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# Exploring the Determinants of Scholarly Book Prices in the Fields of Science, Technology, and Medicine

LEWIS G. LIU, HAROLD GEE, CHARLES TERNG

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## ABSTRACT

This empirical study examines long-term and current book market trends and important factors affecting scholarly book prices in science, technology, and medicine (STM). It analyzes the market demand, supply, and prices of STM books and how they affect academic libraries' budgets. A semilogarithmic econometric model is formulated to explore the factors that affect STM book prices. Various product features, including book length, cover type, format, supplier types, and publication locations, are examined. The empirical results are mostly statistically significant, particularly for some key factors. The overall findings of this study have policy implications for academic libraries' books collections and acquisitions.

## INTRODUCTION

Scholarly books along with scholarly journals are a critical part of the network of scholarly communication. Books can be the sources of original research. Many new ideas, creations, and inventions that are conveyed through books, such as *On the Origins of Species* by Charles Darwin in biology, influence generations of researchers. Books and textbooks play a significant role in knowledge distribution in terms of disseminating research results from scholarly journals and conference proceedings to practitioners who do not necessarily read articles from these original sources (Serenko, Bontis, and Moshonsky 2012). Books also shape cultures, affect people's decisions and behaviors, and are very much part of the history of human civilization.

American academic libraries have long been maintaining book collections to fulfill educational goals of institutions of higher education since the nation's first college received a few hundred books in 1638.<sup>1</sup> There is

no question that books are a critical part of academic libraries' collections. The changes in the demand, supply, and prices of books in the scholarly book market certainly affect libraries' budgets and therefore affect libraries' collections policies and decisions. A number of book-publishing trends influence the scholarly book market, including the changes in both global and domestic book title production, prices of both print books and ebooks, various types of scholarly book-publishing entities, and libraries' monograph expenditures. While some effects of these market factors are predictable, others are unexpected and can create both short-term and long-term budget problems for academic libraries.

Books consume a large portion of academic libraries' materials budgets. In many academic libraries, book expenditures are second only to serials expenditures in libraries' material budgets and increasingly affect their operations more than many think. It is important to have in-depth empirical research on the factors that affect the book prices in the fields of science, technology, and medicine (STM) for a number of reasons. First, the STM book title production in North America has been increasing in recent decades. The total number of book titles in many STM fields has more than doubled since 1989 (Barr and Thomas 2017). The average price of STM books is much higher than that of books in other subject areas. STM books are demanded not only by doctoral-degree-granting research universities but also by master's-degree- and bachelor's-degree-granting colleges that offer core higher education curricula. The sheer volume of STM books demanded and their higher prices have a deep impact on libraries' budgets. Contrary to long-term increases in book title production and STM book prices, average monograph expenditures of American academic libraries have been declining since 2008.<sup>2</sup> How to effectively reduce costs in book collections, acquisitions, and management, efficiently utilize existing resources, and fully maximize libraries' services to their users is a challenging task for many academic library managers.

Second, there is a dearth of empirical research on the STM book market. Little is known about how various publishing factors affect scholarly book prices in various STM subject areas. For example, very few, if any, studies have addressed the issue of whether or not and to what extent books published by commercial publishers are more expensive than books published by noncommercial publishers. Albert N. Greco and Alana M. Spendley's (2016) study that examined book prices of university presses is mostly related to humanities, social sciences, business, and law, with few science subject areas. The lack of research in this area is partly due to the fact that much of the research attention has been focused on scholarly journal prices as a result of the "serials crisis," partly due to the fact that book prices increase at a slower rate than do journal prices, and partly due to the fact that the demand for books by researchers is not as timely as the demand for journals. But given the long-term and current scholarly book

market trends, this issue can no longer be ignored since these market factors have been putting a great deal of pressure on libraries' budgets. It is important to examine this issue since it helps academic library managers better understand the scholarly book market factors so that they can make better choices in their book acquisitions decisions.

Third, published articles on the scholarly book market are mostly descriptive and lack theoretical assumptions and empirical evidence. Therefore, they are not definitive and have limited applications in decision-making for a large number of libraries. Some descriptive articles are certainly informative and educational, but they are not connected to libraries' long-term strategic goals.

Fourth, the data sampling used in book studies tends to be small and limited to just a handful of large scholarly publishing houses and elite research libraries, and is often confined to a single institution. While the issues addressed by these studies are related to a segment of the scholarly book-publishing market, they are certainly not representative of the scholarly book industry with hundreds of publishers and thousands of academic libraries.

Finally, there is lack of quantitative research with statistical testing of whether or not and to what extent ebooks are more expensive than print books. Narda Tafuri (2017) states that "in the academic market, it has always been assumed that e-books are more expensive than their print counterparts" (362). While that assumption reflects a common practice by commercial publishers, who tend to overcharge libraries for ebooks, it is not supported by economic reasoning due to the low marginal cost of ebooks. In fact, some library practitioners (e.g., Anderson 2000; Bunkell and Dias-Correia 2009) and economic researchers (e.g., Besen and Kirby 2014) argue that ebooks should be cheaper than print books.

The paradox between low marginal costs and increasing prices of ebooks has puzzled and frustrated academic librarians in recent years. On the one hand, economic reasoning demonstrates that ebooks should be cheaper than print books because the marginal cost of producing and distributing an ebook is lower. The fixed costs in the general process of producing ebooks should not be substantially different from those of producing print books since almost all of today's print books are initially created in digital format. When books in digital format are printed out for distribution and use, they become print books. When digitized books are distributed to retailers or end users digitally, they become ebooks. There can be some additional costs for editing, designing, converting, formatting, and proofreading an ebook in the way it is enjoyable to read and easy to manage and distribute digitally. Ebooks do not incur paper, ink, and binding costs, and their distribution cost is much lower than that of print books, whereas the material and labor costs associated with these operations for print books can be substantial. The costs of the software

programs used to load and read ebooks incur at the consumer's side and therefore do not affect publishers' income statements. The marginal cost concept of digital information production and distribution has long been recognized by economic researchers. For example, Stanley M. Besen and Sheila N. Kirby (2014) argue that the production of ebooks is not as cheap as many think because of "digitized preparation, quality assurance, and digital distribution. . . . Nonetheless, the cost of producing an additional copy of an e-book is undoubtedly substantially lower than the cost of producing an additional copy of a print book" (130).

On the other hand, the cost-savings from ebooks production and distribution have not trickled down to academic libraries. Rather, they are used as profit-margin boosters by commercial publishers. In recent years, commercial publishers have started charging libraries higher prices for ebooks, causing serious concerns from librarians. For example, Boston Library Consortium (BLC) Executive Director Susan Stearns and President-Elect John Unsworth (2014) sent a letter entitled "Ebook Pricing Hikes Amount to Price-Gouging" to the *Chronicle of Higher Education* complaining that "these newly announced price increases, amounting to several hundred percent in some cases, are levied on short-term uses, and this regressive pricing model is being adopted by the publishers whose ebooks are already among the most expensive in the scholarly market" (1). Librarians' concerns about ebook price increases by commercial publishers are real. They remind librarians of the detrimental effects of the "serials crisis" on academic libraries' budgets, their services to their faculty, students, and the overall financial well-being of their institutions. Given the current trend that commercial publishers have been increasingly gaining the market share of the scholarly book market, academic libraries may soon find themselves in "troubled water" again. As Susan Stearns and John Unsworth (2014) put it, "We've seen it before, and we should not stand for it again" (1).

While some practicing librarians have noticed the profit-maximizing behavior of commercial publishers, the profession as a whole has been more or less mute about the issue. The research on this issue is even further behind. There have been very few, if any, empirical studies on the price differential between ebook prices and print book prices in STM subject areas. The long-term and current market trends in scholarly book publishing, such as increased book prices, declining number of noncommercial publishers, increasing control of the scholarly book publishing market by commercial publishers, and stagnant/declining libraries' monograph expenditures, warrant a timely, comprehensive, and in-depth empirical study of important factors influencing STM scholarly book prices. Empirical findings can help library administrators and practitioners gain a better understanding of the current STM book market conditions and assist them in their collection decision-making.

## REVIEW OF THE LITERATURE

The research literature on the factors affecting the scholarly book market can be mainly categorized into three interrelated areas: studies of the role of commercial publishers in the book market, studies of the issues related to ebooks, and studies of the issues related to university presses. The systematic empirical research of the factors affecting STM book prices is almost nonexistent. Studies with a focus on the role of commercial book publishers in the scholarly book market are scarce as well. A handful of studies related to the role of various types of publishers in providing print books and ebooks are instruction-based case studies. These case studies were conducted not for analyzing the scholarly book market as a whole but rather for the purposes of libraries' acquisitions, collection management, and user services. Some articles discuss the ebook prices and how they affect libraries' budgets. Others focus on the usage and management of ebooks. Studies that have examined prices of university press books have mostly focused on humanities, social sciences, law, and one or two science areas. A great deal has been written on university presses because their book sales have been decreasing and, as a result, university presses have been declining as publishing entities.

### *The Role of Commercial Publishers*

One of the very few studies that set out to examine the role of commercial publishers in the book market was conducted by Tina P. Franks and Daniel S. Dotson (2017) using PhD dissertations published at The Ohio State University between 2003–2012. This case study, an update of a previous study, analyzed over 4,000 dissertation citations in four subject areas: civil engineering, computer science, mathematics, and physics. The findings show that commercial publishers accounted for 73% of the total book citations, and university presses accounted for close to 19%. The main limitations of this case study are that it covered only four subject areas, which are only a small portion of STM fields, and it did not examine the price differential between commercial and noncommercial publishers. James Cory Tucker (2012) studied the roles of nonuniversity publishers and university publishers in ebook provision at the University of Nevada Las Vegas using NetLibrary and Ebrary. He listed ebook circulation data from 2008 to 2010 by college, including business, education, engineering, fine arts, health sciences, hotel, library arts, sciences, and urban affairs. He then ranked ebook usage by the top ten publishers. Except for a few large university presses, such as Oxford University Press, Cambridge University Press, MIT Press, and UC Press, all were commercial publishers (44). Institution-based studies have the advantage of examining the data in detail since the scope of the studies is within one institution. But they tend to be limited to a few large scholarly publishing houses, and the subject areas they cover are limited to the academic programs offered at their institutions.

*The Academic Ebook Market*

Ebook sales have exploded in the recent decade, and ebooks have become an important part of academic library collections. Michael Zeoli (2015) reported, using YBP Library Services data from 2012 to 2015, that “print sales have diminished by over 25%, while digital has increased by more than 100%” (14). Library Journal (2016) also reported that the median number of ebook volumes in all types of academic libraries increased about 150% from 2010 to 2016 (17).

Ebook prices, as argued by some library practitioners, are supposed to be lower than print book prices. For example, Byron Anderson (2000), in the early years of ebook production, stated that ebooks were less expensive to produce than print books. Bonita Wilson (2009), the editor of *D-Lib Magazine*, argued that “E-textbooks offer many features and functions unavailable with printed textbooks. In addition, e-textbooks cost less and are supposed to be more environmentally friendly” (1). Jonathan Bunkell and Sharon Dyas-Correia (2009) asserted that the total cost per use for e-book usage decreased with “each passing year” (216).

Economic-theoretical reasoning also supports the assumption that ebooks should be cheaper because the marginal cost of producing an ebook is lower than that of producing a print book. For example, Bruce R. Kingma (2001) has long demonstrated that the marginal cost of an electronic information product at some product-provision stages can be zero (13). Joel Waldfogel and Imke Reimers’s study (2015) reinforced the argument by stating that digitalization has “the ability to distribute books electronically, . . . reduce costs and, if it also reduces prices, can give rise to a movement along the demand curve for books and possible increases in both consumer and producers surplus” (50).

However, the cost-savings from ebooks have not been translated into lower prices for academic libraries. Susan Stearns and John Unsworth (2014) complained that their Boston Library Consortium was overcharged by commercial publishers selling them ebooks:

Since about 2010, the electronic book, or ebook, has rapidly increased its market share in the publishing business, and in 2013 it accounted for 27 percent of adult trade-book sales. Academic audiences have been somewhat slower to adopt this format, but as the general market for ebooks has begun to plateau, the academic market has been picking up. Now—and probably not coincidentally—academic libraries find themselves facing sharply increased pricing for commercially published electronic books . . . [the Boston Library Consortium] was surprised to learn that a number of the publishers in this program planned immediate, significant, and unexplained increases in price. Even worse, the new pricing goes into effect at a time when library budgets are already committed for the 2015 fiscal year. (1)

Most recently, Bailey, Scott, and Best (2015) examined the price differential between ebooks and print books based on the books requested

by the faculty in one semester at Auburn University at Montgomery. Their findings showed that the average ebook price was higher than that of print books across all Library Congress Subject Classification areas. This price differential existed for books published by nonuniversity presses as well as for books published by university presses. The sample size of the study was very small. For example, six out of thirteen LC subject areas had fewer than four book titles for university presses, and seven out of thirteen LC subject areas had fewer than five books titles for nonuniversity presses (14,15). Some of the LC subject areas only had one or two book titles for the analysis. The total number of book titles examined for university presses was 115, and the total number of book titles examined for nonuniversity presses was 149 (14,15).

#### *University Presses*

Some studies explored the scholarly book market trends related to university presses and discussed the reasons for the decline of university presses. Others made attempts to develop new models of calculating costs of producing monographs by university presses so that their parent institutions can have an idea about the costs when considering subsidizing their authors' book publications. These studies discussed the supply side of the scholarly book market. The decline in university presses can have a number of impacts on the market, including increased commercial publishers' control of the market, which can lead to higher prices of scholarly books.

Greco and Spendley's (2016) article, an update of a 2012 report, examined prices of university press books from 2012 to 2014. They provided a few tables listing book title output, average price per volume, and subject areas by both university presses and commercial publishers. The subject areas included were humanities; social sciences, such as psychology, economics, political science, and sociology; one business subject (finance); one physical science subject area (physics); and statistics and mathematics. The data were collected from Yankee Book Peddler. From these tables, they observed that commercial publishers annually published more books in those subject areas than did the university presses. They also concluded that, in general, commercial publishers charged about 25% more for the books they published than did university presses (114). There was no statistical reporting regarding whether or not this conclusion was statistically significant. This article, however, is one of the very few that made an attempt to compare the book prices between commercial publishers and noncommercial publishers.

Alison Mudditt (2016), the director of UC Press, depicts the grim situation of university presses. She observes that university presses such as UC Press are faced with both external and internal pressures. Externally, university presses have experienced a decline in monograph sales due to the fact that academic libraries increasingly rely on short-term loans and

demand-driven acquisition practices. Internally, university presses increasingly face the pressure from their parent institutions for financial accountability and reduced subsidies. And the costs of running both ebook and print book operations have created additional financial burdens for university presses. This article reflects the discussions and concerns in the current literature about the current market condition for university presses.

Because the current publishing model practiced by university presses is not believed to be sustainable, some researchers have started exploring alternative university publishing models. Scott Smart et al. (2016) developed an accounting framework for university presses so that their parent institutions can have an idea about the total costs of producing a monograph. Their analysis was based on the data from university presses at the University of Michigan and Indiana University. They classified the costs into a number of categories, including labor cost and printing cost. Because labor cost is part of the shared costs of producing various types of publications, including monographs, journals, trade books, and other publications, they allocated labor cost to monographs based on the percentage of time staff members spent working on monographs and applied that percentage to staff's full salaries. When calculating the printing cost, they were faced with various types of cost structures for a range of publications. They calculated the average printing cost from a number of randomly selected monograph titles and applied it to the weight factor (percentage) that measured high, medium, and low costs, respectively. To make the cost calculations more relevant for university press administrators, they also considered the preprinting costs of monographs, which include the total costs involved with turning an unpublished manuscript into a published monograph and exclude printing costs and royalties. Their model basically is an accounting approach that classifies the costs based on the activities they are associated with. It provides a useful accounting framework for universities to document, classify, calculate, and report relevant costs of producing monographs in-house.

Elisabeth A. Jones and Paul N. Courant (2014) studied the market effects of libraries' budgets and book sales of university presses. They challenged the general assumption that academic libraries' monograph budgets were adversely affected by the "serials crisis" and that their reduced purchases of monographs led to the decreased purchases of university press books and eventually to the decline in number of university presses. They examined the relationship between general monograph purchases and university press book purchases of select academic libraries between 1975 and 2010. They argued that the assumption was questionable because, for some libraries, declining purchases of university press books did not occur even though academic libraries in general faced serious budget problems. They pointed out that the sizes of libraries affected purchasing behavior. They observed that large-sized libraries' purchases of university



press books increased during the period when libraries' budgets in general were affected most by the "serials crisis" and that academic libraries' purchasing behavior relating to university press books differed from that relating to general monographs. Basically they argued that the demand variations measured by the sizes of academic libraries and the supply variations measured by university press books and general monographs exist for the scholarly book market. Studies that ignore these market factors can result in inaccurate conclusions.

Important aspects of the scholarly book market have been addressed in the representative studies discussed in this literature review. The studies of commercial publishers, increased ebook production and sales, and university presses address issues related to the supply side of the scholarly book market. The discussions on recent unexpected and unreasonable increases in ebook prices for academic libraries reflect the profit-making behavior of commercial publishers. However, the limitations are evident. There has been no consciously designed empirical research studying the publication factors influencing the print book and ebook prices in STM fields. The institution-based case studies with arithmetic calculations have no statistical inference. Their sample sizes tend to be small, and the coverage of the STM areas tends to be limited. Overall, there has been a lack of research efforts studying the factors affecting the STM book market in general and STM book prices in particular.

### THE LONG-TERM MARKET CONDITIONS FOR SCHOLARLY BOOKS IN THE FIELDS OF SCIENCE, TECHNOLOGY, AND MEDICINE

The long-term STM book market conditions are characterized by increases in the book supply, increases in book prices, and the stagnation and decline in book demand as indicated by academic libraries' monograph expenditures in the recent decade. These market conditions impose serious financial constraints on academic libraries.

#### *Market Supply*

The STM book market supply has been increasing since 1989. Annual book title production measures the total number of new books published on the market each year and reflects the new knowledge created in these books. It is an important aspect of the supply side of the book market. The changes in book title production have an impact on libraries' budgets. Almost all academic libraries have book approval plans in place to acquire newly published books in various subject areas that are part of their institutions' curricula for supporting their institutions' teaching and research missions and goals.

The historical data on book title production and book prices were compiled and explained by the Library Materials Price Index Editorial Board

of ALA's Association for Library Collections and Technical Services' Publications Committee (2017). Much of these historical data were gathered by librarians working at various university libraries using ProQuest Books (formerly Coutts) and GOBI Library Solutions (formerly YBP) and published in the *Library and Book Trade Almanac* (formerly *The Bowker Annual*), edited by Catherine Barr and Rebecca L. Thomas (2017). These reports provide the annual historical data on book title production and book prices in many subject areas between 1989 and 2015.

Figure 1 was graphed based on the data extracted from the above sources. It shows that there was an overall upward trend in book title production in North America from 1989 to 2015 for all the STM subject areas, although there were some fluctuations for a few subject areas in some years. The average number of book titles in all STM areas increased by 100% from 1989 to 2015. Book titles increased by 150% in engineering and by 160% in medicine in the same time period. This upward-moving trend in book title production puts a great deal of pressure on libraries' monograph expenditures if libraries plan to keep up with newly published books year after year.

### *Market Prices*

The long-term changes in book prices in STM subject areas demonstrate an overall upward-moving trend since 1989 as well (see fig. 2). Increased book prices reduce libraries' book-purchasing power. If libraries do not increase their book expenditures or find other ways to reduce or minimize the impact of book price increases on their book collections and services, their institutions' research and educational missions and goals can be undermined.

Figure 2 shows that book prices in all STM areas increased from 1989 to 2012. The average academic book price of twelve STM areas increased by 136%. Book prices increased by 148% in science and by 175% in math during the same time period. Although book prices came down a little bit from 2012 to 2013, they increased again from 2014 to 2015. It was reported by the Library Materials Price Index Editorial Board of ALA's Association for Library Collections and Technical Services' Publications Committee that "the overall average price for books in the North American Academic Book Price Index for 2015 increased 1.3%, a slight hike from the previous year" (2017, 362). The downward price movements in a year or two can be considered as short-term price fluctuations because in the long-run, book prices will continue to increase. Academic libraries' strategies for book collections and acquisitions should be long-term as well.

Inflation is an important factor in the overall economy and a significant factor for libraries' budgets because it reduces the book-purchasing power of each unit of money. The Library Materials Price Index Editorial Board of ALA's Association for Library Collections and Technical Services' Publi-

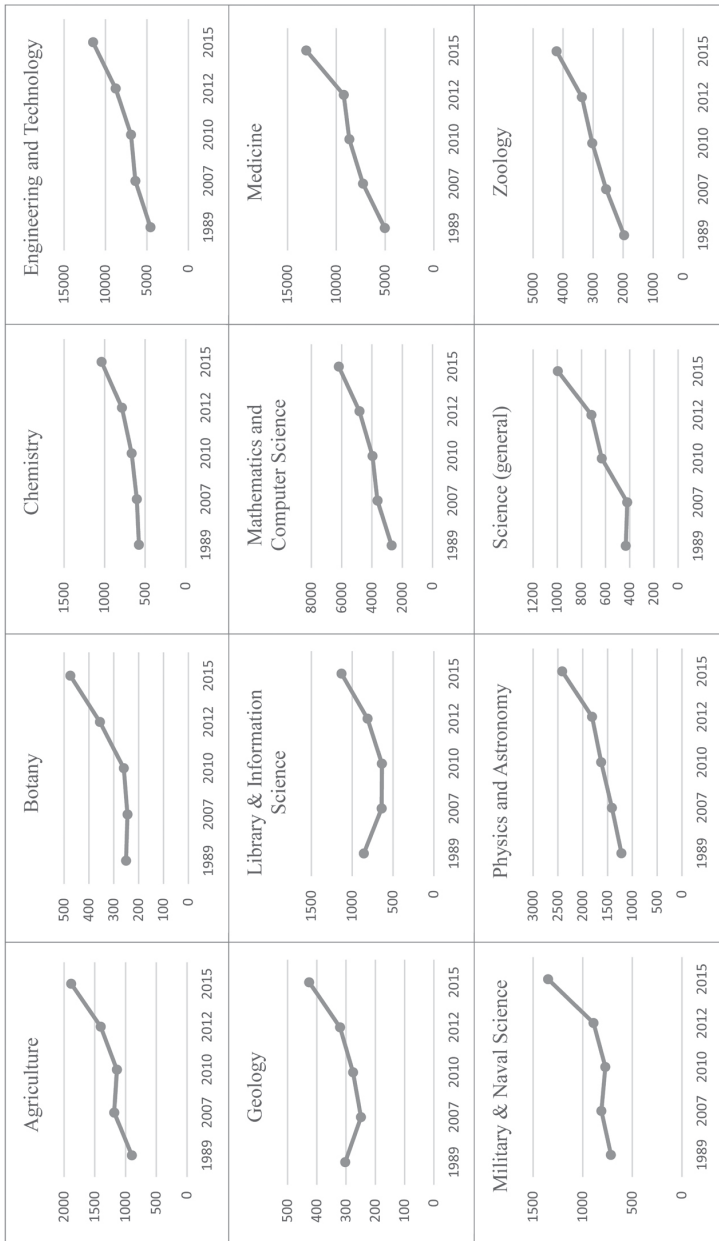


Figure 1. North American academic books: number of book titles published from 1989 to 2015 in 12 STM subject areas

Sources: Data were extracted from the 2017 *Library and Book Trade Almanac*, ed. Catherine Barr and Rebecca L. Thomas, table 4, pp. 280–81; the 2014 *Library and Book Trade Almanac*, ed. David Bogart and Alan Inouye, table 4, p. 432; and the 2011 *Library and Book Trade Almanac*, ed. David Bogart and Julia C. Blixrud, table 4, pp. 468–69.

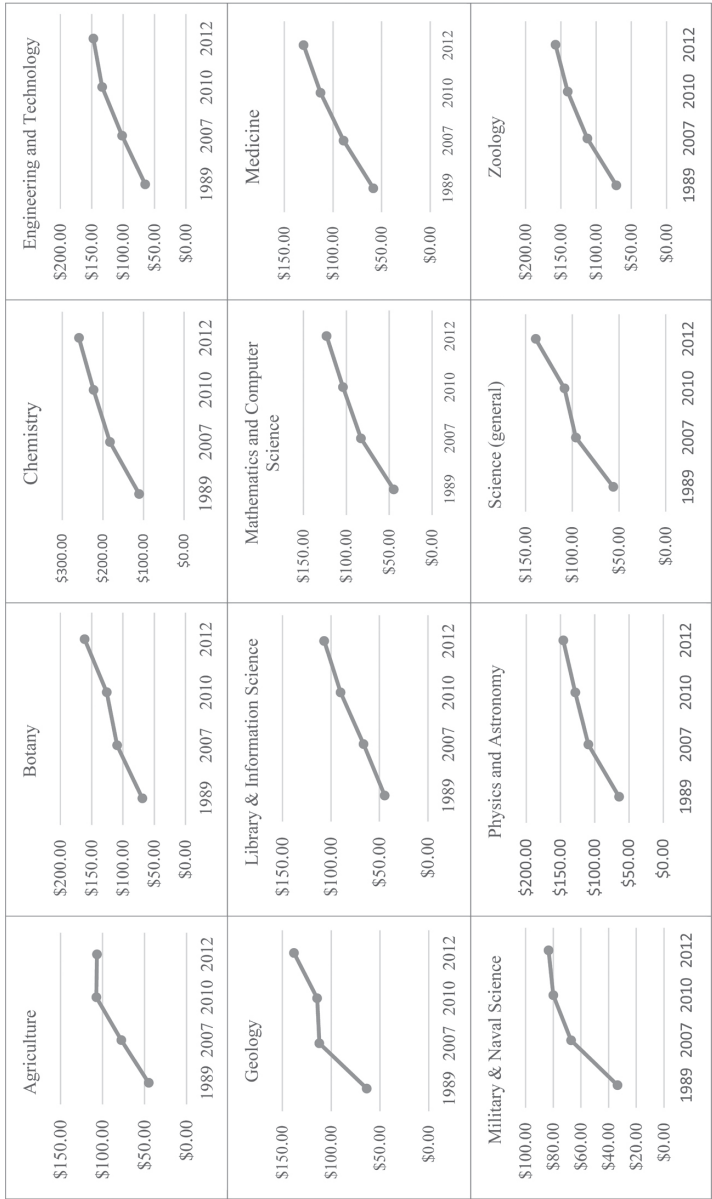


Figure 2. North American academic books: average book prices from 1989 to 2012 in 12 STM subject areas

Sources: Data were extracted from the 2017 *Library and Book Trade Almanac*, ed. Catherine Barr and Rebecca L. Thomas, table 4, pp. 280–81; the 2014 *Library and Book Trade Almanac*, ed. David Bogart and Alan Inouye, table 4, p. 432; and the 2011 *Library and Book Trade Almanac*, ed. David Bogart and Julia C. Blixrud, table 4, pp. 468–69.

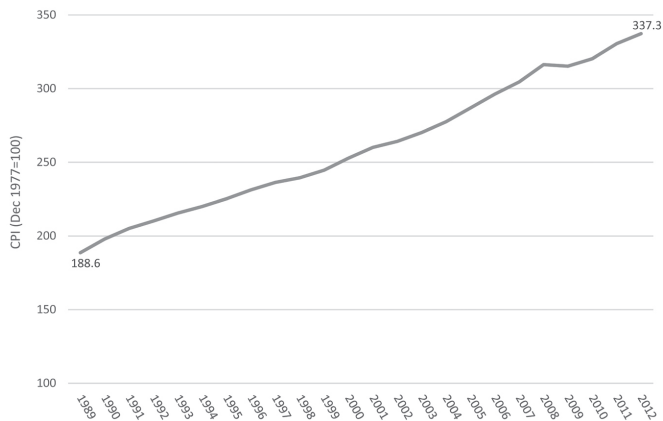


Figure 3. Consumer Price Index from 1989 to 2012

Source: Bureau of Labor Statistics (2018). Consumer Price Index Research Series Using Current Methods (CPI-U-RS).

Note. 1989=188.6 (AVG). 2012=337.5 (AVG). The accumulated inflation rate from 1989 to 2012 was 78.95%.

cations Committee (2017) compiled documents that provide the inflation data on various types of publications, such as books and journals. However, its consumer price indexes for academic books are not available for the 1989–2015 time period, and the US consumer price index data used by the Board only covered the 2012–2015 period (2017, 348). Figure 3 was graphed based on the consumer price index data from the Bureau of Labor Statistics. It shows that the accumulated inflation increased by 78.95% from 1989 to 2012 (188.6 in 1989 and 337.5 in 2012), with an average annual inflation rate of 3.43%. Unless libraries' expenditures increase at this rate, it is unlikely that they would be able to keep up with newly published books over time. In fact, many academic libraries in the US have not been able to increase their monograph expenditures since at least 2008 (see fig. 6).

Considered together, figure 2 and figure 3 demonstrate that increases in STM book prices far outpaced inflation with a 136% increase in the average STM book price from 1989 to 2012 and a 78.95% increase in inflation during the same time period.

STM books are more expensive than their counterparts in other subject areas because the labor cost of producing them and the market demand for them are much higher. The research results in STM fields have practical applications for developing new products and services and can generate a great deal of profit for businesses and industries. Figure 4 provides a price comparison between STM books and books in non-STM subject areas using the data from the *Library and Book Trade Almanac* (formerly *The*

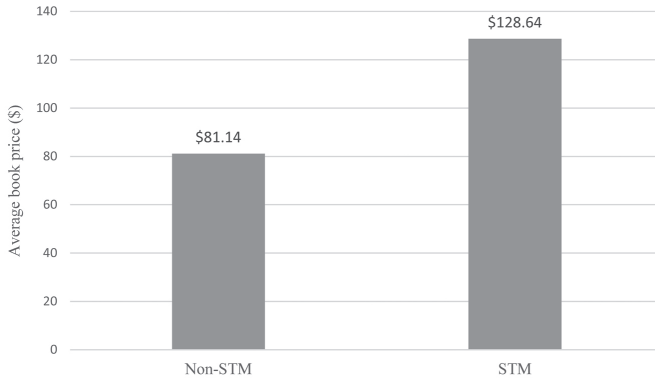


Figure 4. Comparison between the average price of STM books and the average price of non-STM books

Source: Data were extracted from the 2017 *Library and Book Trade Almanac*, ed. Catherine Barr and Rebecca L. Thomas, table 4, pp. 280–81.

*Bowker Annual*) (Barr and Thomas 2017). It shows that the average price of non-STM books in 2015 was \$81.14, whereas the average price of STM books in STM subject areas in 2015 was \$128.64, about 58.5% higher than that of their counterparts in non-STM fields.

The STM book market is dominated by commercial publishers in terms of the total number of publishing entities and the market share of total book production. Figure 5 shows the market presence in terms of publishers. Commercial publishers account for 91% of the total number of STM book publishers (see table 1, on p. 273, below). Given their dominant market presence and lack of competition in the STM book publishing market, it is likely that they charge libraries higher prices for the books they have published.

#### *Market Demand*

While the book supply, book prices, and inflation have been moving upward, the demand side of the market as measured by academic libraries' monograph expenditures has been stagnant/declining in recent years, particularly the demand from master's- and bachelor's-degree-granting institutions, which greatly outnumber doctoral-degree-granting institutions. The continuous increases in the STM book supply, book prices, and inflation have compounded effects on academic libraries' monograph expenditures. They require academic libraries to increase their expenditures for books to keep up with the changes in these market trends since their budgets are stretched by increased book titles and their purchasing power is eroded by increases in book prices and inflation.

Figure 6 was graphed based on the data extracted from the National

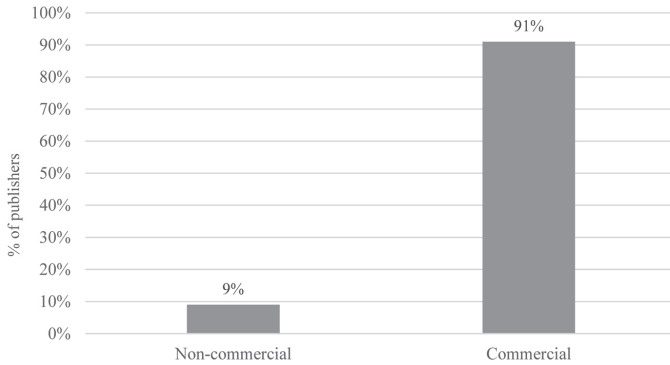


Figure 5. Average percentage of commercial publishers and noncommercial publishers in 14 STM fields

Source: Table 1.

Center for Education Statistics’ datasets: ALS (2002–2012) and IPEDS (2015).<sup>3</sup> It shows that from 2002 to 2008, the average libraries’ monograph expenditures of master’s- and bachelor’s-degree-granting institutions increased by 9.5% and 3%, respectively. The average libraries’ monograph

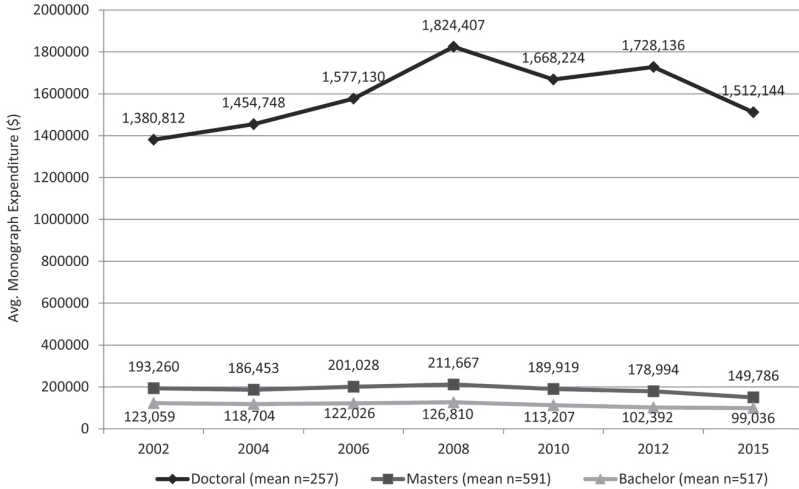


Figure 6. The average monograph expenditure by institution type, 2002–2015

Source: National Center for Education Statistics: ALS and IPEDS (see n. 2). The data from 2002 to 2012 were collected from ALS datasets. The data in 2015 were collected from the IPEDS dataset.

Note: The number of doctoral-degree-granting institution libraries ranges from 256 to 258. The number of master’s-degree-granting institution libraries ranges from 578 and 597. The number of bachelor’s-degree-granting institution libraries ranges from 491 to 533.

expenditures of doctoral-degree-granting institutions increased by 32% during the same time period. From 2008 to 2015, however, the average libraries' monograph expenditures of all three types of higher education institutions decreased. Although there was a short spike between 2010 and 2012 for doctoral-degree-granting institutions, their 2015 average monograph expenditures reduced to below the 2006 level. In 2015, the average libraries' monograph expenditures of both master's- and bachelor's-degree-granting institutions reduced to below the 2002 level.

Given the diverging trends between academic libraries' decreased purchasing power and increased book supply and book prices, it is important to closely examine some important factors that directly affect STM book prices in order to minimize book collections and acquisitions costs and maximize academic libraries' increasingly squeezed resources.

### FACTORS THAT DIRECTLY AFFECT STM BOOK PRICES

Our current empirical study examines some important factors that directly influence scholarly book prices in the fields of science, technology, and medicine, including book length, book binding type, book format, book publishers' type, and geographical publication locations.

This study is unique in number of ways. First, it applies the semilogarithmic model to the analysis of various book publication factors that affect book prices. Because of its semilogarithmic nature, this model can be used to estimate various dichotomous variables affecting book prices since it is a good fit for analyzing dichotomous relationships. This model has been proven to be effective in estimating factors affecting scholarly journal prices in business subject areas (Liu 2011) and STM areas (Liu and Gee 2017). A previous study using a regular linear regression model for estimating journal prices failed to generate statistical significance (Ortelbach, Schulz, and Hagenhoff 2008).

Second, it is an empirical study of the factors influencing scholarly book prices in STM areas. The advantage of this empirical research is that it has a large sample size and comprehensive subject coverage. The sample in this study includes 8,486 books, approximately three hundred publishers, and covers fourteen STM subject areas as opposed to case studies with only a few publishers and a handful of book titles in a limited number of subject areas. The larger sample size of the data is better representative of the population. Therefore it will decrease the statistical bias and strengthen the statistical inference argument.

Third, the books in the analysis are organized by STM subject-specific area. The rationale behind this data organization is that book prices vary from one subject area to another. This is because the demand for books varies across subject areas. For example, books in chemistry are more expensive than books in mathematics since the market demand for chemistry books can be higher and more urgent than the demand for



mathematics books. Lumping them together would reduce the accuracy of the estimates. The regressions by subject grouping have shown that this approach provides better results (Liu 2011; Liu and Gee 2017).

### *Hypotheses*

Five hypotheses related to book prices in STM areas were tested using a modified model from Liu's 2011 original econometric equation. They reflect the relationship between the dependent variable and a number of independent variables.

- H1: It is hypothesized that the total number of pages in a book affects the price of the book. As the total number of pages increases, the costs of labor and materials will increase as well.
- H2: It is hypothesized that the quality of a book cover affects the book price. A cloth/hardcover book requires better material and more labor, therefore is more costly than a paperback book.
- H3: It is hypothesized that ebooks are more expensive than print books based on recent studies and complaints from practicing librarians that commercial publishers overcharged their libraries for their ebooks (e.g., Stearns and Unsworth 2014).
- H4: The business model of commercial publishers is to make a profit. Given commercial publishers' dominance in the scholarly book market in general and the STM book market in particular, it is hypothesized that books published by commercial publishers are more expensive than those published by noncommercial publishers. Noncommercial publishers are university presses, scholarly society presses, scholarly association presses, and nonprofit foundation and educational center publishers whose ultimate goal is not profit.
- H5: Books in the English language are mostly published in the US, Canada, UK, and some other English-speaking and European countries. Because economic conditions vary from country to country, it is hypothesized that book prices vary across countries and regions. Dummy variables are used to differentiate book prices by country and region.

### *Model*

Following Lewis G. Liu's (2011) scholarly journal study, a modified semi-logarithmic econometric model was applied to this book study. The following multivariate semilogarithmic equation shows the relationship between the dependent variable and various independent variables:

$$\ln BKPRICE_i = \beta_0 + \beta_1 PAGE_i + \beta_2 CLOTH_i + \beta_3 EBOOK_i + \beta_4 COM_i + \beta_5 US_i + \beta_6 CANADA_i + \beta_7 UK_i + \beta_8 EUROPE_i + \epsilon_i$$

$\ln BKPRICE$  is the dependent variable and measures 2016 book prices listed by Proquest Oasis (formerly Coutts) in the natural logarithmic form.

The independent variables are the following:

Continuous Variable:

PAGE =the total number of pages of a book

Binary Variables:

CLOTH=1 if a book has cloth/hardcover. Otherwise it is coded 0.

EBOOK =1 if a book is an electronic book. Otherwise it is coded 0.

COM=1 if a book is published by a commercial publisher. Otherwise it is coded 0.

US=1 if a book is published in the US. Otherwise it is coded 0.

CANADA=1 if a book is published in Canada. Otherwise it is coded 0.

UK =1 if a book is published in the UK. Otherwise it is coded 0.

EUROPE=1 if a book is published in a European country other than the UK. Otherwise it is coded 0.

$i$  =a cross-section vector:  $i=1, \dots, n$ .

$\varepsilon$  =the statistical disturbance.

The dependent variable,  $\ln BKPRICE$ , is natural log transformed, while all the independent variables are in their original scale.

#### *Data Collection*

The data on STM books were collected from Proquest Oasis (formerly Coutts), which is used by many academic libraries for their book collections, acquisitions, and management. Subject searches in fourteen STM subject areas were consistent with those used in Liu and Gee's (2017) STM journal price study. ProQuest Oasis searches were conducted for each STM area on the Advanced Search form of the Search All Titles page. A number of limiters were used to create the search criteria. The Copyright Year field was set for the year 2016. The Date Search field was limited to a customized date range of 1/1/2016 through 12/31/2016. The Publication Date option in the Date Search subfield was selected. The Readership Level field selections were Lower Undergraduate, Upper Undergraduate, and Graduate-Research. Library of Congress was selected for the Classification field. In conjunction with this, a Select Classification filter was used for the respective Library of Congress Classification letters for each category. Then a hierarchical classification scheme was selected to narrow down the searches to the subclassifications. The Language field was set to English. For the Binding/Format field, the selections were Cloth/Hardcover Book, Paperback, and Electronic Book. Finally, in the Maximum Results field, the 200 default was changed to display 3000, which was the highest option offered.

#### *Descriptive Statistics*

Descriptive statistics for all the variables are presented in table 1.

Table 1. Descriptive Statistics Results: Total Number of Books, Mean Book Price, Mean Page Numbers, and Proportions for Dummy Variables by Subject Area

	#BOOK	BKPRICE	PAGE	CLOTH	EBOOK	COM	US	CANADA	UK	EUROPE
Agricultural sciences	225	190.79	352.32	0.267	0.596	0.920	0.302	0.031	0.147	0.347
Biological sciences & biological engineering	490	192.64	371.31	0.259	0.537	0.876	0.378	0.006	0.194	0.341
Chemistry & chemical engineering	787	282.62	408.27	0.291	0.531	0.957	0.258	0.038	0.198	0.391
Computer science & information science	852	133.90	345.89	0.180	0.410	0.973	0.317	0.000	0.103	0.502
Ecological & environmental sciences	330	148.23	347.38	0.361	0.279	0.839	0.306	0.012	0.333	0.282
Engineering	970	173.49	428.96	0.247	0.621	0.955	0.258	0.002	0.224	0.378
Food sciences	261	203.88	437.98	0.245	0.510	0.969	0.299	0.015	0.479	0.161
Geological sciences	224	153.54	388.16	0.277	0.513	0.853	0.228	0.004	0.129	0.545
Materials sciences	636	193.58	433.50	0.341	0.502	0.967	0.275	0.009	0.230	0.377
Mathematics	1142	126.96	369.35	0.447	0.468	0.848	0.292	0.007	0.151	0.464
Medical, nursing, health, & psychiatry	747	188.15	388.58	0.154	0.620	0.921	0.394	0.015	0.252	0.280
Pharmacy and pharmaceutical sciences	374	153.44	442.32	0.334	0.452	0.912	0.447	0.016	0.219	0.278
Physics and astronomical sciences	770	195.49	362.41	0.205	0.565	0.912	0.188	0.010	0.105	0.556
Plant, animal, & zoological sciences	678	152.23	403.06	0.381	0.403	0.807	0.425	0.013	0.202	0.288
Total	8486									
Average		176.57	390.61	0.287	0.507	0.910	0.307	0.012	0.195	0.390

Table 1 shows that the percentages of the books published in the US range from 18.80% in physics and astronomical sciences to 44.70% in pharmacy and pharmaceutical sciences. On average, about 31% of books in fourteen STM areas were published in the US. The percentages of the books published in the UK range from 10.3% in computer and information sciences to 47.90% in food sciences. On average, 19.5% of books in fourteen STM areas were published in the UK.

The percentages of the books published in Europe (excluding the UK) range from 16.10% in food sciences to 55.60% in physics and astronomical sciences. On average, 39% of books published in fourteen STM areas were published in Europe. On average, only 1.2% of STM books were published in Canada. The US, the UK, Europe, and Canada accounted for about 90% of the total number of STM books published in 2016. Other countries and regions accounted for only about 10% of STM books published in the same year.

Ebooks accounted for 27.90% of the books published in ecological and environmental sciences (the lowest) and 62.10% in engineering (the highest). On average, about 51% of all the published books in fourteen STM areas in 2016 were ebooks. The average book price (BKPRICE) of fourteen STM areas in 2016 was \$176.57. The average number of pages of STM books (PAGE) was 391. Cloth/hardcover (CLOTH) books accounted for 28.7% of all STM books. Commercial publishers (COM) accounted for 91% of all STM book publishers.

The books published in chemistry and chemical engineering were the most expensive among all the STM subject areas (average price = \$282.62), whereas books published in mathematics were the least expensive (average price = \$126.96). These findings are consistent with those in STM journals (Liu and Gee 2017). Of the total number of pharmacy and pharmaceutical science books, 44.7% were published in the US. It reflects the strong presence of the pharmaceutical industry and market in the US. Ebooks accounted for 62% of the total book publications in medicine and health related fields and 62.1% in engineering, which reflects the demand for the timely access to the books in these fields.

Figure 7 shows the market share of the top four commercial publishers: Springer, Taylor & Francis, Elsevier, and Wiley. They accounted for 66.68% of the total number of STM books published by all the commercial publishers in 2016, revealing the oligopoly behavior of a handful of commercial publishers.

### *Regression Results*

Table 2 shows the regression results.

The adjusted *R* squared value measures the total variance of the dependent variable that is accounted for by the observed variables. The average adjusted *R* squared value of fourteen STM subject regression groups is

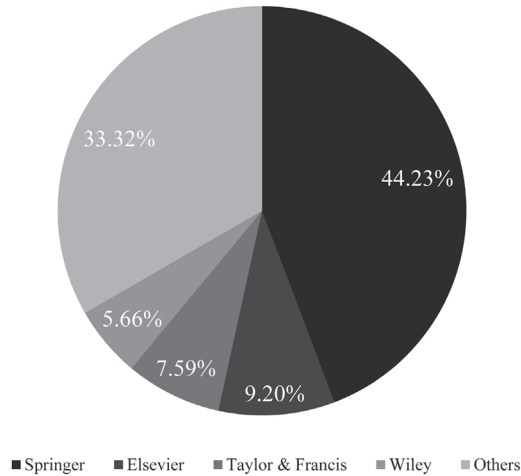


Figure 7. The market share of the top four commercial publishers in the total number of commercially published STM books in 2016

0.41, indicating that, overall, 41% of the STM book price variance, which is a significant amount, is accounted for by the observed variables.

The effect of the coefficients is measured in percentage because of the application of the semilogarithmic model. The coefficient value of continuous variables is the direct percentage interpretation of its value. However, the interpretation of dummy variables is not the same as that of continuous variables and needs special calculations. Many previous studies misinterpreted the coefficients of dummy variables in semilogarithmic regression models. Halvorsen and Palmquist (1980) originally pointed out the mistake and proposed a formula to correct it. Kennedy (1981) further minimized the estimate bias in Halvorsen and Palmquist's calculation. In this study, all the coefficients of dummy variables were calculated using Kennedy's conservative formula ( $g = \exp [c - \frac{1}{2}V(c)] - 1$ ) so that the coefficient values would not be overestimated.

The coefficients of the PAGE, CLOTH, and EBOOK variables show the high statistical significance for all the fourteen STM areas, confirming the hypotheses that books with more pages are more expensive; books with cloth/hardcover are more expensive than books with paperback; and ebooks are more expensive than print books. The coefficients of the COM variable are also highly significant for all the STM areas except for mathematics, and one coefficient is negative. On average, books with cloth/hardcover are 65% more expensive than books with paperback; ebooks are 88% more expensive than print books; and books published by commercial publishers are 61% more expensive than books published by non-commercial publishers.





Table 2. continued

	INTERCEPT	PAGE	CLOTH	EBOOK	COM	US	CANADA	UK	EUROPE
<b>Medical sciences, nursing, health sciences, and psychiatry</b>									
Coeff	3.77600***	0.00060***	0.77130***	1.20500***	0.28090***	-0.30850***	-0.24320	-0.27880**	0.01080
SE	0.11410	0.00006	0.06292	0.04858	0.07242	0.08371	0.17500	0.08653	0.08556
g		0.00060	1.15830	2.33282	0.32085	-0.26802	---	-0.24614	---
N	747								
Adjusted R <sup>2</sup>	0.575								
<b>Pharmacy &amp; pharmaceutical sciences</b>									
Coeff	3.50900***	0.00035***	0.67670***	0.60000***	0.55460***	0.14560	-0.03805	0.10280	0.36200*
SE	0.17060	0.00006	0.07689	0.07269	0.09799	0.14020	0.24960	0.14530	0.14250
g		0.00035	0.96157	0.81731	0.73290	---	---	---	0.42169
N	374								
Adjusted R <sup>2</sup>	0.358								
<b>Physics &amp; astronomical sciences</b>									
Coeff	3.74300***	0.00087***	0.50460***	0.47730***	0.37720***	-0.21850**	0.30220	-0.03896	0.06707
SE	0.11690	0.00006	0.06229	0.05025	0.09299	0.07268	0.20510	0.09892	0.06049
g		0.00087	0.65311	0.60968	0.45190	-0.19840	---	---	---
N	770								
Adjusted R <sup>2</sup>	0.320								
<b>Plant, animal, &amp; zoological sciences</b>									
Coeff	3.80700***	0.00047***	0.41840***	0.34980***	0.70720***	-0.17810*	0.11400	-0.12530	0.18470*
SE	0.09700	0.00007	0.05480	0.05434	0.05469	0.08163	0.19010	0.08774	0.08411
g		0.00047	0.51725	0.41669	1.02527	-0.16592	---	---	0.19861
N	678								
Adjusted R <sup>2</sup>	0.419								
Average g		0.09%	64.56%	87.75%	60.79%	-21.00%	---	-19.25%	19.83%

Notes: g=exp [c - 1/2V(c)]-1 for binary variables, g=coefficient itself for continuous variables. Hyphens “-” denote that nonsignificant coefficient values are not calculated. Statistical significance levels: \*p < .05, \*\*p < .01, \*\*\*p < .001. The average g for 8 observed variables for 14 subject areas was calculated based on the number of significant coefficients and interpreted as such.



The coefficients of US, UK, and EUROPE dummy variables are statistically significant with various degrees. Of the coefficients of the US variable, 64% are statistically significant. Except for one subject area, all of them are negative, indicating that these books published in the US are less expensive than the books published in other countries. Of the coefficients of the UK variable, 43% are statistically significant. All of these UK coefficients are negative, showing that these books published in the UK are less expensive than the books published in other countries. Of the coefficients of the EUROPE variable, 43% are statistically significant. All of these coefficients of the EUROPE variable except for one are positive, indicating that these books published in Europe (excluding the UK) are more expensive than the books published in other countries. Only one coefficient for the CANADA dummy variable is significant.

## DISCUSSION

This empirical research has yielded some significant results that may have a number of policy implications for academic libraries' book collections, acquisitions, and management. First, cloth/hardcover books on average are 65% more expensive than paperback books and accounted for 28.7% of the total books published in the STM fields. These factors can significantly affect libraries' budgets. If libraries acquire paperback books instead of cloth/hardcover books, then they can save about 18.7% ( $0.287 \times 0.65$ ) of their total book expenditures. Of course, cloth/hardcover books have longer shelf lives. But, given the fact that ebooks have been increasingly taking more share of the total book collections in libraries, book shelf lives may become less of a concern in the future. Large-sized libraries with a large volume of STM book acquisitions each year may consider in-house cloth bindings for paperback books or outsource paperback books to specialized cloth/hardcover book-binding services. The average cost decreases as book-binding volumes increase due to economies of scale that often exist for large-sized libraries. As long as the costs are less than 65% of the cloth/hardcover book price, libraries can benefit from the cost savings of this operation.

Second, books published in Europe (excluding the UK) are more expensive than books published in the US, the UK, and other countries in the fields of biology and biological sciences, chemistry and chemical engineering, ecology and ecological sciences, pharmacy and pharmaceutical sciences, plant and animal sciences, and zoology. The EUROPE dummy variable includes Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Poland, Sweden, and Switzerland. Because Springer (based in Germany) and Elsevier (based in the Netherlands) take a large STM book market share in our sample, it can be argued that books published in Germany and the Netherlands by these two large book-publishing houses

can be more expensive than books published in other European countries.

Price-conscious library collections managers would consider this geographical location factor when making book purchases in these STM subject areas. Some scholarly books are unique and specifically demanded by library users, and cannot be replaced by others. In that case, the book price is not an issue. Libraries have to acquire them for their users regardless of the price. However, in many cases when the books cover the same or similar contents, the cheaper alternative can be libraries' acquisition choice. The cost savings from the cheaper alternatives in these fields can be 19.83%.

Third, the findings show that ebooks on average are 88% more expensive than print books in fourteen STM subject areas. This finding has confirmed the librarians' complaints their libraries' ebooks were overcharged by commercial publishers. Given the low marginal cost of an ebook and the fact that about 91% of publishers in our sample are commercial publishers, it is evident that commercial publishers overcharged libraries for ebooks. Library managers should be aware of this fact and may consider forging regional and national coalitions to increase their bargaining powers with commercial publishers to reduce ebook prices.

It should be pointed out that many reports using the arithmetically calculated average value to determine the two dichotomous values (ebook price vs. print book price) could be misleading because a few outliers in the sample can skew the mean. The outliers have extreme high and low values and severely affect the arithmetic mean. The effect of the statistical skewness is much worse in the dichotomous comparison and small samples. The use of the arithmetically calculated mean for comparing ebook and print prices with no statistical testing is most likely not an accurate and reliable measure.

Finally, commercial publishers on average charged 61% more than noncommercial publishers for books in almost all the STM subject areas in this study. Although this overcharging rate is lower than that of STM journals (102%, Liu and Gee 2017, 167), it is still a large profit margin compared with those in other industries. This demonstrates the excessive profit-making behavior of commercial publishers. The use of the COM dummy variable in the regression model for commercial publishers is in essence a cross-sector analysis that compares nonprofit organizations with for-profit enterprises with respect to book prices. One of the advantages of using the semilogarithmic model is that its coefficient not only permits the cross-sector analysis (commercial vs. noncommercial) but also facilitates the cross-industry analysis. While the cross-sector analysis reveals the additional profit commercial publishers generate as compared with their noncommercial counterparts in the scholarly book-publishing industry, the cross-industry analysis can be used to show the additional profit com-

mercial publishers make as compared with their for-profit counterparts in other industries. The measure of net profit margin is often used for a firm's profitability: it is the net income-to-sales revenue ratio used to measure a firm's net profitability after taxes and all operating and nonoperating expenses. The finding of 61% from the semilogarithmic regression model in this current study is the average value of the coefficients of commercial publishers, which measures the average profit made by commercial publishers. It is the profit made on top of the fair market value (price charged by noncommercial publishers), which can be formulated as  $100\% [(P_2 - P_1) \times \text{Units}] / (P_1 \times \text{Units})$ , where  $P_2$  is the price charged by commercial publishers and  $P_1$  is the price charged by noncommercial publishers. "Units" are the total number of books sold, which can be canceled out given the assumption that commercial publishers and noncommercial publishers sell the same quantity at different prices. The new simplified formula is  $100\% (P_2 - P_1) / P_1$ . It is equivalent to the profit margin that has already factored in all the labor and material costs, operating expenses, and nonoperating expenses before taxes. Commercial publishers' profit minus the taxes paid is their net profit margin. If Apple Inc.'s 2016 tax rate of 25.6% is applied to commercial publishers' 61% pretax profit margin, then the commercial publishers' income tax expense rate is 0.156 ( $0.256 \times 0.61$ ).<sup>4</sup> The net profit margin for commercial publishers after tax is 0.45 ( $0.61 - 0.156$ ). This means that the commercial publishers' net profit margin is 45%, much higher than those of ten the most profitable companies in the US except for Altria Group, the tobacco company. Table 3. shows the net profits of the ten most profitable companies in the US ranked by Fortune.

Some may argue that commercial publishers have additional advertising expenses that do not incur to noncommercial publishers. According

Table 3. Net Profit Margin Comparison between the Fortune 500's 10 Most Profitable Companies and Commercial Scholarly Book Publishers, 2016

Company	Net Profit Margin
1. Apple, Inc.	21%
2. J.P. Morgan Chase	23%
3. Berkshire Hathaway	11%
4. Wells Fargo	23%
5. Alphabet	22%
6. Bank of America	19%
7. Microsoft	20%
8. Johnson & Johnson	23%
9. Citi Group	18%
10. Altria Group	74%
Commercial Publishers	42%*

Sources: Jen Wieczner (2017). "The Fortune 500's 10 Most Profitable Companies."

Note: \*Calculations based on this study

to the data from the *2014 Almanac of Business, Financial Industrial Ratios* (Troy 2014, 257), the average advertising expense-to-operating ratio is 3.13% for eleven different-sized book publishers. The operating income is the earnings before taxes and interest expenses. Obviously, this is only a small portion of commercial publishers' profit. If this 3% advertising expense is deducted from 45% of commercial publishers' net profit margin, then commercial publishers' final net profit margin is 42%.

Others may argue that noncommercial publishers such as university presses are subsidized. But the amount of subsidies from parent institutions of university presses is also small compared with the large net profit margin gained by commercial publishers. Scott Sherman (2014) reported that university presses of average-sized institutions receive between \$150,000 and \$500,000 in subsidies. This amount is only a small fraction of a large commercial publisher's profit since it publishes at least hundreds of books with various formats per year and sells them to at least hundreds of academic libraries with the average price of around \$177 per book (see table 1), amounting to tens of millions of dollars in profit. This means that book-publishing subsidies of university presses cannot be used as a reason for justifying the large price differential between commercial and noncommercial publishers.

## SUMMARY AND CONCLUSION

In this study, we have explored the determinants of STM book prices, analyzed market supply and demand factors, and discussed how they affect libraries' monograph expenditures. We have specifically examined the market effects of the types of STM book suppliers (commercial vs. noncommercial), product features (book length and cloth/hardcover vs. paper cover), product formats (ebooks vs. print books), and production locations of book suppliers (various geographical locations of publications). We have proposed some cost-saving strategies for academic libraries based on our findings. The long-term and current STM book market trends have also been analyzed. A number of findings have policy implications for academic libraries' book collections and acquisitions. The cost savings from paperback books and from book acquisitions in lower-priced publication locations are significant for academic libraries. More importantly, the findings show that commercial publishers have been increasingly dominating scholarly book publishing in science, technology, and medicine. Their dominance of the STM book market is also characterized by a handful of large-sized commercial publishers controlling 67% of the total STM commercial book publications. Such dominance gives these commercial publishers oligopoly power to overcharge libraries for books in general and ebooks in particular. Some practicing librarians' argument that commercial publishers overcharge their libraries for ebooks has now been empirically confirmed in this large-scale study.

Librarians need to find ways to effectively negotiate with commercial publishers before ebook acquisitions turn into the “ebook crisis.” Currently, many academic libraries use two supplementary book collection management approaches, namely, short-term loans and demand-driven acquisitions, to deal with market and budget pressures. With the short-term loan approach, libraries request ebooks demanded by their users via e-interlibrary loans and print books via regular interlibrary loans for a short period of time. With the demand-driven acquisition approach, libraries mostly purchase books that are requested by their users instead of purchasing all the books published year after year. While these two approaches helped many academic libraries get the books they need without increasing their book expenditures in the past, ebook prices charged by commercial publishers are much higher than print books. High ebook prices have already impacted many academic libraries, as evidenced by Susan Stearns and John Unsworth’s letter (2014) sent to the *Chronicle of Higher Education*. One solution to increased book prices, particularly ebook prices, is to form regional or national library coalitions to expand libraries’ bargaining power with commercial publishers. The other is to create and support a competing market force in the STM book market. The very existence of noncommercial publishers in the market is actually a competing force to commercial publishers. But there are too few of them, and their numbers are shrinking partly because of the decline of university presses. The recent development of the library-university press partnership and the Library Publishing Coalition (LPC) is encouraging, although their future roles in STM book publishing are unclear. Academic libraries and universities should make conscious efforts to support organized STM book-publishing endeavors by nonprofit entities. These efforts help to maintain a competing publishing force in the STM book market. As a result, the equilibrium of the STM book market can be sustainable in the long run.

## NOTES

1. “John Harvard wills his library (400 books) and half his estate to the College” (“Historical Facts,” n.d.).
2. National Center for Education Statistics (ALS [Academic Library Survey] data files for 2002–2012, accessed January 20, 2018), [https://nces.ed.gov/surveys/libraries/aca\\_data.asp](https://nces.ed.gov/surveys/libraries/aca_data.asp); National Center for Education Statistics (IPEDS [Integrated Postsecondary Education Data System] access databases, accessed January 20, 2018), <https://nces.ed.gov/ipeds/use-the-data/download-access-database>.
3. See n. 2.
4. Apple Inc.’s tax rate for 2016 (25.6%=Income tax/Earnings before tax=\$15,685,000,000/\$61,372,000,000), <http://www.nasdaq.com/symbol/aapl/financials?query=income-statement>.

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Lewis G. Liu, professor at Baruch College of the City University of New York, earned a PhD from the University at Buffalo, specializing in economics and higher education, an MS from the University of Illinois at Urbana-Champaign, and an MBA degree. He has authored and edited a number of books and book series in economics, business, and library and information science. His research articles have appeared in the *Journal of the Academy of Business Education*; *Library Quarterly*; *College & Research Libraries*; *Library Trends*; and *Library Collections, Acquisitions, and Technical Services (LCATS)*. He has taught and teaches courses in macroeconomics, global economic growth and development, economics of information, business information research, and undergraduate and graduate seminars on Bloomberg and Reuters real-time trading systems.

Harold Gee is an associate professor at Baruch College of the City University of New York. He teaches undergraduate information studies courses, and seminars for undergraduates and MBA graduate students on the Subotnick Financial Services Center trading floor. He received his MBA from St. John's University, an MLS from Queens College, and a BS from New York University. His research interests include business information and commercial publishing costs. He has published research articles in *Library Quarterly* and the *Journal of Business & Finance Librarianship*. He has worked as an information professional at LexisNexis, Lazard, and Lehman Brothers. This and his other previous careers as an assistant dean, an adjunct professor of economics, a financial analyst, and a stockbroker are all together professional experiences that valuably assist in his current work.

Charles Terng is an assistant professor and data services specialist at Baruch College of the City University of New York. He teaches an undergraduate course on data mining for business analytics in the Computer & Information Systems department and conducts workshops on statistical programming using R language. He received a master's degree in data analytics and a master's degree in library and information sciences from Rutgers University.