Evaluating big deal journal bundles

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Large commercial publishers sell bundled online subscriptions to their entire list of academic journals at prices significantly lower than the sum of their á la carte prices. Bundle prices differ drastically between institutions, but they are not publicly posted. The data that we have collected enable us to compare the bundle prices charged by commercial publishers with those of nonprofit societies and to examine the types of price discrimination practiced by commercial and nonprofit journal publishers. This information is of interest to economists who study monopolist pricing, librarians interested in making efficient use of library budgets, and scholars who are interested in the availability of the work that they publish.

monopoly | bargaining | all-or-nothing price | efficiency | information technology

Librarians and scholars frequently complain that large commercial journal publishers use their monopoly power to charge inflated subscription prices (1–3). Dewatripont et al. (4) found that the average listed price of for-profit journals was four times as high as that of nonprofit journals when controlling for age, number of citations, number of articles, language, and discipline. The web site journalprices.com (5) reports that in 2011, on average, subscription prices per article or per citation of for-profit publishers are about three times as high as those charged by nonprofit journals in the same academic disciplines.

Listed á la carte prices, however, do not always accurately portray prices paid by buyers. Many libraries negotiate multiyear contracts for bundled site licenses that allow electronic access to nearly all of the journals in a publisher's portfolio. Others receive "quantity discounts" for subscriptions to subsets of the publishers' offerings. A survey of research university libraries in the United States and Canada (6, 7) found that a majority of these libraries had some kind of bundled journal contracts with large commercial publishers.

Almost no systematic information on prices paid for the bundles supplied by large commercial publishers has been publicly available. Bundle prices are negotiated institution-by-institution and publishers endeavor to keep them confidential. Many contracts include explicit "nondisclosure clauses" that forbid the library to release any information about contractual terms. Most state-funded universities, however, are required by state Freedom of Information Act (FOIA) laws to reveal information about their contracts, regardless of confidentiality agreements. We set out to probe the "secrets of the big deal" by sending FOIA requests to a large number of state-funded libraries, asking for copies of contracts to purchase bundled subscriptions from each of six commercial publishers: Elsevier, Emerald, Sage, Springer, Taylor & Francis, and Wiley, and from three nonprofits, the American Chemical Society (ACS), Cambridge University Press (CUP), and Oxford University Press (OUP).[†] All of these publishers sell bundled contracts at institution-specific prices that are not publicly disclosed.

Bundled Sale of Electronic Access

History-Based, Institution-Specific Prices. In the early 1990s, before online editions became widely available, institutional journal subscriptions were sold journal-by-journal at the same subscription price to all academic libraries. Because of high demand for some journals, large research universities often bought multiple subscriptions and maintained separate collections in specialty-based libraries.

In the late 1990s, as online editions of journals became widely available, business models changed drastically. With online editions, there are no printing or mailing costs, and the marginal cost to the publisher of permitting another user is essentially zero. Moreover, the internet enabled commercial publishers to develop new pricing methods that allowed them to exercise their market power much more effectively than in the print-only environment. (3, 8, 9).

Varian (10) pointed out that the classic prescription for economically efficient pricing, with goods priced at marginal cost to everyone, cannot succeed for a technology that has substantial fixed costs and negligible marginal cost. He argued that in the case of goods such as academic journals, "efficiency requires that the *marginal* user pays marginal costs, but making all users face a constant price at marginal cost can easily fail to be efficient." Varian suggested that a profit-seeking firm with some monopoly power has a strong incentive to use differential pricing, setting prices for marginal consumers close to marginal costs and charging higher prices to others.

A monopolist's ability to price according to buyers' willingness to pay is limited by two factors. One of these is arbitrage. If a seller charges different prices to different buyers, those who can buy the product cheaply may purchase the good at a low price and resell it to those facing higher prices. A second limitation is that sellers cannot easily determine the willingness to pay of their customers, and customers have no incentive to reveal this information.

The arbitrage problem was solved by the use of electronic "site licenses" that allow access to IP addresses at the purchaser's

Significance

Little is known about the prices that universities pay for bundled access to the journals published by large commercial publishers. Publishers have insisted that libraries sign confidentiality clauses that keep these prices secret. We used Freedom of Information Act requests to obtain copies of the contracts signed by a large number of institutions. We report the results of this investigation and compare the bundled subscription prices charged by for-profit and nonprofit publishers.

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[†]Elsevier contested our contract request from Washington State University on the grounds that their pricing policy was a trade secret, and brought suit against the university. The Superior Court judge ruled that Washington State University could release the contracts to us. Elsevier and Springer also contested our request for contracts from the University of Texas (UT) System. The Texas state attorney general opined that the UT System was required to release copies of all of these contracts.

location, along with contracts that ensure that rights to electronic access cannot be resold to other institutions. Whereas it would be difficult to observe the transfer of paper copies between owners, unauthorized transfer of electronic access is relatively easily monitored.

Publishers also found an ingenious solution to the problem of determining buyers' willingness to pay. In return for a lump-sum fee, anyone accessing the internet from a subscribing institution would be granted unlimited access to the publisher's entire portfolio of online journals.[‡] The tool that publishers used to estimate a library's willingness to pay for its bundle was the history of the library's spending on print subscriptions. Contracts for bundled access to a publisher's entire journal list have come to be known as the "big deal." The term big deal was coined by University of Wisconsin librarian Kenneth Frazier (12), who argued that, although the big deal might be attractive to individual university libraries, it would be collectively harmful to the academic community.

To estimate how much a library would pay for a big deal, a publisher would not need to know the buyer's valuation for any single journal but could simply estimate the library's willingness to pay for the entire package of previously unsubscribed journals (detailed studies of the effectiveness of multiproduct bundles in monopoly pricing can be found in refs. 13–15). The initial price for a big deal contract would be a library's then-current total expenditure on the publisher's offerings, plus an additional 5–15%. These contracts had a duration of 3–5 y with built-in annual price increases of about 6% (11). A subscribing institution would continue to pay the full cost of all of the journals that it previously purchased, and for a relatively small additional fee it could also electronically access the journals that it had previously chosen not to purchase. Publishers could be assured of increased revenue from any library that accepted the big deal and would lose no revenue from those that did not. The initial big deals were based on the assumption that institutions would be willing to pay at least an added 10–15% of their current expenditure in return for access to the unsubscribed journals. Although there were built-in price increases the increments were gradual, so that libraries could adjust their budgets to these increased costs.

Online journals opened a large new market of potential subscribers among smaller institutions less actively engaged in research. When journals could be accessed only in paper volumes, small, less research-oriented institutions would not have been interested in keeping obscure journals, even if subscriptions had been free. Storage and maintenance costs alone would exceed the value of use.[§] With electronic subscriptions, storage costs are eliminated, and access to rarely used journals has positive value.

Collection of Negotiated Bundle Prices. To obtain information on big deal prices, we wrote to 55 university libraries and 12 library consortia, invoking state Freedom of Information acts and requesting copies of recent site-license contracts signed with each of the nine publishers listed in Table 1. We obtained prices from more than 360 contracts between universities and publishers for bundled subscriptions. *SI Appendix*, Tables S4–S16 list the prices paid by these universities, along with their Carnegie classifications, full-time equivalent enrollments, and annual number of PhDs granted.

Table 1. Estimated 2009 mean bundle prices by Carnegie type

Publisher	Research 1, $	Research 2, $	Master's, $
Elsevier	1,159,137	366,771	89,190
Springer	382,286	184,583	52,692
Wiley	329,535	94,072	30,726
Taylor & Francis*	299,712	72,536	n.a.
Sage	114,015	61,378	26,586
ACS	62,743	42,119	22,227
OUP	61,602	28,253	4,543
CUP	37,395	19,725	9,592
Emerald[†]	24,462	7,590	6,661

*Our sample of Taylor & Francis contracts consists of only five research 1 institutions and one research 2 institution. We used a simple regression of expenditures on full-time equivalent enrollment to estimate average costs for research 1 institutions. We used actual expenditures on the single research 2 institution (University of Montana) for which we had a contract. n.a, not available.

[†]We observed only three Emerald contracts with research 2 institutions and only one (with the California State University library consortium) for master's institutions. Thus, we simply used sample means to estimate mean expenditures for research 2 and master's institutions for Emerald.

The Carnegie classifications that we use are as follows.[¶] Research 1 institutions were classified by Carnegie as "research-extensive universities" in 2000. This classification includes 151 universities. Research 2 institutions were classified by Carnegie as "research-intensive universities" in 2000. This classification includes 105 universities. Master's institutions award at least 50 master's degrees and fewer than 20 PhDs per year. This classification includes 591 institutions.

Our sample of bundle prices was determined by the available responses and might not be representative of the overall population of university libraries in the United States. To deal with this possibility, we used linear regression with our sample data to estimate a relation between observable characteristics of institutions and the prices they pay for journal bundles. Having fitted this regression, we use the actual distribution of observable characteristics to estimate the distribution of prices paid by institutions over the entire population of US colleges and universities.

We explored several alternative specifications of this regression and settled on a regression for each publisher in which the dependent variable was the price paid by a university for the publisher's full bundle and the independent variables were the institution's Carnegie classification, its enrollment, number of PhDs granted, and indicators for whether it has an associated medical school and/or hospital. Table 1 shows the estimated mean price charged for publishers' journal bundles in 2009 to US institutions of higher learning according to their Carnegie classifications. The regression coefficients on which these estimates are based appear in *SI Appendix*, Table S18.

Bundled Sales by Nonprofit Publishers. Some major nonprofit publishers offer bundled pricing schemes known as "tiered

[‡]Poynder (11) reports that the first contract of this type was signed between Academic Press and the United Kingdom's Higher Education Funding Council. This contract granted access to the entire portfolio of Academic Press journals for "all higher education establishments in the U.K." Soon other publishers followed this lead, offering their own multiyear contracts with bundled access. In 2001, Academic Press was purchased by Elsevier from its previous owner, Harcourt.

[§]Courant and Nielsen (16) estimated that the endowment required to provide the space to keep a 350-page book indefinitely in open stacks is about $130. Based on these calculations, the present value of costs of constructing and maintaining the space required to keep a 2,500-page journal volume permanently on accessible library shelves is roughly $1,000. Courant and Nielsen estimated that costs would be reduced by roughly two-thirds if the book were kept in open stacks for 10 years and then moved to compact storage.

[¶]For doctoral institutions, we use the terms research 1 and research 2, which were used by Carnegie prior to 2000 and are more widely familiar than Carnegie's current locutions. Carnegie changed the category names in 2000 and once again in 2005, apparently to appease label-sensitive university administrators. According to Carnegie's online frequently asked questions, "The Research I & II ... categories of doctorate-granting institutions last appeared in the 1994 edition. The use of Roman numerals was discontinued to avoid the inference that the categories signify quality differences." Our sample of historically based contracts included too few undergraduate colleges to allow reliable estimates of the distribution of prices charged to these institutions.

pricing," with posted bundle prices differentiated by the size and nature of the purchasing institution. Tiered price schedules do not depend on a library's previous purchase history but rather on observable university characteristics according to a publicly posted schedule. Hahn (17) reports that the first large-scale tiered pricing scheme was introduced by the American Physical Society (APS) in 2001. Several other societies and two university presses have since adopted tiered pricing schedules. In 2009, we found a total of 16 nonprofit publishers with published tiered pricing schedules. These tier structures correspond fairly closely to Carnegie classifications, and thus allow us to estimate the average prices paid by research 1, research 2, and master's institutions. The bundle prices charged by each of the publishers with tiered pricing are listed in *SI Appendix*, Table S2.

Some nonprofit publishers of multiple journals offer discounts for bundled purchases but present the same price menu to all institutions regardless of size or type. Others offer neither bundle discounts nor tiered pricing. We collected all of the pricing information that we could locate for nonprofit publishers that satisfy the following criteria: (*i*) are located in the United States or United Kingdom; (*ii*) publish at least three subscription-based journals covered by the Thomson-Reuters Web of Science[‖],**; and (*iii*) are not included in bundles offered by for-profit publishers. In addition to the 16 publishers with tiered prices, we found 37 nonprofit publishers that satisfy our criteria for inclusion and charge a uniform price to all educational institutions. A list of the nonprofit publisher bundles and details about their pricing is found in *SI Appendix*, Table S3.

Comparing Bundles by Cost-Effectiveness

Journals differ greatly in size and significance. To compare the cost-effectiveness of journal bundles, we need measures of the content of the individual journals in each bundle. The Thomson Reuters *Journal Citation Reports* (JCR) covers about 12,000 academic journals and reports three useful measures of the content of each covered journal. These are the number of articles published in the most recent 5 y, the number of times that articles published in the most recent 5 y have been cited, and the journal's eigenfactor.

Costs per Citation. The discussion in this paper will measure cost-effectiveness by cost per citation.[††] Table 2 shows estimated costs per citation of bundles purchased from the three nonprofit publishers using institution-specific negotiated prices as well as from each of the nonprofit publishers using tiered pricing and the average cost per citation of the publishers in our sample that price their bundles uniformly. Of course, the number of citations to a journal is not an ideal measure of its usefulness to scholars. Citation practices differ greatly across disciplines (18), and citations from well-cited sources are likely to be more significant than those from more obscure sources. Some of these differences can be accounted for with the eigenfactor metric (19), which is a network-based measure that weights citations more heavily if they come from shorter bibliographies and from more significant sources. *SI Appendix*, Table S17 shows results that are qualitatively similar when cost-effectiveness is measured either by cost per eigenfactor or simply by cost per article rather than cost per citation.

Table 2. Bundle cost per citation: Nonprofits

Pricing method and publisher	Type of institution: Research 1, $	Research 2, $	Master's, $
Negotiated pricing			
American Chemical Society	0.50	0.34	0.18
Oxford University Press	1.27	0.58	0.20
Cambridge University Press	4.06	2.14	1.04
Tiered pricing			
National Academy of Sciences	0.10	0.08	0.04
American Society for Biochemistry and Molecular Biology	0.18	0.16	0.15
American Society for Microbiology	0.28	0.22	0.13
American Physical Society	0.34	0.22	0.17
Endocrine Society	0.41	0.41	0.35
American Medical Association	0.61	0.48	0.48
Ecological Society of America	0.50	0.49	0.49
Rockefeller University Press	0.83	0.68	0.55
American Geophysical Union	1.09	0.73	0.48
American Institute of Physics	0.82	0.73	0.65
American Psychiatric Association	0.93	0.82	0.82
MIT Press	1.16	1.04	0.93
Cold Spring Harbor Press	1.46	1.29	1.29
Company of Biologists	1.52	1.38	1.18
U of Chicago Press	2.36	1.64	1.64
American Psychological Association	2.87	2.11	1.60
Uniform pricing			
Average for 37 journals	1.77	1.77	1.77

Table 3 shows the average cost in 2009 for libraries subscribing to all of the nonprofit bundles in our sample and to the nonprofit bundles with tiered pricing. Of course, there is no reason that a library should subscribe to all nonprofit journals, regardless of their cost-effectiveness. Table 3 shows costs for a library that chose its journals more selectively. A library could, for example, set a threshold level of costs per citation and subscribe only to those bundles whose costs per citation did not exceed this threshold. The table shows the costs per citation that a library would incur if it set this threshold so as to obtain in the least expensive possible way 95%, 80%, and 50% of the citations available from the sampled nonprofit journals.

Table 4 shows estimates of the cost per citation for the bundles offered by each of the six commercial publishers in our study.

Comparing Tables 3 and 4, one sees that for research 1 universities, even with price discounts for big deal bundles, the for-profit publishers charge substantially higher prices per citation than do the nonprofits. Of the major commercial publisher bundles, Elsevier's is the most cost-effective. However, for research 1 institutions, the cost per citation of the Elsevier bundle is more than twice that for the full sample of nonprofit journals and about three times as high for a research 1 institution that chooses nonprofit bundles selectively for cost-effectiveness. The cost per citation of the Springer bundle is slightly higher than that of the

Table 3. Aggregate per-citation costs, 2009

Collection of journals	Type of institution: Research 1, $	Research 2, $	Master's, $
All tiered nonprofits	0.66	0.52	0.44
All nonprofits in sample	1.02	0.83	0.71
Cost-efficient 95% of cites	0.80	0.63	0.50
Cost-efficient 80% of cites	0.61	0.45	0.34
Cost-efficient 50% of cites	0.38	0.29	0.15

[‖]We included the National Academy of Sciences although it publishes only one journal, PNAS, because this journal is very large, including more articles than most bundles offered by publishers of multiple journals.

**For publishers that offer no discount for bundled purchases, we treated the relevant bundle as consisting only of those journals listed by *Journal Citation Reports*.

[††]Not all journals are included in *Journal Citation Reports*. There is a lag between introduction of new journals and inclusion in JCR, and some journals do not meet the quality standards set by JCR. An alternative ranking service, *Scimago*, reports numbers of citations and of articles or academic journals, using less stringent quality thresholds and including more newly started journals. For journals listed by *Scimago*, and not by JCR, we use *Scimago* data to estimate annual numbers of citations and articles.

Table 4. Bundle cost per citation: For-profits, 2009

Publisher	Type of institution		
	Research 1, $	Research 2, $	Master's, $
Elsevier	2.24	0.71	0.17
Springer	3.08	1.48	0.45
Wiley	5.19	1.48	0.48
Emerald	6.94	2.05	1.89
Sage	7.24	3.90	1.69
Taylor & Francis	10.94	2.65	n.a.

n.a, not available.

Elsevier bundle, whereas those of the Wiley, Sage, Emerald, and Taylor & Francis bundles are much higher. Of the three nonprofits with negotiated, historically based pricing, the bundles supplied by the American Chemical Society and Oxford University Press are much more cost-effective than the Elsevier bundle, whereas that from Cambridge University Press is less cost-effective.

For research 2 universities, Tables 3 and 4 show that the Elsevier journal bundle is priced competitively with most of the nonprofit bundles, whereas the prices of the other commercial publishers' bundles average two or three times as high as those of either Elsevier or the nonprofits.

The big deals offer much-reduced prices to master's institutions. For these institutions, the cost per citation of the Elsevier bundle is similar to that of acquiring the cost-effective nonprofit bundles that supply 50% of the citations available from nonprofits. For master's institutions, the Springer and Wiley bundles have similar costs per citation to those of the nonprofit bundles, whereas the bundles of Sage and Emerald are considerably more expensive.

Measuring Bundle "Discounts." It would cost about $3.1 million at 2009 á la carte prices to buy all of the journals in Elsevier's bundle, the "Freedom Collection." The average research 1 university paid roughly $1.2 million, or 40% of the summed title-by-title prices, for access to the Freedom Collection. However, this bundle price is by no means equivalent to a 60% discount from journal-by-journal pricing. The Freedom Collection includes about 2,200 journals, many of which are expensive but rarely cited. The least cost-effective 1,100 journals contained in this collection supply fewer than 5% of the citations, but their prices add to more than 25% of the total of á la carte prices. A library that spent $1.2 million on Elsevier journals at listed catalog prices, selecting journals for cost-effectiveness, could obtain access to journals providing 79% of the citations to journals found in the Freedom Collection. Thus, for the average research 1 institution, the citation-scaled discount obtained from the Freedom Collection is about 21%.

Similar results apply to the bundles offered by other commercial publishers. Table 5 shows average citation-scaled discounts by university type for the complete bundles offered by Elsevier, Springer, Taylor & Francis, and Sage. The citation-scaled discounts show the reduction in cost per citation resulting from the purchase of the publisher's complete bundled collection compared with what the cost per citation would be if the institution spent the same amount of money on title-by-title purchases at listed catalog prices of the publisher's relatively cost-effective journals.

Bargaining, Efficiency, and the Big Deal

Varian (10) noted that efficient provision of academic materials involves complete access. First-degree price discrimination in elementary economics textbooks offers an implementation of the efficient scheme in which each library is charged something near to its willingness to pay for complete access to the publisher's materials. The challenge for publishers is to estimate the willingness to pay. In 2001, Derk Haank, then-CEO of Elsevier and currently CEO of Springer, offered a similar vision. According to Haank:

> But what it [electronic publishing] does do is to dramatically lower the marginal costs of allowing access . . . The extra cost of that is virtually nil and that means that we should be more creative in the business model in the future.. . . So, we should have models where we make a deal with the university, the consortia or the whole country, where we say for this amount we will allow all your people to use our material, unlimited, 24 hours per day. And, basically the price then depends on a rough estimate of how useful is that product for you; and we can adjust it over time (20).

There is ample evidence that large publishers practice price discrimination and that they have been able to set prices well above average costs. In 2011, the journal-publishing divisions of Elsevier, Springer, and Wiley reported profits equal to 36%, 33.9%, and 42%, respectively, of their sales revenue (21). However, the large commercial publishers have not been able to find differentiated bundle prices that all, or even most, university libraries will accept. Table 6 shows the results of surveys taken in 2006 and 2012 of members of the Association of Research Libraries (ARL), an organization of 125 research-intensive university libraries in the United States and Canada.[‡‡] For the four listed commercial publishers, only a declining minority of the sampled libraries have big deal contracts for the publisher's entire portfolio. In contrast, the nonprofit American Chemical Society, which offers a much more cost-effective journal bundle, has contracted with 57% of the sampled libraries for access to its full journal bundle.

The textbook model of first-degree price discrimination assumes that the seller knows the willingness to pay of each buyer and can credibly commit to an all-or-nothing offer to each buyer. We suspect that the low uptake for full-collection big deals is explained partly by imperfect information about libraries' actual willingness to pay and partly by the inability of the major publishers to commit to an all-or-nothing offer. The historical print subscriptions, on which the original big deal prices were based, are now nearly 15 y old, and may no longer be accurate predictors of current willingness to pay. Big deals that were initially attractive have become less so a decade later, as publishers have increased the prices of their bundles by 5–7% per year. A bundle whose price increased by 5.5% per year would have doubled its price between 1999 and 2012, whereas over the same period the US consumer price index rose by 38%.

Publishers have not been able to credibly commit to all-or-nothing price offers based on historical subscriptions. The fallback position for libraries that choose not to purchase full-collection contracts is not a complete lack of access to the publisher's journals. All major publishers allow libraries to purchase subsets of their full collection on an á la carte basis. In fact, the major publishers offer quantity discounts in one form or another for subcollections of their journal lists that fall short of their full collections. A library that does not subscribe to a journal can supply slightly delayed access to its constituents by means of interlibrary loan. Scholars who find that their library lacks access to a desired article can often use the internet to find a freely available copy online, or can quickly obtain a copy by e-mailing the author.

Sometimes bargaining between publishers and institutions has led to an impasse in which a big deal was cancelled, and sometimes bargaining has led to significant concessions. Harvard University, Massachusetts Institute of Technology (MIT), Caltech, Minnesota, Oregon, Oregon State, Purdue, and Kansas are among

[‡‡]Blixrud and Strieb (6, 7) report these survey results. Entries in Table 6 are based on tables 1 and 3 in ref. 7. The ARL did not collect statistics on ACS contracts in 2006.

Table 5. Citation-scaled bundle discounts

Publisher	Catalog list price, $	Citation-scaled discounts		
		Research 1, %	Research 2, %	Master's, %
Elsevier	3,132,000	21	60	84
Springer	2,218,000	50	72	85
Taylor & Francis	1,230,000	35	70	n.a.
Sage	310,000	16	34	55

n.a, not available.

the major universities that currently do not subscribe to Elsevier's Freedom Collection. Of the 2,200 journals in the Elsevier bundle, Harvard subscribes on a title-by-title basis to 892 journals, Minnesota to 899, and Oregon, Oregon State, and Purdue each subscribes to about 800 Elsevier journals, whereas MIT subscribes to fewer than 700 and Kansas and Caltech each subscribes to about 425.

There are notable examples in which bargaining has led to significant price reductions for big deal bundles. In 2003, at the time of renewal of their original Elsevier big deal contract, the California Digital Library, acting for the nine campuses of the University of California System, took a hard bargaining stance (22, 23). As a result, they paid 9% less in 2004 than in 2003 and agreed to annual price increases well below Elsevier's usual 5%. In 2008, California was again able to bargain for price increases well below Elsevier's standard contracts. Over the 10-y period from 2003 to 2013, the University of California's payments to Elsevier for their Freedom Collection contract has increased at an average annual rate of about 1.5%. If they had acceded to Elsevier's requests for annual increases of 5%, their annual subscription price in 2013 would have been nearly $13 million instead of the $9.3 million that they contracted to pay in 2013.

In 2010, with their existing contracts with Elsevier and Wiley due to expire at the end of 2011, members of the Research Libraries of the UK (RLUK), a consortium of 30 British and Irish research libraries, rejected initial offers from these publishers and formulated a "plan B" that outlined the way that they would provide journal access to their constituents if they were not able to reach big deal agreements. Early in 2011, the RLUK stated that they would not sign any new contracts unless "there are significant real-term price reductions" that would "rescind the unreasonable price increases of the last three years" (24). In December of 2011, the RLUK announced that agreements on new contracts had been reached with Elsevier and Wiley. The terms of these agreements were not publicly announced. An RLUK spokesman estimated that the new agreements would "save more than £20 million ($31 million) for the UK higher-ed sector over the lifetime of the five-year agreements." The RLUK statement was not clear about whether price reductions were achieved. The story quotes a member of the RLUK board as saying that the new contracts "reflect increases far lower than we would have anticipated otherwise" (25). Although the UK libraries probably did not achieve the price reductions that they requested, they were able to get much more favorable terms than those offered by the sellers. The likely key to this success was a hard bargaining stance accompanied by a credible contingency plan of action in case big deals were not achieved.

The contract price lists in *SI Appendix*, Tables S4–S17 show striking differences, suggesting that some universities have driven harder bargains than others. In 2009, the University of Georgia paid about $1.9 million, and the University of Colorado paid about $1.7 million, for the Elsevier Freedom package. By comparison, the University of Wisconsin paid about $1.2 million and the University of Texas about $1.5 million. Wisconsin and Texas have much larger enrollments and produce about twice as many PhDs, but were able to bargain for lower prices than Georgia and Colorado. Similar anomalies are found for other publishers. The University of Virginia pays about $450,000 for its Springer package, whereas Dartmouth pays $480,000, despite the fact that Virginia's enrollment and number of PhDs are about four times those of Dartmouth. The University of Arizona pays $108,000 for the Sage package whereas Brigham Young University pays $185,000, although Arizona has a larger enrollment than Brigham Young and produces six times as many PhDs. The University of Kentucky paid about $490,000 and the University of Oklahoma about $500,000 for the Wiley bundle. The University of Illinois and University of California, Los Angeles have enrollments that are nearly twice as large and produce three times as many PhDs, but pay substantially less than Kentucky and Oklahoma for the same bundle.

Conclusion

So what secrets of the big deal have Freedom of Information requests allowed us to uncover?

We find that even with the institution-specific discounts resulting from bundled purchases, the prices per citation charged to large PhD-granting universities by major commercial publishers are much higher than those charged by major nonprofit publishers. Among the commercial publishers in our study, Elsevier's prices per citation are nearly 3 times those charged by the nonprofits, whereas Emerald, Sage, and Taylor & Francis have prices per citation that are roughly 10 times those of the nonprofits.

For smaller PhD-granting institutions (Carnegie research 2), the price per citation from Elsevier's big deal bundle was roughly similar to that charged by the average nonprofit publisher, whereas prices per citation from the other for-profits were two to four times as high as those of the nonprofits.

Commercial publishers reduce their bundle prices to schools classified as master's institutions much more sharply than do the nonprofits. Elsevier's price per citation for the average master's institution is lower than that charged by most nonprofit publishers. Prices charged to master's institutions by Springer and Wiley are similar to those of the nonprofits, whereas the prices charged by Emerald and Sage are more than twice as high.

Commercial publishers have not been able to induce most research libraries to sign big deal contracts, and the number that do so has fallen between 2006 and 2012. This suggests that expenditure on print journals in the pre-electronic journal era is no longer an accurate enough signal of willingness to pay to allow publishers to practice successful first-degree price discrimination. A majority of research libraries have not made full-package big deals with the major publishers, despite the efficiencies that result from full access. This is consistent with economic theory that suggests that when neither side has full knowledge of the benefits and costs to the other, bargaining efforts will frequently fail to reach efficient outcomes. In this case, many institutions make do with less than full access to commercial publishers' bundles, and these publishers lose revenue that they might have gained from more moderate offers.

The contracts that we have seen show remarkable institution-specific price variations that cannot be explained by university

Table 6. Fraction of ARL libraries with full-list big deals

Publisher	2006	2012
ACS	–	0.56
Elsevier	0.25	0.20
Springer	0.38	0.30
Taylor & Francis	0.16	0.14
Wiley	0.29	0.16

characteristics such as enrollment and PhD production. Some institutions have been quite successful in bargaining for lower prices, whereas others may not have been aware that better bargains can be reached. Perhaps this variation explains publishers' desire to keep contract terms confidential.

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