Chapter 1

General Introduction

and Methodology
1.1. Introduction

Scientific scholarly journals are one of the most important media for scholarly communication. Scientists have many kinds of forums and media for communication about their research. They participate in face-to-face seminars and meet at conferences. They use paper mail to send articles to their colleagues. They publish their articles/research papers in journals, books and conference proceedings. The mix of these forums and their relative importance varies from field to field. Earlier researches have shown that scientists depend/prefer more on journals than any other form of information sources (King and Tenopir, 2000).

There has been an economic crisis in scholarly publishing since the late 1980's due to the spiraling costs of scientific journals (Houghton, 2001; Johnson, 2000; Odlyzko, 1997). Libraries were the first to experience the effects of the breakdown as they struggled to keep up with the exploding volume and cost of journals in science, technology, and medicine. As the unit cost of serials in major research libraries soared, libraries were forced to cancel millions of dollars worth of subscriptions.

1.2. A Brief History of Scholarly Publishing

In 1665, the Royal Society of London published the first issue of the first scholarly journal titled "the Philosophical Transactions of the Royal Society of London". The purpose of that journal was to disseminate research results of the members of the society and to reach a wider audience than they would by exchanging private letters. Journals soon became a means of establishing priority for new discoveries, were accepted as the permanent record of research and were archived by libraries. Peer review of all or most articles was instituted as a means of screening and improving what was published. Citations to earlier articles provided a way to weave previous research into the fabric of the new (Walker, 1998).

For nearly 300 years, the numbers of journals grew steadily, mostly as investigators founded new societies to promote new or newly important scientific disciplines. These societies helped members publish their research results by sponsoring
one or more journals. Until the 1960s, most societies recovered publication costs largely from membership fee, which included cost of journal subscriptions. The number of articles published by each author was relatively small, and many members did not publish at all. Library subscriptions were not a major source of income for publishers. Although scientific societies published most science journals, some were published by other nonprofit institutions such as universities, museums and governments. Commercial publishers were generally not attracted to the field because there was little potential for profit.

Walker (1998) opined that the postwar science boom in the U.S. vastly increased employment opportunities for scientists resulting in promotion of higher education and research leading to Ph.D especially in U.S. Investigators seeking jobs, grants, tenure and promotion wanted to improve their chances in an increasingly competitive environment and this led to competition for publication after 1960s. It is believed that one of the important indicators of research success is increase in the number of research papers/articles published.

Societies soon faced the problem of accommodating good manuscripts for publication. The delay in publishing accepted manuscripts was counted due to limited resources possessed by societies and the subsidized publication price charged for members. In 1961, to alleviate the financial position of societies to sustain the cost of journal publishing, the U.S Federal Government approved the payment of page charges (fees for publication) by federal agencies. Nonetheless, societies did not come close to satisfying the burgeoning need for publishing outlets (Walker, 1998).

Commercial publishers seized the opportunity to offer researchers new outlets for their manuscripts. They started new journals in long-established fields and new fields too. Publishers invited carefully chosen eminent scientists in their respective specialty to be members of an editorial board for the journal. Most such scientists were willing to be so recognized and to help establish a journal that would increase the status and publishing opportunities for their field. With the endorsement of an international board of distinguished scientists the commercial publishers not only attracted the manuscripts
needed to start the journals, but also subscribers. Sooner the commercial publishers occupied key place in journal publishing and became indispensable to investigators and to the libraries that served those investigators.

1.3. The Crisis in Scholarly Communication

Data collected by the Association of Research Libraries (ARL) (2001), a membership organization of over 120 of the largest research libraries in North America, reveals that the unit cost paid by research libraries for serials increased by 226 percent between 1986 and 2000 as against 57% increase in the consumer price index over the same time period.

With serials costs increasing at 8.8 percent a year, and library materials budgets increasing at only 6.7 percent a year, libraries simply could not sustain their purchasing power. It may be noted here that even though the typical research library spent almost 3 times more on serials in 2000 than in 1986, the number of serial titles purchased by them declined by 7 percent. Even more dramatically, book purchases declined by 17 percent in the U.S. as libraries diverted resources to support journal subscriptions.

The overall high prices and significant price increases of journals in Science, Technology, and Medicine (STM) have been traced. Studies over the years have led librarians to believe that at least a part of the cause of the high prices in the STM disciplines is the increasing commercialization of science publishing.

Data consistently show that the cost-per-unit of content, the cost-per-citation, and the cost-per-use of commercially published journals are higher than those of journals published by society and not-for-profit organizations. For example, a study by McCabe (1998) showed that the not-for-profit biomedical publishers were providing, for 40 percent of the price of the commercially produced journals, one-and-a-half times the information at four times the quality as measured by number of citations recorded that year. McCabe’s study also shows that not only are commercially produced publications more expensive, but commercial publishers are publishing journals in biosciences seven times more than the publishers in the not-for-profit sector.
In addition to this market dominance, commercial publishers are seeking to expand their market share through mergers and acquisitions. The purchase of individual titles from societies and independent editorial boards increases the number of titles under commercial ownership, while the purchase of other companies consolidates more and more content into the hands of fewer and fewer firms. Both these practices have been shown to exacerbate already high price increases (McCabe, 2000). One of the most significant recent mergers was the purchase in 2001 of Harcourt General by Reed Elsevier. This transaction brought over 400 additional STM titles under the control of Elsevier Science, already the largest publisher of science journals in the world with its sizable portfolio of about 1200 titles.

While the economic impact of mergers is of great concern, there are equally grave implications of more and more scientific information being owned exclusively by a single company. Major content owners, like Reed Elsevier, have aggressively lobbied for database legislation, and restrictions on the educational use of copyrighted digital works. If there are not significant changes in the trends that have emerged over the past fifteen years, the next twenty will be increasingly dire. A study by Association of Research Libraries (ARL) shows that by 2020, the typical research library will be paying $1,632 for a journal subscription and $107 for a monograph compared to $267 and $47, respectively, in 1999 ("Journal Costs," 2000). Such a library would continue to lose purchasing power, buying only 13,700 serials and 15,048 monographs—16 percent fewer serials and 54 percent fewer monographs compared to 1986. With the economy currently struggling and library budgets under siege, the actual results could be far worse.

1.4. Electronic Journals: Economics

Pricing has long been a major issue in the journal marketplace, but it takes on new importance for electronic media because there are no print precedents for price models in the online world. Because there are no print costs, the bulk of the publication expense resides in the production of the initial copy of an electronic work and in its storage. Subsequent "copies" are produced at negligible cost, throwing existing print pricing paradigms into confusion.
MacKie-Mason (1999) and his colleagues believe that information goods such as electronic journals have two defining characteristics. The first and most important is low marginal (incremental) cost. Once the content is transformed into a digital format, the information can be repackaged and distributed at almost zero cost. Nevertheless, information goods often involve high fixed (first copy) costs of production. A production facility and distribution server must be in place in order to take advantage of the low costs of distribution. For a typical scholarly journal, the cost to be recovered by the producer is fixed.

Odlyzko (1995) estimates that it costs between $900 - $8,700 to produce a single math article. Seventy percent of the cost is editorial and production, thirty percent is reproduction and distribution. The same is true for both publisher and distributor in an electronic access environment.

Economics of journals is not only costs of publishing, but also it includes some other issues like access control, archiving, licensing, and pricing models. These issues are discussed at length in the succeeding chapters.

1.5. Electronic Journals: Value

Machlup (1979) recognizes two types of value of the information provided by scholarly journals: purchase value and use value.

Purchase value is what scientists are willing to pay for the information in monies exchanged and their time expended in obtaining and reading the information. The purchase value expended on scholarly journal information exceeds $6,000 per year per scientist; most of which involves their time spent in obtaining and reading the information. In fact, the “price” paid in terms of scientists’ time tends to be five to ten times of the price paid in purchasing journals, separate copies of articles and other journal-related services. Of twenty studies by various researchers that provide estimates of time spent on reading, the median time spent is 9.0 hours per month or about 108 hours per year per scientist. King and Tenopir’s study (2000) shows that scientists annually spend about 105 hours reading scholarly articles; up from 80 hours in 1977.
Also, scientists are spending more time in obtaining articles because they more often use library-provided articles than their own personal subscriptions.

Use value is related to the consequence of using scholarly journal information. Examples of use value include a dollar value on savings achieved by reading (about $25,000 per year) and producing work with greater quality, faster or at a lower cost in terms of time or money. Several studies, dating back to the 1950s, have shown that amount of reading is correlated with productivity. King and Tenopir's surveys established that amount of reading is positively correlated with five indicators of productivity. Another indicator of use value is that scientists whose work has been formally recognized through awards, special assignments, or designated by personnel department tend to read more than others. This was observed in the 1960s and was invariably noted in almost all of King and Tenopir's 16 surveys. Thus, there is also abundant evidence of the purchase and use value of scholarly journals and therefore, any change in the future should ensure that the use, usefulness and value of scholarly journals be retained.

Another important point of consideration is that scholarly publications are produced by researchers as part of their jobs. At most universities and research organizations, publication counts significantly toward salary and job security (e.g., tenure). All publications are not created equally: competition for space in top-ranked journals is intense. The demand for space in those journals is intense because they are highly visible and widely read. Publication in a top-flight journal is an important measure of visibility. In some fields, citation data has become an important observable proxy for "impact". Citations are a way of proving that the articles one publishes are, in fact, read. So citation is used in this research for measuring the value of electronic journals.

1.6. Need and the Importance of the Study

For over 3.5 centuries, scientific scholarly journals have demonstrated remarkable stability. Over the past few decades a large number of studies have shown their continued use, usefulness and value. However, two phenomena have evolved over the past three decades that have the potential of either destroying the system or substantially enhancing its considerable usefulness and value. These two phenomena are the maturation of
communication technologies and the economics of the journal system; particularly pricing of traditional journal subscriptions and access to digital full-text databases (King and Tenopir, 2000). Certainly, the new technologies should, if deployed with care, enhance the journal system; but the greatest threat to the system appears to be pricing policies that have resulted in substantially reduced personal subscriptions, increased reliance on library access. Subscription prices to journals raised far higher than inflation or increased journal sizes would warrant. This has led the libraries and scientists to relay more heavily on obtaining separate copies of articles through interlibrary loan, document delivery, preprints, reprints and photocopies or electronic copies from authors and colleagues.

While there have been literally hundreds of articles written about the price of scholarly journals in recent years, very little has been written about the cost of publishing journals. Yet to understand why prices are what they are, one must know about the cost of publishing journals. One reason that costs are not often discussed is that publishers do not want their competitors to know their costs. Also, costs vary a great deal among journals, depending on the characteristics of journals (i.e., manuscript rejection rates, number of articles, number of pages, number of issues, circulation, etc.) and type of resources used (i.e., location and experience of editors, technologies applied, quality of paper, etc.).

Moreover, much has been written on issues pertaining to digital information. Until recently, there has not been enough information to evaluate how these digital products, particularly journals, are being used. Furthermore, meaningful data are often difficult to obtain as some publishers and vendors supply little or no data or only information they feel supports the purchase of their products. As it becomes increasingly difficult to afford all digital content, librarians must be able to measure digital use of electronic journals in order to make the best purchasing decisions for their institutions.

Now, scenario of scholarly electronic journals is changing dramatically. Economics of scholarly journals is changed, as the environment is changing from print to electronic. In order to cope with the present volatile electronic environment, increasing
attention needs to be directed towards an understanding of new scenario and issues. A better understanding of these scenario and issues would undeniably result in bringing not only clarity but help understand the realities based on empirical evidence, rather than mere perceptions.

1.7. Statement of the Problem

The scholarly journals have played a very prominent role in the scholarly communication system for several centuries. In the last three decades two major forces have challenged their pre-eminence:

1. The Spiraling Cost; and

2. Transition to Electronic Medium for storage, access and distribution

The high and fast-rising cost of journals has had a devastating effect on the flow of scientific communication, the research community and the library collections.

In 1997, Tenopir and King presented evidence showing that the average institutional price of a scholarly journal subscription has increased from $39 in 1975 to $284 in 1995, a factor of 7.3 in just twenty years. Based on these figures, Tenopir and King conclude that: “Traditional scholarly publishing is in serious economic difficulty.” General inflation and increase in size of the journals, account for only 52 percent of the price increase. Tenopir and King attribute the remaining 48 percent of the price increase to the dramatic decrease in personal subscriptions which started in the late seventies. Publishers have apparently addressed this fall in revenue by increasing institutional subscription rates, thereby causing a vicious circle of cancellation and further increase in institutional rates. This phenomenon is also known in the library community as the “serials pricing crisis”.

The present study conceived under the title “Economics and Value of Electronic Journals: A Correlative and Comparative Study” and is proposed to investigate correlations between economics of electronic journals and their value.
The topic of the research consists of two important concepts: “economics” and “value”. Economics of electronic journals includes access control, licensing, archiving, and pricing. An analytical study of many aspects of economic scenario was carried out for the ten selected publishers. The focus was more on pricing of journals. In order to analyze pricing of electronic journals, it was necessary to take into consideration subscription pricing lists that are available on the Internet for each publisher.

As is discussed in earlier sections, use value of information is related to the consequence of using scholarly journal information. For measuring value of electronic journals, it was necessary to carry out usage study of electronic journals. Usage study was carried out using questionnaire method and impact factor.

1.8. Objectives of the Study

The general objectives of the study are:

1. To survey different publishers of electronic journals;

2. To identify and develop parameters for measuring value of electronic journals;

3. To study the economics of electronic journals and their pricing patterns;

4. To study the value of electronic journals in terms of parameters developed and chosen for this purpose;

5. To identify the correlation between the economics and value of different electronic journals; and

6. To compare the economics and value of different electronic journals published by different publishers;

The specific objectives of the study are:

1. To study different pricing patterns of electronic journals in selected area

2. To compare journal pricing and value of commercial publishers and society publishers
1.9. Scope and Limitation

Publishers of electronic journals were grouped into two broad categories - commercial and society publishers - for the purpose of this study. Due to limitation of time, for the detailed study ten publishers (top five from each category) were selected for the study. These ten publishers are:


The study also focused on 4,415 electronic journals published by the above ten selected publishers in 2003. The study is limited to these ten publishers and their 4,415 electronic journals. The overall economic scenario and pricing of these 4,415 journals for the year of 2003 were analyzed.

There are different kinds of electronic journals, but this research focuses on scholarly electronic journals. Therefore “electronic journals” in the present study refers to “scholarly electronic journals”.

To study the value of electronic journals, a user study was carried out at the Indian Institute of Science, Bangalore. All forty Departments at IISc and their faculty, research staff and postgraduate students were selected for the usage study.

Top-thirty journals at IISc were identified based on user’s feedback obtained through questionnaire. The population of journals for impact factors is limited to these thirty journals.

1.10. Methodology

The present investigation was carried out in two distinct levels, each involving different approaches. It is quite usual for a single study to combine quantitative and qualitative methods and to use primary and secondary data. In this research, a multi-
method approach was employed in order to ensure that data analysis and interpretations are more holistic.

At the first step, library and Internet based searches were conducted and three hundred and six documents related to the field of research were identified. These documents were carefully studied to prepare a literature review. The literature was reviewed in order to obtain a better understanding of and insight into previous research. The literature review covers the following issues: scholarly publishing, electronic publishing, usage studies of scholarly journals, impact factor, pricing studies of scholarly journals, pricing models, access control, licensing, archiving, format and technical issues of electronic journals.

Many factors affect the economics and usage of electronic journals. One can not study the economics and usage of electronic journals without considering the issues like access control, archiving, format, licensing, and pricing models. So, at macro level, the researcher has carried out an analytical study of all these issues and also compared the ten selected publishers according to their policies about these issues in 2003. The data regarding publishers' policies of access control, archiving, format of electronic articles, licensing and pricing models were obtained by visiting the website of each publisher. The chapters four, six, seven and eight deal with these issues.

The last part of the macro level study was identifying publishing and pricing models of electronic journals. The following models were identified: TULIP, PEAK, SPARC, BioOne, HighWire Press, Project MUSE, JSTOR, PubMed, and EPIC. The analytical study of these publishing and pricing models is presented in chapter five.

Selection of ten publishers for detailed study is explained in this chapter later.

In the pricing studies, obtaining the average subscription price is one of the common methods of computing data. In most pricing studies, researchers compute the Average Subscription Price (ASP) for one or more specific disciplines among different publishers. Almost all researchers use price lists prepared by publishers. A few
investigators work on libraries' expenditure on subscription to journals but access to this information is not easy.

In the present study, pricing data was calculated to obtain the Average Subscription Price (ASP) and the Average Subscription Price Per Issue (ASPPI). In order to study and compare various pricing models of the selected publishers, the annual institutional subscription price in US Dollar for the year 2003 was collected. This primary data relating to institutional subscription price was collected by visiting publishers' web sites.

In addition to the 2003 annual institutional subscription price, titles of journals, number of issues per year, and subject of journals for the ten selected publishers were taken into consideration. It may be noted that all analysis and calculations were conducted on electronic journals. So, a journal without an electronic version was not considered. The data was collected for 4,415 journal titles. This data was used to compute Average Subscription Price (ASP) and Average Subscription Price Per Issue (ASPPI) based on the following formulas:

\[
ASP = \frac{\text{Total Sum of 2003 Subscription Price for all E-Journals of a Specific Publisher}}{\text{Total Number of E-Journals of the same Publisher}}
\]

\[
ASPPI = \frac{\text{Total Sum of 2003 Subscription Price for all E-Journals of a Specific Publisher}}{\text{Total Number of Issues of all E-Journals for the same Publisher in 2003}}
\]

The ASP is an average price of a journal per year. A factor that might account for the price of a journal is “number of issues per year”. Number of issues of all journals is not equal in a year and the ASP may not reflect actual price of a journal. The ASPPI is a value that gives some more information about price of a journal in a specific year. For this reason, the ASPPI is also chosen as a parameter for better pricing analysis.

With a view to study the pricing differentials across subjects/disciplines, subject-wise categorization of top ten publishers was conducted. Then the Average Subscription Price (ASP) and the Average Subscription Price Per Issues (ASPPI) of various disciplines were calculated.
Though individual publishers follow their own subject categorization, in order to standardize the categorization, the Australian Standard Research Classification (ASRC) was chosen as a standard subject classification. This classification was established by Monash University Library as part of a Group of Eight initiatives in Australia. The ASRC includes 24 subject classifications for the human knowledge. More explanations regarding the ASRC are given in chapter nine.

All 4,415 electronic journals of the ten selected publishers were classified according to ASRC subject classification. The subject wise ASPs and the ASPPIs for the year 2003 were computed for all subject categories using the formula already stated.

The chapter nine presents details of all pricing data analysis and pricing models of the ten publishers covered under the present study.

The next step of micro level research was usage study of electronic journals as an empirical study. Empirical studies invariably have to be localized, but only general applications lend respectability to research. The preliminary survey of the electronic resources particularly e-journal, the facilities and services in various libraries located in Mysore and Bangalore cities revealed that the electronic journals are made available at the Indian Institute of Science (IISc) for all the forty Departments and users have access to these electronic resources at anytime. The IISc has access to around 6000 e-journals from different publishers.

Major parameters for choosing IISc are listed below:

1. Access to significant number of electronic journals published by distinguished publishers;

2. Multi-disciplinary institute providing coverage of different subjects areas;

3. Significant number of users of electronic journals; and

4. Geographical constraints
The study also proposed to investigate electronic journals usage in a multidisciplinary institute in order to see usage pattern across different subjects. IISc being a premier institute having 40 departments covering most of the disciplines in science and technology, found to be most suitable to satisfy this requirement of studying usage pattern of users across multidisciplinary subjects.

In addition, the study sought to find significant users of electronic journals. There are 2,145 users at IISc apart from guest users from other institutes from all over India, large number of whom use electronic resources. Hence, users at IISc were found to be significant both in number and in using e-resources.

Basically four methods of data gathering are normally used in electronic journals usage studies. These are questionnaire, interview, transaction log and citation study. Each method has its unique strengths and weaknesses.

In the usage surveys, data are often obtained by using a questionnaire, these data are standardized, allowing easy comparison. Data gathering by questionnaire is a popular method and it is easily understood. However, much time has to be spent in designing and piloting the questionnaire. Analysis of the results, even with the aid of an appropriate computer package, is also time-consuming. Like many other studies, questionnaire method was used for collection of usage data in the present study.

Keeping in view the objective of collecting usage data from users belonging to different disciplines/subjects areas, the study focused on distributing questionnaires to the faculty and students of all the Departments at IISc. The study was carried out in two stages:

1. A Pilot Study

2. The Full Fledged Study

A pilot study by distributing 50 questionnaires among 12 departments of IISc was conducted in December 2003. The pilot study was conducted in order to design an elaborate questionnaire for the full fledged study. The pilot study helped the researcher in
many ways. The initial study helped to identify the major publishers whose journals were being used at IISc. It also helped to eliminate ambiguity in some questions and fine tune the questionnaire. In addition, it helped in finalizing and enumerating the publishers i.e. those publishers whose journals were not used were deleted and those publishers whose journals were regularly used were included. Some of the comments and suggestions of the respondents were incorporated into the final questionnaire design.

For the full fledged study, 500 copies of questionnaires were randomly distributed among academic staff, researchers and P.G. students of all the departments of IISc in January 2004. Further in March 2004, 200 questionnaires were also distributed among users at the J.R.D TATA Memorial Library. Users from 33 of the 40 departments of the IISc positively responded by returning the completed questionnaire. A total of 397 filled in valid questionnaires (56.7%) were received. This included respondents from a total of 2,145 users (Includes 450 Academic Staff, 1,215 Research Staff and 480 P.G. Students) at the entire IISc and guest users as well.

A database using Microsoft Access format was designed and the data entered into for further analyses and inference. The Principal Component Analysis (PCA) was used for statistical data analysis. The PCA is a statistical data analysis technique used to reduce the dimensionality of multivariate data. The analysis of the questionnaire–based data is reported in chapter ten.

Transaction log is a computer-aided method of data gathering in the usage studies of electronic journals. The transaction log is also available at IISc but based on their policy, it was unavailable to the researcher. So transaction log could not be used for this study.

Citation study is another method of the usage study. Citation and article counts are important indicators of how frequently current researchers are using individual journals. The “impact factor” is one of the famous tools for measuring citation. The impact factor helps everyone evaluate a journal’s relative importance, especially when he/she compares it with other journal(s) in the same field. The impact factor is the ratio of the number of citation by source items in a particular year to the total number of source
items published over a fixed period of time in a particular periodical publication, say a journal. Journal Citation Report (JCR) impact factor is computed considering the fixed period as two years. The Institute for Scientific Information (ISI) has been publishing impact factor since 1975 in its Journal Citation Report (JCR). The impact factor of nearly 8,400 journals is listed in the SCI Journal Citation Report. Coverage is both multidisciplinary and international, and incorporates journals from over 3,000 publishers in 60 nations.

The last part of micro level study was selecting of the most-used journals at IISc and obtaining their impact factor from JCR. The respondents were asked to list the titles of journals that they use regularly. The objective was to identify the most used journals. Respondents from IISc listed 562 journal titles. Among of total 562 journals (titles) being used by the IISc users group, top 30 journals, ranked by the number of people using them, were further analyzed. The ranked top-thirty journal titles used by users group at IISc, the name of publishers, the annual subscription price, the number of issue per year, the Average Subscription Price Per Issue (ASPPI) were obtained. The ASPPI was computed based on the formula already stated in the precedent section.

The impact factors of these journals were collected from the Journal Citation Report (JCR) for the year 2001 and 2004. The impact factor do changes from year to year, therefore the impact factors of two different years were considered to obtain better results. The objective was to find any correlation between use and value as measured by number of recorded citations to a journal/impact factor and use of journals. Correlation and comparison between price and value is discussed in chapter eleven.

1.11. Selection of Publishers

With a view of different publishers have different pricing models for their electronic journals, an attempt was made in this thesis to study and compare the various pricing models. In this section the methodology used in this research is succinctly given.

In accordance with conventional wisdom, publishers were grouped into two broad categories—for-profit (“commercial”) publishers and not-for-profit (“society/university”)
publishers. One hundred twenty-four commercial publishers and ninety society/university publishers were identified and ranked according to the number of electronic journals they published. It was difficult to distinguish between commercial and society/university publishers; it must be noted therefore that academic presses were grouped with the nonprofit/university publishers for the purposes of the study. Table 1.1 and Table 1.2 show the first fifteen top commercial and society publishers respectively.

<table>
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<tr>
<th>SN</th>
<th>Commercial Publishers</th>
<th>Number of Electronic Journals</th>
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<tbody>
<tr>
<td>1</td>
<td>Elsevier (Includes Academic Press)</td>
<td>1,349</td>
</tr>
<tr>
<td>2</td>
<td>Taylor &amp; Francis Group</td>
<td>740</td>
</tr>
<tr>
<td>3</td>
<td>Kluwer Academic Publishers</td>
<td>673</td>
</tr>
<tr>
<td>4</td>
<td>Blackwell Publishing</td>
<td>577</td>
</tr>
<tr>
<td>5</td>
<td>Springer - Verlag</td>
<td>436</td>
</tr>
<tr>
<td>6</td>
<td>Sage Publications</td>
<td>317</td>
</tr>
<tr>
<td>7</td>
<td>John Wiley &amp; Sons, Inc</td>
<td>309</td>
</tr>
<tr>
<td>8</td>
<td>Lippincott Williams and Wilkins</td>
<td>230</td>
</tr>
<tr>
<td>9</td>
<td>Allen Press</td>
<td>112</td>
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<tr>
<td>10</td>
<td>Marcel Dekker, Inc.</td>
<td>80</td>
</tr>
<tr>
<td>11</td>
<td>S. Karger AG</td>
<td>71</td>
</tr>
<tr>
<td>12</td>
<td>World Scientific Publishing Co.</td>
<td>67</td>
</tr>
<tr>
<td>13</td>
<td>British Medical Journals Publishing (BMJ Publishing)</td>
<td>25</td>
</tr>
<tr>
<td>14</td>
<td>Humana Press</td>
<td>23</td>
</tr>
<tr>
<td>15</td>
<td>CRC Press</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Total Number of Electronic Journals</td>
<td>5,027</td>
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</table>

Table 1.1: Ranked List of Commercial Publishers
Table 1.2: Ranked List of Society Publishers

While the complete lists were used for initial studies, for this detailed study, the research was limited to ten publishers, the top five from each category. Elsevier, Taylor & Francis, Blackwell, Kluwer and Springer-Verlag formed the commercial publishers group; since that time, Kluwer and Springer-Verlag have merged. Oxford University

One reason for selecting only ten publishers was limitation of time. This research was proposed to be completed within two to four years as a Ph. D award requirement. The detailed study of more than ten publishers was not possible given the constraints time of and an in-depth study. In addition to ten publishers, the study also focused on 4,415 electronic journals which belong to the ten selected publishers. In fact, 3,775 out of 5,027 electronic journals from top 15 commercial publishers and 640 out of 914 electronic journals from top 15 society publishers were chosen for further study. Total number of electronic journals in this study was 4,415. This size of sample, 4,415 electronic journals, was adequate for generalization and interpretation. Increasing the size of sample could lead to inaccuracy in data analysis.

Moreover, several different aspects were to be studied at macro and micro levels for all selected publishers. All of these aspects were explained in the research methodology.

1.12. Summary

Scientific scholarly journals are one of the most important media for scholarly communication. Based on the literature, scientists rely more on journals than any other source for their information. There has been an economic crisis in scholarly publishing since the late 1980’s due to the spiraling costs of scientific journals. Libraries were the first to experience the effects of the breakdown as they struggled to keep up with the exploding volume and cost of journals in science, technology, and medicine. As the unit cost of serials in major research libraries soared, libraries were forced to cancel millions of dollars worth of subscriptions.

This research was undertaken with the hope of finding a correlation between economics and value of electronic journals. The results of this research could help clarity certain issues and hopefully clear the air of tension prevailing in the field.