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Non-Subscription Costs of Print and Electronic Periodicals on a Life-Cycle Basis

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Abstract:

The paper compares the non subscription costs for print and electronic journals in order to assist decisions for the transition to electronic format. In a project of eleven US academic libraries, data on the costs of selecting, acquiring, cataloguing and providing access were collected. Based on these data, the life-circle costs of print and electronic journals were calculated. Life-cycle costs – including long-term preservation and access – are proved to be substantially lower for the electronic format. The favorable cost differentials are considered as to the implications on long-term preservation. These results were first reported in D-LIB magazine, January 2004: http://www.dlib.org/dlib/january04/schonfeld/01schonfeld.html

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. There may be significant cost advantages to moving away from print collections and towards electronic collections. 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. 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 [1].

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. The study focuses strictly on non-subscription costs, thereby excluding the actual costs of the subscription or license. In addition, it uses 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 [2].

Data Collection

Data related to the non-subscription costs of journals were collected in eleven academic libraries. The libraries differ as to size, affiliation, and degree of commitment to electronic resources. Some libraries have collected data only for certain collections. All the collections included in this study of the participating libraries are open-stack and, with one exception, the collections under examination at each institution were identical for both print and electronic formats [3].

Data collection took place during the first half of 2003. All library staff who spend any amount of time on periodicals-related activities reported the proportion of time they devoted within a specified time period to each of 14 periodicals-related categories:

- 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

The costs of electronic infrastructure and support were excluded from the analysis, as they are very difficult to allocate directly to periodicals in general and to print or electronic periodicals more specifically.

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

Figure 1 shows the size of the periodicals collections in the participating libraries. The small and medium size libraries have very large electronic collections relative to their print collections. Figure 2 shows the total cost, across all holdings categories, of non-subscription periodicals operations at each of the library participants.

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

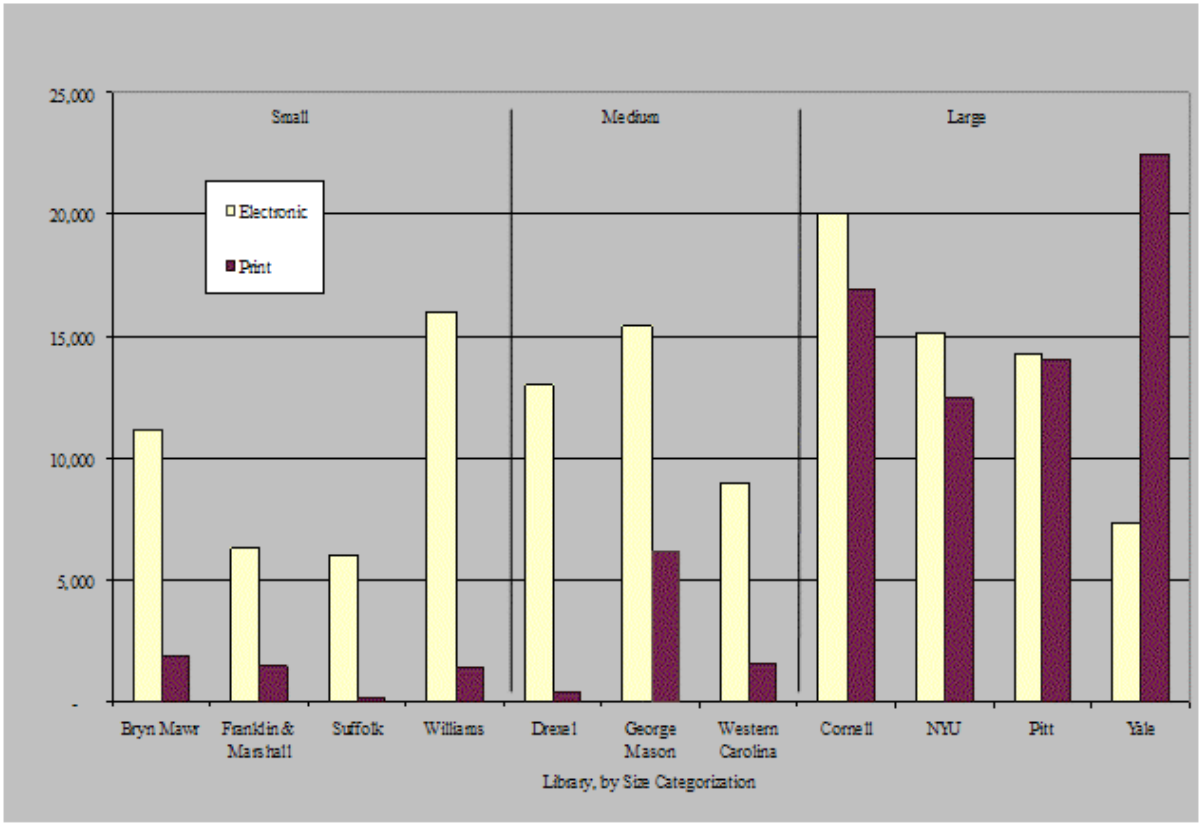
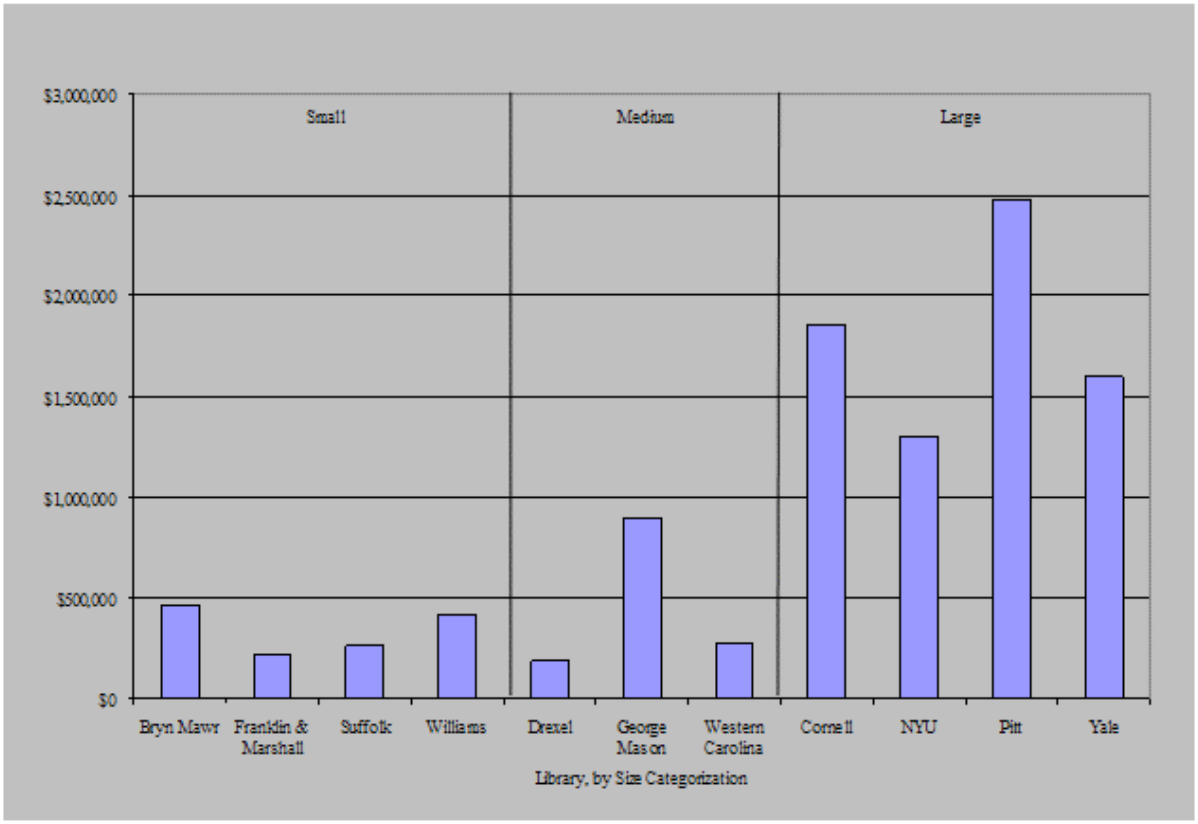


Figure 2. Total Annual Non-Subscription Periodicals Cost, by Library



Data Analysis: A Life-Cycle Approach

In the life-cycle analysis that follows, *the total non-subscription costs are tracked 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.

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. The 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

The analysis of print periodicals starts 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. The one-time costs are:

- 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, the ongoing costs are determined. These are costs that can be expected to recur every year for every bound volume of every title:

- 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*.

The one-time cost per title and the annual ongoing cost per volume are combined 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), an extra step is needed to bring them together in the life-cycle. The ratio of bindings to titles is used for this purpose. This is a most important step, because not every print title yields one bound volume per year.

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.

The analysis of the electronic life-cycle starts with those activities that are expected to take place only once for a given year of a given title. The costs are:

- 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;
    - 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. The recurring costs in our data are therefore assumed to be spread across five years.

Of the recurring costs, some 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
    - 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. This annual total is divided 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.

This sum is called the *use-related cost*, and it is divided by the number of titles to determine 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 [4]. 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:

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 1 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 the 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 1. Twenty-Five-Year Costs Allocated to Print and Electronic Periodicals, per Title

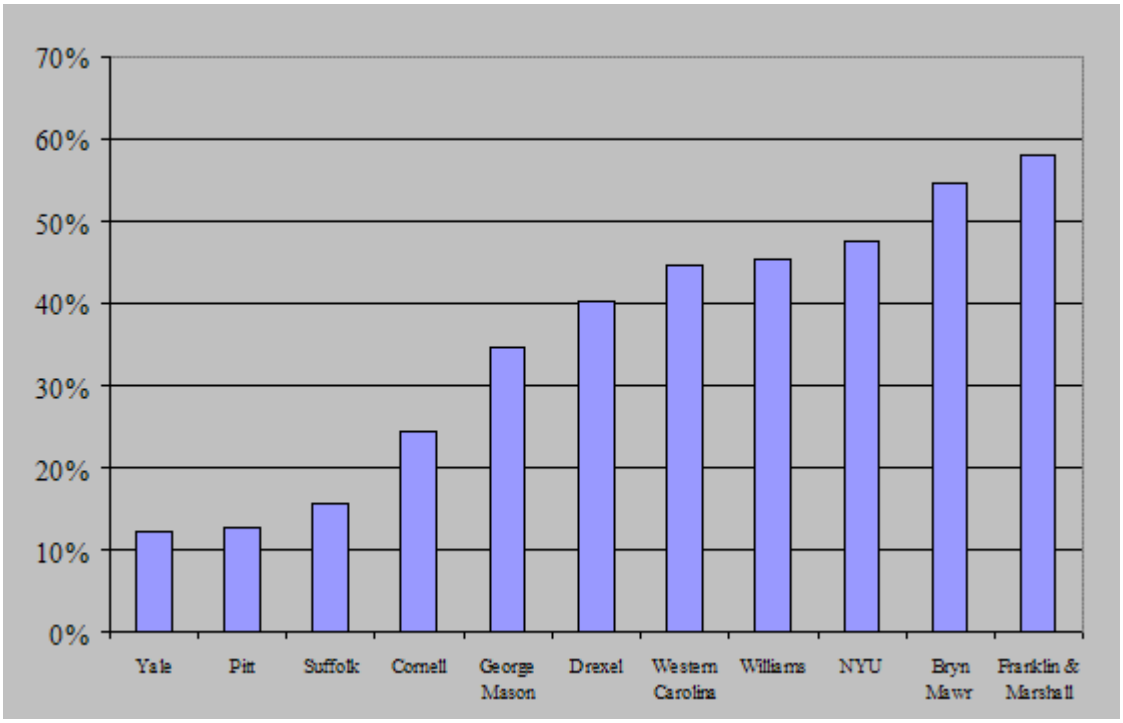
	Electronic Cost per Title	**Print Cost per Title**
Bryn Mawr	$13	$150
Franklin & Marshall	$13	$ 99
Suffolk	$41	$353
Williams	$12	$146
Drexel	$16	$225
George Mason	$22	$ 72
Western Carolina	$21	$101
Cornell	$36	$ 63
NYU	$21	$ 71
Pitt	$69	$ 92
Yale	$39	$ 48

The potential savings are most pronounced at the smaller institutions. Because the larger libraries have long benefited from economies of scale in their print operations, the relative savings to be generated from the further economies brought by electronic periodicals are simply not as great.

The electronic format's substantially lower life-cycle costs, in comparison with those of print, are striking. Other things being equal, the 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.

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 is represented in Figure 3 as a percentage of the total annual expenditures found in Figure 2.

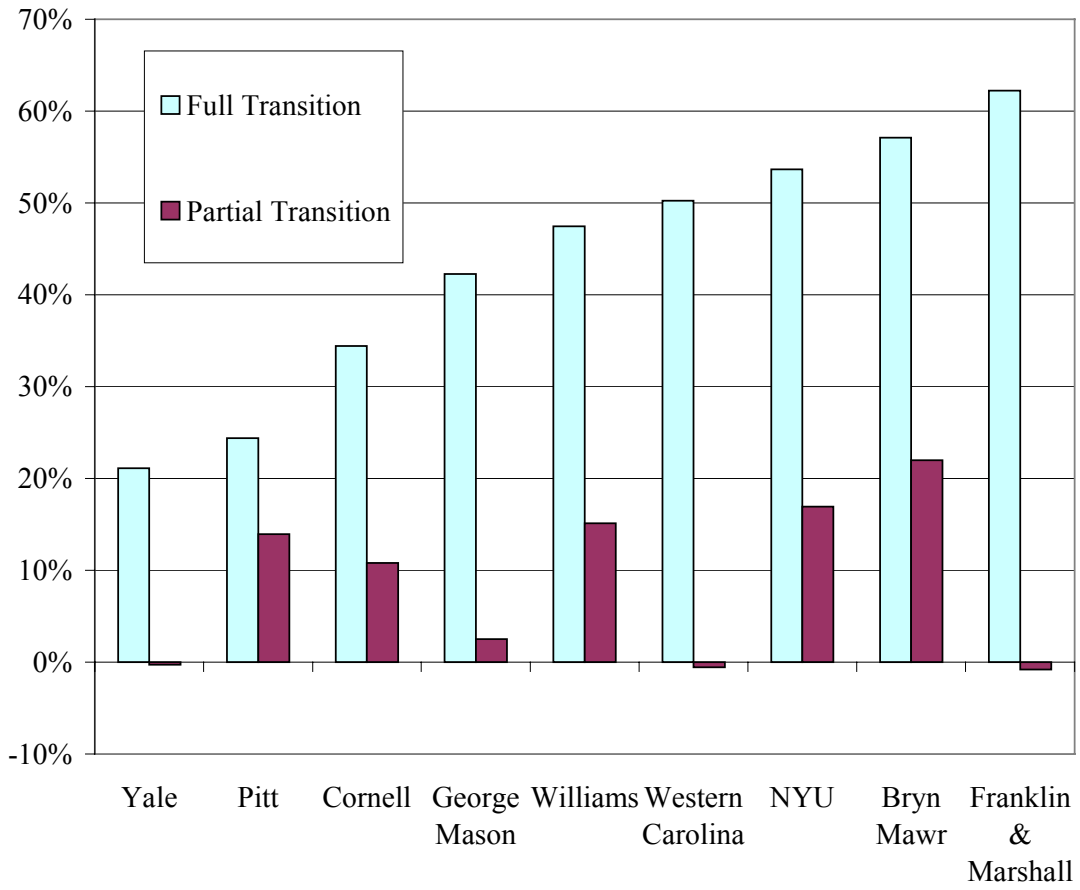
Figure 3. Total 25-Year Life-Cycle Cost Differentials as a Percentage of Annual Non-Subscription Periodicals Expenditures



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 we have no model for this outcome, we can further refine our projections to take account for a number of other variables not captured in the generic model shown in Figure 3. First, 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. Because there are significant scale effects on the print – economies of scale that would be reduced in a partial transition – it is important also to model for a partial case, which we have arbitrarily taken to be a transition of 50% of print titles to electronic. Second, there are many periodicals to which libraries carry subscriptions in both print and electronic format; cancellation of print for these titles therefore brings a larger net savings. Taking into account these two important variables, we present a revised model in Figure 4. [5]

Figure 4. One Year after a 50% Transition from Print to Electronic (Total Cost Differential over 25-Year Life Cycle)



Under a full transition, accounting for duplication of print and electronic and for the scale effects on the print side serves only to increase the level of savings. However, a partial transition offsets these beneficial cost effects. Indeed, all the libraries would see their savings eroded and some might even experience a (slight) net cost. The cost effects we have found to be associated with a partial transition, which are driven by the positive scale effects of the print format, deserve careful consideration by any library planning a strategy for the transition from print to electronic formats. Although, assuming a full transition would eventually be achieved, the near-term transitional effects may be of less importance, it seems that the transitional period, especially if it is a long one, will result in increased unit costs for print periodicals as the number of print titles is reduced. Many libraries are already, to one degree or another, along the path of the partial transition. But the slow ripping of the Band-Aid is always more painful. From this perspective, a faster transition would, other things equal, be preferable.

Conclusion

The transition to the electronic format seems likely to afford reductions in libraries' long-term financial commitments to non-subscription costs. 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 [6]. This study's focus on the relative costs of the two formats may offer a point of entry. It documents 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. 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.

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. 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

[1] The study was funded by The Andrew W. Mellon Foundation.

[2] 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).

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).

[3] For a more detailed view of the methodology, including the data collection instruments themselves, please see the extended version of this study: Roger C. Schonfeld, Donald W. King, Ann Okerson, and Eileen Gifford Fenton, *The Non-Subscription Side of Periodicals: Changes in Library Operations and Costs between Print and Electronic Formats* (Council on Library and Information Resources, forthcoming 2004).

[4] 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>.

[5] For an exact description of how this model was developed, see Roger C. Schonfeld, Donald W. King, Ann Okerson, and Eileen Gifford Fenton, *The Non-Subscription Side of Periodicals: Changes in Library Operations and Costs between Print and Electronic Formats* (Council on Library and Information Resources, forthcoming 2004), page XXX.

[6] 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.