

Longitudinal Study of Scientific Journal Prices in a Research Library

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The investigators conducted a benchmark longitudinal study of scientific journal prices for a land-grant research university to study the determinants of price increases over time. The study covered the period from 1967 to 1987, and included journal titles from a variety of publishers, disciplines, and countries. Information was collected about many factors that could influence serial prices. It was determined that inflation and greater journal length explained most of the increase in journal prices. However, it was also found that prices of journals from commercial publishers increased much more rapidly than those from nonprofit publishers over the study period.



Increases in the prices of professional journals over the last decade have probably elicited more attention from librarians and the academic community than any other single issue in library services. This issue was one of the principal concerns at the 1988 New Orleans and 1989 Dallas American Library Association meetings, and it has reached the U.S. Congress in the form of a Congressional Research Service Report prepared by Richard E. Rowberg, chief of the Science Policy Research Division.¹ A recent report by the Association of Research Libraries (ARL) vividly describes the situation as having "spiraled out of control".²

Review and commentary on journal pricing are regular and substantial: A

number of publications provide annual updating of journal price changes for the previous year by broad subject category.³ Other studies offer analyses of price increases by specific publishers within specific disciplines.⁴ A third group describes processes for reducing journal holdings and the effects of reductions on the library and its patrons.⁵

While the above-mentioned literature is extensive, little involves lengthy statistical analysis. Often the articles are anecdotal and descriptive. Apart from the ARL report, the few quantitative studies done have been limited to specific subjects and have covered rather short time intervals with a restricted set of journals.⁶ Except for the ARL report, we have been unable to identify benchmark studies examining the problem for a large

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number of journals and, at the same time, a sufficiently long period of time to allow generalization about trends in pricing policies.

The present work is closely related to the ARL project.⁷ However, some differences make these two reports complementary rather than redundant. The purpose of the ARL study was "to identify factors contributing to the rising costs and to suggest possible remedies."⁸ Our study was undertaken to create a mechanism that would provide better price information that could be used for decisions on the acquisition and retention of journals. Both studies reached conclusions that are, if not identical, entirely compatible.

The ARL study focused on four major publishing firms, one each from the Netherlands, West Germany, England, and the United States. A sample of 167 titles was drawn using the publishers' catalogs. The sample was selected to ensure that five disciplines were covered: physical sciences, medicine, biology, earth sciences, and technology. Data were collected for the years 1973-1987.

Compared with the ARL reports, the present study involves a much larger and broader sample of journals. It attempts to hypothesize possible causes of journal price increases and to ascertain from an examination of actual price data whether any causes could be empirically verified. The research consists of a longitudinal examination of the prices of a representative collection of scientific, technical, and agricultural journals from 1967 through 1987.

DATA COLLECTION

The data used in this study were assembled by first selecting a random sample of 1,000 titles from the 1971 Utah State University Library Catalog of Serials. The 1971 Catalog of Serials was used because it was the first organized list of serials for the library and provided the most accurate list of serials being received in 1967. The investigators did not attempt to confine the study to a particular group of publishers as was done in the ARL study. The titles selected repre-

sented publishers from the private, institutional, academic, governmental, and societal sectors. Nine countries were represented in the sample: the United States, England, the Netherlands, France, Switzerland, West Germany, Australia, Japan, and Austria.

Titles included the physical, biological, and mathematical sciences; agriculture; engineering; technology; natural resources; medicine; general science; and a small, unclassified category. A total of forty-seven different disciplines was represented. The authors determined the focus of this study should be scientific journals because of the attention they were receiving from librarians. A second study is under way to examine a similar set of journals in the humanities, arts, and social sciences held in the Utah State University Library collection. From an initial number of more than 1,000 titles, more than half had to be eliminated for a variety of reasons. Approximately 300 titles were removed from consideration because they had ceased publication or the library had canceled its subscription during the period 1967 to 1987. Another 350 titles were withheld from the analysis because of missing, incomplete, or unavailable data. The authors wanted to ensure the results were not distorted by the missing data elements. The 370 titles analyzed in this study had been held by the library for the entire time period, and for each year we verified the number of pages, number of volumes, number of articles, cost to a U.S. library subscriber, and in the cases of foreign titles, cost to the library subscriber in the country of origin. Work continues on acquiring the missing data and verifying data elements that were determined to be unreliable for the journals not included in the final sample.

Table 1 presents characteristics of the journal sample. The largest number represents the biological sciences. About 67 percent of the journals were of U.S. origin, with titles from the United Kingdom ranking second in total number. About 40 percent of the journals were published by U.S. or foreign commercial firms; the remainder came from U.S. or

foreign institutional, academic, governmental, and societal sources.

Many factors can affect the levels and rates of increase in journal prices. The following determinants of journal prices were examined: length (i.e., number of pages published annually), inflation in the nation of origin (i.e., the country in which the journal was published) for foreign publishers, inflation in the dollar, differential pricing between nation of origin and the United States, pricing practices of the profit-making versus noncommercial publishers, and price variations by discipline.

TABLE 1. CHARACTERISTICS OF THE JOURNAL SAMPLE

Discipline	Number	Percentage
Physical Sciences	96	26
Biological Sciences	158	43
Engineering	51	14
Mathematical Sciences	22	6
Other	43	11
Total	370	100
Publisher Type:		
U.S. Commercial	72	19
U.S. Noncommercial	178	48
Foreign Commercial	76	21
Foreign Noncommercial	44	12
Total	370	100
Nation of Origin		
United States	249	67
United Kingdom	59	16
West Germany	21	6
Netherlands	19	5
All Others	22	6
Total	370	100

Ulrich's International Periodical Directory was used to verify the name and type of publisher for each journal in the sample. Students, after training, collected the following additional data by direct examination of the individual journal

volumes: presence or absence of advertising; pages charges; use of photos, charts, graphs, and color; copyright ownership; whether the journal is a translation; self-indexing; frequency of publication; number of volumes per year; number of pages; and number of articles. Although we had wanted to include subscription or circulation data, they were generally unavailable and, when available, suspect.

Information on prices presented its own challenges. We did not use *Ulrich's* pricing data because they were considered unreliable. Due to the lead-time required to assemble the data for *Ulrich's* publication, pricing was often six months to a year out-of-date. Instead, Utah State University Library serial payment records, Faxon pricing information, and prices found in the journals themselves were used. We believed that prices paid by the library reflected the prices paid by other academic libraries because of the variety of subscription mechanisms used by the Utah State University Library. Even with several sources of pricing information, subscription data for foreign titles were often difficult to locate because of the "bill later" approach. Pricing data for the early years in the study were the most difficult to acquire and verify. Library serial payment information often did not exist or was recorded in so cryptic a manner as to be unusable. Because of these factors, a number of titles were eliminated from the study; a similar experience was reported in the ARL study.

For each foreign title, we attempted to obtain prices in the currency of the nation of origin, as well as in U.S. dollars. Unfortunately, these figures were not always provided in the physical volumes. Currency exchange rates were used to convert prices of foreign journals to U.S. dollars. Adjustments for inflation were made using price indices for each country. Data on inflation rates and currency exchange data were obtained from *The U.S. Statistical Abstract*, *The Europa World Yearbook*, and *United Nations Statistical Yearbook*.

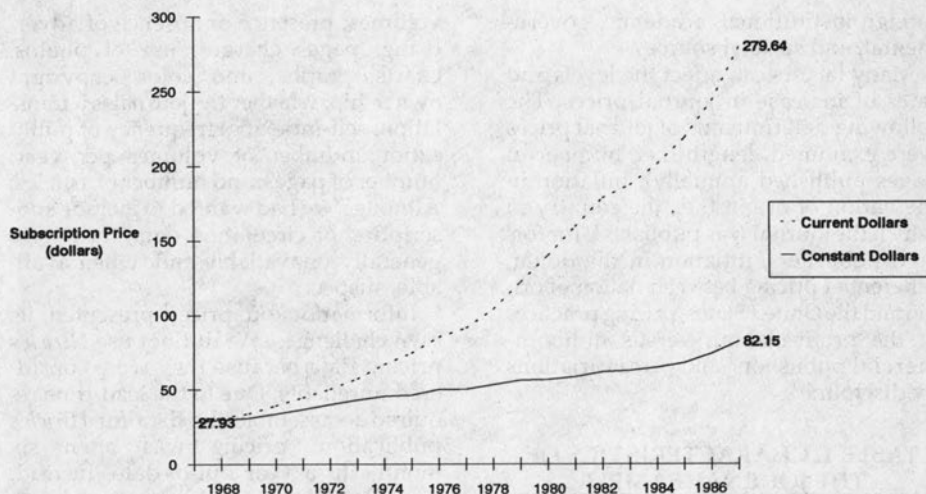


Figure 1. Trends in average subscription price: Constant and Current dollars. (For U.S. subscribers)

RESULTS

A comparison of annual subscription prices to a U.S. library buyer for the twenty-year period 1967-1987 in current and constant (i.e., inflation adjusted) dollars is shown in figure 1. Although the average current dollar price has increased ten times during the period, the constant dollar price only tripled. Clearly, general inflation is the single most important cause of journal price increases during the last twenty years.

To determine how much of the price increase over time was due to changes in journal length, we computed the average price per page in current and constant dollars. The results are shown in figure 2, which does indicate some effect due to journal length when compared to figure 1. In current dollars, the cost per page was six times greater in 1987 than in 1967, while in constant dollars one page in 1987 cost about 78 percent more than its cost in 1967. Thus, inflation in the dollar and changes in average journal length accounted for most of the overall cost increase of ten times between 1967 and 1987. The remainder of our study dealt with possible causes of

the residual price increase over time—about 78 percent between 1967 and 1987.

Differential pricing by publishers of foreign journals is one possible explanation for the residual price increase. Prices charged to U.S. libraries for foreign journals have always been higher than prices for the same journals in the country of publication. Some differential would be expected in order to cover shipping costs. But it has been alleged that in recent years some foreign publishers have sharply increased prices in the U.S. relative to those in the nation of origin. This proposition was examined using our data set. For all foreign serials in the sample for which the data were available, we converted the U.S. dollar price for each year to the currency of the country of origin for that year. We then calculated the ratio of the U.S. price to the country of origin price. The average for the journals in the sample is shown in figure 3. Although rather large fluctuations appear, no clear trend emerges over the twenty-year period. The ratio was about 1.3 in 1967, that is, the price in the U.S. averaged about 30 percent more than the price in the country where the journal was published. The ratio fluctu-

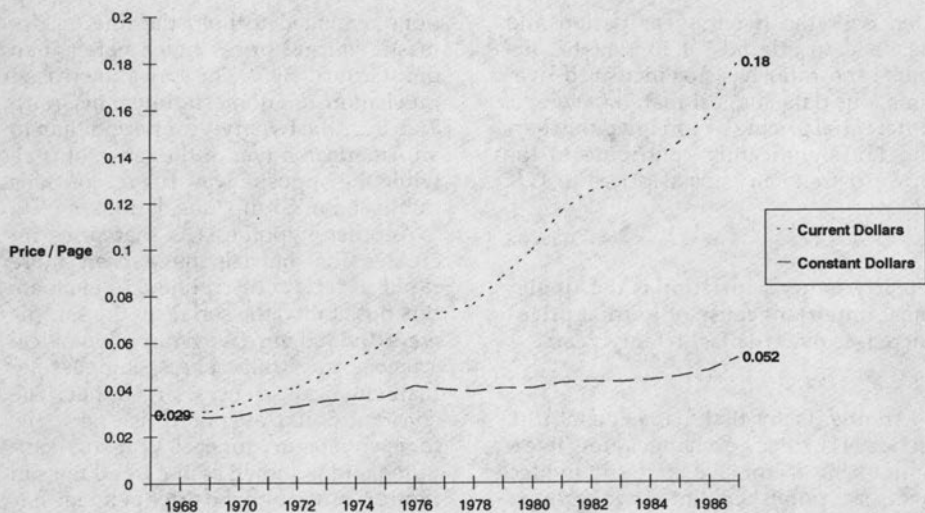


Figure 2. Trends in average price per page: Constant and Current dollars. (For U.S. Subscribers)

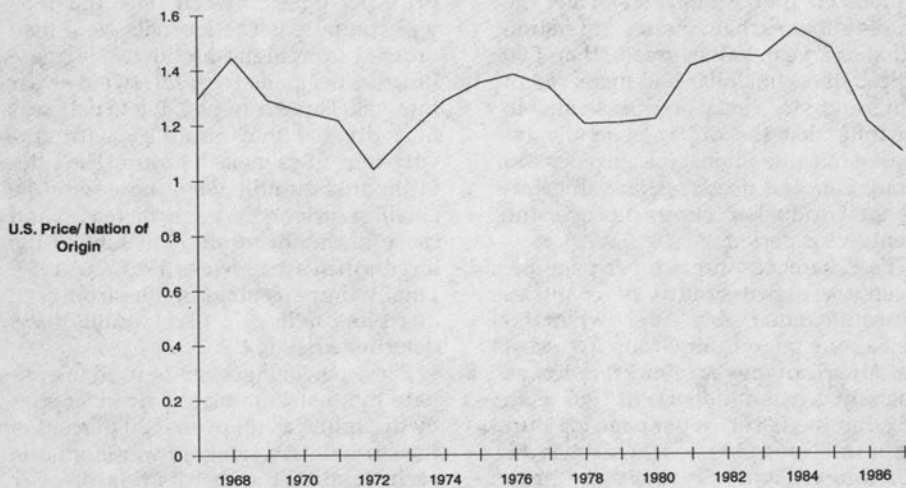


Figure 3. Differential Pricing: average price to U.S. Library divided by average price to library in nation of origin.

ated over the twenty-year period and declined to around 1.1 in 1986-87. Because the ratio has not increased over time, our data suggest that, on average, differential pricing by foreign publishers did not significantly contribute to the upward trend in journal prices to U.S. libraries.

Clearly, general inflation is the single most important cause of journal price increases over the last twenty years.

Another factor that may explain price trends is currency exchange rates. To examine this factor, we first subdivided overseas publishers into two groups. Group One included Australia, France, and the United Kingdom, while Group Two comprised Austria, Germany, Japan, the Netherlands, and Switzerland. These groups were delineated based on the behavior of the dollar against their currency. As shown in figures 4a and 4b, the exchange rate for each country was normalized to 1.00 for 1967. Thus the figures show exchange rates in relation to that base year. Values greater than 1.00 indicate that the dollar had increased in value, and vice versa. Figures 4a and 4b illustrate that the dollar generally increased in value against the currencies in Group One and decreased in value versus the Group Two currencies over the twenty-year period.

The differences in price per page between these two groups of countries were quite remarkable. As shown in figure 5a, one page from Group Two cost the American buyer almost twice as much (in constant dollars) in 1987 as in 1967. But the 1987 cost per page for journals from Group One was three times the 1967 figure. Figure 5b shows the price per page to a buyer in the nation of origin, in the inflation adjusted currency of that nation. Here the difference is even more dramatic. For a Group One buyer, the 1987 price per page was 1.4 times the price in 1967; however, the corresponding ratio for Group Two domestic buyers was 4.7 times. Evidently, Group One na-

tions managed to hold the line on domestic journal prices much better than did Group Two. The price increased much more to a domestic buyer in Group Two over the twenty-year period than to an American buyer of the same journal, while the opposite was true for journals published in Group One nations.

Another hypothesis is that price increases for journals have been more rapid in certain disciplines. To evaluate this possibility, the serials in the sample were divided into five groups: biological sciences, physical sciences, engineering, mathematical sciences, and other. The constant dollar average price per page for each category for each year was computed and is shown by the trend lines in figure 6. Although the price per page has increased in each of the five groups, there is no clear evidence that the increases have been more rapid in one category than in the others.

Another way to analyze the data is by examining the distribution of price increases by discipline. For each of the journals in the sample, the increase in price per page between 1967 and 1987 was computed. The journals were then ordered from highest to lowest increase in price per page over the twenty-year interval. This array of 370 journals was next divided into quintiles, with seventy-four titles in each group. The titles in the first quintile were those with the smallest price per page increase, and those in the fifth quintile exhibited the largest increase between 1967 and 1987. Finally, the percentage of titles from each discipline falling in each quintile was determined.

These percentages can be used to evaluate the distribution of price increases by discipline as follows. If 20 percent of the journals in a category were found in each quintile, the distribution of price increases for that category would be identical to that of the entire sample. In contrast, if a substantial percentage of titles for a discipline appeared in the fifth quintile (those with the largest price increases), that discipline could be identified as contributing disproportionately to higher prices.

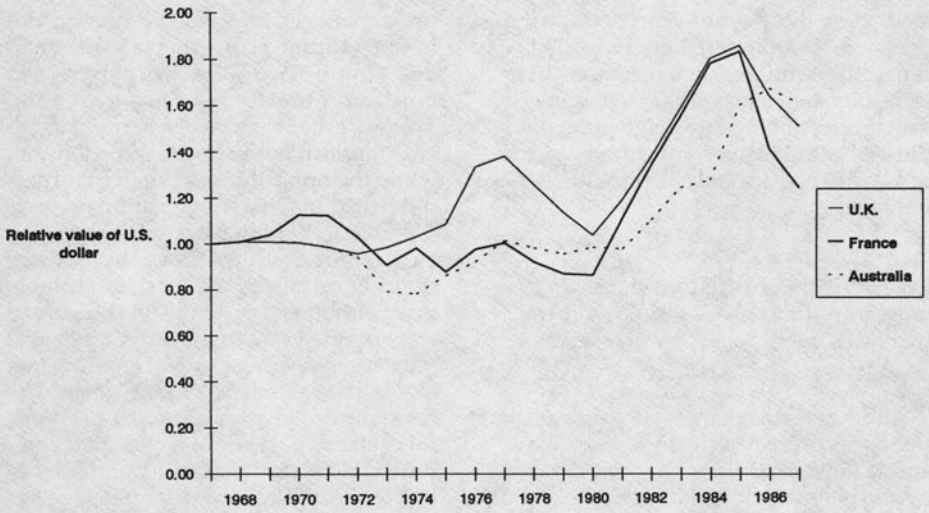


Figure 4 a. Group I Comparison of exchange rates from 1967 to 1987. (Note 1967=1.00)

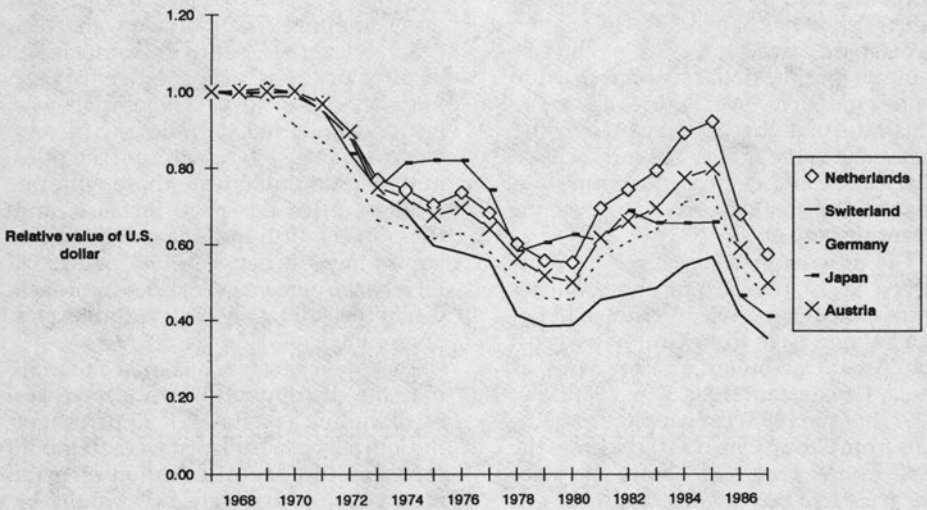


Figure 4 b. Group II Comparison of exchange rates from 1967 to 1987. (Note 1967=1.00)

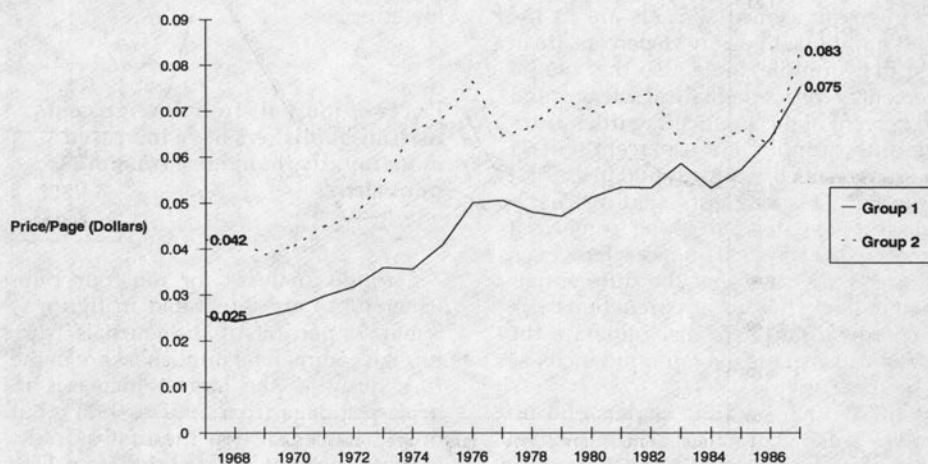


Figure 5 a. Comparison of average Price per page, in constant dollars, to U.S. buyer, for two groups of countries: Group One includes Australia, Germany, Japan, Netherlands and Switzerland.

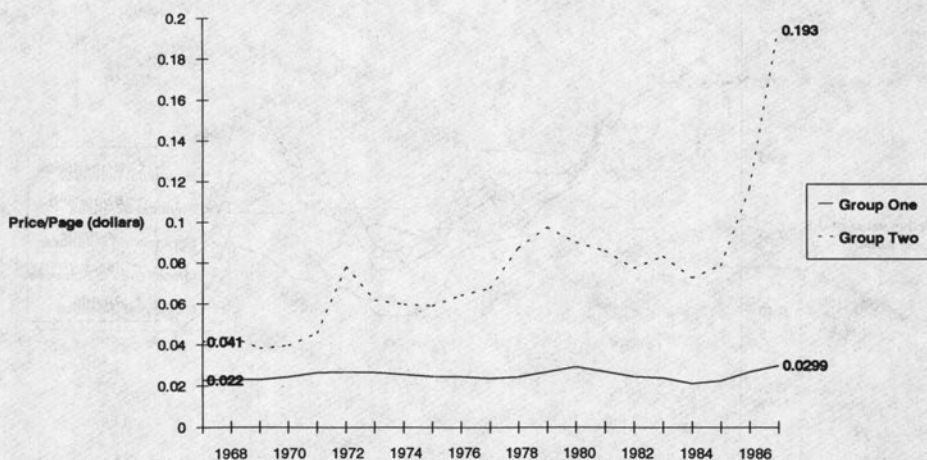


Figure 5 b. Comparison of average price per page in constant local currency for two groups of countries: Group One includes Australia, France and the United Kingdom; Group Two includes Austria, Germany, Japan, Netherlands and Switzerland.

Figure 7 shows the quintile distribution by discipline. Note that 28 percent of physical science journals are in the fifth quintile while only 16 percent are in the first quintile. Note also that only 4 percent of the mathematical sciences and 18 percent of the engineering titles are in the fifth quintile, but 9 percent and 31 percent respectively are found in the first quintile. This suggests that price increases have tended to be somewhat larger in the physical sciences. However, figure 7 indicates that the differentials are not large. It is not apparent that price increases in any one discipline are the major cause of the overall rapid increase in journal prices.

Still another possible explanation involves pricing practices of commercial versus noncommercial publishers. Figure 8 displays constant dollar average prices per page for journals categorized by publisher type. Foreign journals provided by commercial publishers have been, on average, more expensive throughout the twenty-year period than were the other three publisher categories,

while serials from U.S. noncommercial publishers have been consistently lower priced.

Prices of journals from foreign commercial publishers have increased more rapidly than those from other publishers.

Quintile analyses for the four publisher types are illustrated in figure 9. Some 44 percent of the journals from foreign commercial publishers are in the fifth quintile (the largest increases in price per page from 1967 to 1987), but only 3 percent are in the first quintile. Only 20 percent of the titles from U.S. commercial publishers are in the fifth quintile, with 44 percent in the two quintiles depicting the smallest price increases. The implication is that foreign commercial publishers are responsible for a disproportionate share of journal price increases.

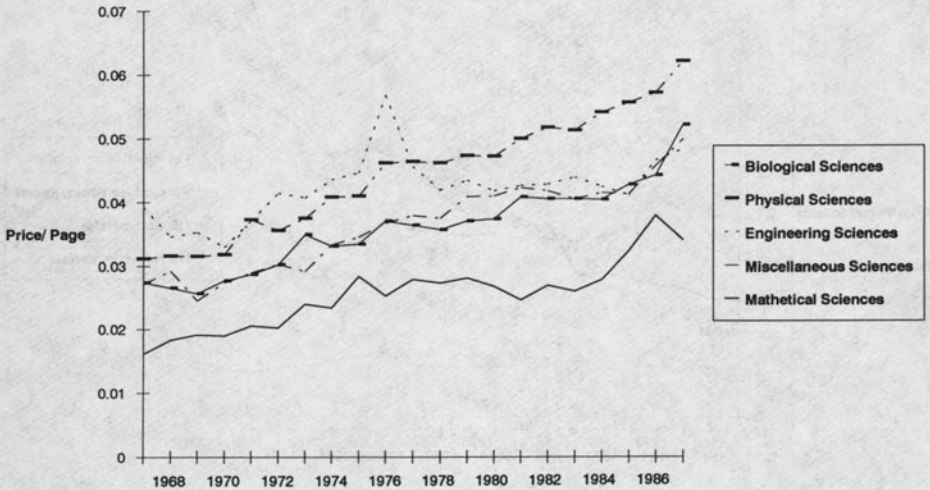


Figure 6. Trends in constant dollar average price per page: By discipline. (For U.S. subscribers)

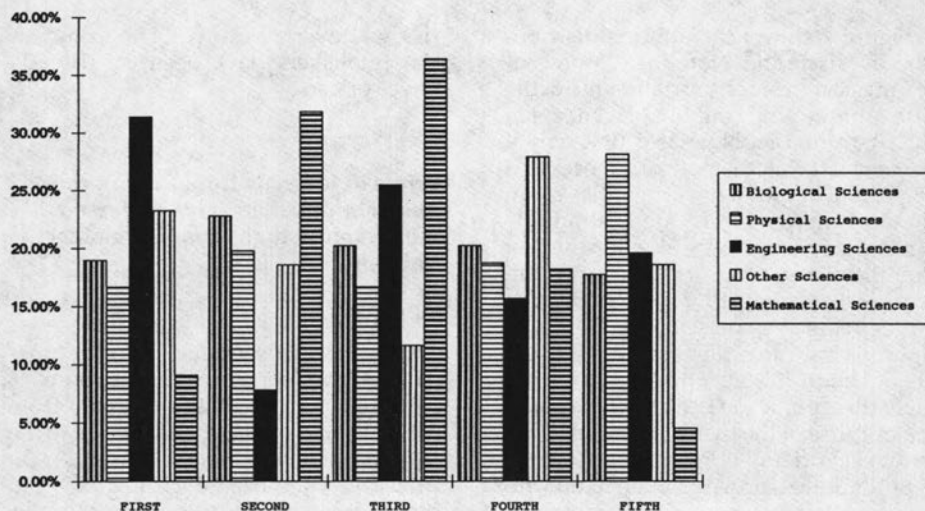


Figure 7. Increase in price per page between 1967 and 1987: Discipline. (For U.S. Subscriber)

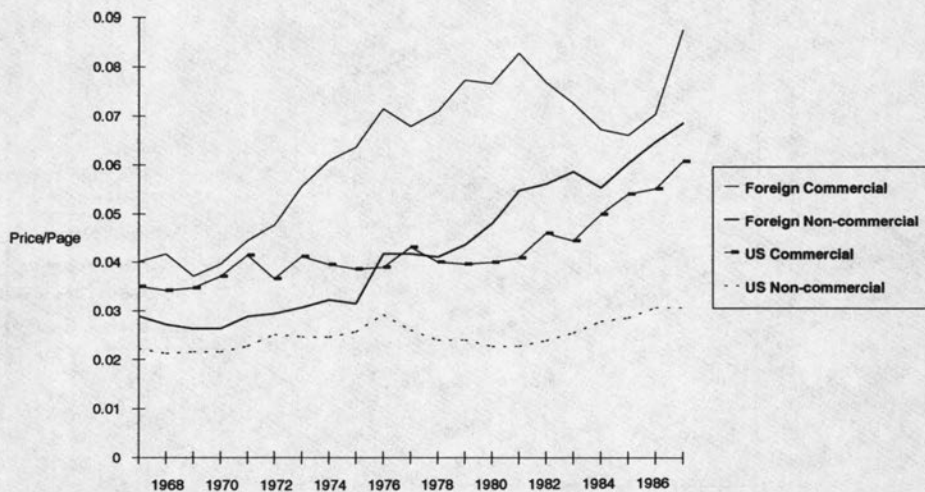


Figure 8. Trends in constant dollar average price per page: By publisher type. (For U.S. subscribers)

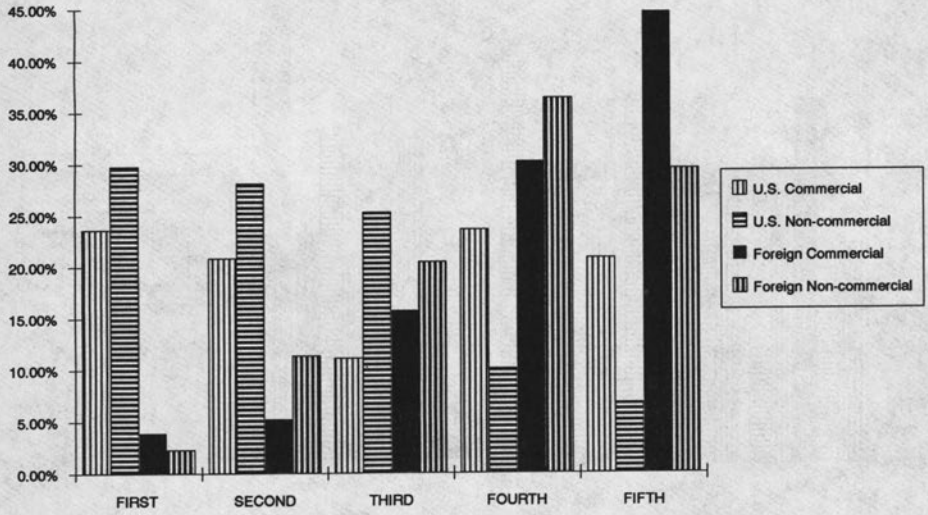


Figure 9. Increase in price per page between 1967 and 1987: Quintile distribution by publisher type.

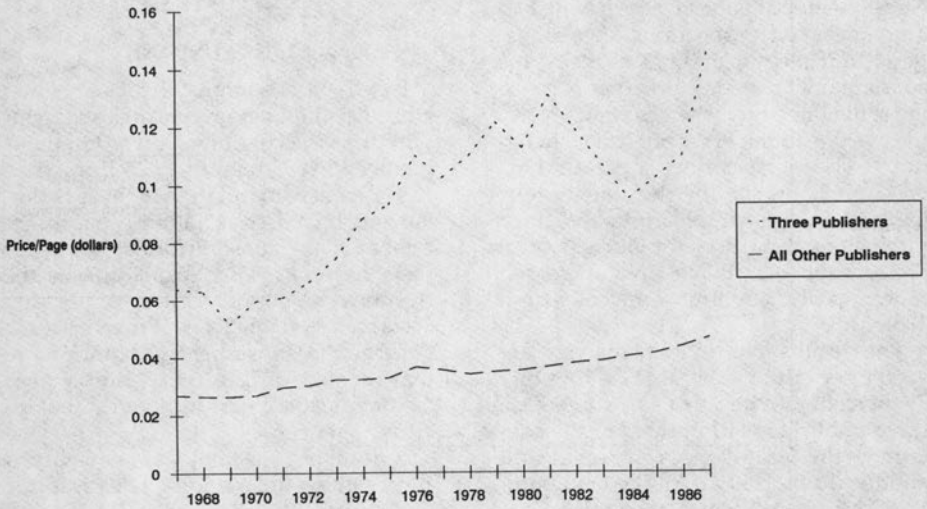


Figure 10. Trends in constant dollar average price per page: Three Publishers vs. All Other Publishers. (For U.S. Subscribers)

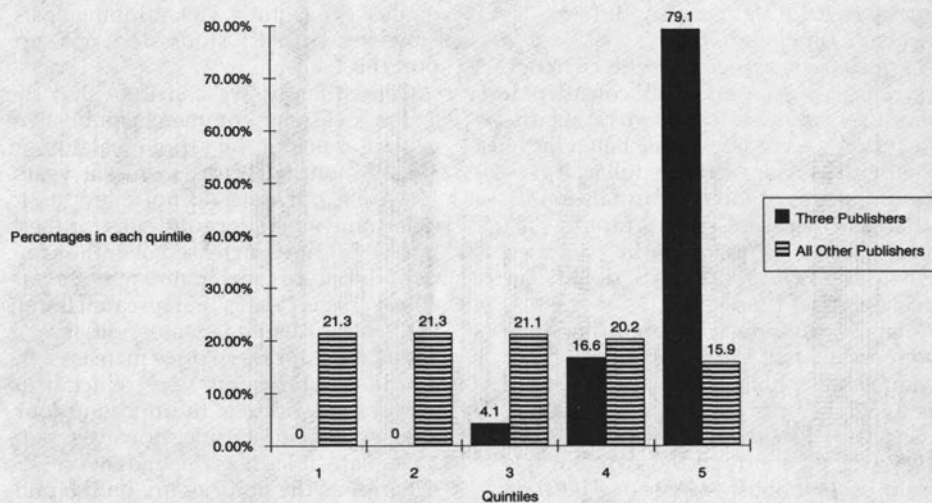


Figure 11. Increase in Price per Page between 1967 and 1987: Quintile distribution for Three Publishers vs. All Other Publishers. (For U.S. Subscribers)

A recent study by Richard M. Dougherty and Brenda L. Johnson identified three foreign commercial publishers as having had a significant effect on journal price escalation.⁹ To relate our findings to theirs, the constant dollar average price per page for the same three publishers is compared to the average for all other publishers in figure 10. The average price per page in 1967 was much higher for the twenty-four journals in the sample from the three publishers. But prices for journals from these publishers have also increased more rapidly over time, especially from 1967 to 1987.

The results of quintile analysis are even more striking. Figure 11 shows that 79 percent of the journals from these three publishers fall in the quintile containing the largest price increases and another 16 percent are in the next quintile. Thus 95 percent of the titles from these three foreign commercial publishers are in the top 40 percent of price increases for the entire sample. It is noteworthy that the same three publishers were among those studied by ARL, which concluded that their price in-

creases could not be explained by increases in producer cost.

CONCLUSIONS

Based on a sample of 370 scientific journals, the average journal subscription price to U.S. libraries was ten times greater in 1987 than in 1967. But, when the influences of inflation in the U.S. dollar and increases in journal length are removed, the constant dollar price per page has risen 78 percent during the twenty-year period. Unless publishing costs increased much faster than prices in general (the Consumer Price Index more than tripled during the period), other factors must account for the residual increase over time.

A number of factors were considered as possible explanations. One was the price differential charged to U.S. buyers for foreign journals. Some differential is justified by shipping costs. But we found no evidence that the differential has increased over time. Price increases were also analyzed by discipline. Our data do not indicate that rates of increase in price

per page have significantly differed between disciplines.

Price effects associated with currency exchange rates were also considered. Producer nations fall into two rather distinct types according to the behavior of their currency against the dollar. As expected, prices of foreign journals to U.S. libraries increased more rapidly for those serials originating in countries where the value of the U.S. dollar had declined over time.

Finally, the effects of publisher type were evaluated. We found that foreign commercial publishers charge substantially higher prices per page and that their rate of increase between 1967 and 1987 was greater than those of journals from other publisher types. The data indicate that the three foreign publishers studied by Dougherty and Johnson and ARL increased their prices per journal page much faster than did other publishers. In constant dollars the average price per page for the twenty-four journals in the sample from these three publishers increased by \$0.055 during the twenty-year interval, while the average for the 346 journals from other publishers increased by only \$0.019 during the same period.

Library managers should seek ways to exert more effectively their market power as clients in dealing with commercial publishers.

The finding that prices and rates of increase have been higher for journals from foreign commercial publishers does not necessarily imply price gouging, because many journals from non-profit institutions or societies are subsidized. It is also possible that the foreign firms tend to publish journals with higher production and distribution costs because of color, photographs, art,

quality of printing, and shipping costs. However, the ARL study does not support this conjecture.¹⁰

Consequently, we conclude that the actions of foreign commercial publishers explain much of the rapid escalation in average journal prices in recent years. However, our data do not allow us to determine whether profit rates for these publishers have increased over the same period. Indeed, such data are not available. What is clear is that research libraries in the United States deserve a justification for these price increases. Individual libraries are very reluctant to cancel subscriptions to important journals. At the same time, however, publishers are at least as dependent on U.S. libraries as the libraries are on the publishers. In the future, library managers should seek ways to exert more effectively their market power as clients in dealing with commercial publishers. When publishers announce price increases that exceed the general rate of inflation or are substantially greater than the industry average, library managers should use the forums of professional meetings, trade publications, and individual correspondence to indicate their concerns and to request justification of the publisher's actions.

Librarians should remember that publishers, especially commercial publishers, are in business for profit, and in the final analysis, their actions will ensure the attainment of this objective. The circumstances of the information economy have provided publishers of scientific journals with an extremely attractive opportunity to enhance their position in the marketplace. Nothing is fundamentally wrong with this. However, librarians must remember they have the power to make choices among publishers and to seek existing alternatives or assist in the development of alternatives to the traditional systems for distributing scholarly information.

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