On the Cost of Keeping a Book

*Paul N. Courant and Matthew "Buzzy" Nielsen**

1. Introduction

Among the critical functions of research and academic libraries is preservation—keeping both the scholarly record and much of the associated cultural record fit for use over time. Until recently, maintaining this record entailed managing primarily printed works, of ink on paper, bound in book form. The advent of electronic texts poses a novel and expensive set of preservation problems for academic libraries that have been addressed by many current and recent studies on the cost of digital preservation.[1] The topic of this report is the cost of storing and using print in old-fashioned codex form.[2]

We have two motivations for doing this work. The first is something of a straw man: as librarians and their funders become increasingly aware of the daunting technical and economic problems associated with digital preservation, there is often a certain wistfulness for

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[1] Several high-profile projects have addressed the financial implications of digital preservation: JISC and the British Library's Life Cycle Information for E-Literature (LIFE) project (McLeod, Wheatley, and Ayris 2006; Wheatley et al. 2007; Ayris et al. 2008); the University of California Libraries' Collection Management Initiative (Schottlaender et al. 2004); and CLIR's *The Nonsubscription Side of Periodicals* (Schonfeld et al. 2004). Others have studied digital preservation in light of the growing problem of where to store analog materials (Chrzastowski, 2003; Cooper, 2006; Schonfeld et al. 2004). Finally, many current projects on the subject are sponsored by governments on several continents, including the National Digital Information Infrastructure and Preservation Program from the U.S. Library of Congress and the Blue Ribbon Task Force on Sustainable Digital Preservation and Access.

[2] We use the term *preservation* often throughout this paper. By this we mean the long-term maintenance of materials for scholarly purposes and ensuring future access to the cultural record.

the good old days of print. After all, we have been solving the problem of print preservation for centuries. Just because we understand how to preserve print well does not mean, however, that we know how to do it without cost. It behooves us to calculate and understand the cost of keeping not only works that are born (or as yet unborn) digital but also print works that are currently stored by research libraries, are held in buildings that will deteriorate over time, and that will eventually have to be replaced. For most books in libraries today, including bound print journals, which we include as books throughout this study, we have already paid to keep the materials accessible for users today. But the next round of bills to be paid, both for new space and for replacement of existing facilities, is foreseeable and real. We undertake this study in part to show the continuing cost of holding print—old and new.

The second reason for undertaking this study is to help libraries evaluate collection and preservation strategies going forward. In any plausible configuration, academic and research libraries will be called upon to preserve and make available both print volumes and electronic records.[3] At the same time, as more works are made available digitally, libraries will increasingly have to choose between keeping a given work in digital or print form—acknowledging that either can be converted to the other at some cost. Libraries will face continuing choices in collection management, and making choices well will require understanding the cost of different modes of keeping materials accessible. Thus we are motivated to supplement the burgeoning literature on the cost of holding electronic records with a review and an addition to an older literature on the cost of keeping and using print books (hereafter referred to as *pbooks* when it is important to distinguish them from electronic books, or *ebooks*).

We take seriously an implicit commitment to maintaining, in usable form, the works that research libraries hold today and the works that they will continue to acquire in the service of scholarship. The commitment to preservation is not time limited—the international complex of research libraries has taken on the obligation of saving materials that others do not or cannot save. To complicate matters, where reliable electronic copies of works exist—and the number is increasing by tens of thousands a week—the argument for research libraries to share a good deal of both digital and print collections becomes stronger. The kind of collaboration needed to take advantage of the opportunities for shared collections is always expensive. Because the payoff to collaborative collection strategies depends, among other things, on the storage and preservation costs that can be avoided by employing such strategies, we need to have a fairly clear

[3] Even in a world where almost all use is digital, print can serve as a backup that is subject to a different profile of risk than electronic records. Thus it makes sense to keep some print copies as insurance against loss of electronic records. Additionally, even for works that are of quite ordinary quality and purpose (for example, university press monographs of the 1940s), the original print version may prove to have value as an artifact. Finally, original print copies often have significant historical value beyond the nominal content that is recorded in their pages. Libraries are in part museums of print, for many good reasons.

picture of the magnitude of those costs.[4]

In this report, we aggregate prior research and other information on pbook storage and analyze and synthesize these studies, supplemented by our observations and experiences at the University of Michigan. Our work draws heavily on earlier studies, particularly those by Cooper (1989, 1991, 2006); Lawrence, Connaway, and Brigham (2001); and Reilly (2003). We expand upon these studies by analyzing the data they present and drawing new connections about the relationship among facility type, storage policies, how books are used, and cost.

2. What's Involved in Storing a Book?

Upon examining the cost of storing a book, or several million books, it becomes immediately apparent that decisions about storage should be based on the anticipated use of the book. At one extreme—representing the approach most research libraries took until about 20 years ago—pbooks are placed on fixed shelving in facilities near their users. There is a good deal of space between shelves and shelving units, and the climate is controlled to make it comfortable for users to spend time in the stacks finding, retrieving, and replacing the books. In this scenario, the books are stored so as to be easily accessible and usable.[5] The real estate occupied by these books is usually near the center of campus and is therefore among the most desirable and valuable of locations.[6]

At the other extreme, pbooks can be stored in highly compact configurations, usually off-site and only accessible with lead times ranging from several hours to a day or two. This configuration is easier on the books and is cheaper in terms of land rent and construction cost per book. But access is also sacrificed. Browsing the off-site collection is generally impossible because the books are not shelved by subject, and although the labor required for storage is less than that in a central facility, the cost of accessing a particular book is generally much higher. In these configurations, books are stored in an environment that favors preservation, with substantially reduced convenience for the user.

The trade-off between storage cost and access implicit in these two extremes poses a number of issues as we attempt to assess the cost of storing pbooks. For example, direct comparisons of the costs need to be adjusted for ease of use. Additionally, libraries can move

[4] Collaborative collection projects are already in place for both print and digital repositories. Among these projects are HathiTrust (http://www.hathitrust.org) and the Research Collections and Preservation Consortium (http://recap1.princeton.edu/about/general.html).

[5] We have oversimplified, of course. Even 20 years ago, compact shelving was not uncommon. Moreover, there continues to be an important differential between open- and closed-stack facilities; the latter are more expensive to operate because they require more staff for circulation and more waiting time for users, but they are easier on the books. These differences matter, but for now we ignore them.

[6] This choice of location stems from the fact that in the print world the physical library was perforce at the center of scholarly activity. Almost everyone needed to use the library's works, which were available only by direct physical access. The cost of supporting scholarly work was minimized by placing the library's intellectual assets in the geographic center of the user population.

their collections across different facilities over time. A library could put books in the central, fixed-stack facility (which we term *open-stack*, even though in some libraries it is not open to all users) for a time, and then move them to more-distant storage facilities for the longer term. It could also make sense to place some new acquisitions directly into storage facilities, in cases where a library holds collections of record containing items that are not expected to be used frequently, and whose use, if any, is as likely in the future as in the present.

It is interesting that this trade-off has no parallel with ebooks. An electronic copy of a book, once securely stored on a server with appropriate redundant backup, can be browsed (although differently than pbooks), searched, and read pretty much anywhere, and pretty much instantly. For electronic works, there is no equivalent to compact distant storage, provided that the library has the rights to use the electronic works.

Because there are many different ways to store pbooks, our inquiry into the cost of storing a book will yield highly variable conclusions. How the book is stored, and how it is to be used, currently and in the future, will determine cost, and the cost differences that we discuss in this report can vary by as much as a factor of 12, depending on the assumptions made.

3. Space, Time, and Money

The term *life cycle* refers to a sequence of events or stages in maintaining a resource and making it accessible.[7] There is an extensive literature on the life cycle of library materials, which delineates a predictable course of uses, actions, and associated costs. Many authors, including Lawrence, Connaway, and Brigham (2001) and Shenton (2003), have advocated the use of life cycle analysis. The ongoing LIFE Project[2] uses a sophisticated implementation of the life cycle approach in assessing the costs of library materials (Wheatley, Ayris, Davies, McLeod, and Shenton 2007). Life cycle costs are organized by activities that vary over time, with some predictability. Using this approach, the total cost of a library resource can be decomposed into six parts: creation or purchase; acquisition by the library; ingest (i.e., processing upon receipt of the item); production of relevant metadata; storage costs; and cost of access or use.[8]

In this paper we focus on storage costs, but we will take note

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[7] We could quibble with the term *life cycle* on the grounds that the standard life cycle in biology invariably includes death, whereas the life course for many library materials is meant to include permanent preservation, or as close to permanent as can be contemplated.

[8] The LIFE Project (Ayris et al. 2008) uses an equation and a set of symbols as follows:
$L_T = C + Aq + I_T + M_T + BP_T + CP_T + Ac_T$
L represents the total cost. This cost is composed of creation/purchase (C), acquisition (Aq), ingest (I), metadata (M), bit-steam preservation (BP, called "storage" in the first phase of the project), content preservation (CP, previously called "preservation"), and access (Ac). Ongoing costs are calculated over a time horizon, T. Because LIFE focuses on digital media, its cost categories reflect this focus, but the framework is easily adapted to print.

repeatedly of the fact that ease of access is determined in part by methods of storage, such that there is often a trade-off between storage costs and access costs. It is relatively cheap to store materials that are rarely used; conversely, it is generally quite expensive to use materials that are stored in high-density facilities far from users. Storage costs are often invisible in the annual budget because they may be subsumed in other budget categories such as building construction, maintenance, cleaning, climate control, or other areas that are often seen as part of library overhead. These costs would be much lower if the library did not store millions of books.

Time is crucially important to the use of life cycle modeling and storage costs. The total cost of storage at any given time depends on the costs incurred up to that point as well as on those that are committed in the future.[9] Many of the elements of life cycle cost, such as creation/purchase, acquisition, and even metadata, represent one-time, or at least irregularly occurring, costs. Metadata updates, for instance, may occur haphazardly or only during major database upgrades. The costs for storage and preservation of pbooks, as well as for access, depend chiefly on how long materials are to be kept, how expensive they are to circulate, and how frequently they will be used. In many cases, the right time period for this analysis will be indefinite—as close to infinite as the library can get.[10]

The length of time one expects to store a pbook greatly affects its ultimate cost, and the annual costs may increase or decrease depending on how well the book was cared for in its early years and on the quality of the medium on which it was printed. It is relatively easy to study how much libraries spend on electricity, buildings, and staff. But time is arguably the most significant variable librarians must consider in conserving pbooks. When research libraries purchase pbooks, in most cases they implicitly commit to maintain them in perpetuity. Whether they keep a book for only 10 years or for its entire life, the ongoing costs to maintain it may, and likely will, far exceed the volume's initial purchase price. Indeed, as Lawrence, Connaway, and Brigham (2001) estimate in a study similar to ours, the storage costs of a pbook over time may exceed the purchase price by about 50 percent.

Time is particularly important because as it passes, libraries' responsibilities grow. We mean this not in the sense that libraries gain new missions—although they assuredly do—but because the corpus of work that libraries are charged to keep and make accessible expands. Librarians are responsible not only for materials that their own generation deems worth preserving but also for everything that

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[9] The LIFE Project considers the life cycle costs over a specified period of time (e.g., period 0 to T) and sums the preservation costs from each year. Assessment of the present value of costs allows one to make economically meaningful comparisons of costs incurred at different times. We will describe and employ present value later in this paper.

[10] For this reason, as we have discussed above, we believe that *life cycle* is not the correct terminology. More accurately, we have an essentially infinite lifeline for each item, with different actions required over the passage of time.

the preceding generations did.[11] To manage this increased volume of material, research libraries must (in some combination) secure more resources for storage, choose to discard an ever-increasing volume of material, or increase the efficiency of their storage. One mechanism that would improve efficiency would be to reduce duplication across libraries, but this issue is beyond the scope of this paper.[12]

The decisions we make early in an information object's life cycle influence both the future accessibility of the item and the overall life cycle cost of maintaining it. For instance, if a library chooses to leave a set of important newspapers in a hot, humid boiler room for 30 years, the damage done to those papers cannot be undone, and the cost of making these now-brittle newspapers accessible increases dramatically. To coin a term, we might call this the "Clementine Principle": if libraries do not properly care for their materials, whether electronic or print, from the beginning, those materials may be lost and gone forever. The loss is much more serious if there is no duplicate elsewhere. The cost associated with this loss is not reflected in the life cycle equations. It is the loss of value that would have been available had the material been kept fit for use. Avoidance of such losses—that is, maintenance of the scholarly and cultural record—is central to the mission of research libraries.[13]

Our work attempts to find the most efficient use of libraries' limited monetary resources for storage, making no assumptions about the value of the information in any particular volume. Economists call this "cost-effectiveness analysis," in which we hold output constant (we are holding a book's worth of information, indefinitely, at a specified level of accessibility) and compare the cost associated with different storage modes. This technique is complicated in the case at hand because it is difficult to hold the output constant. In particular, the trade-off between cost and accessibility is at the heart of decisions that libraries must make with respect to print storage. Implicitly, then, we are asking the reader of this essay to judge the value of delivery time and ease of browsing. Regardless of how that trade-off is resolved, we can determine cost-effectiveness. For any level of accessibility over any time path, a major source of cost will be the infrastructure that preserves the collection: buildings, climate-control systems, and technology. All must be replaced at some point, and these replacement costs are part of the total cost of providing continual access.

As we have already seen, the cost of storing a book depends on how it is stored and its use over time. At one extreme, libraries could opt to store books in densely packed, climate-controlled warehouses.

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[11] Libraries should reassess continually what they are storing, but even if they decide certain information is no longer worth keeping, the vastly expanding amounts of information being produced, combined with the need to maintain the historical record, all but guarantee a growing commitment to preservation.

[12] For more discussion of the issue of duplication across libraries, see Schonfeld and Housewright 2009.

[13] We do not have good measures of the benefits generated by libraries and archives, though it is not for lack of trying. See, for instance, Griffiths and King 1994, Ozdemiroglu and Mourato 2001, Aabø 2005, and Americans for Libraries Council 2007.

In such a case, storage costs would be relatively small. However, such facilities reduce accessibility to patrons because the warehouses might be off-site or require staff mediation for checkout. At the other extreme, books could be stored in traditional main libraries, with standard shelves and climate controlled for users' comfort. Patrons could easily browse the shelves and consult materials of interest, but the suboptimal storage climate and potentially heavier use of materials mean that their future accessibility may be compromised and that future restorative costs may be higher. The actual average cost of pbook storage will generally fall between the costs generated by the open, main-stack model and the closed storage facility model because libraries often employ mixed strategies over time.

4. Dealing with Costs Incurred at Different Times—Discounting and Present Value

How much does it cost to keep a book for a century or more? Over this period, it is likely that the building that houses the book will be replaced two or more times; that the roof will be replaced even more often; and that the book will spend part of its life in accessible stacks, part in compact shelves, and, perhaps, part in high-density storage. Each of those systems will be constructed and installed at different times. And the buildings will be heated and cooled, requiring the use of fuel and electricity, the prices of which will change over time.

Economists compare expenditures undertaken at different times by using a technique called discounting to calculate the present value of all of the expenditures. The present value, in turn, is defined as the amount of money that we would need today to undertake the entire future set of activities that is contemplated at an assumed interest rate. In the case at hand, the present value of storage costs associated with a book includes the amount of money that we would have to spend today in order to persuade a reputable contractor to guarantee delivery of the requisite buildings, maintenance, and associated services in perpetuity. Perhaps surprisingly, the relevant amount is not infinite.

Suppose, for example, that the cost of storing a book for a year in today's prices is $3.00. Suppose that the interest rate on federal inflation-adjusted bonds is 3 percent. The present value of storing a book in perpetuity is $3.00 divided by 3 percent, or $100.[14] Why does it work? Because the $100 is just enough so that at the 3 percent interest rate, it will generate $3 per year. This works in the first year, the second year, and each succeeding year, into perpetuity. To generate $3.00 a year in perpetuity at an interest rate of 3 percent per year, one needs $100. At the end of the first year, the investment pays $3.00 and the principal amount of $100 is still intact. The concept is similar to an endowment, where an organization uses the interest while leaving the principal untouched.

Thus we say that the present value of $3.00 a year in perpetuity,

[14] See Gramlich 1990, 93-97, for an explanation of why this calculation yields the correct present value.

at a 3 percent discount rate, is $100.[15] In this scenario, we should put aside $100 to store a single book in perpetuity. We will use this money to pay for storage and upkeep of the book; whatever is not being used to pay current costs will be invested in bonds to generate income for future upkeep. Notice that calculations of this kind are very sensitive to the assumed discount rate. If we used 1 percent, the present value would be $300. If we used 10 percent, the present value would be $30. Our method in this paper is to calculate a present value for each element of storage cost.

Fortunately, inflation, which is difficult to forecast, is relatively easy to deal with in calculations of this kind. Interest rates generally exceed inflation rates, meaning that a dollar invested today will be able to purchase more than a dollar's worth of goods and services in the future, even after accounting for inflation.[16] For example, if prices are rising at 3 percent a year and the market (or "nominal") interest rate is 6 percent a year, a dollar that is saved for a year will buy the same goods it could buy today with three cents left to use for other things. Alternatively, if we anticipate buying goods a year from now that cost a dollar today, an investment of about $0.97 today is all that will be required.

In the example given here, the real rate of interest is 3 percent: the nominal rate of 6 percent less inflation of 3 percent. In the literature on benefit-cost analysis, it is common to assume a real rate of interest of 5 percent (Gramlich 1990, 93). Any positive real rate implies that current dollars are worth more than future ones. Discounting by a higher real interest rate would mean that today's dollars are worth relatively more—the future is discounted more heavily. A lower discount rate would have the opposite effect. To be conservative, we will calculate costs in this paper using the standard real discount rate of 5 percent, 3 percent (our base value), and 1 percent. Using the 1 percent rate results in future costs being higher in today's terms. The current economic situation tends to support the use of lower rates. Over the past 10 years, the CPI, the generally accepted measurement for annual price inflation, increased on average by 2.6 percent per year (United States Bureau of Labor Statistics 2009). The return on 10-year U.S. Treasury constant maturities averaged 5.2 percent annually over the same period (United States Board of Governors of the Federal Reserve System 2009). Three percent thus represents a fairly conservative—and fairly realistic—return on investment.[17]

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[15] The term *discount rate* denotes the rate at which future sums of money can be made directly comparable to current dollars. In almost all cases, the discount rate will be the same as the interest rate. In this paper we preserve conventional economics usage and use the more general term discount rate. For more information on discount rates, see Gramlich 1990, 92-99.

[16] The current economic crisis has produced some short-term and short-lived counterexamples that are best ignored.

[17] The difference between the CPI and the return on 10-year Treasury maturities suggests that we should be discounting at 2.6 percent, not 3 percent. We choose 3 percent because, in the long run, it better reflects a conservative overall expected return from investments, and a lower rate would lead to an even higher estimate for storage costs than we calculate. We also show our calculations under the assumptions of 1 and 5 percent. In a paper similar to ours, Lawrence, Connaway, and Brigham

The use of real interest rates avoids the complication of trying to forecast the rate of inflation. If the assumed real interest rate is 3 percent, at an inflation rate of 6 percent the market rate of interest will be 9 percent. If inflation is 1 percent, the market rate of interest will be 4 percent. For our purposes, all that matters is the difference between the market rate and the inflation rate, namely, the real rate.[18]

Even though prices on average increase at the rate of inflation, the price of specific categories of production may rise faster or slower than the average. This will be important for our analysis of construction costs, which historically have increased at rates greater than general inflation. For construction, we will estimate inflation relative to prices in general. That is, if we anticipate that inflation in construction exceeds the growth in the CPI by two percentage points a year, which has been the norm for several decades, we can build that assumption into our calculations of the present value of storage costs, and continue to express the present value in today's dollars. All of our calculations will be expressed in terms of what money buys in 2009.

Our calculations, unlike those of Lawrence et al. (2001), Schonfeld et al. (2004), and others, assume that a given pbook will be stored in perpetuity.[19] This may seem odd, given the fragility of paper, but we would argue that perpetual storage best captures the mission of libraries. Except perhaps in the case of duplicates or ephemeral materials, research libraries generally intend to store their materials for as long as the institution exists, and they often spend money restoring, preserving, and, when necessary, duplicating deteriorating materials. To the extent that restoration and duplication are important, the calculations we make here underestimate the cost of preserving pbooks.

In sum, the idea of present value is essential for the kind of analysis we undertake here because of the very long time periods under consideration. When expenditures are undertaken at different times we can use present value to make each of them commensurable. Construction of 100,000 square feet undertaken in 20 years has a present value of the sum required today to pay for the construction then, in today's dollars. Put another way, how much would we have to invest today to cover the cost in 20 years?

(2001) use a discount rate of 7.5 percent. They use it because it represents "the long-term average discount rate delivered by state and municipal bonds" (p. 547). While they do not specifically state as such, this rate represents a "nominal" interest rate, i.e., one that does not factor out normal price inflation. As mentioned, using a high discount rate downplays future costs compared with present ones. A real discount rate of between 3 and 5 percent would more accurately represent the relative values of present and future costs. If normal inflation is subtracted from Lawrence et al.'s discount rate, their real rate would fall between 4 and 5 percent.

[18] Defining i as the market interest rate, π as the inflation rate, and r as the real rate, the formal relationship is that $(1+i) = (1+r)(1+\pi)$. For small values of r and π this is well approximated by $i = r+\pi$.

[19] The assumption of storage in perpetuity does not affect greatly our calculations of present value relative to storage for, say 100 years. At a real discount rate of 3 percent, a dollar spent 100 years from now has a present value of 5.2 cents. For a given sum of money spent annually, approximately 95 percent of the present value of perpetuity is accounted for in the first 100 years. Thus, our analysis would be little changed if we looked at storing a book for 100 years versus essentially for eternity.

5. The Costs of Pbook Storage

Our strategy is to estimate the present value of each element of pbook storage (for example, construction, energy, curation, maintenance) and to combine these values to approximate the total cost. Rather than try to develop one best estimate, we offer a range of estimates, reflecting varying assumptions about particular cost elements and the way in which books are used and stored (for example, in open main stacks, in closed storage facilities, or in a combination of the two). We also discount at a low rate of 3 percent, the more conventional rate of 5 percent, and the very low rate of 1 percent. With these varied assumptions, we wind up with a large range of estimated costs.

It is important to reiterate that storage cost alone (cost being primarily dependent on books/square foot) does not determine how best to store pbooks. Implicit in the range of storage choices is a range of functionality and operating costs: more books per square foot of library space requires more time, staff mediation, and transportation to get a book to a patron.

Following Gramlich (1990, 93-97), the arithmetic of computing present values for perpetual flows of resources is straightforward. To estimate the total present value, we add the following elements, as shown in table 1, on a per-volume basis: construction cost, maintenance cost, cleaning and janitorial services, electricity (including heating and cooling), staffing, and expected costs of circulation, recognizing that many volumes are unlikely to circulate at all.[20]

We calculate the present discounted value of each of these costs under three different storage models, with a slight variation in one case. In all cases we update past estimates to 2009 dollars.

- *Standard open-stack facility:* We estimate costs for a typical main library, with standard subject-organized shelving, assuming the industry standard of 10 books per square foot (Leighton and Weber 2000, 178). Our calculations are primarily based on Cooper (1989, 1991).
- *High-density storage facility:* These estimates—based primarily on a CLIR survey of such facilities (Reilly 2003)—represent costs for warehouse-style shelving buildings, likely located off campus or in a remote part of it. We assume 150 books per square foot (McLaren 2004, 20).
- *Hybrid model:* We estimate costs for a model that more closely matches what most libraries do: keep pbooks in a standard facility for a time before shifting them to a high-density facility. We

[20] We use the following formula to calculate the total net present value of storing pbooks:

$$\sum_{t=0}^{\infty}\left(\frac{Construction\ \$/vol.}{1.01^t}+\frac{Maintenance\ \$/vol.}{1.03^t}+\frac{Cleaning\ \$/vol.}{1.03^t}+\frac{Electricity\ \$/vol.}{1.03^t}+\frac{Staffing\ \$/vol.}{1.03^t}+\frac{Prob.\ of\ circulation/vol. * Circulation\ cost/vol.}{1.03^t}\right)$$

In words, this formula states that the net present value of storing a book is the sum over an infinite number of years of the cost elements we identified divided by the discount rate raised to the power of the time (the year). Construction cost differs slightly by being divided by 1.01, as we estimate construction costs increase at 2 percent annually over general inflation. Details on the calculations within each cost element are noted below.

estimate two variants of this model. In one variant, we assume that the books stay in the standard facility for 10 years; in the other, the books stay for 20 years. This model includes the costs of building the high-density facility and transferring materials to it.

We estimate costs under what we consider to be the most likely scenario: we assume that construction prices increase at 2 percent annually over inflation, and we use a real discount rate of 3 percent, implying that the interest rate is 3 percent greater than the inflation rate. All values are in 2009 dollars.

Our base case results are shown in table 1. The units are dollars per book, and all figures, except the final row, are present values for perpetual storage. Details of how we calculate various cost categories are found in the next section, The Critical Elements of Storage Costs. Total costs under different assumptions are shown in table 2. These varying assumptions are discussed in the section entitled Costs under Different Assumptions.

Cost Element	*Shelving Model*			
	Open Stack	**High Density**	**Hybrid (10 years in open stack)**	**Hybrid (20 years in open stack)**
Construction	108.51	16.40	32.36	43.21
Maintenance	16.69	1.24	5.66	8.99
Cleaning	3.64	0.28	1.32	2.09
Electricity (heating and cooling)	2.39	0.20	1.03	1.53
Base staffing	6.08	1.20	2.42	3.36
Circulation	4.58	9.45	8.19	7.25
Total	**141.89**	**28.77**	**50.98**	**66.43**
Annual Average	**4.26**	**0.86**	**1.53**	**1.99**

Table 1: Our best storage cost estimates (in 2009 US$)

6. The Critical Elements of Storage Costs

Our estimates combine six major cost elements—construction, maintenance, cleaning, electricity, staffing, and circulation—though these variables are by no means comprehensive. In the following paragraphs we explain why we included these costs and how we estimated them. We use general estimates for typical open-stack and high-density facilities. Specific cost elements, such as construction, may differ by geographic region. Main campus libraries may be more expensive to heat in the northern reaches of the country, while storage facilities will be relatively expensive to cool in the south. Despite these variations, we believe these costs provide a good framework with which to understand how costs differ between facilities.

6.1 Construction

We use two primary sources to estimate construction costs for library facilities to house pbooks: Cooper (1989, 1991) for the construction costs of standard open-stack facilities and Reilly’s (2003) CLIR report for storage facilities. These sources include shelving as a part of construction costs.

Unlike the other variables in our storage cost formula, for our base case we discount construction costs at 1 percent rather than 3 percent. Historically, construction prices have risen at rates much higher than general costs (for example, the CPI). Using the Fisher construction price index maintained by the U.S. Census Bureau (2009), we estimate that construction costs rise at a rate that is about 2 percent greater than general prices. Discounting assumes one will be able to get a basic real return on money if it is invested (in our case, 3 percent). However, with costs such as those of construction, which increase at a greater rate than general inflation, the potential net return on investing those monies is less roughly by a factor of the difference between the annual percentage increase and general inflation. Thus, if construction prices rise at about two percentage points a year more than inflation and the real discount rate is 3 percent, savings made for future construction costs will yield only 1 percent a year.

Many studies—including those of Schonfeld et al. and of the LIFE Project[2]—have done an excellent job of estimating costs for storing pbooks (or at least printed journals and other similar print materials). However, these studies generally don’t address the replacement cost of facilities that are involved in keeping resources indefinitely. In our calculations, we assume that buildings must be replaced every 40 years, the estimated useful life of a building according to the American Hospital Association’s *Estimated Useful Lives of Depreciable Hospital Assets* (2004). Hence, in year 40, 80, 120, and so forth, the cost of building a new building is incurred. If we lengthened this time in recognition of typical university practice, the results would not change greatly, although the present value of our estimated space costs would fall. For instance, if we assume that buildings are replaced every 60 years, the net present value of storing a pbook in an open-stack facility is $112.52 versus $24.35 for a high-density facility, compared with $141.89 and $28.77, respectively, under an assumption of replacement every 40 years. While the values are lower under the 60-year replacement model, the difference in costs between the two facility types is still large.

Finally, we vary the way we calculate space costs for the hybrid model. Because a book will not stay in an open-stack facility for the entire life of the building, we calculate an annual rent that is consistent with our assumptions about construction cost and building life. We use that estimated rent to calculate the cost to use the space in the open-stack facility for the first 10 or 20 years.[21] The result is $1.52 annual rent (in 2009 dollars) per book over the period. At year 10 or 20,

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[21] We have specified periods of 10 and 20 years for illustrative purposes. In reality, libraries typically move an item off-site after its circulation drops below a certain threshold, a figure that likely differs depending on the subject area.

the cost of constructing the high-density facility is incurred. That cost then repeats every 40 years, as previously discussed.

The hybrid model incurs an additional cost during the years the books are transferred, namely, the cost to select and transfer the materials to the storage facility. We estimate these costs at $3.99 per volume, using figures from Cooper (1991, 417) updated to 2009 dollars.

6.2 Maintenance

Buildings must be replaced, and before they are replaced they must be maintained: bricks need to be resealed; heating systems fail; windows need to be replaced. Using figures gathered from the University of Michigan's Buhr Shelving Facility, we estimate a basic annual maintenance cost (including labor and materials) for library buildings. We derive these estimates by averaging a five-year cross-section of Buhr's maintenance costs, breaking down those costs by the cost per square foot, and then estimating a per-book value by factoring in the number of books per square foot for the various shelving types.

6.3 Cleaning

Buildings must be cleaned as well. We estimate cleaning costs using a method similar to the one we used to calculate maintenance. Taking five years' worth of cleaning data from the Buhr facility, we averaged it, estimated a cost per square foot, and calculated a cost per book based on the storage capacity of various shelving types.

6.4 Electricity

Electricity is a critical portion of the operating costs of any library. It runs the lights that allow users to see materials, powers the computers used to catalog them, and maintains the climate necessary to preserve pbooks.

We use a 1999 poll by the U.S. Energy Information Administration (EIA) to estimate energy consumption. EIA polled organizations on their energy consumption, dividing their findings across a number of categories, including buildings of different types and sizes, calculated per square foot. Storage facilities are generally kept at temperatures more hospitable to pbooks, while the climate of main libraries is maintained for human comfort, so it makes sense that there would be a difference in energy usage. In our calculations, we assume that open-stack facilities have the same energy footprint as an education-style building; warehouse-style buildings, by contrast, fit with storage facilities using compact or high-density shelving systems.

Using EIA's figures (p. 188) and the estimated number of volumes per square foot, we estimate the kilowatt-hour (kWh)/pbook/year at 0.91 for open-stack facilities and at 0.06 for warehouse-style facilities. Assuming that educational institutions pay the commercial rate for electricity (an average of $0.1028/kWh in 2008), we calculate an annual average kWh/pbook value and use that figure to estimate our overall electricity costs. The costs are varied in the hybrid model according to where a book is stored and for how long.

6.5 Staffing

The number of staff required to maintain a building is significant. After space-related costs such as maintenance and construction, we estimate that staffing is the next-largest cost associated with pbook storage. One problem with measuring such costs is that it is difficult to isolate the staffing costs that are strictly associated with storage, for example, people responsible for stacks maintenance or reshelving. To attempt to isolate these costs we again use Reilly (2003), who counted the number of staff (measured by full-time employees) for the facilities he studied. Using these figures, we estimate an approximate number of annual staff hours spent per book and, using an hourly rate inclusive of salary and benefits, estimate an annual cost.

We use $27 per hour as a standard hourly rate, including benefits. We calculated this value using the Association of Research Libraries' (ARL) 2007–2008 data tables (2009). These tables provide data on salary expenditures for professional, support, and student staff in research libraries nationwide. We calculated a single average hourly rate of $19.98, weighted based on the proportion each category of staff represents in overall library salary expenditures. Unfortunately, ARL does not include benefits in their figures. We use a benefits rate of 33 percent over the salary, which is typical at the University of Michigan, and round up slightly, resulting in an hourly rate of approximately $27. We then used this figure to estimate an annual staffing rate per volume.

This annual cost represents a base level of staffing necessary per book. For each type of facility, we then subtract from this base level of staffing the amount required for circulation (see fig. 1). Circulation is what economists call a marginal cost,[22] that is, it increases only as usage or circulation of the books increases. By subtracting the circulation costs from the overall base staffing as determined from Reilly's figures, we can estimate a fixed level of staff required per volume for each type of facility, independent of how much the typical item circulates.

Determining the storage costs for a main open-stack facility is difficult because so many other things are going on in such a building. Staffing in such facilities includes many people—reference librarians, system administrators, managers—who are not strictly associated with the storage, retrieval, and circulation of items. We therefore draw on Reilly (2003) and assume that the overall circulation and base staffing cost per pbook will be approximately the same for a standard facility as for a facility for storage-related purposes only. As the Reilly data regarding staffing show (see fig. 1), the relationship between staffing and current holdings is remarkably consistent.[23] The need for staff does not drop off as facilities become larger, as might be expected. What makes staffing costs different is

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[22] *Marginal cost* is a standard term in economics referring to a cost that changes as the quantity of a good or service delivered changes. Specifically, it is the change in cost resulting when quantity changes by one unit. In our case, this change refers to the cost of storing one additional pbook.

[23] For the statistically inclined, the correlation is 0.86 and the r^2 is 0.74.

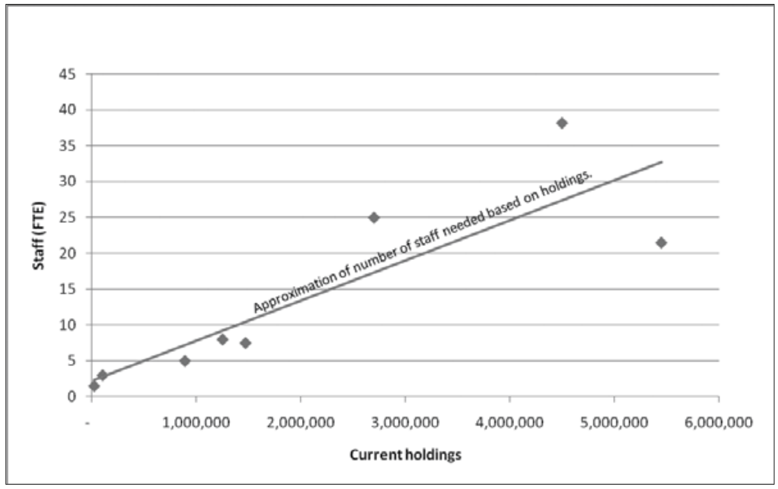

Fig. 1: Storage facility staffing versus current holdings.
Data Source: Reilly (2003)

circulation, which is more expensive per instance in a storage facility, but for which there are fewer instances per book. Open-stack facilities also have higher base levels of staffing, as they have higher use than do high-density storage facilities.

6.6 Circulation

Most of the cost elements we have mentioned dramatically favor high-density facilities. Circulation is the exception. Given the staff mediation and travel required, circulating an item from a high-density facility is much more expensive than from an open-stack facility. We estimate these circulation costs based on Cooper (1989), updated to 2009 dollars using the CPI and the producer price index (PPI) for gasoline costs (United States Bureau of Labor Statistics 2009). We assume a 25-mile round trip to deliver the materials to the patron.

To estimate an annual circulation cost, we take the updated Cooper figures and multiply them by estimated probabilities that an item will circulate from a specific facility. Payne (2007) reports that high-density facilities circulate about 1 to 2 percent of their collections annually. We use 2 percent. To estimate the circulation rate from open-stack facilities, we average the 2007–2008 ARL (2009) data on collection sizes and circulation, resulting in an annual circulation rate of approximately 13 percent. This figure may be slightly low for open-stack facilities, given that the ARL data include circulation from high-density facilities, but we believe it is a good approximation.

6.7 Other Factors

Readers may be thinking of other expenses, such as the cost of security systems and fire protection, replacement costs for climate-control systems, or insurance, that should be included in the cost of storing books. While these factors are important, we choose not to analyze them because their costs, when averaged per book, would be very low.

One element that may be worth investigating in future work, however, is the cost of replacing automated storage and retrieval systems (ASRs). These robotic order pickers are common in many newer high-density storage facilities (Boss 2002). While a building's useful life is estimated at 40 years, we suspect that the robotic order pickers in ASRs must be replaced before that. It is machinery, after all, and machines break down over time. Additional data on these replacement costs may change the cost differential between using an automated versus a human-mediated system.

7. Costs under Different Assumptions

The costs estimated earlier are those that we believe are most relevant to projecting future library storage costs, specifically the applicable discount rate, the relative inflation rate for construction costs, and the time that books spend in an open-stack facility before moving to high-density storage. Those three variables account for a fairly wide variation in cost estimates. We have already estimated costs based on whether books stay in an open-stack facility for 10 or 20 years. We estimate costs under slightly different assumptions in table 2. We discuss these differences below.

The discount rate dramatically affects costs because it has an impact on the weight placed on future costs. During the boom times of the late 1990s and the first several years of the current decade, discounting at 5 percent real interest would have been conservative; one could make far more than a 5 percent real return by putting money almost anywhere other than under a mattress. The recent financial climate is much less favorable for investment. Still, libraries are in the storage business for the very long term. What is a reasonable annual interest rate in the long run? We use 3 percent, which is quite

	Shelving Model							
	Open Stack		**High Density**		**Hybrid (10 years in open stack)**		**Hybrid (20 years in open stack)**	
Assumptions	*Net present value*	*Annual*	*Net present value*	*Annual*	*Net present value*	*Annual*	*Net present value*	*Annual*
Base	141.89	4.26	28.77	0.86	50.98	1.53	66.43	1.99
No construction increase	83.94	2.52	20.02	0.60	40.59	1.22	52.91	1.59
1% discount rate[24]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1% discount rate and no construction increase	169.72	5.09	44.79	1.34	57.36	1.72	65.97	1.98
5% discount rate	73.12	3.66	15.37	0.77	43.99	2.20	61.76	3.09
5% discount rate and no construction increase	62.91	3.15	13.83	0.69	40.23	2.01	53.91	2.70

Table 2: Storage costs under different assumptions (in 2009 US$)

[24] It is impossible to calculate the net present value of storage cost under a 1 percent discount rate with construction costs increasing at 2 percent annually. This is because the construction costs increase by more than the amount of interest we could receive by investing the money, making construction costs essentially infinite.

conservative and which puts a fairly heavy weight on future construction costs. Five percent is more typical of analyses of this kind, so we make our calculations at 5 percent as well. For illustrative purposes, we also discount at 1 percent.

Our estimates are quite sensitive to assumptions about future construction costs. Implementing this assumption makes a larger difference on our cost than any other except the discount rate itself. Space is the single largest cost associated with storing books. Buildings are expensive, whether one pays rent to use them or pays for the property and construction outright. If we assume that space costs increase systematically relative to the overall price level, our estimate of the present value of storage will be higher than if we assume that the relative price of space is constant. Of course, construction costs do not always increase, as the financial events of late demonstrate, so we also provide estimates assuming no relative price increase for construction.

Most noticeable about the estimates for the hybrid model is the significant difference between keeping a book in open stacks for 10 or for 20 years, particularly at high discount rates. This difference arises from discounting and the fixed costs inherent to constructing facilities. Open-stack facilities are much more expensive to construct on a per-book basis. When books are kept in those facilities from the start, the highest costs are incurred in the early years, which contribute most to the present value.

The vast difference in costs between the hybrid model and both the high-density and open-stack facilities is also instructive. On the one hand, it tells us that we may be wasting money on items we do not expect to circulate often. Placing them in an open-stack facility is expensive, given the much higher per-volume cost of such facilities. If an item circulates infrequently, a high-density facility may save a great deal of money, even though circulating from that facility is 10 times as expensive as circulating from open stacks.

The degree of cost difference between the hybrid and "pure" models also suggests that, even if libraries put some high-circulation items in storage facilities, there still may be a significant cost saving. New storage facilities are expensive, but their cost pales in comparison with that of constructing a new main-campus, open-stack facility. Cooper (2006, 337) makes a similar argument with respect to bound journals. Substantial monetary savings are associated with using high-density storage facilities. Against these savings libraries must weigh the inconvenience and time costs imposed on users by slower retrieval and the inability to browse. In cases where electronic surrogates are available for pbooks held in high-density storage, the use of such surrogates can reduce these costs by providing alternative mechanisms for both browsing and retrieval of content.

8. Analysis

Tables 1 and 2 make clear that under any set of assumptions and any configuration of storage, the biggest costs derive from the construction and operation of space. Dense storage is much cheaper than open-stack storage because it requires less construction, less electricity, less cleaning, less everything but staff per book. Circulating volumes from high-density storage is more expensive than circulating from low-density, so it is important to be careful about what sorts of materials are put into high-density storage.

High-density storage can be used to reduce costs, but a penalty is incurred in terms of functionality and circulation. There is a delay between ordering and obtaining a copy of a book; moreover, it is essentially impossible to browse a collection held in high-density storage. Thus our cost numbers are not really comparable (in the literal sense of being suited to make comparisons), and the cost advantage of high-density storage, while accurately portrayed for storage per se, does not take into account the operational disadvantages of high-density storage, which are often compounded by physical distance between the facility and the user.

Table 2 shows the effect of key assumptions on both the level of costs and the comparison of costs across different models of use. Increasing the discount rate reduces present values across the board, but has a smaller effect on annual cost and does not change the basic picture. The biggest effect would come from assuming that construction costs grow with inflation in general, rather than at a faster rate, as we have assumed. We see no basis for assuming such a favorable environment. Were it to materialize, all of our costs would fall substantially, because, as we have said, space costs are the principal driver.

The space costs that we have counted here do not include location rents. Including these would increase the dollar cost of all storage facilities, and would increase the cost of central campus facilities in the highest proportion. Central campus space is valuable for many purposes—classrooms, study and collaborative work space, arts production and display, administration, nearly every university function other than intercollegiate athletics and medical practice. If there were an active rental market within a university, the land upon which libraries tend to sit would be among the most expensive. Because we do not estimate land costs, we understate the true cost of holding books in open-stack facilities by a considerable amount. The economic advantages of high density and (as we discuss in the next section) electronic storage are even greater than the dollar estimates that we present here.

The cost advantages of off-campus high-density storage could be realized, at least to a substantial degree, through a complementary pair of strategies involving electronic storage and sharing of print collections. To the extent that digitized copies of print works are available to a university population for searching and browsing, it would be possible to restore much of the lost functionality that is inherent in high-density storage while retaining the cost advantages of such storage. (We are aware that the rights environment may limit that extent, and that the outcome of current lawsuits will bear upon it.) Users would search and browse electronically, eliminating or at least reducing the need to make cursory uses of the physical book. Thus high-density storage would impose less cost in terms of functionality, and would likely be less costly to operate because there would be less circulation. The cost of running the electronic facility would have to be added, but as we will see, the net is likely to favor the kind of mixed-platform hybrid we suggest in this paragraph.[25]

Similarly, in an environment where there is widespread digital access, libraries could share their print storage, keeping only several copies nationally or regionally, rather than duplicating substantial swaths of their collections. Given the magnitude of the costs that we have discerned here, the savings from sharing of this kind could be substantial.

9. Comparison with Costs of Storing Electronic Books

A good deal of the current literature (Ayris et al. 2008; Beagrie, Chruszcz, and Lavoie 2008) shows that secure, long-term storage of digital objects is costly. Librarians bemoan the fact that these costs are often additional to print storage, in the sense that libraries will surely require the capacity for storage in both print and digital media.

As we briefly discussed earlier, however, for many titles libraries will have to choose between print and electronic copies. In many other cases, they will have no choice: vendors will provide one or the other. With respect to academic journals, the trend has clearly been toward electronic-only. Where there is choice, more and more libraries (Chrzastowski 2003; Johnson and Luther 2007) have switched exclusively to digital. The reason is often posed as usability. But considerable pressure and concurrent costs for storage have been removed, potentially reducing need for new facilities. Both functionality and storage costs are highly relevant to libraries' decisions about storage media.

Just as the question "What does it cost to store a pbook?" depends on how it is to be stored and used, so, too, does the question "What does it cost to store an ebook?" But the functionality of ebooks is much less dependent on storage than that of pbooks. To be sure, it is possible to put electronic resources into dark archives, but the darkness of the archive is not technologically determined; it is rather a matter of policy, usually as a result of copyright law, licensing agreements, or both.[26] When a library has rights to display the text of

[25] It is also possible that the ability to search and read electronically will increase demand for the physical resources. In this case, costs could rise because of the increased use unless libraries took offsetting actions.

[26] When the digital copy sits on a publisher's server and the publisher holds archival rights, the library's legal ability to assure permanent access is compromised. This set of problems is important and troubling (Jansen 2006; Stemper and Barribeau 2006) but in no way inherent to digital technologies. Several initiatives and organizations are working to ensure the future accessibility of digital content, including Lots of Copies Keep Stuff Safe (http://www.lockss.org), Portico (http://www.portico.org), and JSTOR (http://www.jstor.org).

a work, as in the case of public domain works, there is no electronic analog to off-site dense storage. On a server with redundant backup, the ability to search and read ebooks is essentially independent of the physical location of the server; users can access files from nearly anywhere with an Internet connection. Moreover, while pbooks deteriorate with use, the reliability of ebooks tends to improve with use. Even dark print archives—those that exist purely for backup—can be compromised in a variety of ways, intentional and accidental: for example, fire, flood, or poor stewardship. When something goes wrong with a collection that is being used, as with digital collections, the users can be relied upon to act as whistle-blowers. Since many more people are able to access files when they are provided digitally, there is an even greater chance that problems will be noticed.

The forms of electronic media relevant to the missions of academic libraries are growing and changing rapidly, and we have no way to predict how myriad elements of cost and functionality will play out. In this paper, we consider a relatively straightforward comparison—that of storage costs of a printed book versus the storage costs of page images and encoded text of the same book. We focus on relatively simple text and images, scanned or born digital, of the kinds that can be easily stored and retrieved in widely used formats, rather than on multimedia digital objects or databases. Many complexities regarding costs of ingest and development and reliable acquisition and production of metadata do not arise in this simple comparison.

Both the HathiTrust and the Internet Archive, among other entities, have a good deal of experience in storing electronic scans of print books.[27] HathiTrust provides rich access and reliable storage to ebooks at a fraction of our lowest estimates for providing compact off-site pbook storage. The predominant cost of print storage—space—is nearly absent for electronic storage, and the staff time devoted to electronic storage is less than that for storing and circulating print books. Moreover, and crucially, there is no reason to provide storage for ebooks that is difficult to access. Secure storage in the electronic case requires redundancy, which has no negative effect on access. Secure storage of print material makes access harder, rather than easier.

The HathiTrust provides a fully mirrored digital archive of millions of books, with tape backup, for less than $0.15 in fully loaded costs per book per year. Full color and a third site could increase the cost to as much as $0.40 cents per book per year.[28] Converting these

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[27] See www.hathitrust.org for more information on the HathiTrust and www.archive.org for information on the Internet Archive. In both cases, explore the Web site and download and view public domain books to see the functionality provided by scanned texts.

[28] York 2009 provides documentation of the $0.15 annual cost for permanent storage per an OAIS Reference Model. (Downloaded from http://www.hathitrust.org/papers.) Per personal communication with John Wilkin, executive director of HathiTrust, and Paul Courant, founding and continuing member of the HathiTrust Executive Committee, these costs are fully loaded, including replacement of hardware and software and estimated costs of migration to new formats. $.40 per year is Wilkin's estimate of the upper bound on cost with an independent third site, again per personal communication with Wilkin.

costs into present value at the focal 3 percent discount rate that we have used in this paper would yield estimates of $5.00 and $13.10, respectively. Even $13.10 is less than half of the cost of high-density storage cost for pbooks shown in table 1, and is about a quarter of the cost for the most economical hybrid case. Moreover, it is likely that electronic storage costs will fall over time, which would reduce these estimates. Additionally, extensive use of ebooks for most purposes would enable libraries to use the most economical and secure methods for keeping reference pbook copies, and to share print storage as well. If everyone has a good electronic copy for use, it is not necessary for many libraries to hold print copies of the same works. A few instances of shared storage would do, as suggested in Schonfeld and Housewright (2009).

Storing and providing access to electronic material is indeed expensive and poses many problems, both technical and economic. And there is no doubt that complicated multimedia objects provide costly challenges to storage, some of which are not yet foreseen. But storage of scanned (or born-digital) books is much cheaper than equivalent storage of print materials. Where it is legally and functionally possible to make the move to electronic storage and use of the working copies of these kinds of materials, there is substantial economic gain.

The crucial differences in storage costs between electronic and print resources are found in expenditures for physical space and for access and delivery of works that are in high-density storage. In both of these domains electronic resources have enormous advantages. In table 3, we compare cost categories relative to the overall cost of print storage. Primarily because of the much smaller space required for it, electronic storage enjoys significant advantages. Even with very large collections of digitized works, the sheer amount of space required to store the servers on which those files reside will be dramatically smaller than that required for pbook storage. This factor alone will result in much lower costs, even if the cost per square foot of space is higher than for print storage.

Cost Element	Print	Electronic
Space	High	Much less
Cleaning	Low	Much less
Maintenance	Medium	Much less
Electricity/climate control	Low	Somewhat less
Staffing	Low	Somewhat less
Circulation/Access	Low	Much less

Table 3: Comparison of per-object cost of print versus electronic storage (relative to print cost)

10. Conclusion

Academic libraries will face many choices in the coming years as they continue to struggle with preserving and providing access to the cultural and scholarly records in an environment where the number and types of materials that they are expected to collect grow rapidly. As librarians grapple with these changes, it is important to recognize that the costs associated with a print-based world, often assumed to be small, are actually large.

Our analysis has been undertaken in terms of the cost of storage for a printed book. It makes the argument that the costs are high and that they sharply increase with the practical usability of a book. As we have seen with a number of journals, it is possible to substitute digitized print works for the original print (while keeping, as in the case of JSTOR, a set of original print copies). The savings in terms of space and the increase in functionality are parallel to the arguments made in this paper. If the cost of digitization is less than the difference in present value between print storage and digital storage, adding back in the cost of maintaining a shared print archive, there will be a net gain to the university sector of digitizing print collections and using the digitized versions for access. For most of our estimates of the cost of ebook and pbook storage, these conditions would hold. If another party, for example, Google or the Internet Archive, undertakes the digitization and provides the access, the argument becomes all the stronger.

Finally, we note that the argument in favor of moving toward digital versions of books and sharing both electronic and print collections is further enhanced when we recognize that university libraries tend to be located on prime real estate, and that there are uses of central campus stack space—for classrooms, study, offices, and enhanced library services, among others—that would be far more valuable than using that space to store materials most of which are used rarely, provided that access to the materials in aggregate could still be provided reliably.

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