explanations. Differences in the processes used to perform similar activities also play a significant role, as do variations in salaries and benefits.

Within these libraries, the breakdowns by format exhibit striking differences. That is, within the total annual non-subscription expenditures shown in

Figure 2, spending by format differed considerably. These breakdowns are shown in Figure 3, in which the libraries are ordered by the percentage of spending that is devoted to the electronic format.

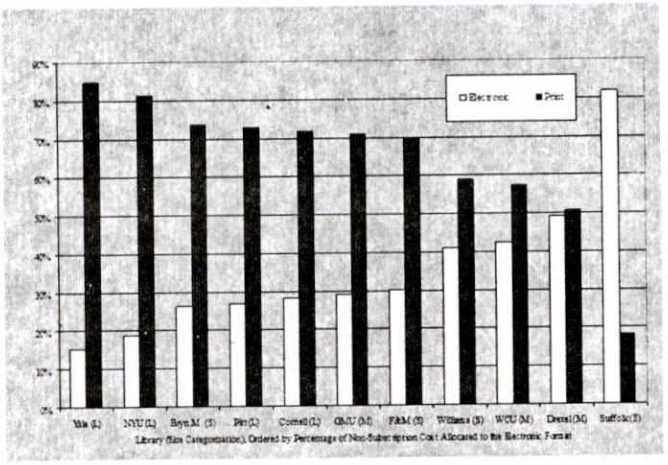


Figure 3. Share of Total Annual Non-Subscription Periodicals Cost by Format, by Library

The two schools with the largest proportional electronic spending, Drexel and Suffolk, have both transitioned away from print and to the electronic format already. It also appears that several of the larger schools, notwithstanding the presence of significant numbers of electronic periodicals on their campuses, continue to devote high proportions of their spending to their formidable backfile collections. The large libraries appear towards the left in part because they have major costs associated with their print backfile collections. In Figure 3, Yale appears furthest to the left because its collections represented in this study are humanities and areas studies alone, the periodicals of which are least likely to be available in electronic format

Data Analysis: A Life-Cycle Approach

Since we wanted to understand the long-term implications of the format choice, we adopted the life-cycle approach. In the life-cycle analysis that follows, we track *the total non-subscription costs over the course of 25 years of accessioning one year of a typical periodical title*. One way to think about this analytical technique is to imagine following one year's worth of a given periodical, tracking its total non-subscription costs over time. The costs reported therefore represent the implicit long-term financial commitment made at the point of acquisitions for a given year of a given periodical item. It is by comparing these total costs over time that we can best compare the non-subscription cost implications of the two formats.

It is important to clarify exactly the purposes for which we intend to utilize the life-cycle approach. The purpose of this exercise is for a comparison between the print and electronic formats at each library. This approach cannot be expected to predict costs for different libraries or for the same libraries operating under alternate procedures or processes. Rather, the life-cycle approach allows us to calculate the costs over the course of time for each of the participating libraries, if they continue to operate under the same set of processes as they do today. Moreover, our focus has been on developing internally consistent measurements at each library allowing for the by-format comparison. Our data are most valuable for this comparison, rather than for examining absolute costs or patterns across the libraries. The findings that this section yields will certainly offer direction and guidance to other libraries, but any number of variables, including different levels of service and usage, lead to variance among the costs of the participating libraries and might cause costs at other libraries to differ from the costs presented here.

Life-Cycle Formulae

Our work involves decomposing the annual cost data presented above into one-time expenditures and recurring expenditures. We then allocate these as they are expected to occur in the first and subsequent years. For costs in subsequent years, we use a discount rate of 5%.

We begin our analysis of print periodicals with the one-time costs, those costs that can be expected to take place only once during the life-cycle. For the typical print periodical, most of these costs are experienced in the first year. They include all activities associated with current issues and certain presumptively one-time costs associated with preparing the backfile volumes. We include one year of the following costs:

- *All staff costs for current issues; plus*
- *Staff costs for those backfiles activities that are*

effectively one-time in nature
  - *Collection Development;*
  - *Licensing & Negotiations;*
  - *Subscription Processing, Routine Renewal, and Termination;*
  - *Receipt and Check-in;*
  - *Routing of Issues and/or Tables of Contents;*
  - *Cataloging;*
  - *Linking Services; and*
  - *Physical Processing; plus*
- *The depreciation of staff workstations, allocated on the same basis as the staff costs; plus*
- *The total cost of binding; plus*
- *The total cost of subscription agents; plus*
- *The cost of space occupied by the current issues reading room during the year.*

The sum of these costs is divided by the total number of current issues titles per library to reach the *one-time cost per title*.

Separately, we determine the ongoing costs. These are costs that can be expected to recur every year for every bound volume of every title. Our approach here is to calculate the total annual ongoing costs experienced by each library. This is determined by summing:

- *Staff costs for backfiles activities that are ongoing, calculated on a $/year basis*
  - *Stacks Maintenance;*
  - *Circulation;*
  - *Reference and Research;*
  - *User Instruction;*
  - *Preservation; and*
  - *"Other" activities; plus*
- *The depreciation of staff workstations, allocated on the same basis as the staff costs; plus*
- *The depreciation of publicly available workstations, allocated at 2% to print periodicals; plus*
- *The annual cost of storage space in an off-campus facility, calculated on a $/year basis; plus*
- *The annual cost of new and replacement shelving, calculated on a $/year basis.*

The sum of these costs for each institution is divided by the number of volumes held in the backfile to reach the *annual ongoing cost per volume*.

We combine the one-time cost per title and the annual ongoing cost per volume that have just been reported to yield the life-cycle cost. Because these two figures are reported on two different unit bases (titles in one case and volumes in the other), we must take an extra step to bring them together in the life-cycle. We utilize the ratio of bindings to titles for this purpose. This is a most important step, because not every print title yields one bound volume per year. Some periodical titles are not bound at all, are not bound every year, have multiple subscriptions, or yield multiple bound volumes per subscription due to their length.

The ultimate life-cycle formula for one title is as follows:

Print Life-cycle Cost = 1* *(One-time cost per title)* + Net Present Value of 25 Years of [*(Bindings per title)*(Annual ongoing cost per volume)*]

The life-cycle cost analysis for the electronic format is fundamentally similar, although the structure of the format necessitates some differences. There is no "natural" distinction between current issues and backfiles, which makes some of the distinctions between ongoing and one-time costs less intuitive. We nevertheless were able to group activities by those that are fundamentally one-time in nature and by those that are recurring in nature. This allows us to perform an analysis mirroring our estimates for the print format.

We begin our analysis of the electronic life-cycle with those activities that are expected to take place only once for a given year of a given title. We include one year of the following costs:

- *Staff costs for those activities on the electronic format that are effectively one-time in nature:*
  - *Collections development*
  - *Receipt and check-in;*
  - *Cataloging; and*
  - *Linking services;*
- *An allocation of staff costs for two activities that are principally (we estimate 75%) one-time in nature but have recurring components to them as well*[16]*;*
  - *75% of Negotiations and Licensing; and*
  - *75% of Subscription processing; plus*
- *The depreciation of staff workstations, allocated on the same basis as the staff costs.*

The sum of these costs is divided by the total number of titles per library to reach the one-time cost per title.

For other activities, which are more recurring or

ongoing in nature, we developed a mechanism to spread costs across the multiple years of the electronic periodicals that are available on campus. For these, we assumed that there is an average of five years of content for every electronic periodical currently provided on campuses, so that use of electronic journals over the five years represents use of one-year-old titles, two-year-old titles, up to five-year-old titles. The recurring costs in our data are therefore assumed to be spread across five years.

Of the recurring costs, we first consider separately those that are believed not to vary by usage. These include:

- *Staff costs for those activities on the electronic format that are effectively recurring, unrelated to usage, in nature:*
  - *Routing;*
  - *Preservation; and*
  - *"Other" activities; plus*
- *An allocation of staff costs for two activities that are principally (we estimate 25%) one-time in nature but have recurring components to them as well*[17]
  - *25% of Negotiations and Licensing; and*
  - *25% of Subscription processing; plus*
- *The depreciation of staff workstations, allocated on the same basis as the staff costs.*

The annual expenditure on these activities is divided by the five years to achieve an average cost per title per year. or one year's worth of the annual ongoing costs. We divide this annual total by the number of titles held to reach the *annual ongoing cost per title*.

Finally, there are costs that vary based on the degree of usage. These include:

- *Staff costs for those activities on the electronic format that are effectively recurring, related to usage, in nature:*
  - *Circulation;*
  - *Reference and research; and*
  - *User instruction; plus*
- *The depreciation of staff workstations, allocated on the same basis as the staff costs; plus*
- *The depreciation of publicly available workstations, allocated at 6% to electronic periodicals.*

We call this sum the *use-related cost*, and it is divided by the number of titles to determin the *use-related cost per title*. We expect usage of electronic periodicals to decay over time, as is also typical with print. Our data are, however, believed to include only five years of titles. Recent surveys in three universities suggest that there is only about 21% more use beyond the five years[18]. Thus, the use-related cost per title (circulation, reference and research, and user instruction) is multiplied by 1.21 in the formula.

The ultimate electronic life-cycle formula can now be presented. We have structured it to calculate the costs, over a 25-year period, that are experienced by accessioning one year of a typical periodical title:

Electronic Life-cycle Cost = 1* *(One-time cost per title)* + Net Present Value of 25 Years of *(Annual ongoing cost per title)* + 1.21* *(Use-related cost per title)*

The Life-Cycle Findings

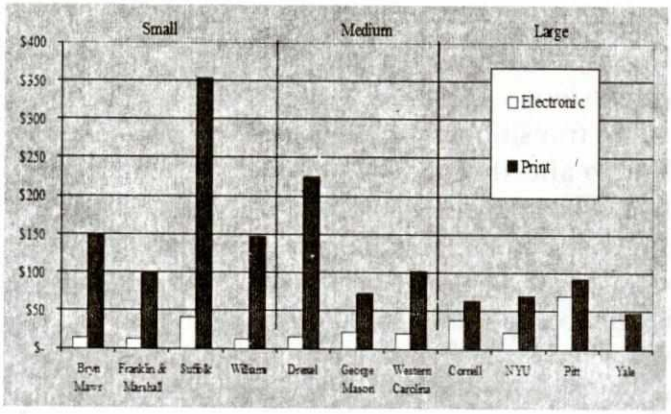
The cost comparison in Table 3 and Figure 4 indicates that the long-term financial commitment associated with accessioning one year of a periodical is lower for the electronic format than for print, at every library included in our study. There is strong reason to conclude that the electronic format brings a reduction in the non-subscription costs of periodicals across the board.

Table 3. Twenty-Five-Year Costs Allocated to Print and Electronic Periodicals, per Title

	Electronic Cost per Title	Print Cost per Title
Bryn Mawr	$13	$150
Franklin & Marshall	$13	$ 99
Suffolk	$41	$353
Williams	$12	$146
Drexel	$16	$225
George Mason	$22	$ 72
Western Carolina	$21	$101
Cornell	$36	$ 63
NYU	$21	$ 71
Pitt	$69	$ 92
Yale	$39	$ 48

Figure 4. Relationship between Print and Electronic 25-Year Life-Cycle Costs

Of great interest in these data, we find that the potential savings are most pronounced at the smaller institutions. This development is consistent with our understanding of these libraries. Because the larger libraries have long benefited from economies of scale in their print operations[19], the relative savings to be



generated from the further economies brought by electronic periodicals are simply not as great. This finding should not be discouraging to the larger libraries, which nevertheless would stand to save, but seems compelling for the smaller libraries, for which there appear to be opportunities to realize roughly the same per-title cost basis as the larger libraries.

This life-cycle analysis has offered a window into the ways in which the non-subscription costs vary on a unit basis. Before reaching any conclusions based on these findings, however, it is necessary to consider—as we now will in the following two sections—how these life-cycle unit costs may impact total library expenditures on non-subscription periodicals costs.

The Total Cost Picture

As we have just seen, the electronic format's substantially lower life-cycle costs, in comparison with those of print, are striking. Other things being equal, our unit cost findings imply that the total non-subscription cost, on a life-cycle basis, will also be lower in the electronic format compared with print. In this section, we first show why we believe this to be the case, and then we offer a number of cautionary notes.

To measure the total potential cost effects of these differentials, we estimate the decrease in the implicit long-term financial commitment under the hypothetical case of a complete transition from print to electronic formats for periodicals. To do so, we simply multiply the number of current print titles by the cost differentials between the print and electronic life-cycle figures. This yields in Figure 5 the amount by which the total financial commitment decreases for every year's worth of acquisitions. We also represent this in Figure 6 as a percentage of the total annual expenditures found in Figure 2.

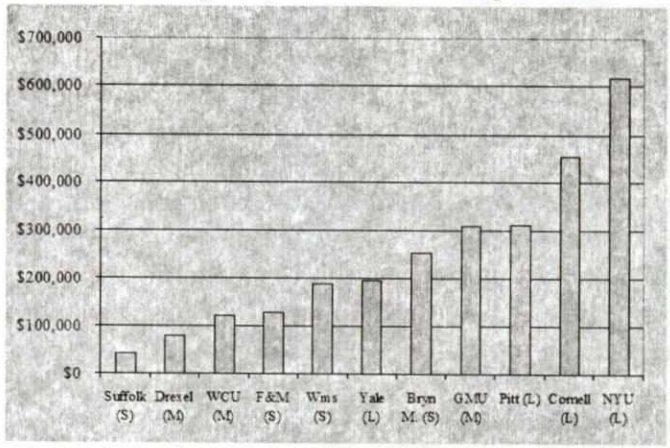


Figure 5. Total 25-Year Life-Cycle Cost Differentials

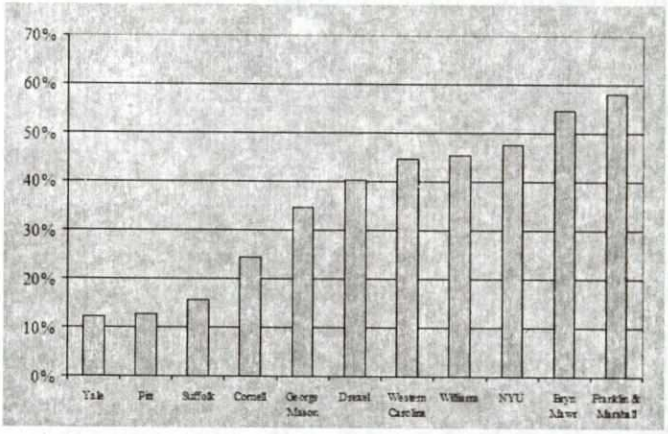


Figure 6. Total 25-Year Life-Cycle Cost Differentials as a Percentage of Annual Non-Subscription Periodicals Expenditures

These figures in these two graphs do not include the collections (including law, science, and medicine) that were excluded from a number of these libraries, which we believe constitutes a downward bias on the total potential cost differential. The total differentials at Drexel and Suffolk (shown in Figure 5) are at the low end of the spectrum because they have already transitioned to the electronic format and there are few remaining print periodicals.

The data reported in the figure assume a complete transition, and of course it may be years, if ever, that the majority of users at many of the libraries in this study would demand (or tolerate) such a complete transition. The data are therefore presented for the

hypothetical case only, to get a sense of the potential scale. During such a transition, if it were to be gradual, the economies of scale on the print format would decline, driving up average costs on that format at least temporarily[20].

One positive note is that a significant amount of the cost differential that this study has documented is attributable to lower staff time expenditures. Unlike savings that result from unbuilt space, which are difficult to realize[21], staff and student worker time may be re-directed or their positions reassigned.

We should note that it might not be possible to recapture the total annual cost differentials listed here. It might not be possible to reallocate all the staff time expenditures in perfectly efficient ways, due to the varying skill sets of individuals and the difficulty of reallocating relatively small amounts of employees' time expenditures. For example, it might be difficult to reassign 2% of a librarian's time expenditures, especially if that person is a skilled cataloger who will not necessarily take on public service tasks during the freed-up period of time. Realizing the full potential cost decreases would therefore pose a significant management challenge.

Before we could conclude with any certainty that cost differentials on this scale could be expected, we would need to know whether the collection size of a given library will grow significantly during the transition from print to electronic and, if so, how. The evidence from several of the libraries in this study—in particular the small and medium libraries—suggests that far more electronic titles are being received than was ever the case with print (see Figure 1). If this phenomenon holds true, then some might be led to conclude that the lower unit costs may nevertheless be offset, at least partially, by a higher total number of units.

While our data is conclusive that unit costs will decline, this section has suggested a number of reasons why local practices will determine the budgetary impact of the potential cost decreases. Where collection sizes do not increase significantly and where efficient procedures and time-reassignments can be implemented, a transition would be expected to have a salutary effect. We believe, on balance, that decreases in total non-subscription costs present the most likely scenario for the future.

Conclusion

The transition to the electronic format seems likely to afford reductions in libraries' long-term financial commitments to non-subscription costs. This is good news for the many libraries that are well along into this transition and would find it difficult to step back. This finding may also be useful to the libraries that have been more reluctant to move towards this new format. Each year, a library that has transitioned to the electronic format for periodicals may have the opportunity to avoid immediate costs and long-term financial commitments on the order of hundreds of thousands of dollars.

We have documented the likelihood that non-subscription costs as *they presently exist* will decline for libraries as a result of the transition to electronic periodicals. The process differences make electronic costs lower than those of print. And it might be anticipated that certain efficiencies for electronic processes have yet to be developed and that electronic non-subscription costs might therefore be expected to decline in certain ways. On the other hand, there is presently a total absence in the electronic format of any costs associated with the long-term archiving of the periodical content.

For the print format, several characteristics have combined to help ensure the long-term archiving of periodicals at many if not all of the libraries participating in this study. First, once a bound volume is accessioned to the collection, it is rarely if ever intentionally de-accessioned. Second, adequate storage space with satisfactory environmental conditions is provided to house the collection, including the periodic expansions of that space. Finally, at several of the libraries in this study, some amount of preservation program costs are devoted to periodicals collections, including conservation, reformatting, and rebinding. Costs associated with these policies present themselves throughout the data on the print format.

For the electronic format, there is no allocation for the equivalent costs. Today, there is no archiving solution in place for electronic materials, although more efforts are being devoted towards developing

possible solutions[22]. While opportunities for tackling this complex and vexing problem may be difficult to identify, this study's focus on the relative costs of the two formats may offer a point of entry. We have documented the extensive efforts in which libraries engage, at great cost, to ensure the long-term preservation of and access to their print periodicals collections. If the library community is to continue to ensure the long-term availability of the resources that it provides, some provision must be made[23]. Just as all manner of non-subscription expenses have been (or will be) re-allocated from the print format to the electronic format, so the cost of long-term preservation and access must also be re-allocated, and our findings suggest that a source exists for such re-allocations.

Because every library has traditionally incurred certain costs associated with the long-term preservation of and access to print periodicals, each will have potentially re-allocatable funds. For example, even a relatively small academic library will not, for the electronic format, need to construct building expansions for periodicals, bind current issues, re-shelve materials after use, or maintain items sitting on shelves. Each library that benefits from electronic periodicals could therefore contribute to the cost of long-term preservation and access. Certainly, if an archiving solution is preventing a given library from making the format transition more fully, it would appear to make sense for that library to be willing to re-allocate funds towards the costs of the solution. If all libraries that benefit make contributions in this key area of work, the costs for any given institution would thereby be lowered by distributing them broadly.

While the archiving solution is yet to be put into place, other observers have noted their belief that the format yields "savings" to which they might like to lay claim. Some publishers appear to be making the case that savings resulting from the transition should somehow be returned to them in the form of rising prices. Similarly, some provosts might make the argument that savings should be returned to the general fund rather than re-allocated within the library itself. However, these perceived savings ignore the absent archiving solution coupled with the historic responsibility of the academic library to ensure the long-term preservation of and access to the scholarly resources that it provides. Certainly, libraries should carefully consider the implications of re-allocations deriving from the format transition.

As the format transition continues and resulting re-allocations take place, long-term preservation and access must not become lost in the mix. Moreover, the format transition itself has been hindered at least somewhat by the lack of these broadly accepted archiving solutions for the electronic format. While the perfect system of archiving solutions is not yet in hand, a number of initiatives are under way in the United States in the university, the federal, and the not-for-profit spheres, any of which will require supporting resources. And many libraries are waiting for an opportunity to participate in an appropriate archiving solution. But perceived library "savings" in the short term must not crowd out the library community's ability to ensure the availability of such archiving solutions in the coming months and years. If appropriate solutions are developed and funds made available to support them, the transition to the new format will be a much smoother one, and the long-term preservation and access of these resources can be assured.

Notes and References

1. This study was funded by The Andrew W. Mellon Foundation. We have benefited from the helpful comments of William G. Bowen, Rebecca Griffiths, Kevin Guthrie, Jennifer Horner, Richard E. Quandt, Susan Lane Perry, Emily Ray, Abby Smith, Dan Terpening, and Donald J. Waters. Thanks to Lisa Bonifacic, Matt Herbison, and Susanne Pichler for research assistance.

2. For a number of papers that touch on this matter, on all sides of the issue, see Richard Ekman and Richard E. Quandt, *Technology and Scholarly Communication* (Berkeley: University of California Press, in association with the Andrew W. Mellon Foundation, 1999).

3. See, for example, *The Consortium Site Licence: Is It a Sustainable Model?* (Oxford: Ingenta Insitute, 2002); Kenneth Frazier, "The Librarians' Dilemma: Contemplating the Costs of the 'Big Deal'," *D-Lib Magazine* 7, no. 3 (2001), available at <doi:10.1045/march2001-frazier>; International Coalition of Library Consortia, "Statement of Current Perspective and Preferred Practices for the Selection and Purchase of Electronic Information," (2001), available at <http://www.library.yale.edu/consortia/

2001currentpractices.htm> . For additional references, a good source is Richard E. Quandt, "Scholarly Materials: Paper or Digital?," *Library Trends* 51, no. 3 (2003).

4. Wherever the term "periodical" is used in this report, we use it to refer to the widely accepted definition: "A serial publication that contains separate articles, stories, other writings, etc., and is published or distributed generally more frequently than annual." This is the 006 code for Type of Continuing Resource that appears in OCLC's *Bibliographic Formats and Standards*, Third Edition, available online at <http://www.oclc.org/bibformats/pdf/ffe.pdf>, at page 73.
5. Forthcoming from the Council on Library and Information Resources.
6. Carol Hansen Montgomery and Donald W. King, "Comparing Library and User Related Costs of Print and Electronic Journal Collections: A First Step Towards a Comprehensive Analysis," *D-Lib Magazine* 8, no. 10 (2002), available at <doi:10.1045/october2002-montgomery> Carol Hansen Montgomery, "Measuring the Impact of an Electronic Journal Collection on Library Costs: A Framework and Preliminary Observations," *D-Lib Magazine* 6, no. 10 (2000), available at <doi:10.1045/october2000-montgomery>. Carol Hansen Montgomery and JoAnne L. Sparks, "The Transition to an Electronic Journal Collection: Managing the Organizational Changes at Drexel University," *Serials Review* 26, no. 3 (2000), available at <http://www.library.drexel.edu/facts/staff/dean/Serialsreview.pdf>. Donald W. King et al., "Library Economic Metrics: Examples of the Comparison of Electronic and Print Journal Collections and Collection Services," *Library Trends* 51, no. 3 (2003).Another recent article has used a different approach to project the cost differentials: Lynn Silipigni Connaway and Stephen R. Lawrence, "Comparing Library Resource Allocations for the Paper and the Digital Library: An Exploratory Study," *D-Lib Magazine* 9, no. 12 (2003), available at <doi:10.1045/december2003-connaway>.
7. Andy Stephens, "The Application of Life Cycle Costing in Libraries: A Case Study Based on Acquisition and Retention of Library Materials in the British Library," IFLA Journal 20, no. 2 (1994). Andy Stephens, "The application of life cycle costing in libraries," *British Journal of Academic Librarianship* 3, no. 2 (1988). Helen Shenton, "Life Cycle Collection Management," *LIBER Quarterly* 13, no. 3/4 (2003). Our thanks to Ms. Shenton, and her colleague Stephen Morgan, for a series of valuable conversations while both our studies were underway.For another recent application of the life-cycle approach, see Stephen R. Lawrence, Lynn Silipigni Connaway, and Keith H. Brigham, "Life Cycle Costs of Library Collections: Creation of Effective Performance and Cost Metrics for Library Resources," *College & Research Libraries* 62, no. 6 (November 2001).
8. For a more detailed view of the methodology, including the data collection instruments themselves, please see the extended version of this study that is forthcoming from the Council on Library and Information Resources.
9. Another implication is that we may have excluded copies of print subscriptions that are duplicated at collection not included. This may also have the effect of biasing down the cost of print at any libraries that have significant duplication across print collections that are and are not included in our data.
10. A library such as the Humanities and Social Science Library of the New York Public Library that is closed-stack would presumably have higher print-related costs. Similarly, any special collections that were closed-stack, even at a library whose main collection is open-stack, might be expected to experience higher costs.
11. Our thanks to Berry Chamness at Bryn Mawr; Ross Atkinson, Jim LeBlanc, and Karen Calhoun at Cornell; Carol Hansen Montgomery at Drexel; Marty Gordon at Franklin & Marshall; Aaron Hartman and John Walsh at George Mason; Arno Kastner at New York University; Sarah Aerni, Fern Brody, Matt Herbison, and Amy Knapp at Pitt; Robert Dugan and Becky Fulweiler at Suffolk; Clarissa Fisher at Western Carolina; Sandy Brooke and Dave Pilachowski at Williams; and Ann Okerson and Marcia Romanansky at Yale. Space limitations prevent us from recognizing the many other contributors from each participating library without whom this study would not have been possible.
12. When initiating a borrowing request, a patron does not understand an item to be missing from the local print materials or from the locally-provided electronic materials, but simply from the periodicals collection as a whole. Consequently, it is not possible to allocate ILL by format or holdings category. Its costs do not affect the relative costs of the formats and are therefore excluded from the study.
13. For a consideration of the costs for libraries that store all their backfiles on campus, please see the extended version of this study that is forthcoming from the Council on Library and Information Resources.
14. Because several of the libraries have in recent years opened (or begun to participate in) off-campus high-density shelving facilities, it seemed that for them—and eventually for many of the others—a new backfile volume accessioned would be shelved off campus or would displace an existing item to the off-campus facility. The cost of space in such a shelving facility would therefore be a reasonable proxy for the cost of space for all backfiles. In reality, backfiles today are usually shelved on campus, so, in using the off-

campus space for these calculations, we derive figures that are far more conservative than the actual costs of the space generally occupied by backfiles.

15. We used the reported construction costs of several of the libraries to create this cost estimate, although in the past several years estimates nationally for construction costs of new library space have tended to average about $250 per square foot.
16. While the allocation of 75% of these costs here is an approximation, we believe strongly that most of the costs of these two activities on the electronic format are one-time in character. Even though re-negotiations and processing take place on a recurring basis for electronic periodicals, it is important to distinguish new years of a given periodical from previous years. These two categories of "recurring costs" are properly attributed in large measure to the *new* years of the title, not to the previously accessible years.
17. For explanation, see Footnote 16.
18. Surveys were conducted with University of Tennessee, Drexel University, and University of Pittsburgh. Donald W. King, Carol Tenopir, Carol Hansen Montgomery, and Sarah E. Aerni, "Patterns of Journal Use by Faculty at Three Diverse Universities," *D-Lib Magazine* 9, no. 10 (October, 2003), available at <doi:10.1045/october2003-king>.
19. These economies of scale characterize large centralized operations, and a library like Yale, whose data in this study include only the large central collections at Sterling Memorial Library, therefore exhibits such economies dramatically. However, the data for other large institutions, such as the University of Pittsburgh, include, in addition to an extremely efficient central library, a significant number of small libraries (24), spread across multiple campuses, thus exhibiting higher average costs per title. For more detail about the economies of scale that we observe, please see the extended version of this study that is forthcoming from the Council on Library and Information Resources.
20. For more analysis of several plausible scenarios, please see the extended version of this study that is forthcoming from the Council on Library and Information Resources.
21. Re-allocating the cost of unbuilt space is, economically, a sound concept. It is, however, a complex argument to make, except for those cases when shelves are bursting at their seams and expansion is imminent. See Roger C. Schonfeld, *JSTOR: A History* (Princeton: Princeton University Press, 2003), 367-72.
22. Libraries have only recently begun to request licensing terms that provide for long-term access to electronic resources after the subscription period ends. Often long-term access will be guaranteed by the terms of the license, but via an indeterminate mechanism and for an unknown price. Most frequently, this licensing term is expressed as the opportunity to receive tapes, CDs, or other media on which data has been copied. However, budgetary provision is rarely if ever made by the subscribing library for the installation and servicing of these data or more generally for the preservation practices and safeguards for this new medium. Certainly, the location, not to mention the custody, of electronic periodicals today almost always remains with the publisher and rarely with libraries or independent organizations with a mission dedicated primarily to ensuring long-term access. There are a number of important projects underway. The LOCKSS project at Stanford University, the National Library of the Netherlands in partnership with Elsevier, and the initiatives at the Library of Congress are noteworthy developments in the search for acceptable archiving solutions.
23. We are assuming here that costs of archiving will be borne at least in part on the library side, because that appears to be the emerging model (witness, for example, LOCKSS and the Elsevier/KB arrangement). We would note, however, that all the same principles discussed in this section would hold true in a publisher-pays model, since publishers would presumably pay the costs by increasing their prices (at least) commensurately, and libraries would have to be prepared to allocate monies in that direction under such a model.