

## An Exploratory Quantitative Analysis of Academic Library Services

An Examination of Performance Based Metrics

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### Abstract

This exploratory study addresses performance measurement in academic libraries by using selected responses provided by academic libraries to national surveys. For comparative purposes, the authors suggest the construction and use of a total service index and various cost measurements as determined by enrollment and by library use. The statistical analyses of academic library data presented in this study may be helpful in initiating a discussion among scholars and academic library administrators regarding the costs of using an academic library and how this information could be used for various purposes such as benchmarking or requesting additional funds to support library services.

### Introduction

As a result of budgetary constraints and the demand for accountability, academic libraries face the challenge of measuring organizational performance. This study provides an overview of performance measurement in academic libraries, revealing why these organizations pose special challenges for analysis. Next, using national survey data and statistical analysis, the authors establish a methodology that can be applied in a variety of academic library settings. They propose the development of a total service index (TSI) to measure the actual use of academic libraries as reported to the U. S. Department of Education. The exploratory quantitative analyses also examine specific performance measures of academic libraries in relationship to costs of library services, including cost per enrolled student and cost per library use, which can then be used in other calculations of effectiveness or efficiency.

### Academic Libraries and Performance Measurement

The approach to developing performance measures of academic libraries arises from the larger movement of public sector performance measurement. The basic theory that underlies performance-based management is that managers should develop program goals and strategies and establish performance measures that effectively document performance and support decision-making in pursuit of these goals and strategies. According to Wholey, "Managers will then use performance information in systems for managing their agencies and programs, in accountability to stakeholders and the public, to demonstrate effective or improved

performance and to support resource allocation and other policy decision making.”<sup>1</sup> The rationale behind performance measurement is to produce objective, relevant information on organizational performance that can lead to improved decision-making and increased accountability.<sup>2</sup>

Academic libraries, as with other public sector and nonprofit organizations, offer challenges to those who wish to employ business practices to measure their effectiveness or total use, as related to service activities, due to the different characteristics and missions of nonprofit organizations versus business firms. While attempts to use performance measurement have increased within libraries, many scholars question how libraries have gone about this task, arguing that performance is either not properly being measured, or that there is an awkward correlation between input and output measures.<sup>3</sup> This awkwardness of using appropriate measurements certainly applies to academic libraries due to the nature of their mission and the intangible services that they provide. According to Morgan, outcomes or impacts of academic library services are the most difficult indicators to assess.<sup>4</sup> Since academic libraries exist as a fixed cost within the budgets of colleges and universities and do not generate large amounts of revenue (besides small amounts due to late fees or other services), it appears more difficult to calculate performance or efficiency as can be done in the business environment where profits can be seen as a surrogate for performance.

The difficulties of measuring performance in academic libraries are a reflection of the problems in measuring performance of public and nonprofit organizations generally. In terms of the public sector, major limitations to effective performance measurement systems include difficulty in measuring effectiveness, limited use of performance information after collection, ambiguity in organizational life, and the cost of data collection and analysis.<sup>5</sup> Therefore, not only is it problematic to establish accurate and valid performance measures in terms of effectiveness, but it is also difficult to implement, manage, and use the data even after collection has taken place.

Most traditional methods of measuring library services and resources are based upon the most readily obtainable statistical data concerning inputs, such as size of the collection, annual expenditures for library materials, and operations budget.<sup>6</sup> Such data regarding academic libraries may be found through the Academic Libraries Survey (ALS), a voluntary survey conducted biannually by the National Center for Education Statistics (NCES).<sup>7</sup> Data that are regularly gathered by the ALS include such information as total library budget, size of staff, general and reserve circulation transactions, number of reference transactions, gate count, number of individuals who attended instruction sessions, number of volumes, among other measurements. The difficulty of using any of these statistics to provide a measurement of library quality, however, is easily discernible for those familiar with academic libraries. Many libraries have instituted regular studies of their clientele using instruments such as LibQual+ and locally produced surveys to determine the satisfaction of users with library services. These instruments, however, do not measure quality *per se* and they do not examine how such service activity correlates with cost of providing the services. The focus of most library surveys upon outputs as a measurement of the application of inputs, however, ignores the library’s impact upon individual learning. “As such, outputs do not measure individual student learning outcomes because inputs and outputs are institutionally centered, not individually centered.

Outputs do not measure changes in skills or attitudes of the individual as a result of that person's interaction with the library."<sup>8</sup> Therefore, there exist limitations in approaching this question of viewing outputs as a measure of quality of effectiveness.

While acknowledging these problems, the measures of inputs and outputs included in the ALS do imply that high levels of activity indicate one aspect of effectiveness in the sense that if patrons are using library services, the library is apparently fulfilling its mission of meeting user needs in the areas measured. This work uses the available data to measure outputs since educational outcomes are outside the scope of the study. Yet, if these measurements are not put together into some kind of framework or in comparison with established benchmarks, they exist without a proper context in order to engage in informed decision-making.

Budd's recent analysis of data from academic libraries points out the complexities of interpreting and using this data as he identifies certain trends over time, such as the decrease in reference transactions and the increases in gate counts.<sup>9</sup> While in relation to the analysis of services and resources, the author mentions the importance of identifying costs, "costs of every possibility – on its own merits and relative to its usefulness and to the costs of other possibilities," the study does not examine costs in terms of ratios except in the case of pointing to salaries as a percentage of total expenditures.<sup>10</sup> As with other studies that have analyzed the ALS data, there have been no attempts to measure the costs of academic library service activities.<sup>11</sup> A good reason for this reluctance on the part of researchers may be the fact that, as Lu shows, costs for academic libraries are often based upon expenditures that are broken down into three categories: total salaries and wages, total information resources, and operating expenditures.<sup>12</sup> While this picture may provide information on expenditures in terms of broad classifications of the budget, it does not attempt to quantify specific service activities or to calculate a service index score based upon service activities, potential impacts or benefits in relationship to cost.

The authors acknowledge that there exists an essential dilemma, therefore, in measuring the value of academic library performance and in determining the level of service quality delivered through these institutions. While most college and university administrators, faculty, and students tend to think of the academic library as a good thing, the concept of "library goodness" is something abstract and difficult to quantify or measure. As Buckland says, "Single measures of library goodness can be concocted, but their credibility is undermined by the number of arbitrary assumptions that have to be made to piece the parts together."<sup>13</sup> In an article providing an overview of evaluation research in libraries, Powell relates that while measuring inputs or resources of libraries are quite straightforward, it is extremely challenging to measure how LIS resources actually impact patrons.<sup>14</sup> Similarly, since many factors reported in national surveys, such as those done by the Association of Research Libraries and the Association of College and Research Libraries, invariably rank those institutions with larger budgets and larger student bodies higher than smaller schools, Getz states, "Libraries need a criterion of excellence that is independent of size."<sup>15</sup>

While conducting service quality surveys and satisfaction studies can measure effectiveness of academic library support to a certain extent, academic libraries must nevertheless rely upon quantifiably measuring financial expenditures and service activity to provide institutional data

regarding performance. This study attempts to analyze historical data of academic libraries to view performance measurement based upon variables relating to service, cost, and use data. The authors recognize and appreciate that this study is only a one step in analyzing efficacy and costs of academic libraries. While this study cannot address all of the factors regarding the impact of these libraries on individual learning, the authors submit that the analysis of outputs does provide indications of activity, such as use, efficiency, and cost.

## Methodology

Using archival data to determine time trends and differences between institutional types based upon Carnegie Classification and control, this study seeks to understand changes of library costs and frequency of use by students over time.

### A. The Academic Libraries Survey

The data used in this study are taken from the Academic Library Survey (ALS). The ALS is a voluntary survey of the National Center for Education Statistics that generates descriptive statistics for approximately 3,600 academic libraries in the United States. For the purposes of the survey,

“an academic library is defined as an entity in a postsecondary institution that provides all of the following: an organized collection of printed or other materials, or a combination thereof; a staff trained to provide and interpret such materials as required to the meet the informational, cultural, recreational or educational needs of the clientele; an established schedule in which services of the staff are available to the clientele; and the physical facilities necessary to support such a collection, staff, and schedule.”<sup>16</sup>

Therefore, almost all the entities classified as “academic libraries” in this survey are traditional, “bricks and mortar” organizations that serve as active service units within the institutions that they serve. While these organizations may have rich digital collections, they nevertheless contain the physical facilities, in terms of buildings, staffing, and services, to provide access to academic library resources. The ALS is conducted every other year. Biennial data for the years 1996-2008 are included in this study.

### B. Carnegie Classification of Academic Institutions

The institutions surveyed within the ALS are classified based upon the Carnegie Classification of Institutions of Higher Education. This classification system, organizing higher education institutions based upon the characteristics of degree offerings and specialization, has developed into a standard used by many when examining these organizations.

“Although the Carnegie Classification was created for research purposes with particular analytic needs in mind, it has evolved into a sort of general-purpose classification employed by a wide range of users for a variety of applications. Now commonly used by institutional personnel, state systems, foundations,

membership organizations, news magazines, and others, it is so highly institutionalized that it is often invoked without explanation or rationale.”<sup>17</sup>

Acknowledging that no classification system can harness all of the complexities of diverse and multi-dimensional organizations such as colleges and universities, this method of classifying colleges and universities serves the purposes of the authors since “the Carnegie Classification has been the leading framework for describing institutional diversity in U.S. higher education.”<sup>18</sup>

For the purposes of this study, only those institutions classified as baccalaureate, masters, or doctoral institutions were selected for analysis. The data for this study were drawn from those institutions that provided data for the ALS for all the years included in the study, i.e., 1996-2008. In addition, to be included in the final analyses, institutions must have reported data for their total library expenditures and their total enrollment for each year. As a result of these limitations, the total number of institutions included in the study was 1272 for each year, although for some specific analyses fewer institutions were included due to missing data for individual variables. For the perspective of the overall coverage of institutions in this study, in 2008 the ALS reported responses from 1,385 baccalaureate, master’s, and doctoral institutions. Thus, the current study represents 92% of this total. As a final step in preparing the data for analysis, institutions were standardized to the Carnegie Classification they reported in the 2008 ALS, in order to provide consistent institutional comparisons across the time frame of the study. A word of caution is necessary: the Carnegie Classifications changed again in 2010, but since the ALS was current only through 2008, the 2008 classifications were used for the purpose of consistency.

Table 1 lists the number of institutions by Carnegie Classification. Each institution included in the study was also coded for its control: that is, if it was a private or a public institution.

**Table 1. Carnegie Classification as of 2008**

	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
Doctoral/Research Universities-Extensive	149	11.7	11.7
Doctoral/Research Universities-Intensive	100	7.9	19.6
Master's Colleges and Universities I	461	36.2	55.8
Master's (Comprehensive)	97	7.6	63.4
Baccalaureate Colleges-Liberal Arts	200	15.7	79.2
Baccalaureate Colleges-General	265	20.8	100.0
Total	1272	100.0	

Table 2 lists the number of institutions by control.

**Table 2. Control as of 2008**

	Frequency	Percent	Cumulative Percent
Public	479	37.7	37.7
Private	793	62.3	100.0
Total	1272	100.0	

For a separate analysis, changes in the total library expenditures were compared to estimated expenditures that used both the consumer price index (CPI) and the higher education price index (HEPI) as inflationary multipliers. According to the Commonfund, “HEPI is a more accurate indicator of changes in costs for colleges and universities than the more familiar Consumer Price Index. It measures the average relative level of prices in a fixed basket of goods and services purchased by colleges and universities each year through current fund educational and general expenditures, excluding research.”<sup>19</sup>

### **Variables**

The following variables were used in the statistical analyses included in the study. These variables were calculated using existing data provided by the ALS. The variables include:

- Cost per Circulation (Total Expenditures divided by Total Circulation)
- Cost per Interlibrary Loan (Total Expenditures divided by Total ILL)
- Cost per Gate Count (Total Expenditures divided by Total Gate Count)
- Cost per Reference Transaction (Total Expenditures divided by Total Reference Transactions for Year)
- Cost per Attendance at Instructional Sessions (Total Expenditures divided Total Attendance at Instructional Sessions)
- Total Service Index (Total Circulation plus Total ILL plus Total Gate Count for Year plus Total Reference Transactions for Year plus Total Attendance at Instructional Sessions).
- Cost per Service (Total Expenditures divided by Total Service Index)
- Cost per Enrollment (Total Expenditures divided by Enrollment)
- Total Service by Enrollment (Total Service Index divided by Enrollment)
- Total Expenditures Adjusted by CPI (Using 1996 as the base year, the Total Expenditures were multiplied by the average annual CPI for the intervening years)
- Total Expenditures Adjusted by HEPI (Using 1996 as the base year, the Total Expenditures were multiplied by the average annual HEPI for the intervening

years)

Before the previous variables were calculated, several intermediate variables were derived from the data for use in the analysis. These variables include:

- Total ILL (calculated by adding the number of interlibrary loans provided and the number of interlibrary loans received)
- Total Circulation (calculated by adding general circulation and reserves circulation)
- Total Gate Count for Year (Gate Count in a typical week x 30)
- Total Reference Transactions for Year (Reference Transactions in a typical week x 30)

### **Rationale for the Total Service Index**

The authors designed a Total Service Index (TSI) that attempts to quantify the total use of an academic library over the course of a fiscal year. This score is calculated by combining all the standard service activities of an academic library, excluding the use of electronic resources since data for such use was not included in the ALS for the time period studied. This model calculates the TSI as the sum of total circulation plus total interlibrary loan transactions plus gate count plus total reference transactions plus total attendance at instructional sessions. The rationale behind this model is to view each activity within the library, whether the circulation of a book or the answering of a reference question, as a transaction. Each activity, or transaction, counts as a service interaction within the library and is treated equally for purposes of quantification. In the case of the reference transactions and gate count, in order to estimate a yearly total, each variable was multiplied by thirty since the variables are reported as a “typical” week in a semester. For the total circulation, the number of general circulation and reserve circulation transactions were added together. For the interlibrary loan total, the number of interlibrary loans provided and interlibrary loans received were added together. The total service by enrollment measurement was generated by dividing the TSI by the total enrollment of the institution. For variables which used enrollment in their formula, only data from the years 2002-2008 were used since the way this data was reported changed from reporting total headcounts prior to 2002 to reporting total FTEs for 2002 and later.

### **Cost variables**

To determine the costs of providing services in an academic library, several cost variables were calculated that can be used for comparative purposes. First, the average Cost per Circulation was calculated (Total Expenditures divided by Total Circulation). Second, the Cost of Interlibrary Loan was calculated (Total Expenditures divided by Total ILL). Next, the Cost per Gate Count was determined (Total Expenditures divided by Total Gate Count). Fourth, the Cost per Reference Transaction was calculated (Total Expenditures divided by Total Reference Transactions for Year). Finally, the Cost per Attendance at Instructional Sessions was calculated (Total Expenditures divided by Total Attendance at Instructional Sessions).

These individual cost variables are based upon the assumption that each, by itself, can be viewed as the primary reason for the existence of the library. For example, the cost per circulation assumes that the major service that a library provides is the circulation of library materials. Thus, the cost of this service can be seen as paramount. Similarly, if one assumes that reference is the primary service of a library, then the cost per reference transaction becomes the most important variable. By calculating each cost variable separately, all these major services can be the focus, even if temporarily, of the analysis of library services and their cost effectiveness.

To overcome such limiting assumptions, however, this study uses two additional cost variables and one service variable which can be considered the most important variables in the study, especially for comparative or benchmarking purposes: Cost per Service (Total Expenditures divided by the Total Service Index), Cost per Enrollment (Total Expenditures divided by Enrollment), and Total Service per Enrollment (Total Service Index divided by Enrollment).

## Analyses

Several steps were included in the analyses, including both descriptive and inferential statistics. First, descriptive statistics were generated for all the variables used in the study. Then, Analyses of Variance (ANOVA) were conducted both for the entire dataset and for each individual year of data to determine differences between institutions as grouped by their Carnegie Classifications. Next, t-tests were run on each variable for the entire dataset and for each individual year to determine differences by institutional control, i.e., if the university or college was public or private. Finally, an analysis was done to determine the change over time of the total expenditures, i.e., the budgets of the libraries as compared to both the consumer price index (CPI) and the higher education price index (HEPI).

## Results

As shown in Table 3, the descriptive statistics provide the overall mean, minimum, maximum, and standard deviation of each variable for the aggregate data of all institutions throughout the time span represented. Standard deviations for several variables, such as those for total expenditures, are rather high due to the great differences among the institutions and several outliers. The standard deviations of the primary variables, however, are not as large.

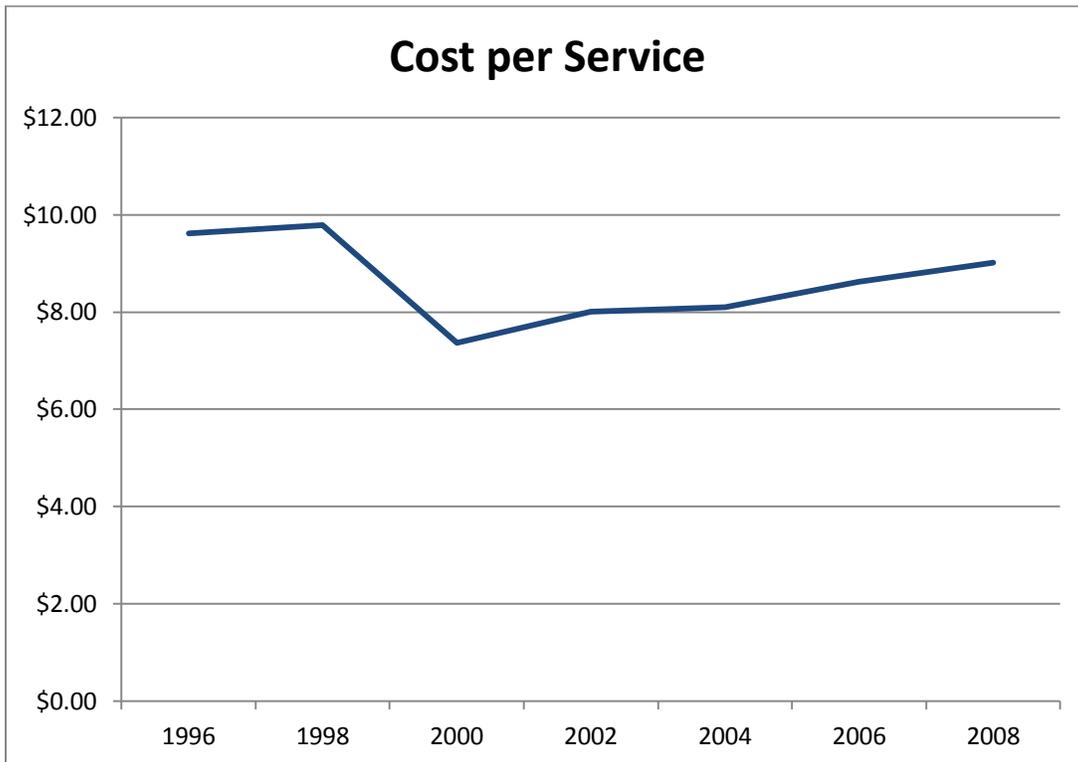
**Table 3. Descriptive Statistics**

	N	Minimum	Maximum	Mean	Std. Deviation
Total Expenditures	8901	38400	117884296	3436398.90	6793986.16
Enrollment*	5088	70	75180	6055.31	7614.29

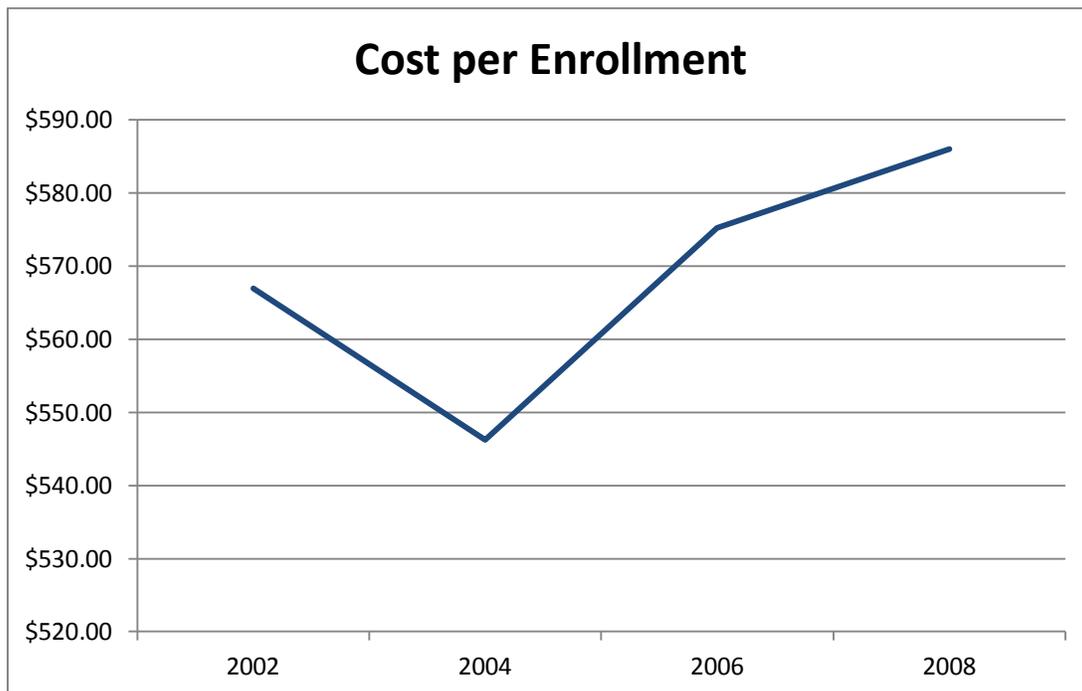
Total Circulation	8901	.00	3626282.00	120486.92	250037.00
Total ILL	8901	.00	332701.00	12143.52	20970.09
Total Gate Count for Year	8901	.00	29904120.00	279333.64	501047.00
Total Reference Transactions for Year	8901	.00	7851390.00	22595.99	104313.00
Attendance at Instructional Sessions	8901	0	561489	3590.92	9521.29
Cost Per Circulation	8891	1.30	19050.73	47.75	287.73
Cost Per ILL	8877	2.59	227247.00	1017.97	5829.32
Cost Per Gate Count	8833	.16	19038.37	19.98	296.38
Cost Per Reference Transaction	8882	.30	321692.73	357.29	4879.76
Cost Per Attendance	8844	1.84	84854.27	1153.70	2056.38
Total Service Index	8901	151.00	30427995.00	438151.01	7.24585.00
Cost Per Service	8901	.16	4018.05	8.64	55.50
Cost Per Enrollment*	5088	24.36	8335.93	568.58	524.14
Total Service by Enrollment*	5088	2.04	1905.55	83.28	80.90
*Represents only 2002-2008					

For this study, three variables are of prime importance: Cost per Service, Cost per Enrollment, and Total Service per Enrollment. The minimum cost per service was \$0.16, with the maximum being \$4018.05 and the mean \$8.64. Similarly, the minimum cost per enrollment was \$24.36, the maximum was \$8335.93, and the mean was \$568.58. In addition, for the total service per enrollment, the minimum was 2.04 uses per student, the maximum 1,905.55 and the mean 83.28. Figures 1 – 3 provide a graphical representation of these variables over time.

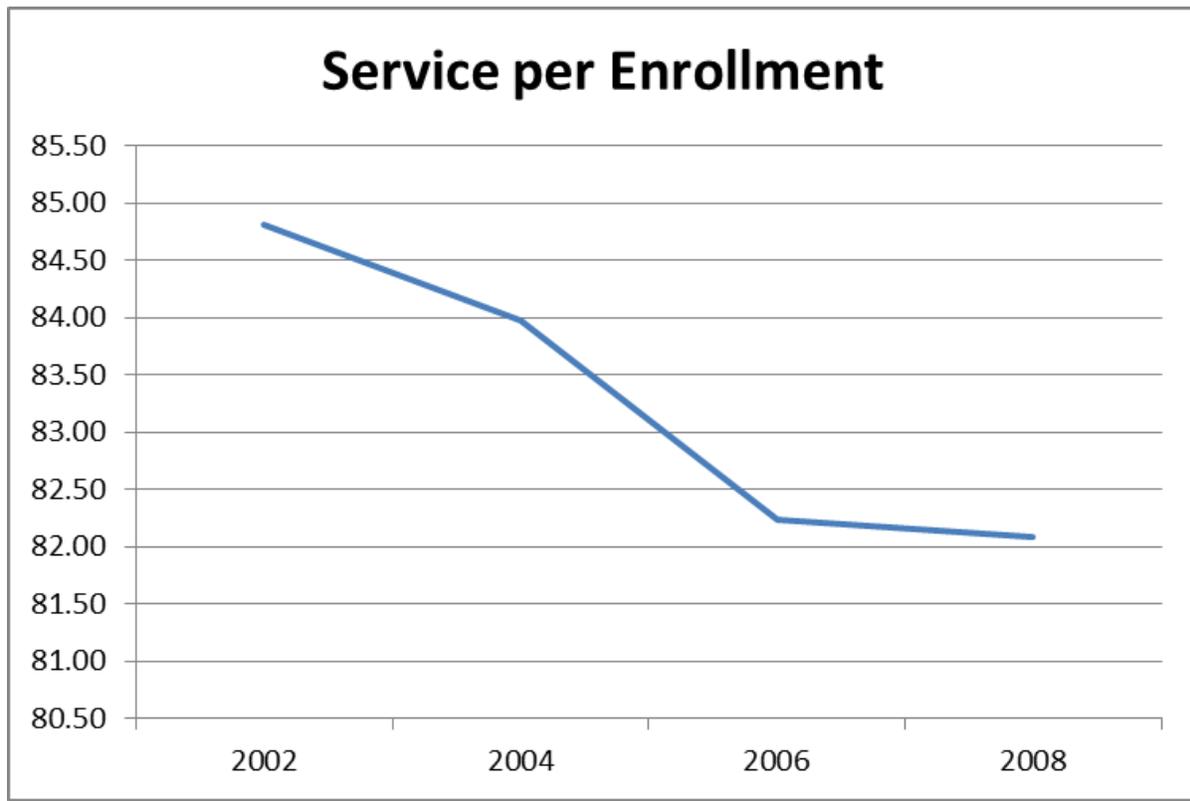
**Figure 1. Average Cost per Service**



**Figure 2. Average Cost per Enrollment per Year**



**Figure 3. Total Use per Enrollment**



ANOVA tests were used to determine if there were significant differences between the institutions due to their Carnegie Classifications. Table 4 summarizes the analyses for each year and for the dataset representing all years taken together.

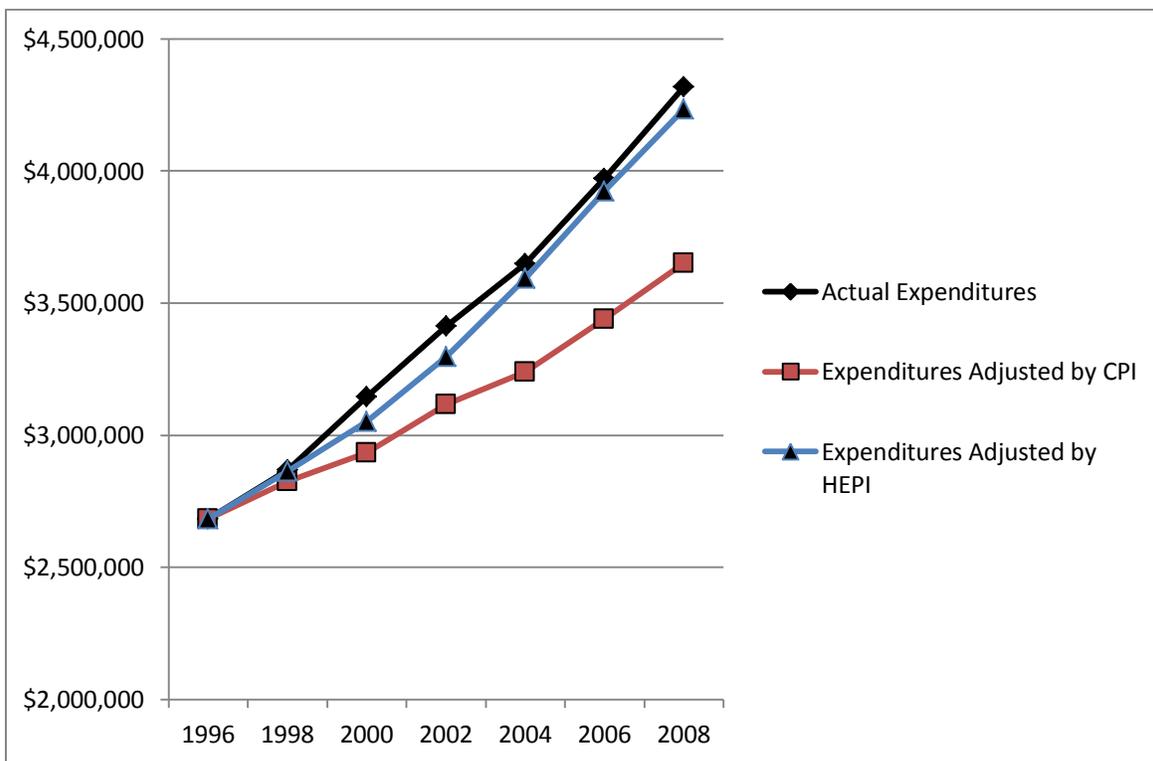
**Table 4. Significance by Year by Carnegie Classification**

	Cost per Circulation	Cost per Interlibrary Loan	Cost per Gate Count	Cost per Reference Transaction	Cost per Attendance at Instructional Sessions	Total Service Index	Cost per Service	Cost per Enrollment	Total Service per Enrollment
1996	*	**	*	**	***	***		n/a	n/a
1998			***	***	***	***		n/a	n/a
2000			***	***	***	***	***	n/a	n/a
2002		**	**	***	***	***	***	***	***
2004		***	*	***	***	***	***	***	***
2006				**	***	***	***	***	***
2008		***		*	***	***	***	***	***
All years		***		***	***	***	***	***	***

	ANOVA - differences by Carnegie Classification								
	*>.05	**>.01	***>.001						

Post hoc Scheffé tests were used to examine all possible pair-wise comparisons between the groups in the analysis. Although each significant ANOVA yielded slightly different results, for the vast majority of the individual analyses the Scheffé tests showed that the major significant differences centered on doctoral universities and baccalaureate colleges. In general, the doctoral institutions, especially those classed as research-extensive differed significantly from master’s and baccalaureate institutions. Similarly, liberal arts colleges differed significantly from the other institutions, including the other baccalaureate colleges, in many of the variables in the study. In many cases, however, the liberal arts colleges and the extensive doctoral universities were similar in their costs and differed significantly from the other institutions. As Table 4 illustrates, there were no significant differences between the institutions on the cost per circulation or the cost per gate count when all the years were considered simultaneously.

**Figure 4. Actual Expenditures as Compared to CPI and HEPI**



All the other analyses showed highly significant differences. Part of these differences can be attributed to the relative sizes of the institutions with the largest institutions generally being the doctoral granting universities and the smallest being the baccalaureate colleges. For this study, however, the most important variables to examine are the cost per service, the cost per enrollment, and the total service per enrollment, since they can be easily compared across institutions regardless of size.

For the cost per service, although the overall ANOVA showed a highly significant difference, the post hoc Scheffé tests, which use a more stringent method to achieve significance, failed to distinguish significant differences between the groups when examined pairwise. The lowest mean for the cost per service was \$6.06 for comprehensive master's institutions and the highest was \$12.20 for liberal arts colleges. General baccalaureate colleges averaged \$6.42 per use while master's colleges and universities averaged \$7.36. Both types of doctoral universities averaged \$11.53 per use.

For the cost per enrollment, all pair-wise comparisons were significant. The mean cost per enrollment was lowest for both the master's institutions and for the general baccalaureate colleges, ranging from \$352.99 to \$406.08 per student. Intensive doctoral institutions averaged \$565.27 per student compared to \$885.65 for liberal arts colleges and \$1101.02 for extensive doctoral universities.

The analyses for differences between the institutions on the total service per enrollment variable also reported significant differences, although the groupings of institutions were less clear. Four overlapping subsets emerged: both master's classifications with intensive doctoral universities, general baccalaureate colleges with intensive doctoral and comprehensive master's universities, extensive doctoral institutions and liberal arts colleges, and liberal arts colleges alone. The total service by enrollment for the master's institutions/intensive doctoral universities group varied from 64.05 to 70.93 uses per enrolled student. For the general baccalaureate colleges the average was 81.65 and for the extensive doctoral universities it was 87.49. The liberal arts colleges had the highest average use per enrolled student at 139.83, showing that the students in such colleges use the library services covered by the study much more frequently, on average than students in other institutions. In fact, students at the liberal arts colleges used the library more than twice as frequently as those enrolled in comprehensive master's universities and almost 60% more than students in extensive doctoral universities.

**Table 5. Significance by Year by Institution Control (private versus public)**

	Cost per Circulation	Cost per Interlibrary Loan	Cost per Gate count	Cost per Reference Transaction	Cost per Attendance at Instructional Sessions	Total Service Index	Cost per Service	Cost per Enrollment	Total Service per Enrollment
1996		*		***		***		n/a	n/a
1998				***	**	***		n/a	n/a
2000		*		***	*	***		n/a	n/a

2002		**		***	**	***		***	***
2004		**		**	***	***		***	***
2006		*				***		***	***
2008		**				***		***	***
All years		***			***	***		***	***
	t-test of differences by Control								
	*>.05	**>.01	***>.001						

Table 5 presents the results of t-tests for the analyses performed when the control of the institution (private or public) was the grouping factor. Overall, when the entire time span of the study was considered, there were no significant differences between private and public institutions for the cost per circulation, the cost per gate count, the cost per reference transaction, or the cost per service. The significant difference in the total service index showed that public institutions had a much higher index score (743,062.89) versus that of the private institutions (253,785.68), although this is probably attributable to the larger size of the public institutions. On average, public colleges and universities were significantly larger (11,229) than private schools (3,052) ( $t=57.3$ ,  $p<.001$ ). Public institutions had significantly lower cost per enrolled student (\$458.06 versus \$635.40,  $t=-16.37$ ,  $p<.001$ ) and a lower average number of total uses of library services per student (64.13 versus 91.10,  $t=-19.88$ ,  $p<.001$ ).

The final analysis examined the actual total expenditures as reported on the Academic Library Survey when compared to growth in total expenditures as predicted by the consumer price index and the higher education price index when using 1996 as the base year. As shown on Figure 4, actual expenditures of academic libraries, on average, have not only kept pace with inflation as evidenced by both the CPI and the HEPI, but have actually exceeded it for the time period covered by the study. Actual total expenditures increased by 61% over the period 1996 to 2008 as compared to an increase of approximately 36% for the CPI and 58% for the HEPI.

## Discussion

The variety of measurements included in this study attempts to provide meaningful indications of performance since they are based upon services and usage in addition to financial information. However, in the case of measuring services, the Association of Research Libraries (ARL) urges caution and states that “readers should take care when using service indicators for comparing institutions, because local policies can influence the level of service activities.”<sup>20</sup> The example that is given is the comparison of circulation, since loan periods vary across institutions. Therefore, a library with a shorter loan period will report a higher number of circulation transactions. ARL then points out, however, that “it is useful to look at the trends of select services assuming that changes due to policies and other conditions affecting

measurement of services are random across institutions.”<sup>21</sup> While the authors acknowledge ARL’s caution regarding differences in local policies, they also embrace ARL’s affirmation that it is valuable to use such data in order to view trends across institutions since the various changes of local policies across these institutions can be considered random.

While the analyses yielded significant differences between institutions on the cost per enrollment, it notable that the differences are not hierarchically related to the type or level of institution, i.e., baccalaureate institutions would be less than master’s which would be less that doctoral. In fact, this research shows that while general baccalaureate level colleges are at the lower range in terms of cost per enrolled student (\$392.77), they are in the same range as both types of master’s institutions (\$352.99 for comprehensive master’s universities and \$406.08 for master’s colleges and universities I). The next highest mean is for intensive doctoral universities (\$565.27), followed by liberal arts colleges (\$885.45), and then finally with extensive doctoral universities with the highest cost per student (\$1101.02). How these figures relate to different levels of quality of service or resources to different institutions is open for debate.

The analysis of the total service per enrollment variable yielded three groupings of institutions: both master’s level institutions and intensive doctoral universities together; general baccalaureate and extensive doctoral universities together; and finally liberal arts colleges by themselves. The average use of the library for the liberal arts colleges was 134.22 compared to 86.69 for the extensive doctoral universities (the next highest) and 62.09 for the master’s colleges and universities I (the lowest). Various explanations for these results can be surmised. For example, in terms of students living on campus, there may be larger percentages of residential students at liberal arts colleges than master’s institutions and this could potentially account for higher gate-count and library use of services and resources across the board. Differences may also be due to the number of part-time students who may be attending the master’s institutions in contrast to the liberal arts colleges and doctoral universities. Various dimensions of such questions are ripe for further examination.

As the analyses show, there are significant differences between colleges and universities grouped by either their Carnegie Classification or by their control. In general, libraries at larger institutions have larger budgets and greater use, since there is a high correlation between size of enrollment and library expenditures ( $r=.727$ ,  $p<.001$ ).

Contrary to expectations, expenditures to support academic library resources and services have outpaced the CPI and are a few percentage points higher than even the HEPI. Various explanations may be given for this result. As academic library administrators and academic librarians have lamented for years, the ongoing price escalation for academic journals has taken a serious toll on library budgets. The so called “serials crisis,” in which commercial journal publishers increase the prices of journal subscriptions at double-digit rates on a regular basis over years and years, has had an impact on budgets and may help explain some of this difference.<sup>22</sup> In addition, the new pricing models for electronic resources that academic libraries must offer in this digital age have also contributed to this higher rate of inflation for library resources and services.<sup>23</sup> Also, staff costs have risen greatly over the time span included in the

study.<sup>24</sup> Again, such topics provide great opportunity for additional research, analysis and discussion for the implications of these results.

## **Strengths and Weaknesses of the Study**

This research attempts to examine trends in the costs of using an academic library based upon reported budgets and outputs. The data can be used for comparative purposes, such as benchmarking, and also for justifying current funding levels or requesting additional funds to support library service activities.

Potential weaknesses of the study include the fact that, by necessity, the study focuses upon outputs and does not address outcomes. As previously stated, outcomes in terms of library use and academic success are extremely difficult to determine, and are not related to this study. Another weakness may be that each of the service activities selected for inclusion within the total service index is weighted equally with the other components of the index. The justification for this is that the index attempts to take into account the fact that every transaction, whether a reference question, the checking out of a book, attending an instruction session, or merely coming to the library to study or socialize, can be considered a service activity, that is, each transaction is an interaction between the library and the customer. Whatever that point of contact may be, these interactions provide a source of performance measurement in that a discrete transaction took place. Regarding gate counts and reference transactions, since those counts are based upon a typical week, the authors multiplied the number by thirty as a rough yearly estimate, acknowledging that this may overestimate or underestimate the actual count. Finally, many institutions had to be dropped from the analysis due to missing data and this may have skewed the results. The spread of institutions across Carnegie Classifications and across institutional control, however, is consistent and should reduce the likelihood that those missing institutions could have changed the results significantly.

The greatest weakness in the study, however, is the lack of good data on electronic use of the library. The ALS for the years included in the study did not ask for any data regarding the amount of electronic use of library resources. Since most libraries now feature a wealth of electronic resources such as databases, journals, and books, such use is a major feature of the modern library. Not counting this use invariably underestimates the total use of the library. Hopefully, standards will be set on how this data is counted and collected. When this happens, a better overall view of library use may be forthcoming.

This study reports several cost measurements which could be used for comparative purposes. For these measures, such as cost per service activity, the authors make no claim that either a lower or higher measure is better or worse. Rather this approach is one way to compare efficacy across institutions.

## **Conclusion**

The complexity of understanding academic libraries and their usage poses challenges for the utilization of any measurement tool for the purpose of institutional comparisons since differences exist within the operations, policies, and budgets of these institutions. The total service index proposed in this study and variables such as cost per use, cost per student, and use per student, do provide measures that may be used for inter-institutional comparisons. While various metrics may be applied to these organizations for the purposes of general comparisons, one should be careful in making conclusions about these results due to the lack of standards or agreed upon benchmarks, the dispersion of budgets, and policy differences (for example, length of circulation). Although the approach taken by the authors seeks to discuss the application of the use and cost measurements within academic libraries as a whole, the process also reveals the weaknesses or flaws of such an undertaking, since many unmeasurable variables may be in play. The lack of standards or benchmarks for comparison with other institutions and the necessity of calculating figures for organizations that are funded using different budgeting models create difficulties. Therefore, this process reveals the need for creating a system of relevant measures so that academic libraries can more effectively evaluate their services, their efficiency, and their effectiveness.

The profession of academic librarianship must devise new ways to measure and assess the impact that libraries have on their primary clientele, especially students and faculty. Such measurements should be included in national surveys such as the ALS so that they are available for the purposes of comparison and benchmarking.

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