

A SYSTEM FOR GENERATING PUBLICATION STATISTICS
BASED ON BIBLIOGRAPHIC INFORMATION
—BIBLIOMETRIC ANALYSIS FOR THE DEVELOPMENT
OF ECONOMIC AND SOCIAL THOUGHT—

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Abstract

Bibliographic information consists of bibliographic descriptions such as authors, titles, details of publication status, etc. This secondary information not only functions as access points to literature but also provides experimental data for bibliometric analyses. In particular, bibliographic information, despite its seemingly simple components such as an author's name, title, place and date of publication, offers useful data for a bibliometric analysis when used with a bio-bibliographic approach. We try linkage experiments of the bibliographic items belonging to the same authorship in the *Widener Library Shelflists* (WLS) database compiled by the Harvard University Library by applying the "*Repeated Publication Over Generations* (REPLOG)" pattern. The REPLOG system, devised for this study, identifies principal authors, two or more of whose books were published beyond their lifetimes. In addition to ferreting out important figures in the history of social sciences a tentative trial for producing statistics on transitions of important cities in the history of economics is carried out.

I. *Introduction*

Recently bibliometric analysis has become an indispensable tool in research on the sociology of science. However, because of the availability of data, such analyses are currently concerned mainly with science and technology. To expand the scope of analysis to social sciences and the humanities we present here a system for generating materials for bibliometric analysis in these areas.

In Section II we discuss the characteristics of materials used in bibliometric analysis and review the present state of the art. In Section III we show our database, which is sufficiently qualified for these analyses. In Section IV we propose the *REPLOG* (*Repeated Publication Over Generation*) system to ferret out important figures in the history of social sciences and try to evaluate the system by reviewing persons generated from the system. Finally, Section V describes a tentative trial for producing transitions of important cities in the history of economics.

II. *Academic Research and Bibliographic Information*

2.1 Formation of Bibliographic Information

Computer processing of bibliographic information is progressing with the advancement of computer sciences. Large quantities of bibliographic information have now been prepared and processed by computer, and stored and disseminated in a machine-readable form. Such computer processed information contains both primary and secondary information.

Before discussing computer processed information, we review how both primary and secondary information has been circulated among researchers. Methods of circulation are closely related to how academic research itself has been formed. Formation of academic research and the recent study of sociology of science drive us to a new story which is completely different from the one based on the older history of science. That is, academic research is the result of institutionalization of science. Originally, scientific research was not admitted as an occupation but as individual work among intellectuals who liberated themselves from the theology of fifteenth century Europe.

The history of the transmission of academic information is simply the process of institutionalization of science. When science became gradually independent of theology, scientists like N. Copernicus (1473–1543) and G. Galilei (1564–1642) wrote letters to their colleagues to exchange their ideas. Thus, letter writing became a primary way of conveying information. Letters or manuscripts, sometimes rewritten by scribes, were in most cases in Latin. Then, the days of printing, which was initiated by J. H. Gutenberg (1394–1468), came in the sixteenth century. The practice of circulation of handwritten papers, however, continued even in the seventeenth century when science was still in its infancy. The most influential writers in the seventeenth century, such as B. Pascal (1623–1662), R. Descartes (1596–1650) and G. W. von Leibniz (1646–1716), first circulated their works among their colleagues by letter. However, they could not make a living from the money obtained from these contributions and depended on various sources such as the patronage of wealthy people, nobles and so on. The receiver of a letter read it at a salon of a patron, or transcribed it for further circulation. Circulation of ideas by correspondence or by transcribing manuscripts was inevitably limited. Later, a few papers were printed.

Printing gradually increased and it became possible to put a price on printed books and pamphlets. This gave researchers the impetus to form their own societies and to acquire independent occupations. This enabled the birth of academies for researchers. The readership of letters and papers began to form academies to discuss the contents of letters and papers.

Then papers began to be published in journals for wider circulation, and journals became the medium of information exchange. As the circulation of journals increased, they began to publish several issues a year. This is a good place to mention two quite representative samples: *Journal des Sçavans* in France in 1665; *Philosophical Transactions* issued by the Royal Society of London also in 1665. When the number of issues a year was

increased, an annual index was annexed to the last issue of the year. This was a seminal form of index journals.

Institutionalization of science was realized by the appearance of the researchers who were paid by academies or chairs at universities. This was first done in France immediately after the French Revolution to liberate intellectual training from the hands of nobles and the rich, and to protect the Republic from anti-revolutionary actions of neighboring countries (Clark, 1973). Such institutions were l'Ecole normale, l'Ecole centrale des travaux publics, later called l'Ecole polytechnique. Then came the modernization of German universities (Turner, 1974). Great Britain was a little behind the Continent in the institutionalization of educational systems; universities like Oxford and Cambridge were in the hands of churchmen (Stone, 1974, Vol. I; Hasley and Trow, 1971). However, Great Britain was successful in organizing academies. Most of the Royal Societies were formed as private organizations, but they were free from the church. There were about 600 members in the Royal Society at the beginning of the nineteenth century, but only 100 were purely scientists. They formed their own specialized societies in the early 1800s. The most important one was the British Association for the Advancement of Science, formed in 1831. Because of these pressures, the Royal Society was reformed in 1846. In parallel with France and Great Britain, Gesellschaft deutscher Naturforcher und Ärzte appeared in Germany in 1822. The American Association for the Advancement of Science was founded in the United States in 1848, with an initial membership of only 461 (Hiroshige, 1973, pp. 63-65).

France had a leading position in the institutionalization of science. Showing these trends by statistics is a recent fashion and no comprehensive statistics have been compiled. However, Terry Nichols Clark's pioneering work (1973) shows some tendencies. He gathered the number of positions of employed researchers and the number of students from 1850 to 1968, and showed that they first increased since 1914 and second burst out since 1945 (p. 35).

The formation of academies had a very large impact on the development of science and technology because it functioned to authorize normal science. Thomas S. Kuhn (1962) formulated the concept of the "scientific revolution" and "normal science." Scientific revolution is the process of breaking through the traditional thinking accepted as truth in the days. After creating a new set of theories as truth by scientific revolution, they are regarded as normal science even though they are mere working hypotheses. The normal science standardizes a set of theories as paradigms to be used as routine procedures for practical applications and textbook knowledge for a classroom. Further elaboration of Kuhn's theory by historians of science is the concept of "institutionalization" of science and research programs (Elias, et al., 1982).

The institutionalization of educational systems needs textbooks and handbooks to propagate the normal science. This was the main function of books in the field of science and technology in the nineteenth century. On the other hand, the outcome of new studies or experiments are reported in journal articles, following a standardized form at which allows a follow-up test or experiment.

The next phase in enlarging scientific knowledge was World War I. In the 1920s various new disciplines of science were formed, and the rising productivity of European economies created a middle class and stimulated higher education. During that time, universities and various academic societies specializing in particular disciplines were established

one after another. Higher educational systems were reorganized and expanded. Professorships were founded and systematic Ph.D. courses were established. Clark (1973, p. 32) also pointed out that the degrees were the result of the institutionalization of research program and the educational training system, and gathered statistics on degrees awarded by selected French faculties from 1850 to 1960. The institutionalization of higher educational systems expanded the potential readership of academic journals. Hence, these new institutions started to publish their own journals, thus adding to the total number of journals. This increasing number of journals made it difficult to find all relevant articles on a particular topic.

Accordingly, to annex an abstract to each article became a rule of writing. Then came the emergence of independent abstract journals which gathered and published abstracts of papers from various journals. Then further increase in the number of articles led to the publication of index journals, which required less space than abstract journals. For example, *Chemisches Zentralblatt* (Jahrg. 1–140, 1830–1969) is a specialized abstract journal. Another example is *International Catalogue of Scientific Literature* (1st–14th annual issues, 1902–1921), an index journal (or an annual bibliography) for all the scientific fields. Furthermore, the increased number of articles to be indexed now exceeds the capacity of manual processing; thus, the era of computer processing is timely. *Chemical Abstracts*, first issued in 1907, was successful in compiling its index journal *Chemical Titles* by computer in 1960. Then, online retrieval systems are created. Similar examples are found in the fields of medicine, such as *Index Medicus*.

Such computerization of index journals or abstract journals creates a new approach to the sociology of science called “bibliometrics” (Harada, 1974). One good example is citation analysis, which is used to discover an influential person, for example, a frequently cited author. This is an elaboration of Alfred J. Lotka’s (1880–1949) finding. Early in the 1920s, he formulated a hypothesis about the productivity of science, i.e., the relation between the number of distinguished scientists and the number of their articles (Price, 1963, pp. 42–48).

Various bibliometric analyses emerged in the second half of the twentieth century. For example, Derek J. de Solla Price (1963, pp. 8–10) tried to formulate a relation between the increase in the number of journals and abstract journals as an exponential function. Similar research has been tried by other sociologists, such as Henry W. Menard (1971). This kind of research was based on statistics derived from quantifying index journals or abstract journals. Citation indexes have been compiled as source data for such analyses. For example the *Science Citation Index* (SCI) has been compiled by large-scale computer processing of bibliographic information and published by the Institute for Scientific Information (ISI) since 1961.

2.2 Role of Monographs in Academic Research

The relation between the propagation of scientific knowledge and the means of communication in science and technology was described in Section 2.1. The situations in the humanities and social sciences are somewhat different.

The first point is that the ideas or theories in science and technology are expressed by well-defined terms or paradigms or explanatory examples. Thus, the facts discussed in

scientific papers are translated or expressed in terms peculiar to the particular fields. In the humanities, however, the expression itself is important, because it will be copied by other writers. For this reason, the texts of influential writers will be published repeatedly and read for generations. Social sciences lie between the humanities and science and technology. Social sciences are definitely based on facts. However, these facts are not obtained from experiments. Accordingly, they need to be expressed by words and figures determined by the frame of reference of the writers.

The second point is that social sciences differ from the humanities in the way in which discussions are apt to concern contemporariness. From the time of their formation in the seventeenth century, social sciences have aimed to solve problems of the day. This occurred about a century later than science which realized its independence by N. Copernicus' *De revolutionibus orbium coelestium* (6 vols., 1543).

Social sciences became independent of theology under the disguise of *jus naturalis* (natural law) as expounded by H. Grotius (1583–1645), T. Hobbes (1588–1679), and S. von Pufendorf (1632–1694). They developed the policies related to societies in which people were living, and opinions and ideas were expressed by the opinion leaders of the day. Social science as an independent occupation was not yet formed in that period. Hence, opinions and ideas were often published anonymously or under pseudonyms in the form of pamphlets. Otherwise, they appeared in articles of newspapers or journals issued by particular political groups. In contrast to scientists, economists' ideas depended on their nationalities because the validity of their policies were influenced by the conditions of their particular nation.

Leading economists appeared from country to country where economic prosperity was realized. They were classified into two groups. One comprised consultant administrators. They constituted Kameralwissenschaft (cameral science) or Staatswissenschaft (science of the state) and gradually obtained the chairs in German universities. The other group comprised pamphleteers. They published their opinions mainly in newspapers such as *Journal économique* (founded in 1751) and *Gazette du commerce* (founded in 1763, later to become *Journal de l'agriculture, du commerce et des finances*, for a while an organ of Physiocrats).

Pamphlets were ephemeral in a sense and limited in number but some of them had a strong influence upon society. Thus, some were regarded as source data explaining the situations of their day. Pamphlets were sometimes reprinted in various styles and forms, and they were occasionally bound in one volume as a new book. Library systems of the days were not matured; so that collecting these ephemeras for potential readers was a difficult task. As a consequence, collected writings were repeatedly published to overcome the limitedness of the number of copies of the first publication. The first example appeared in Spain as her eighteenth century documents, i.e., *Biblioteca española económico-política* (Juan Sempere y Guarinos, 1801–21), and then in Italy as *Scrittori classici Italiani di economia politica* (P. Custodi, 50 vols., 1803–16). These two examples reflected the fact that these countries played essential roles in the formation of economics based on their economic prosperity. In the latter part of the eighteenth century, economists emerged from France, e.g., F. Quesnay (1694–1774), and later members of the classical school from Great Britain became prominent, e.g., A. Smith (1723–1790), D. Ricardo (1772–1823) and T. R. Malthus (1766–1834).

The basic characteristic of economics in contrast to science in those days was the impossibility of experiment. Objects of economic analysis are individual people, and groups of people or institutions like companies or factories. However, it is not possible to make them objects of manipulation for experiment, or to isolate a person or a company, a constituent of society, from surrounding conditions. Thus, to carry out experiments with them under controlled conditions is not possible. Therefore, it is necessary to observe and describe society as a whole by verbal or numerical expressions based on a fact-finding or statistical surveys. To analyze a social phenomenon based on a statistical survey is to show the data from one angle, but the same data may be used to show society from different angles. Such analysis and description following one's viewpoint or frame of reference require enormous quantities of data and explanations of them. For this reason, the outcome of research is often not summarized in a small article but described in the form of a monograph. It is defined as "a systematic and complete treatise on a particular subject" by the *ALA Glossary of Library and Information Science* (1983, p. 148). As a result, monographs are collected and utilized for academic research as an essential source of reference. It is well known that Karl H. Marx (1818–1883) utilized extensively the reading room of the British Museum (founded in 1753).

After the days of the classical school of Smith, Ricardo and Malthus, the economy experienced radical changes and required the formulation of a new economic theory. For this purpose, the economists of those days began to gather existing publications. Some of them made personal collections, for example, H. S. Foxwell (1849–1936) whose collection is now held in the Kress Library at Harvard University and in the Goldsmiths' Library at the University of London, C. Menger (1840–1921) whose collection is now at Hitotsubashi University as the Menger Library, E. R. A. Seligman (1861–1939) whose collection is now reserved at Columbia University in the United States. This shows that economists of those days were well aware of the importance of collecting books, pamphlets and related documents. Then, the neo-classical schools, or the reformed classical school, were formed in various countries by reformers, such as W. S. Jevons (1835–1882) and A. Marshall (1842–1924) in Great Britain, M. E. L. Walras (1834–1910) in France, and V. Pareto (1848–1923) in Italy. The difference between these reformers, member of the neo-classical school and members of the classical school, is that the latter did not occupy chairs at universities but the former did. For example, Walras and Pareto were at Lausanne in Switzerland. They worked as university professors and this is an example of the institutionalization of economics. Radical reformers of society should also be mentioned. They include Karl H. Marx (1818–1883), F. Engels (1820–1895) and other radicals like P. J. Proudhon (1809–1865). Differences of opinion between these radicals and the former groups initiated the long ideological and political disputes between socialism and capitalism. These radicals did not hold chairs at universities, except in Germany (Kathedersozialismus).

As stated above, in the late nineteenth century, institutionalization was first realized in economics and then in other social sciences. This was followed by the publication of new journals like the field of science and technology. Table 1 lists the new journals in economics first appearing in the second half of the nineteenth century.

The importance of books, however, remains. There are two types of evidence, one indirect and the other direct. The indirect evidence is obtained from bibliographies newly compiled for social science research. These include books (especially monographs), pam-

TABLE 1. EMERGENCE OF JOURNALS IN ECONOMICS AROUND THE LATTER HALF OF THE NINETEENTH CENTURY

| Journal title | Founded | Country |
|--|---------|---------|
| Revue d'économie politique | 1887 | France |
| Giornale degli Economisti e Annali di Economia | 1875 | Italy |
| Economic Journal | 1891 | U.K. |
| Quarterly Journal of Economics | 1886 | U.S.A. |
| Journal of Political Economy | 1892 | U.S.A. |
| American Economic Review | 1911 | U.S.A. |
| Ekonomisk Tidskrift | 1899 | Sweden |
| Schmoller's Jahrbuch für Wirtschafts- und Sozialwissenschaften | 1880 | Germany |
| Archiv für Sozialwissenschaft und Sozialpolitik | 1904 | Germany |
| Zeitschrift für Volkswirtschaft, Sozialpolitik und Verwaltung | 1892 | Germany |

Source: Journal titles are cited from Schumpeter (1954, p. 756), and the other notes are based on *Union List of Scientific Periodicals in European Languages* (National Center for Science Information System, 1989).

phlets and documents reflecting the needs of researchers. They supply detailed information about what was discussed, when and where. The most striking fact is the simultaneousness of the publications in different countries, e.g., *Bibliographie générale des sciences juridiques, politiques, économiques et sociales de 1800 à 1925/26* (3 vols., 1926) by A. Grandin in France, *Bibliographie des Socialismus und Communismus* (3 vols., 1893–1909) by J. Stammhammer in Austria and the most distinguished *London Bibliography of the Social Sciences* (1931–) by London School of Economics.

Direct evidence was found in recent researches by George J. Stigler. He has written many essays extensively employing bibliometric approaches, although he has not used such naming. They are now contained in two books (1965, 1982). He has analyzed a variety of characteristics of the citation practices used by economists from 1886 to 1969 (1982, pp. 174–175). He divided the period into two: 1886–1924 and 1925–1969. He used the same number of articles written by two groups of economists: 1) Presidents and Clark Medalists of the American Economic Association; and 2) other randomly selected economists. The number of articles is 76 for each group, 1) and 2) above, for the period 1886–1924; 97 for each group for 1925–1969; thus, 346 in total. The total number of citations in these articles is 2,850. One of his analyses is the characteristics of citations to books versus those to articles. The percentage of citations to journal articles increased by half between the two periods, i.e., from 27.5% to 40.1% in group 1), and from 28.1% to 40.3% in group 2). He also examined the relative frequency of citations to journals versus citations to non-journal sources (books, pamphlets and government publications, etc.) in the articles used in the above study. Figure 1 shows that non-journal sources are still the dominant type of citation, except in economic theory (1982, pp. 177–178). These findings suggest that books are still considered important to scholars in economics. Another example is given in Table 2, where we use three review articles as sources of data (Matsuda, 1973, p. 3). They are (1) Arrow (in *Intriligator*, 1969) on theoretical economics, (2) Harcourt (1972) on capital theory, and (3) Klein (also in *Intriligator*, 1969) on econometric model building. All the items referenced in these review articles are 378, and on average 24% of them are books.

FIGURE 1. CITATIONS TO JOURNAL AND NON-JOURNAL SOURCES BY SELECTED SUBJECT CLASSIFICATION OF CITING ARTICLE, 1925-69

| | Total citations | Citations to Journal articles | Citations to non-Journal sources |
|---|-----------------|-------------------------------|----------------------------------|
| (1) Economic theory | (648) | 51% | 49% |
| (2) Mathematical, statistical and other tools of analysis | (119) | 43% | 57% |
| (3) International economics | (79) | 42% | 58% |
| (4) Agriculture | (73) | 41% | 59% |
| (5) Scope and method | (101) | 33% | 67% |
| (6) Industrial organization | (134) | 31% | 69% |
| (7) Money, credit, and banking, etc. theory | (109) | 30% | 70% |
| (8) History of economic thought | (94) | 27% | 73% |
| (9) All fields | (1,824) | 40% | 60% |

0 10 20 30 40 50 60 70 80 90 100(%)

Source: Stigler (1982) p. 178, Table 2.3.

TABLE 2. WEIGHTS OF BOOKS IN CITATIONS IN REVIEW ARTICLES

| | Arrow ¹ | Harcourt ² | Klein ¹ | Total |
|-------------------|--------------------|-----------------------|--------------------|------------|
| Articles | | | | |
| (1) Single author | 39 | 166 | 29 | 234 |
| (2) Joint authors | | | | |
| Two | 5 | 22 | 17 | 44 |
| Three | 0 | 1 | 5 | 6 |
| Four | 0 | 2 | 1 | 3 |
| Subtotal | 44 (75%) | 191 (78%) | 52 (71%) | 287 (76%) |
| Books | | | | |
| (1) Single author | 13 | 49 | 15 | 77 |
| (2) Joint authors | | | | |
| Two | 2 | 4 | 3 | 9 |
| Three | 0 | 1 | 0 | 1 |
| Four | 0 | 1 | 3 | 4 |
| Subtotal | 15 (25%) | 55 (22%) | 21 (29%) | 91 (24%) |
| Total | 59 (100%) | 246 (100%) | 73 (100%) | 378 (100%) |
| (1) Single author | 52 (88%) | 215 (87%) | 44 (60%) | 311 (82%) |
| (2) Joint authors | 7 (12%) | 31 (13%) | 29 (40%) | 67 (18%) |

Source: Matsuda (1973), data based on the references of 1) Intriligator (1969) and 2) Harcourt (1972).

2.3 Role of Persons and Subjects for Literature Retrieval

The institutionalization of science came with the formation of normal science. There is disagreement about whether normal science should be included in the field of social sciences.

It is accepted as a fact that at least two ideologies, Marxism and Non-Marxism, divides the social sciences into two distinct groups, although people have seldom tried to bridge these two groups. Hence, in information retrieval on economics, irrelevant recall occurs because of the divisions of ideology. On the other hand, science and technology as a whole does not experience these difficulties except in a very few cases such as T. D. Lysenko (1898–1976) in genetics. Thus, information retrieval and citation analysis in natural sciences are more effective than they are in social sciences.

The *Science Citation Index (SCI)* has been published since 1961, and has cumulated references or bibliographies of journal articles by individual authors. Authors cited in many articles are thus assembled in one place. The *SCI* presupposes that the cumulation of references in journal articles is good for retrieval, and that the quality of papers accepted by certain journals is sufficiently standardized to be considered comparable.

In the fields of natural science, experiments are often carried out jointly by groups of people sharing various roles. For this reason, many articles are not written by a single author but by two or more (joint) authors. In this case, it is less effective to locate an article from an author's name because the roles in the experiment are divided among authors. However, the *SCI* can discriminate the dominant or influential persons who guided the experiment. It can also find persons' roles by comparing articles by the same author in the *SCI*.

In addition to the *SCI*, the Institute for Scientific Information (ISI) has published the *Social Sciences Citation Index (SSCI)* since 1972. However, no citation index is sufficiently long-termed to cover academic literature over centuries. Moreover, since the *SSCI* does not cover monographs, it has quite limited value in social science research. This is because in the fields of social sciences some works are published repeatedly and handed down from generation to generation over the centuries, long after the author's death.

Therefore, for academic research in social sciences, a new device like a citation index but covering a long period must be developed to realize effective retrieval and citation analysis. This index should have standardized forms for recording references or bibliographies in journal articles and in monographs.

Nowadays, the increasing numbers of research institutions and research groups have promoted the production of increasing numbers of articles. In addition, the advent of new subject fields has triggered the publication of new journals, resulting in an increase in the total number of journals. However, each journal specializes in a certain subject category, and articles carried in one journal deal with more or less the same subject. Information retrieval for academic research needs to be performed by focusing carefully on subjects in a journal or a group of journals. The increase in the number of journals also requires extensive searches among journals. However, in social sciences, such division of topics or subject fields among journals is not so distinct.

Opinions of authors on social science literature are expressed in the form of arguments because it is impossible to verify the opinions by experiment. Fact-finding and statistical surveys are conducted to give objectiveness to such arguments. However, even if such a survey is carried out, a social phenomenon to be described or analyzed may have with different interpretations, depending on the frame of reference. Consequently, subjects dealt with in different publications may overlap each other. This makes it difficult to identify even a single subject, let alone a compound one, and to organize and retrieve the litera-

ture based on its subject matter.

One remarkable difference between natural sciences and social sciences is that research in social sciences is carried out more often by an individual researcher than by a group of researchers in cooperation. Generally speaking, there are comparatively fewer publications written by two or more authors. Thus, using the author's name for a retrieval key exerts higher discriminating power in social sciences than in natural sciences. However, as shown in Table 2 referred in Section 2.2, this tendency is gradually changing with the propagation of empirical research which requires much more cooperative work than theoretical research does. Our example shows that the percentage share of single authors is 87% in the field of theoretical economics, but only 60% in the field of empirical research using econometric approaches. This implies that joint authorships are increasing in these fields, becoming like those in science and technology.

A personal author carries the highest importance in the area of the humanities, where a writing style unique to an author counts for a great deal. For this reason, text analysis occupies a larger area among computerized analyses. On the other hand, in social sciences, the importance of an author's statement is usually independent of his writing style. Thus, text analysis is not so important, with exceptions such as studies on Karl Marx.

To sum up this section: 1) social science information should cover books, especially monographs, along with journal articles; 2) the time span for information retrieval in social sciences is longer than that for science and technology; 3) the role of an author's name is still effective, or is necessary, in searching for an important person in social sciences; and 4) subject approaches between natural sciences and social sciences are not homogeneous.

In the next section, these characteristics are discussed more precisely using statistics compiled from our analysis, and source data for such statistics compilation are evaluated.

III. *Publication Statistics Reconstructed from Bibliographic Information*

3.1 Source Data and its Evaluation for Adequacy of Analysis

The US/MARC (MACHINE-Readable Catalog) database is the largest and most widely used bibliographic database in the world. The U.S. Library of Congress (LC) has produced and distributed this database since 1969. The LC is the United States' copyright depository library which receives all the publications in the United States in the year of publication. The US/MARC database contains catalog information on these publications in a machine-readable form. The publication year of any book contained in the US/MARC database is not long before the date of issuing the database. Thus, the US/MARC database consists mainly of literature published after 1968. Therefore, it does not provide sufficient information for retrospective research.

The accumulation of retrospective literature at the LC before and after the development of the US/MARC database is observed from the number of volumes added per year. Table 3 shows the number of added volumes surveyed every five years in the thirty-year period from 1946 onwards. They are classified into three broad categories according to

TABLE 3. VOLUMES ADDED TO LIBRARY OF CONGRESS EVERY FIVE YEARS
CLASSIFIED BY LC CLASSIFICATION*

| | Natural sciences | Social sciences | Humanities | Total |
|-----------|------------------|-----------------|----------------|-----------------|
| 1946/1947 | 8, 299 (18%) | 10, 140 (22%) | 27, 808 (60%) | 46, 247 (100%) |
| 1951/1952 | 11, 716 (18%) | 16, 270 (25%) | 37, 136 (57%) | 65, 122 (100%) |
| 1956/1957 | 15, 396 (24%) | 14, 488 (22%) | 34, 577 (54%) | 64, 461 (100%) |
| 1961/1962 | 17, 668 (26%) | 17, 225 (25%) | 33, 098 (49%) | 67, 991 (100%) |
| 1966/1967 | 23, 381 (19%) | 29, 142 (23%) | 73, 714 (58%) | 126, 237 (100%) |
| 1971/1972 | 51, 087 (24%) | 55, 261 (26%) | 108, 981 (50%) | 215, 329 (100%) |
| 1976/1977 | 37, 404 (20%) | 52, 557 (28%) | 99, 913 (52%) | 189, 874 (100%) |

Source: *Annual Report of the Librarian of Congress, 1947-1977.*

* Among main categories of LC Classification, Q, R, S, T, U, and V are classified into natural sciences; G, H, J, K, and L, social sciences; and A, B, C, D, E, F, M, N, P, Z, and Incunabula, the humanities.

their subject: natural sciences, social sciences, and the humanities. As shown in Table 3, the accumulation in natural sciences is the lowest, followed by social sciences. The humanities, the highest accumulation area, occupies the majority of the volumes added every year, because literary works written for popular consumption fall into this category. On the other hand, the number of volumes added to the social sciences is smaller than the number added to the humanities, because they include a larger portion of academic literature. The area of the natural sciences has the smallest number of books, because journal articles are used more frequently for research in this area, as mentioned in Section 2.2. Thus, the LC has acquired and stored quantities of books on the humanities and social sciences for many years. However, as mentioned above, the US/MARC database contains only those books added to the library since 1969.

Since the US/MARC database is insufficient for retrospective searches, many large libraries containing large numbers of past publications have converted their catalog information into a machine-readable form. These libraries have evaluated their holdings before starting their machine-readable conversion projects. William J. Baumol and Matityahu Marcus's study (1973) is one such evaluation project. That is, fifty-eight university research libraries in the United States are classified into four groups by size of holdings (p. 4). The average number of volumes held by libraries in the largest library group is 3,680,409 in 1968-69 (p. 11). This group consists of the fourteen university libraries, mainly the so-called Ivy League, including Harvard University.

Harvard University has collected a variety of literature for academic studies since its foundation in 1636. The Widener Library was established as its central library in 1915. This library launched a project to convert its shelflists to a machine-readable form in 1965 (De Gennaro, 1970). Thus, the *Widener Library Shelflists* (Harvard University Library, 1970) database contains abundant catalog information on past literature (see Figure 2 for examples of bibliographic descriptions in the shelflists). The format applied to the WLS (*Widener Library Shelflists*) database was originally developed by the library because there was no standard format at that time. Since the beginning of the 1980s, the library has compiled a separate database for newly acquired books applying *MARC Formats for Bibliographic Data* developed by the Library of Congress as the American standard format (now called the US/MARC format).

FIGURE 2. EXAMPLES OF BIBLIOGRAPHIC DESCRIPTIONS IN WIDENER LIBRARY SHELFLISTS: ECONOMICS

| | | | |
|-----------------|---|------------------|---|
| Econ 429 7 86 | Smith, Adam. Inquiry into nature and causes of the wealth of nations. 4th ed. London, 1786. | Econ 4296 17 | Smith, C.F. A book of famous ships. Boston, 1924 |
| Econ 429 9 01 5 | Smith, Adam. An inquiry into the nature and cause of the wealth of nations. 3rd ed. London, 1922 | Econ 4296 17 10 | Smith, C.F. Ocean races. N.Y., 1962 |
| Econ 429 9 04 2 | Smith, Adam. An inquiry into the nature and cause of the wealth of nations. London, 1901 | Econ 4296 17 5 | Smith, C.F. There was a ship. London, 1929 |
| Econ 429 9 01 3 | Smith, Adam. An inquiry into the nature and cause of the wealth of nations. London, 1904 | Econ 7067 2 40 5 | Smith, Charles. Britain's food supplies in peace and war. London, 1910 |
| Econ 429 7 99 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations 9th ed. London, 1799. | Econ 5179 8 | Smith, Charles W. Original theories upon and remedies for depression in trade, land, agriculture, and silver. London, 1893 |
| Econ 429 8 17 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. Edinburgh, 1817 | Econ 7705 239 | Smith, D. Puerto Rico sugar facts. Washington, 1939 |
| Econ 429 8 17 1 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. Edinburgh, 1817 | Econ 6419 25 10 | Smith, D. An economic geography of Europe. London, 1925 |
| Econ 429 8 46 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. Edinburgh, 1816 | Econ 7129 40 10 | Smith, D.H. The United States shipping board. Washington, 1961 |
| Econ 429 8 55 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. Edinburgh, 1855 | Econ 5169 36 20 | Smith, D.T. Defectors and depressions. N.Y., 1936 |
| Econ 429 8 66 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. Edinburgh, 1863 | Econ 5767 216 | Smith, Dan T. Federal tax reform. N.Y., 1961 |
| Econ 429 8 11 2 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. London, 1811 | Econ 7122 70 3 | Smith, Dan T. Taxable and business income. N.Y., 1949 |
| Econ 429 8 12 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. London, 1812 | Econ 6172 220 | Smith, David. No rain in those clouds, being an account of John Smith. 1882. London, 1913 |
| Econ 429 8 19 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. London, 1819. | Econ 6080 126 | Smith, David M. The industrial archeology of the East Midlands Nottinghamshire, Leicestershire and the adjoining parts of Derbyshire. Dawlish, 1965 |
| Econ 429 8 43 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. London, 1843 | Econ 5190 2 | Smith, E.A. The history of the confederate treasury. Hattisburg, 1901 |
| Econ 429 8 64A | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. London, 1844 | Econ 3879 3 | Smith, E.J. New trades combination movement. London, 1889 |
| Econ 429 8 52 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. London, 1852 | Econ 5179 40 | Smith, F.L. Tides in the affairs of men. N.Y., 1939 |
| Econ 429 8 71 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. London, 1871 | Econ 429 19 | Smith, F.P. A manual of political economy. N.Y., 1853 |
| Econ 429 8 73 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. London, 1873 | Econ 429 19 3 | Smith, F.P. A manual of political economy. Philadelphia, 1872 |
| Econ 429 8 76 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. London, 1876 | Econ 4279 12 10 | Smith, F.W. Passenger ships of the world. 1st ed. Boston, 1961 |
| Econ 429 8 84 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. London, 1884 | Econ 4279 12 | Smith, F.W. Trans-Atlantic passenger ships: past and present. 1st ed. Boston, 1947 |
| Econ 429 8 91 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. London, 1891 | Econ 4279 12 5 | Smith, F.W. Trans-Pacific passenger ships, and appendix. 1st ed. Boston, 1953 |
| Econ 429 9 15 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. London, 1910. | Econ 5275 126 20 | Smith, Edgar, L. Investment trust fund A. N.Y., 1926 |
| Econ 429 9 37.5 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. N.Y., 1937 | Econ 5275 124 15 | Smith, Edgar Lawrence. Common stocks as long term investments. N.Y., 1924 |
| Econ 429 8 69 | Smith, Adam. An inquiry into the nature and causes of the wealth of nations. Oxford, 1869. | Econ 5275 125 10 | Smith, Edgar Lawrence. Common stocks as long term investments. N.Y., 1925 |
| | | Econ 5275 125 12 | Smith, Edgar Lawrence. Common stocks as long term investments. N.Y., 1930 |
| | | Econ 5275 124 11 | Smith, Edgar Lawrence. Common stocks as long term investments. N.Y., 1934 |
| | | Econ 7715 5015 | Smith, Eugene A. Index to the mineral resources of Alabama. Montgomery, 1901 |
| | | Econ 6171 541.15 | Smith, F.D. Back to the country, how to make a living on the land. London, 1941. |
| | | Econ 4618 38 10 | Smith, F.O.J. A letter on the proposed policy of the national administration. Bangor, 1838 |
| | | Econ 4618 38 11 | Smith, F.O.J. A letter on the proposed policy and measures of the national administration. Washington, 1838 |
| | | Econ 6218 77 | Smith, F.W. The hard times agricultural development. Boston, 1877 |
| | | Econ 7725 16 | Smith, F.W. The Irish linen trade hand-book and directory. Belfast, 1876 |
| | | Econ 6189 166 | Smith, Frank Ellis. The politics of conservation. N.Y., 1966 |
| | | Econ 5379 136 | Smith, Frank F. War finance and its consequences. London, 1936. |

The WLS database is the main source of data used for our study. We selected thirty-five subfiles containing bibliographic items on the humanities and social sciences from the entire WLS database (see Appendix for the files selected). Using this subset of the entire WLS database, we compiled publication statistics and tried further analyses. This subset is referred to in this paper as the "WLS database."

Table 4 shows that the WLS database contains 668,386 bibliographic items in the various fields of the humanities and social sciences: economics, sociology, government, law, education, philosophy, psychology, American and other countries' history and literature. We have reclassified the above thirty-five subfiles into these thirteen subfiles, which cover publications over many centuries. Publications up to 1889 (including those with publication dates unknown) account for 26.5% of all the publications contained in the database. The remaining 73.5% are publications of 1890 and after. Figure 3 shows the percentage share of three groups by their publication dates, divided as follows: 1) before the nineteenth century; 2) the nineteenth century; and 3) the twentieth century. This triangle diagram shows that publications before the nineteenth century occupy under 20% of all the subject fields. The percentage share of the nineteenth and twentieth centuries, however, varies according to the subject field. The social sciences have a smaller share in the nineteenth century than have those of the humanities. These proportions are reversed in the twentieth century.

Figure 4 shows the number of volumes added to the Widener Library in chronological order in four typical subject fields: economics, sociology, English literature, and American history. The vertical axis is log, and hence we find that the number of volumes on econ-

TABLE 4. NUMBER OF RECORDS IN WIDENER LIBRARY SHEFLISTS DATABASE
CLASSIFIED BY PUBLICATION DATE

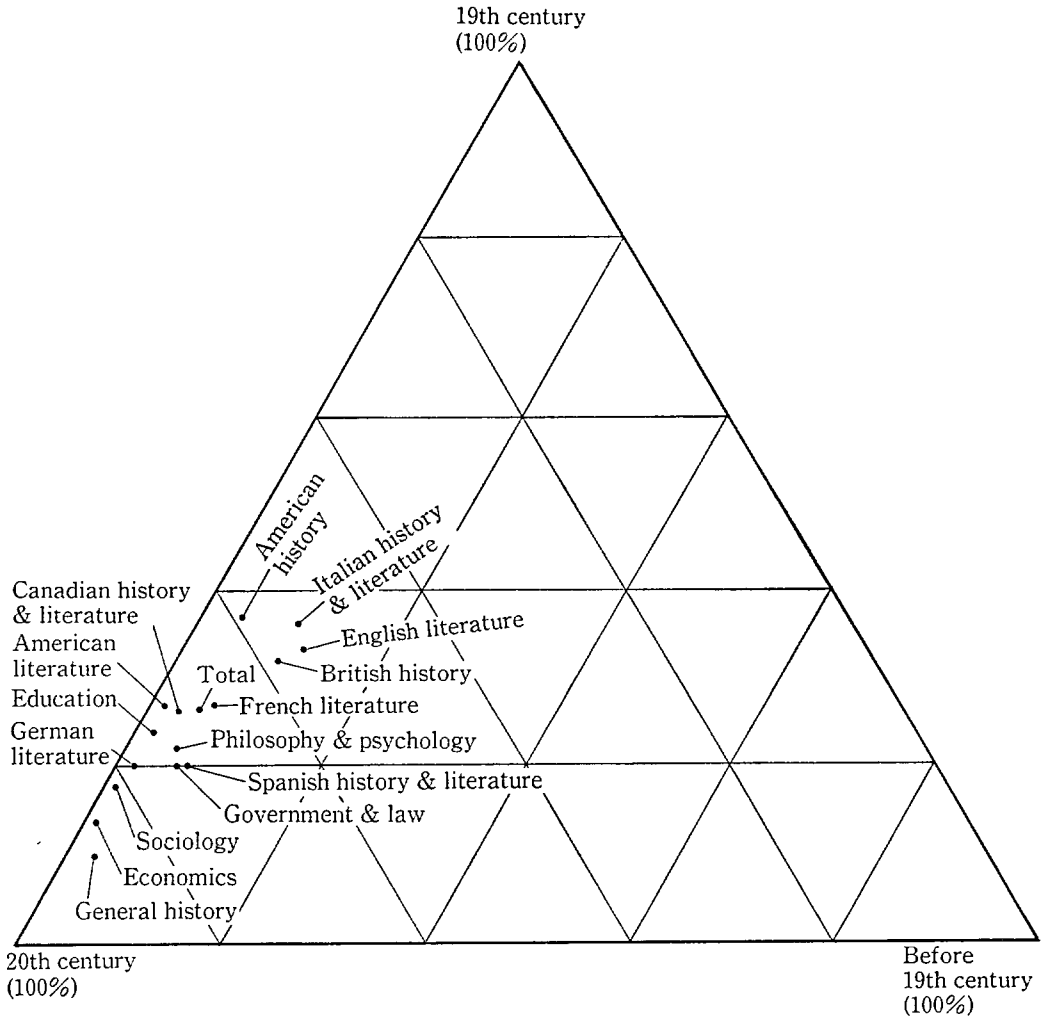
| Subject file (Class code) | No date | -1799 | 1800 -49 | 1850 -89 | 1890 -929 | 1930 -76 | Total | Latest acquisition |
|--|-----------------|------------------|------------------|-------------------|--------------------|--------------------|---------------------|-----------------------|
| Economics (ECON, ECONP) | 671 | 384 | 1,618 | 5,283 | 20,664 | 37,620 | 66,240 | 1974. 4 |
| Sociology (SOC) | 407 | 550 | 1,750 | 3,223 | 11,892 | 19,741 | 37,563 | 1972. 9 |
| Government and law (GOV) | 34 | 325 | 259 | 639 | 1,668 | 2,888 | 5,813 | 1969. 2 |
| Education (EDUC, EDUCP) | 300 | 498 | 1,420 | 3,334 | 10,835 | 11,637 | 28,024 | 1967. 10 |
| Philosophy and psychology* | 472 | 3,063 | 3,414 | 8,157 | 17,533 | 24,583 | 57,222 | 1972. 9 |
| General history and others** | 906 | 7,530 | 6,239 | 14,939 | 29,442 | 49,148 | 108,204 | 1970. 3 |
| American history (US) | 1,230 | 2,754 | 6,926 | 16,825 | 22,100 | 29,669 | 79,504 | 1973. 8 |
| British history (BR) | 530 | 3,889 | 4,059 | 6,122 | 10,910 | 14,752 | 40,262 | 1976. 11 |
| English literature (02, ELB, PZ, PZB) | 1,923 | 10,797 | 10,752 | 12,938 | 30,797 | 30,065 | 97,272 | 1971. 5 |
| American literature (ALA, ALB, PZ, PZB) | 487 | 236 | 2,636 | 7,786 | 20,248 | 24,258 | 55,651 | 1976. 10 |
| French literature (04, FL) | 943 | 2,632 | 2,546 | 6,623 | 13,446 | 19,677 | 45,867 | 1973. 1 |
| German literature (05, GERL) | 563 | 981 | 2,321 | 4,859 | 13,795 | 20,644 | 43,163 | 1973. 6 |
| Reference collection (REF, RR) | 49 | 1 | 9 | 98 | 361 | 3,083 | 3,601 | 1974. 3 |
| Total | 8,515 (1.3%) | 33,640 (5.0%) | 43,949 (6.6%) | 90,826 (13.6%) | 203,691 (30.5%) | 287,765 (43.0%) | 668,386 (100.0%) | |

Source: Matsui (1981).

* (PHIL, CRUS, DN, TDN, MOL, MON).

** General history, Canadian, Italian and Spanish history and literature (H, HB, HP, CAN, ITAL, IT-DOC, SPAN, SPANDOC).

FIGURE 3. PERCENTAGE SHARE OF RECORDS IN WLS DATABASE CLASSIFIED BY CENTURY



omics and sociology increases markedly after the 1830s. In contrast, the number of volumes added to English literature and American history is relatively constant from the early 1800s to the 1900s.

Since all the catalog information of the Widener Library has been converted into a machine-readable form, the WLS database is fully retrospective. This means that the library has devoted enormous labor and cost to this conversion project. It clearly indicates the demand for retrospective bibliographic information for academic studies.

Another point to be discussed is a bias in the present study resulting from the use of

FIGURE 4. VOLUMES ADDED TO WLS DATABASE IN CHRONOLOGICAL ORDER

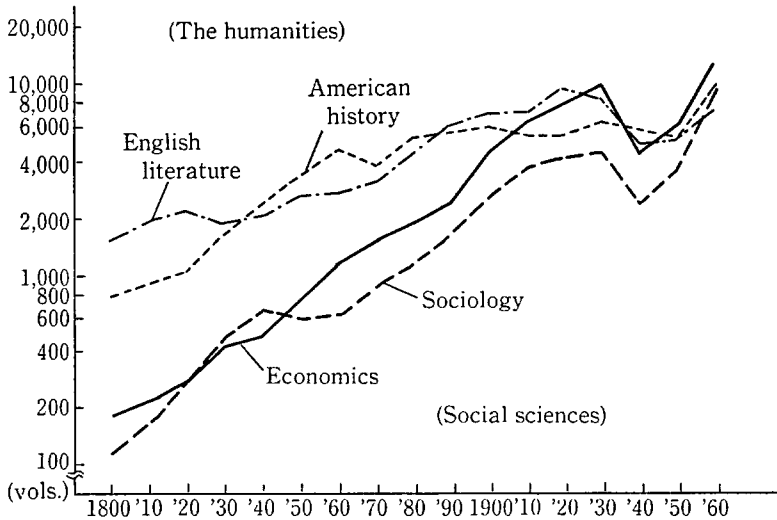


Table 5. NUMBER OF RECORDS IN WIDENER LIBRARY SHEFLISTS DATABASE CLASSIFIED BY LANGUAGE

| Subject file (Class code) | English | German | French | Italian | Spanish | Russian | Others | Total |
|---|------------------|-----------------|-----------------|----------------|----------------|---------------|----------------|-------------------|
| Economics (ECON, ECONP) | 37,263 | 10,078 | 8,789 | 2,695 | 2,459 | 2,036 | 2,920 | 66,240 |
| Sociology (SOC) | 21,881 | 5,562 | 4,727 | 1,197 | 1,158 | 1,143 | 1,895 | 37,563 |
| Government and law (GOV) | 3,047 | 933 | 741 | 372 | 282 | 74 | 364 | 5,813 |
| Education (EDUC, EDUCP) | 18,118 | 3,856 | 2,007 | 819 | 1,022 | 403 | 1,799 | 28,024 |
| Philosophy and psychology* | 22,023 | 13,466 | 9,344 | 5,906 | 1,178 | 1,397 | 3,908 | 57,222 |
| General history and others** | 28,216 | 6,259 | 11,092 | 37,934 | 18,744 | 1,552 | 4,407 | 108,204 |
| American history (US) | 74,630 | 1,235 | 1,430 | 335 | 842 | 263 | 769 | 79,504 |
| British history (BR) | 37,681 | 675 | 809 | 118 | 48 | 83 | 848 | 40,262 |
| American literature (ALA, ALB, PZ, PZB) | 54,602 | 325 | 302 | 103 | 80 | 88 | 151 | 55,651 |
| English literature (02, ELB, PZ, PZB) | 91,902 | 2,402 | 1,083 | 587 | 167 | 161 | 970 | 97,272 |
| French literature (04, FL) | 6,846 | 1,784 | 35,840 | 534 | 253 | 153 | 457 | 45,867 |
| German literature (05, GERL) | 3,912 | 37,559 | 817 | 265 | 86 | 113 | 411 | 43,163 |
| Reference collection (REF, RR) | 2,584 | 303 | 235 | 78 | 83 | 19 | 299 | 3,601 |
| Total | 402,705 (60%) | 84,437 (13%) | 77,216 (11%) | 50,943 (8%) | 26,402 (4%) | 7,485 (1%) | 19,198 (3%) | 668,386 (100%) |

Source: Matsui (1981).

* (PHIL, CRUS, DN, TDN, MOL, MON).

** General history, Canadian, Italian and Spanish history and literature (H, HB, HP, CAN, ITAL, IT-DOC, SPAN, SPANDOC).

a library catalog of the United States. Table 5 shows languages of the publications contained in the WLS database. English is used in 60% of all the publications, and the remaining 40% are in German (13%), French (11%), Italian (8%), Spanish (4%), Russian (1%),

and other languages (3%). This breakdown reflects the relative importance of each country's cultural influence. The biasedness of the WLS database due to the location of Harvard University is discussed in Section V.

3.2 Contents of Bibliographic Databases

The WLS database is the machine-readable catalog information on the holdings of the Widener Library at Harvard University. Such catalog information can be divided into two categories: bibliographic information, and subject information. Bibliographic information consists of author name, title, publisher, publication date and place, language code, etc. Class entry belongs to the subject information category. In Section 3.1, we have used this database for compiling statistics, such as the number of publications, by subject field, publication period, or language. This serves as the basic data for bibliometric analysis. The main purpose of compiling the database using the fields held at the Harvard University Library is to construct historical data of publications in the social sciences.

One important factor in analyzing such data is an author's name. We discuss this in detail in Section IV. Here we summarize the facts. The number of books written by one author is an indication of his importance. Table 6 shows the number of books contained in the five subject areas in the WLS database, and the number of major authors who wrote two or more books with a publication time span of fifty-one years or more. Table 6 also shows the number of major authors whose books appear in the ECON (economics) file and one or more other subject files. The result suggests that authors in the field of economics are also active outside the boundaries of this discipline. In addition, the data indicates that the average number of books per author is higher in the humanities than in the social sciences. This is partly because publications in the humanities dated back as early as the fifteenth century when printing was invented, whereas those in the social sciences started to appear in the eighteenth century when social sciences were first established (see Section II). The other reason is that in the humanities works written by the major authors were often published repeatedly over a long period, as is the case with literary works.

However, in the social sciences, whether it is a monograph on a theory or an analysis of a current situation, each author focuses on different topics, periods or geographic areas and writes one or more books. They are published repeatedly as books less often than in the humanities. This means that not only bibliographic information such as author name

TABLE 6. MAJOR AUTHORS CO-OCCURRENCES BETWEEN FIVE SUBJECT FILES OF WLS DATABASE

| File name (Subject) | Number of records | Number of major authors* | Number of records written by major authors (average) | Co-occurrences of major authors in ECON and others |
|----------------------------------|-------------------|--------------------------|--|--|
| ECON (Economics) | 66,229 | 472 | 964 (2.04) | — |
| SOC (Sociology) | 37,563 | 327 | 644 (1.97) | 22 |
| GOV (Government and law) | 5,813 | 72 | 123 (1.71) | 8 |
| EDUC (Education) | 27,893 | 210 | 461 (2.20) | 5 |
| PHIL (Philosophy and psychology) | 49,685 | 760 | 3,823 (5.03) | 23 |

* Those whose works are published with the publication time span of 51 years or more.

but also subject information such as topic, area, and period are indispensable for analyzing social science literature.

3.3 Change of Status from Current to Retrospective

When a work of one author is published repeatedly over centuries, the work acquires significance beyond the author's lifetime. This often happens to literary works appreciated as classics. In the social sciences, however, an analysis of contemporary affairs at one point in time is considered in subsequent periods as an analysis of a past event. This means that bibliographic items concerning "current" analyses turn into "historical" analyses with the lapse of time.

Corresponding to this change, bibliographic information can be divided into retrospective information and current information. The former is the accumulation or stock of information on literature published in the past, whereas the latter is the addition or flow of information concerning literature currently published. At a certain point in time, current information becomes retrospective. In the business world, data is mainly used for analysis of a current situation. For academic research on social sciences, however, we need both types of information. For example, Stigler (1982, p. 176) has pointed out that the lifetime of economic works written after 1899 is over twenty years, because the mean is about twelve years, and the standard deviation is about ten years. Therefore, in the social sciences current and retrospective information must be integrated for the construction of a bibliographic database.

In constructing a database, there is a need to unify or standardize the description form of retrospective information. Thus, description rules of bibliographic information accumulated over a long period must be established. For this purpose, authority information plays an essential role (Matsui, 1989). After controlling descriptions of bibliographic information based on authority information, accurate discrimination among works can be assured. Then, quantifications of bibliographic information for bibliometric analysis can be realized.

IV. *REPLOG (Repeated Publication Over Generation) System and its Workability*

4.1 Design of the *REPLOG* System and Discovery of Major Authors from the WLS Database

We have examined the possibility of bibliometric analysis in the establishment and development of economic theories by employing the WLS database. In natural sciences, Thomas S. Kuhn (1962) has described the change of normal sciences as the concept of "scientific revolutions." That is, one science can survive as a normal science in one period of history while all others are rejected as being impossible to prove. On the other hand, in the social sciences, this idea does not hold true. As with philosophy, the history of economics tells us that one person's idea repeatedly influences the development of theories in

succeeding generations, and that two or more theories can coexist in one period. This paper has bibliometrically traced the development of economic theories based on each author's publication status by using ECON (Economics) and other related files from the WLS database.

We used two kinds of data sets: the ECON file and the other twelve subject files in the fields of either the social sciences or the humanities. All the records in the ECON file were gathered under the names of authors by author identifiers devised for computer identification. Then the results of this automatic identification was checked by eye-scanning and reference materials. In this way, some authors with the identical names were discriminated. Moreover, dates of birth were compared for some authors with dates of publications in the records, because no item can be published before its author's birth. These additional procedures improved the accuracy of author name identification. Thus, we call the records in the ECON file the "refined" data. The records in other twelve files were gathered under the same author only by computer identification. Hence we call these the "crude" data. In so far as we checked the *SSCI*, control of the author's name used for matching of citations are under the level of the crude data (Matsui, 1978, p. 87).

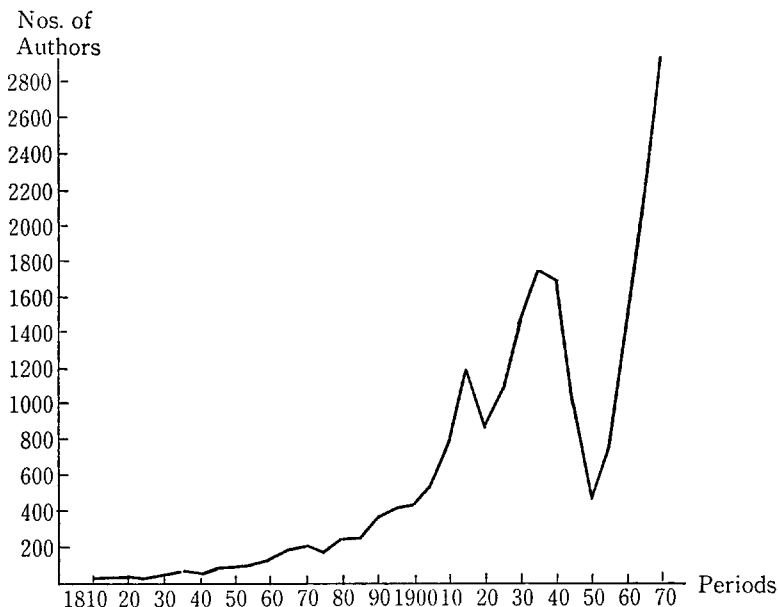
In this study, all the books in the ECON file were classified into one of several publication patterns, and used as measures showing how economic theories were established and developed. Categorization into patterns was carried out on the basis of three kinds of data: 1) the total number of books written and published by an author; 2) the publication span (the number of years from the publication of the first book to that of the latest) of that author when the total number of books is two or more; and 3) the number of books written and published by the author in a certain period of the author's total publication span. In this paper, such publication pattern is called the *REPLOG* (*Repeated Publication Over Generation*) pattern, because some works are repeatedly published beyond their authors' lifetimes. The *REPLOG* system classifies authors into a certain *REPLOG* pattern.

One precedent to the *REPLOG* system is "Statistical Studies in the History of Economic Thought" by Stigler (1965, pp. 31-50). It covers fifty-four English economists who had their main works published from 1766 to 1915. It examines those economists and lists their dates of birth and death, writing period and occupation. Moreover, it is confined to books published in England before their authors' deaths. Hence, its angle of analysis differs from that of the *REPLOG* system, as discussed below.

The main analysis, *Analysis 1*, was carried out by applying the *REPLOG* system to the ECON file: the refined data file. In addition, *Analysis 2* was conducted using the ECON file and the other twelve subject files: the crude data files. By applying the *REPLOG* patterns simpler than those in *Analysis 1*, *Analysis 2* examined characteristics of fields in the social sciences.

The ECON file employed in *Analysis 1* contains 66,229 records. Of these records, 51,825 include 34,300 personal authors. Of these authors, 7,160 had two or more books published, and they represent 21% of all the personal authors. Books written by them total 24,685, accounting for 48% of all the books written by personal authors. The remaining, 27,140 personal authors have only one book recorded in the ECON file. They represent 79% of all the personal authors. Figure 5 shows the number of these authors and when their books were published. The number of such authors has drastically increased since 1890, corresponding to the period when economics became independent of

FIGURE 5. CHRONOLOGICAL CHANGES IN NUMBER OF AUTHORS WITH ONE BOOK CONTAINED IN ECON FILE



moral philosophy and was established as a discipline of the social sciences. The year 1890, therefore, can be regarded as a turning point in the history of economic theories.

Analysis 1 aims to statistically analyze what kind of roles the authors, whose earliest books were published before 1890, played in the establishment and development of economics as a discipline. The ECON file keeps bibliographic information on books published from 1581 to 1973. *Analysis 1* examined authors who had their first book published in 1889 or earlier, and had two or more books published. Figure 6 shows examples of those authors with the number of books and their publication span. On the basis of these publication statuses, authors were categorized into four different *REPLOG* patterns. They were defined as follows:

Pattern A: This includes authors with a publication span of 101 years or more and with at least one book published every 50 years. They are regarded as writers of economic classics.

Pattern AB or *B:* *Pattern AB* includes authors with a publication span from 51 to 100 years and whose first book was published in 1865 or earlier. These authors may be recategorized into *Pattern A* in the future. *Pattern B* includes those with their first publication in 1866 or after and with the same span as above.

Pattern C: This includes authors with a publication span of 101 years or more but with no publication during the 50 years from the 51st to 100th year of the whole publication span. Their theories are assumed to have been revived after an interval of 51 years or more.

FIGURE 6. EXAMPLES OF AUTHORS IN ANALYSIS I

| Identifier | Publication span | Vols. | Publication pattern | | | | |
|--------------|------------------|-------|---------------------|--------|---------|---------|---|
| | | | 0-50 | 51-100 | 101-150 | 151-200 | |
| SACHS I | (1885-1971) | 86 | 5 | 1 | 4 | • | • |
| SAY JB | (1819-1936) | 117 | 12 | 10 | 1 | 1 | • |
| SAY L | (1818-1901) | 83 | 10 | 3 | 7 | • | • |
| SCAEFFLE AFF | (1835-1905) | 70 | 4 | 2 | 2 | • | • |
| SCHMIDT A | (1874-1970) | 96 | 6 | 5 | 1 | • | • |
| SCHMIDT H | (1857-1966) | 109 | 8 | 3 | 2 | 3 | • |
| SCHMOLLER G | (1870-1968) | 98 | 19 | 17 | 2 | • | • |
| SCOTT W | (1826-1957) | 131 | 3 | 1 | • | 2 | • |
| SCOTT WA | (1856-1933) | 77 | 11 | 7 | 4 | • | • |
| SEEBOHM F | (1883-1971) | 88 | 7 | 6 | 1 | • | • |
| SENIOR NW | (1828-1928) | 100 | 12 | 10 | 2 | • | • |
| SERING M | (1887-1939) | 52 | 12 | 10 | 2 | • | • |
| SINCLAIR J | (1791-1925) | 134 | 7 | 6 | • | 1 | • |
| SISMONDI JCL | (1819-1936) | 117 | 4 | 2 | • | 2 | • |
| SMITH A | (1776-1967) | 191 | 56 | 26 | 11 | 14 | 5 |
| SMITH FW | (1876-1936) | 60 | 4 | 3 | 1 | • | • |
| SMITH G | (1863-1963) | 100 | 5 | 3 | 2 | • | • |
| SMITH HL | (1887-1950) | 63 | 4 | 2 | 2 | • | • |
| SMITH J | (1830-1970) | 140 | 4 | 1 | 1 | 2 | • |
| SMITH JF | (1838-1918) | 80 | 2 | 1 | 1 | • | • |
| SMITH L | (1860-1951) | 91 | 2 | 1 | 1 | • | • |
| SMITH MH | (1871-1972) | 101 | 3 | 2 | • | 1 | • |
| SMITH TE | (1882-1952) | 70 | 2 | 1 | 1 | • | • |
| SOETBEER A | (1839-1892) | 53 | 10 | 9 | 1 | • | • |
| SPACKMAN WF | (1843-1969) | 126 | 3 | 2 | • | 1 | • |
| SPENCE W | (1807-1933) | 126 | 6 | 5 | • | 1 | • |
| STEIN L | (1860-1918) | 58 | 5 | 4 | 1 | • | • |
| STEUART J | (1767-1966) | 199 | 3 | 2 | • | • | 1 |
| STIRLING PJ | (1846-1909) | 63 | 3 | 2 | 1 | • | • |
| STRACHEY J | (1882-1956) | 74 | 7 | 1 | 6 | • | • |
| SULLY MD | (1888-1970) | 82 | 2 | 1 | 1 | • | • |

Pattern D: This includes authors with a publication span of up to 50 years. All books written by them were published within 50 years of their first publication.

In addition, to show whether books were published after the end of World War II, each pattern was subdivided into two groups. That is, if the latest book was published in 1946 or later, '1' is added to the end of each pattern name, e.g., *Pattern A1* or *AB1*, while if the last publication dates back to 1945 or earlier, '2' is added, e.g., *Patterns A2* or *AB2* (see Table 7).

Table 8 shows the results of *Analysis I*: the number and examples of authors classified into each *REPROG* pattern. The personal authors totaled 945, made up as follows: *Pattern A*, 16; *AB* or *B*, 89; *C*, 62; *D*, 778. Thus, 167 authors belonging to either *Pattern A*, *AB*, *B* or *C*, have a publication span of 51 years or more. This study regarded them as "major authors" on economics. They were discovered by the *REPROG* system.

TABLE 7. REPROLOG PATTERNS FOR ANALYSIS 1

| Publication span | A1 | A2 | AB1 | AB2 | B1 | B2 | C1 | C2 | D1 | D2 |
|------------------|----|----|-----|-----|----|----|----|----|----|----|
| 0- 50 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 51-100 | ○ | ○ | ○ | ○ | ○ | ○ | — | — | — | — |
| 101- | ○ | ○ | — | — | — | — | ○ | ○ | — | — |

Note: ○ = one or more books published.
 — = no books published every 50 years.

Table 8. RESULT OF ANALYSIS 1: NUMBER AND EXAMPLES OF AUTHORS IN ECON FILE

| REPROLOG patterns | Number of authors (%) | Examples |
|-------------------|-----------------------|--|
| A1 | 13 (81.3) | J. Bentham, F. List, F. Galiani, T.R. Malthus, J.S. Mill, D. Ricardo, A. Smith, R. Torrens, A.R.J. Turgot, L. Walras |
| A2 | 3 (18.7) | J.R. McCulloch, J.B. Say, A. Young |
| AB1 | 41 (77.4) | E. Böhm-Bawerk, F.Y. Edgeworth, H. Higgs, A. Marshall, C. Menger, G. Schmoller, M. Weber |
| AB2 | 12 (22.6) | L. Brentano, R.T. Ely, B. Hildebrand |
| B1 | 1 (2.8) | N. Cresme |
| B2 | 35 (97.2) | A. Cournot, K. Knies, W. Roscher, A. Wagner |
| C1 | 45 (72.6) | C. Babbage, J.E. Cairnes, M. Carey, H. Greeley, W.S. Jevons, W. Petty, A. Quetelet, T. Tooke, P. Verri |
| C2 | 17 (27.4) | V.R. Mirabeau, T. Mun, J.C.L. Sismondi, W. Spence, J. Taylor, H. Thornton, A. Walras |
| D1 | 0 (0.0) | |
| D2 | 778 (100.0) | F. Bowen, H.C. Carey, J.B. Clark, H. Fawcett, H.S. Foxwell, H. Dietzel, S.N. Patten |
| Total | 945 (100.0) | |
| 1 | 100 (10.6) | (Subtotal of A1 to D1) |
| 2 | 845 (89.4) | (Subtotal of A2 to D2) |

Characteristics of the development of economic theories are well observed in *Patterns A* and *AB1*, to which authors with the publication span of 101 years or more belong. The 16 authors of *Pattern A* includes A. Smith (1776-1967, 54 vols.), T. R. Malthus (1798-1966, 30 vols.), D. Ricardo (1815-1969, 24 vols.) and J. S. Mill (1844-1969, 38 vols.), all representing the classical school. In addition, it includes A. R. J. Turgot (1811-1973, 8 vols.) and F. Galiani (1803-1968, 6 vols.). If it is assumed that books of the authors of *Pattern A* have been read over generations, this finding is noteworthy, because in Japan books by Turgot and Galiani have been studied only by researchers of the history of economic theories. The authors of *Pattern AB1*, who may be recategorized into *Pattern A* in the future, total 41. They include E. Böhm-Bawerk (1881-1970, 19 vols.), F. Y. Edgeworth (1881-1970, 6 vols.), A. Marshall (1881-1961, 26 vols.), as well as C. Menger (1871-1963, 8 vols.). The analysis by the *REPROLOG* system found that books by those authors are now being established as economic classics. This means that in the history of economics two or more theories have coexisted, reflecting conflicts among different schools.

Since economics depends considerably on descriptions produced from an insight into economic affairs, some economic theories revive from time to time. In this context, a total of 62 authors of *Pattern C*, whose books were published after an interval of 51 years or more, deserve attention. They can be further divided into three groups. The first consists of authors who analyzed economies by using statistical data derived from *Political Arithmetick* (London, 1690) by W. Petty (1691–1967, 6 vols.). This group includes A. Quetelet (1835–1968, 6 vols.) and T. Tooke (1824–1959, 8 vols.). Charles Babbage (1826–1969, 6 vols.), famous for computer science, also belongs to this group. The second group is composed of American economists such as M. Carey (1810–1970, 13 vols.), H. Greeley (1844–1972, 7 vols.) and J. Taylor (1794–1913, 4 vols.). This is because the WLS database is a library catalog of one university in the United States. The third group includes J. E. Cairnes (1864–1965, 8 vols.), W. S. Jevons (1863–1972, 24 vols.), T. Mun (1664–1930, 7 vols.), W. Spence (1807–1933, 6 vols.) and P. Verri (1804–1964, 8 vols.). Their books have been reprinted and used for reexamination of their theories in the perspective of the history of economic theories.

The publication span of the authors belonging to *Pattern AB2* (12), *B* (36) and *D* (778) is 100 years or less. These groups include authors who are important for American area studies and those of the *historische Schule* (Historical school of Germany). The former authors include F. Bowen (1856–1889, 11 vols.), H. C. Carey (1835–1877, 23 vols.), R. T. Ely (1888–1940, 35 vols.) and S. N. Patten (1878–1924, 9 vols.), while the latter include L. Brentano (1867–1931, 23 vols.), H. Dietzel (1882–1922, 10 vols.), K. Knies (1850–1930, 13 vols.) and W. Roscher (1843–1921, 27 vols.).

As the next step, *Analysis 2* was conducted to reveal characteristics of the fields in social sciences in comparison with those of the humanities. First, a total of thirteen subject files were selected as major subject fields of either the social sciences or the humanities. Then the publication status of books contained in each file were examined. The number of records in these files total 437,857. The files on social sciences consist of four subject files: ECON (Economics), SOC (Sociology), GOV (Government and law), and EDUC (Education). On the other hand, for the humanities, the files on philosophy, psychology, history and literature were selected. They include PHIL (Philosophy and psychology), H and HB (General history), US (American history), BR (British history), GER (German literature), FR (French literature) and others. As for *Analysis 1*, author identifiers devised for computer identification were assigned to personal authors who wrote books recorded in those subject files. Then, the number of books and the publication span were determined for each identifier. Unlike in *Analysis 1*, however, for all the twelve files except the ECON file eye-scanning of the results of computer matching was not conducted, because of the large number of authors. Consequently, the results of identification of these files may contain some errors. Hence, *Analysis 2* used three *REPLOG* patterns, simpler than those in *Analysis 1*, as follows:

Pattern 2A: Authors with two or more books published and a publication span of 51 years or more.

Pattern 2B: Authors with two or more books published and a publication span of 50 years or less.

Pattern 2C: Authors with only one book published.

TABLE 9. RESULTS OF ANALYSIS 2: NUMBER OF AUTHORS IN 13 SUBJECT FILES

| Subject files | REPLOG patterns | | | |
|----------------------------------|-----------------|----------------|-----------------|------------------|
| | 2A (%) | 2B (%) | 2C (%) | Total (%) |
| Economics | 472 (1.4%) | 6,688 (19.5%) | 27,140 (79.1%) | 34,300 (100.0%) |
| Education | 210 (1.3%) | 2,884 (18.5%) | 12,525 (80.2%) | 15,619 (100.0%) |
| Sociology | 327 (1.6%) | 3,999 (19.1%) | 16,619 (79.3%) | 20,945 (100.0%) |
| Government & Law | 72 (2.0%) | 657 (17.8%) | 2,956 (80.2%) | 3,685 (100.0%) |
| Subtotal | 1,081 (1.4%) | 14,228 (19.1%) | 59,240 (79.5%) | 74,549 (100.0%) |
| General History | 116 (0.7%) | 3,550 (20.8%) | 13,396 (78.5%) | 17,062 (100.0%) |
| American History | 2,099 (5.9%) | 8,814 (24.9%) | 24,463 (69.2%) | 35,376 (100.0%) |
| British History | 1,238 (6.6%) | 4,613 (24.6%) | 12,899 (68.8%) | 18,750 (100.0%) |
| Canadian History & Literature | 196 (3.7%) | 1,303 (24.9%) | 3,735 (71.4%) | 5,234 (100.0%) |
| Italian History & Literature | 1,120 (6.3%) | 4,498 (25.4%) | 12,098 (68.3%) | 17,716 (100.0%) |
| Spanish History & Literature | 437 (4.5%) | 2,259 (23.1%) | 7,090 (72.4%) | 9,786 (100.0%) |
| Philosophy & Psychology | 760 (3.3%) | 6,057 (26.6%) | 16,004 (70.1%) | 22,821 (100.0%) |
| German Literature | 732 (5.2%) | 3,631 (26.0%) | 9,634 (68.8%) | 13,997 (100.0%) |
| French Literature | 701 (5.4%) | 3,597 (27.7%) | 8,686 (66.9%) | 12,984 (100.0%) |
| Subtotal | 7,399 (4.8%) | 38,322 (24.9%) | 108,005 (70.3%) | 153,726 (100.0%) |
| Total | 8,480 (3.7%) | 52,550 (23.0%) | 167,245 (73.3%) | 228,275 (100.0%) |

TABLE 10. RESULTS OF ANALYSIS 2: NUMBER OF BOOKS IN 13 SUBJECT FILES

| Subject files | REPLOG patterns | | | |
|----------------------------------|-----------------|-----------------|-----------------|------------------|
| | 2A (%) | 2B (%) | 2C (%) | Total (%) |
| Economics | 964 (1.8%) | 23,721 (45.8%) | 27,140 (52.4%) | 51,825 (100.0%) |
| Education | 461 (2.1%) | 9,533 (42.3%) | 12,525 (55.6%) | 22,519 (100.0%) |
| Sociology | 644 (2.1%) | 13,525 (43.9%) | 16,619 (54.0%) | 30,788 (100.0%) |
| Government & Law | 123 (2.3%) | 2,214 (41.8%) | 2,956 (55.9%) | 5,293 (100.0%) |
| Subtotal | 2,192 (2.0%) | 48,993 (44.4%) | 59,240 (53.6%) | 110,425 (100.0%) |
| General History | 251 (1.0%) | 11,282 (45.3%) | 13,396 (53.7%) | 24,929 (100.0%) |
| American History | 5,229 (7.8%) | 37,392 (55.7%) | 24,463 (36.5%) | 67,084 (100.0%) |
| British History | 3,065 (8.7%) | 19,454 (54.9%) | 12,899 (36.4%) | 35,418 (100.0%) |
| Canadian History & Literature | 413 (4.2%) | 5,762 (58.1%) | 3,735 (37.7%) | 9,910 (100.0%) |
| Italian History & Literature | 6,450 (15.7%) | 22,573 (54.9%) | 12,098 (29.4%) | 41,121 (100.0%) |
| Spanish History & Literature | 2,878 (13.5%) | 11,306 (53.2%) | 7,090 (33.3%) | 21,274 (100.0%) |
| Philosophy & Psychology | 3,823 (8.1%) | 27,472 (58.1%) | 16,004 (33.8%) | 47,299 (100.0%) |
| German Literature | 5,302 (13.7%) | 23,805 (61.4%) | 9,634 (24.9%) | 38,741 (100.0%) |
| French Literature | 7,466 (17.9%) | 25,504 (61.2%) | 8,686 (20.9%) | 41,656 (100.0%) |
| Subtotal | 34,877 (10.6%) | 184,550 (56.4%) | 108,005 (33.0%) | 327,432 (100.0%) |
| Total | 37,069 (8.5%) | 233,543 (53.3%) | 167,245 (38.2%) | 437,857 (100.0%) |

Tables 9 and 10 show the number of authors and their books classified into patterns within each subject file. This indicates that authors of *Pattern 2C*, authors who had only one book published, occupy an extremely high proportion of every field. The fields belonging to the social sciences occupy a higher proportion of *Pattern 2C* than those classified into the humanities. The number of authors assigned to *Pattern 2C* represents 73.3% of the whole. Authors of *Pattern 2B*, who had two or more books published within 50 years, account for 23.0%. In contrast to *Pattern 2C*, subjects on the humanities of this *Pattern 2B* occupy a higher proportion than those in the social sciences. The authors of *Pattern 2A*, who had two or more books published in a period of 51 years or more, occupy the smallest percentage. They account for only 3.7% of the total. In this pattern, percentage by subject shows almost the same tendency as in *Pattern 2B*. By comparing *Patterns 2A* and *2B*, it was found that the social sciences have a higher proportion of authors classified into *Pattern 2B*, a group of authors with the publication span of 50 years or less, than the humanities. This means that books on the social sciences are less retrospective than those on the humanities. Those findings indicate that there are bibliometric differences between the humanities and the social sciences.

Apart from the *REPLOG* patterns devised for *Analyses 1* and *2*, one can make different *REPLOG* patterns by adding new elements such as "language (used in the texts of the original book and its translations)," "publication country" and "publication place," all recorded in the WLS database. Designing new *REPLOG* patterns by adding those elements make

FIGURE 7. EXAMPLES OF REPLOG PATTERNS INCLUDING LANGUAGE CODES AND PUBLICATION PLACES

| Identifier | Publication span | -1749 | 1750 -1799 | 1800 -1849 | 1850 -1899 | 1900 -1949 | 1950 | Total vols. |
|---------------------|------------------|-------|---------------|---------------|---------------|---------------|------|----------------|
| SINCLAIR J | 134 (1791-1925) | | | | | | | |
| ENG Lerwick | | • | • | • | • | 1 | • | 1 |
| ENG London | | • | 3 | 3 | • | • | • | 6 |
| Total vols. | | • | 3 | 3 | • | 1 | • | 7 |
| SISMONDI JCL | 117 (1819-1936) | | | | | | | |
| ENG London | | • | • | 1 | • | • | • | 1 |
| FRE Paris | | • | • | 1 | • | 1 | • | 2 |
| ITA Firenze | | • | • | • | • | 1 | • | 1 |
| Total vols. | | • | • | 2 | • | 2 | • | 4 |
| SMITH A | 191 (1776-1967) | | | | | | | |
| ENG Calcutta | | • | • | • | 1 | • | • | 1 |
| ENG Cambridge | | • | 1 | • | • | • | • | 1 |
| ENG Cambridge, Eng. | | • | • | • | • | • | 1 | 1 |
| ENG Edinburgh | | • | • | 4 | 2 | • | • | 6 |
| ENG Hartford | | • | • | 2 | • | • | • | 2 |
| ENG London | | • | 8 | 8 | 6 | 7 | • | 29 |
| ENG New York | | • | • | • | 2 | 2 | • | 4 |
| ENG Nashville | | • | • | • | • | 1 | • | 1 |
| ENG Oxford | | • | • | • | 3 | • | • | 3 |
| ENG Philadelphia | | • | 1 | • | • | • | • | 1 |
| GER Breslau | | • | 1 | 1 | • | • | • | 2 |
| GER Leipzig | | • | 1 | • | • | • | • | 1 |
| FRE Paris | | • | 1 | 1 | 1 | • | • | 3 |
| ITA Torino | | • | • | • | • | 1 | • | 1 |
| Total vols. | | • | 13 | 16 | 15 | 11 | 1 | 56 |

it possible to evaluate an author's theory, based on its international acceptability and influence (for example see Figure 7).

4.2 Evaluation of the *REPLOG* System

The *REPLOG* system classifies personal authors into several *REPLOG* patterns using *Analysis 1*. We examined whether these authors really made a contribution to the history of economic theories and how they were evaluated. Two relatively small dictionaries on economics (Tsuru, 1974) and the history of economic theories (Kobayashi, 1963) were used as reference sources. The number of people listed in at least one of these dictionaries and that of authors automatically extracted from the WLS database by the *REPLOG* system were compared.

Analysis 1 revealed that 945 authors in the ECON file had their first book published from 1581 to 1889 and had two or more books published in total (see Table 8). Table 11 shows that 749 of them are listed in at least one of the two dictionaries used for evaluation. Of those 749 people, 416 born in 1869 or earlier were considered to correspond to authors who had their first publication in 1889 or earlier. In addition, the reference sources contained 200 people with no information concerning their dates of birth. Of these, 14 were identified as being one of the 945 authors of the ECON file. Thus, 430 people were extracted from the reference sources.

Figure 8 is a Venn diagram illustrating the relationship between the 945 authors extracted from the ECON file by the *REPLOG* system and the 430 people listed in at least one of the two reference sources. The diagram shows that 173 people were recorded in both the ECON file and at least one of the reference sources. This figure equals 18.3% of the 945 authors from the ECON file and 40.2% of the 430 people from the reference sources. This result does not seem to indicate a high rate of correspondence. However, it must be recalled that 945 authors account for only 2.8% of all the personal authors (34,300) recorded in the ECON file. Hence, in evaluating the *REPLOG* system, one must consider that such a small percentage of authors corresponds to over 40% of the 430 people extracted from the reference sources. Furthermore, some people appearing in the reference sources may be recorded in other subject files such as the SOC, GOV and PHIL files.

TABLE 11. NUMBER OF PEOPLE LISTED IN REFERENCE BOOKS

| Reference books** | Birth-and-death dates category* | | | Total |
|-------------------|---------------------------------|-----|--------|-------|
| | 1 | 2 | 3 | |
| G and I | 110 | 49 | 2 | 161 |
| G only | 301 | 53 | 187*** | 541 |
| I only | 5 | 31 | 11 | 47 |
| Total | 416 | 133 | 200 | 749 |

* 1 = People born in 1869 or earlier.

2 = People born in 1870 or later.

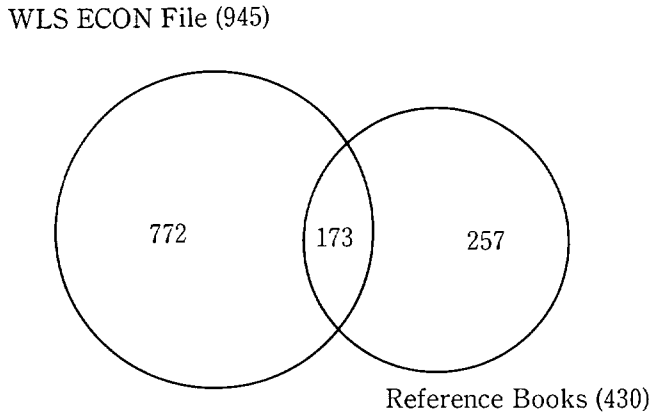
3 = People whose birth dates are not found in reference books.

** G = *Keizaigakushi Shojiten* (Kobayashi, 1963).

I = *Iwanami Keizaigaku Shojiten* (Tsuru, 1974).

*** Including 14 people also contained in major authors identified by *Analysis 1*.

FIGURE 8. RELATIONSHIP OF AUTHORS FROM ECON FILE AND OF THOSE LISTED IN REFERENCE BOOKS



A further examination was conducted on those 430 people listed in the reference sources based on a less strict condition that authors must have at least one book recorded in the ECON file. It was found that 259 people, representing 60.2% of the 430 people, were recorded in the ECON file. In the comparison discussed in the preceding paragraph, authors were extracted from the ECON file on condition that they had had two or more books published. Thus the number of authors is increased by only 86 (20%) by decreasing the number of books published from two to one. Therefore, the present study concluded that the *REPLOG* system, which automatically extracts a group of major authors by assigning measures called the *REPLOG* patterns, is effective for bibliometric analysis.

However, as a precondition of a bibliometric analysis like *Analysis I*, author information must be kept under control to allow accurate identification of books written by the same author. To realize such control, it is indispensable to find out what kind of name authority information is available. This is a question of how to compile and maintain authority information to secure consistent data description throughout the databases.

V. *Transition of Major Publishing Places and Concluding Remarks*

Using the *REPLOG* system, we statistically determined the major authors in the development of economic and social thought. Another bibliometric approach is to determine the growth of publications in this area. In section II we looked briefly at the growth of publications in the social sciences and the humanities in verbal expression. In Section III, Table 4 is classified by publication date and Table 5 by language. The statistics based on this data are not sufficiently minute to correspond to the description in Section II. For example, the number of publications listed in Table 5 shows that the major languages of the WLS database are English, German, French, Italian, Spanish and Russian. However, the increase in the number of publications was not only even between languages but also

between nations. Thus, analysis of the development of economic and social thought requires more detailed data. This is because the topics discussed at the formation of social sciences depend on the conditions applying in respective countries. Theories of particular authors thus apply within their own national boundaries, even if they try to formulate general theories. Therefore, publication statistics should be classified by country.

Before categorizing the data in Tables 4 and 5 by country, the publications in the ECON file were reclassified by language and period as shown in Table 12. Although Russian books occupy about 3% of the total, they were published mainly after World War II, when the economic and political importance of the U.S.S.R. was clearly observed and admitted among Western people. In the twentieth century, the international circulation of ideas has gradually occurred in every place. Thus, institutionalization requires standardization of theories and stimulates the publication of textbook style monographs, even though there is a great difference between Marxian and Non-Marxian social and economic thought. Tracing the development of the social sciences through the statistics of publications has primary significance before the twentieth century. Thus, for national publication statistics, we concentrate on these publications.

In Section III we restricted the degree of bias to the statistics based on the holdings of the Widener Library, which belongs an American university. As a first approximation, it does not affect the analysis. However, the statistics cannot escape some bias in a detailed analysis, and the location of Harvard University affects the statistics. More than half of the books in the ECON file are in English, and the majority of these books were published in the United States. However, it is rather misleading to evaluate the influence of English speaking people in the field of economics based on these publications, because the most influential economics was formed by the classical school, first in Scotland and then in England. Therefore, by excluding the publications in the United States and British Dominions, such as Canada, India and Australia, the three major cities are London, Edinburgh and Oxford, as shown in Table 13-1. Edinburgh has replaced by Oxford as the most influential center in 1890. The importance of Edinburgh before the twentieth century was the result of the formation of the classical school of economics based on the thoughts of Scottish philosophers.

In German publications of the ECON file, we found various dominant cities in the

TABLE 12. NUMBER OF RECORDS IN ECON FILE CLASSIFIED BY LANGUAGE AND PUBLICATION DATE

| | No date | -1799 | 1800-49 | 1850-89 | 1890-929 | 1930-76 | Total |
|---------|---------------|---------------|-----------------|-----------------|-------------------|-------------------|-----------------------------|
| English | 442 | 267 | 1,306 | 3,092 | 11,449 | 20,676 | 37,232 (56.2%) |
| German | 56 | 28 | 79 | 755 | 3,817 | 5,333 | 10,068 (15.2%) |
| French | 87 | 61 | 135 | 764 | 3,143 | 4,592 | 8,782 (13.3%) |
| Italian | 20 | 3 | 57 | 322 | 829 | 1,458 | 2,689 (4.1%) |
| Spanish | 11 | 16 | 26 | 211 | 689 | 1,506 | 2,459 (3.7%) |
| Russian | 4 | 0 | 6 | 29 | 173 | 1,824 | 2,036 (3.1%) |
| Others | 14 | 9 | 9 | 109 | 556 | 2,218 | 2,915 (4.4%) |
| Total | 634 (1.0%) | 384 (0.6%) | 1,618 (2.4%) | 5,282 (8.0%) | 20,656 (31.2%) | 37,607 (56.8%) | 66,181 (100.0%) (100.0%) |

Source: Matsui (1981).

TABLE 13-1. MAJOR CITIES PUBLISHED ENGLISH ECONOMIC LITERATURE

| | No date | -1649 | 1650 -99 | 1700 -49 | 1750 -99 | 1800 -09 | 1810 -19 | 1820 -29 | 1830 -39 | 1840 -49 | 1850 -59 | 1860 -69 | 1870 -79 | 1880 -89 | 1890 -99 | 1900 -74 | Total |
|--------------------------|------------|-------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------|
| London | 38 | 4 | 4 | 15 | 91 | 47 | 57 | 74 | 76 | 83 | 100 | 98 | 160 | 231 | 293 | 3,826 | 5,197 |
| Cambridge ¹ | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 3 | 5 | 9 | 23 | 15 | 850 | 911 |
| Oxford | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 5 | 4 | 5 | 7 | 303 | 326 |
| Edinburgh | 1 | 0 | 0 | 0 | 6 | 4 | 9 | 8 | 2 | 11 | 12 | 7 | 6 | 14 | 4 | 42 | 126 |
| Manchester | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 4 | 5 | 92 | 109 |
| Dublin | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 2 | 1 | 2 | 2 | 3 | 5 | 2 | 32 | 52 |
| (North America) | | | | | | | | | | | | | | | | | |
| New York | 23 | 0 | 0 | 0 | 4 | 5 | 7 | 11 | 18 | 38 | 66 | 94 | 140 | 271 | 278 | 6,656 | 7,611 |
| Boston | 10 | 0 | 0 | 5 | 6 | 7 | 2 | 18 | 33 | 40 | 38 | 56 | 58 | 83 | 91 | 847 | 1,294 |
| Washington | 5 | 0 | 0 | 0 | 0 | 4 | 4 | 11 | 43 | 55 | 15 | 29 | 32 | 38 | 48 | 931 | 1,215 |
| Chicago | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 5 | 27 | 59 | 798 | 901 |
| Philadelphia | 7 | 0 | 0 | 0 | 17 | 9 | 15 | 17 | 41 | 14 | 23 | 26 | 51 | 30 | 57 | 398 | 705 |
| Baltimore | 1 | 0 | 0 | 0 | 0 | 1 | 4 | 4 | 4 | 0 | 0 | 0 | 3 | 9 | 23 | 224 | 273 |
| Toronto | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 3 | 6 | 7 | 11 | 228 | 259 |
| Princeton | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 251 | 252 |
| New Haven | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 1 | 6 | 172 | 183 |
| Albany | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 3 | 3 | 2 | 8 | 4 | 3 | 2 | 24 | 54 |
| (Other British Dominion) | | | | | | | | | | | | | | | | | |
| Bombay | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 312 | 313 |
| Calcutta | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 3 | 1 | 200 | 209 |
| Melbourne | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 6 | 0 | 0 | 119 | 129 |
| Sydney | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 78 | 85 |
| Paris | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 1 | 2 | 3 | 119 | 128 |
| Total | 96 | 4 | 4 | 22 | 127 | 79 | 99 | 150 | 228 | 248 | 267 | 345 | 494 | 756 | 911 | 16,502 | 20,332 |

Source: Matsui (1981).

Note 1: It is difficult to distinguish Cambridge in England from Cambridge, Mass. in the United States.

nineteenth century scattered all over Germany (see Table 13-2). This indicates the situation in Germany before the formation of a nation state. As to French publications, the dominance of Paris was not exceeded by any other city in France throughout the period (see Table 13-3). However, we found the names of towns outside French boundaries, such as Geneva, The Hague, and London in eighteenth and early nineteenth century publications. This shows the common practices of publishing actually outside France or purportedly outside France, where a book might be prohibited by the current strict censorship in France.

Italian publications before 1850 are under 50 in the ECON file (see Matsui, 1981, p. 34). However, Italian contributions during the emergence of economics in the seventeenth century was more important than these figures show as Schumpeter (1954) pointed out by referring to the Custodi's collection of previous publications (see Section II). Therefore, we compiled another database based on the *Kress Library Catalogue* (Harvard University, 1940-67). Its subfile on the Italian works published before 1848 contains 1,184 records (Matsui, 1982; Barucci and Carpenter, 1985¹). This Kress Italian subfile is a supplement

¹ The indexes were compiled under the joint auspices of our computer processing of the Kress database.

TABLE 13-2. MAJOR CITIES PUBLISHED GERMAN ECONOMIC LITERATURE

| | No date | -1649 | 1650 -99 | 1700 -49 | 1750 -99 | 1800 -09 | 1810 -19 | 1820 -29 | 1830 -39 | 1840 -49 | 1850 -59 | 1860 -69 | 1870 -79 | 1880 -89 | 1890 -99 | 1900 -74 | Total |
|------------|------------|-------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------|
| Berlin | 7 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 3 | 4 | 6 | 18 | 47 | 41 | 62 | 1,661 | 1,853 |
| Leipzig | 6 | 0 | 0 | 0 | 2 | 1 | 2 | 0 | 2 | 3 | 15 | 24 | 41 | 51 | 53 | 566 | 766 |
| Stuttgart | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 4 | 6 | 15 | 17 | 40 | 489 | 575 |
| Jena | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 12 | 29 | 36 | 437 | 519 |
| München | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 7 | 2 | 7 | 403 | 427 |
| Wien | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 6 | 8 | 22 | 25 | 29 | 296 | 389 |
| Tübingen | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 2 | 3 | 14 | 11 | 331 | 364 |
| Köln | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 3 | 0 | 233 | 238 |
| Frankfurt | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 5 | 4 | 4 | 215 | 236 |
| Zürich | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 3 | 1 | 2 | 203 | 214 |
| Hamburg | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 1 | 2 | 1 | 2 | 1 | 1 | 3 | 192 | 207 |
| Bern | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 6 | 121 | 130 |
| Basel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 112 | 115 |
| Heidelberg | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 2 | 1 | 4 | 0 | 1 | 99 | 111 |
| Göttingen | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 2 | 2 | 0 | 4 | 91 | 103 |
| Düsseldorf | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 95 | 97 |
| Freiburg | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 10 | 82 | 96 |
| Halle | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 3 | 2 | 10 | 76 | 93 |
| Wiesbaden | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 83 | 87 |
| Bonn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 80 | 86 |
| Würzburg | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 1 | 1 | 67 | 73 |
| Dresden | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 10 | 33 | 50 |
| Hannover | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 38 | 43 |
| Nürnberg | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 35 | 38 |
| Breslau | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 1 | 0 | 1 | 2 | 2 | 0 | 3 | 23 | 36 |
| Total | 20 | 0 | 0 | 1 | 16 | 6 | 9 | 3 | 11 | 17 | 49 | 81 | 177 | 200 | 295 | 6,061 | 6,946 |

Source: Matsui (1981).

to the ECON file because it excludes the holdings of the Kress Library. Publications of the top seven cities from Venice to Bologna in this subfile are classified by period and place. Table 14 shows that the dominant cities shifted from Venice, first, to Florence and Naples, then to Milan, after changes in economic prosperity of these cities. This corresponds to the fact that recent studies on the history of economic thought have paid attention to the differences between schools in these Italian cities.

The institutionalization of economics came after that of science and technology, except in France, as discussed in Section II. The first group of professional economists were mainly pamphleteers, who were active in various countries. Thus, the publication centers shifted from city to city following the transition of the economically prosperous cities, where economic disputes among the opinion leaders were serious.

To get statistics comparable to the Kress Italian subfile, we integrate five subject files in the social sciences and the humanities: the ECON, SOC, GOV, EDUC, and PHIL in order to check the situations in the United Kingdom, as shown in Table 15. We include the PHIL file, which takes into consideration the thoughts of moral philosophers as fore-runners of political economy.

The publication statistics based on the library holding are merely an approximation

TABLE 13-3. MAJOR CITIES PUBLISHED FRENCH ECONOMIC LITERATURE

| | No date | 1650 -1649 | 1700 -99 | 1750 -49 | 1800 -99 | 1810 -09 | 1810 -19 | 1820 -29 | 1830 -39 | 1840 -49 | 1850 -59 | 1860 -69 | 1870 -79 | 1880 -89 | 1890 -99 | 1900 -74 | Total |
|-------------------------|------------|---------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|
| Paris | 43 | 0 | 0 | 0 | 16 | 9 | 7 | 12 | 12 | 34 | 88 | 131 | 120 | 161 | 204 | 4,581 | 5,418 |
| Toulouse | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 86 | 87 |
| Bordeaux | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 82 | 84 |
| Lyon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 5 | 72 | 79 |
| Nancy | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 66 | 69 |
| Montpellier | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 59 | 64 |
| Lille | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 52 | 53 |
| Marseille | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 2 | 1 | 22 | 31 |
| Poitiers | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 27 | 29 |
| Rennes | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 26 | 27 |
| Grenoble | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 20 | 23 |
| Strasbourg | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 21 | 23 |
| Caen | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 17 | 18 |
| (Outside France) | | | | | | | | | | | | | | | | | |
| Bruxelles | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 9 | 2 | 6 | 11 | 185 | 219 |
| Geneva | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 79 | 85 |
| Lausanne | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 7 | 58 | 71 |
| Louvain | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 62 | 64 |
| Montreal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 33 | 36 |
| Liège | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 14 | 17 |
| The Hague | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 14 | 16 |
| London | 1 | 0 | 0 | 0 | 6 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 4 | 15 |
| New York | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 13 | 15 |
| Total | 46 | 0 | 0 | 0 | 26 | 10 | 7 | 14 | 14 | 38 | 97 | 145 | 128 | 182 | 243 | 5,593 | 6,543 |

Source: Matsui (1981).

TABLE 14. MAJOR CITIES PUBLISHED SOCIAL SCIENCE LITERATURE IN ITALY

| | -1499 | 1500 -49 | 1550 -99 | 1600 -49 | 1650 -99 | 1700 -49 | 1750 -99 | 1800 -09 | 1810 -19 | 1820 -29 | 1830 -39 | 1840 -48 | Total |
|--------------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|
| Venice | 12 | 14 | 46 | 19 | 13 | 7 | 37 | 6 | 2 | 5 | 0 | 0 | 161 |
| Florence | 1 | 4 | 9 | 5 | 3 | 6 | 47 | 8 | 4 | 5 | 5 | 13 | 110 |
| Naples | 0 | 0 | 1 | 5 | 4 | 7 | 31 | 3 | 0 | 5 | 6 | 8 | 70 |
| Rome | 5 | 5 | 7 | 7 | 8 | 11 | 14 | 4 | 2 | 1 | 1 | 3 | 68 |
| Milan | 0 | 1 | 2 | 2 | 2 | 2 | 19 | 11 | 7 | 6 | 2 | 7 | 61 |
| Turin | 0 | 0 | 2 | 4 | 0 | 1 | 14 | 5 | 1 | 3 | 7 | 5 | 42 |
| Bologna | 2 | 2 | 6 | 5 | 5 | 4 | 9 | 0 | 3 | 2 | 0 | 0 | 38 |
| Total | 20 | 26 | 73 | 47 | 35 | 38 | 171 | 37 | 19 | 27 | 21 | 36 | 550 |

Source: Matsui (1982).

of the actual publication statistics which were never compiled in the time series. The actual number of publications must be much larger than indicated by these figures. What is more important is their circulations. The total number of volumes circulated in the age of hand printing before machine printing in the late nineteenth century was not large. Table 16 is based on fragmentary data on the number of copies of works which played important roles in the development of economic thought. Except for works by J.-B. Say (1767-1832)

TABLE 15. MAJOR CITIES PUBLISHED SOCIAL SCIENCE LITERATURE IN UNITED KINGDOM

| | No | | 1650 1700 1750 1800 1810 1820 1830 1840 1850 1860 1870 1880 1890 1900 | | | | | | | | | | | | | | Total |
|------------|------|----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|--------|--------|
| | date | | -1649 | -99 | -49 | -99 | -09 | -19 | -29 | -39 | -49 | -59 | -69 | -79 | -89 | -99 | |
| London | 118 | 90 | 218 | 343 | 485 | 151 | 161 | 237 | 290 | 334 | 419 | 380 | 573 | 790 | 1,065 | 11,502 | 17,156 |
| Oxford | 4 | 6 | 14 | 3 | 7 | 2 | 6 | 4 | 9 | 8 | 9 | 16 | 15 | 42 | 40 | 835 | 1,020 |
| Edinburgh | 3 | 0 | 1 | 3 | 48 | 15 | 19 | 31 | 24 | 30 | 53 | 43 | 36 | 76 | 39 | 237 | 658 |
| Manchester | 2 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 3 | 3 | 7 | 3 | 12 | 14 | 12 | 242 | 302 |
| Dublin | 0 | 0 | 0 | 15 | 23 | 2 | 1 | 2 | 9 | 5 | 6 | 4 | 10 | 12 | 4 | 114 | 207 |
| Glasgow | 3 | 0 | 0 | 2 | 10 | 0 | 3 | 7 | 6 | 7 | 1 | 2 | 3 | 9 | 17 | 80 | 150 |
| Total | 130 | 96 | 233 | 366 | 574 | 172 | 190 | 282 | 341 | 387 | 495 | 448 | 649 | 943 | 1,177 | 13,010 | 19,493 |

Source: Matsui (1981).

TABLE 16. EXAMPLES OF NUMBER OF COPIES OF MAJOR ECONOMIC WORKS PUBLISHED IN 1600-1830

| Author | Title | Publication Place | Date | Number of Copies |
|--------------------------|---|-----------------------|------|------------------|
| Milles, Thomas | The Customers Apologie. | London | 1601 | 50 |
| | —, (Abridged version) | | 1602 | |
| Vauban, Sébastien | Projet d'une dixme royale. | Paris | 1706 | 200-300 |
| Quesnay, F. | Tableau économique, 1er éd. | Versailles | 1758 | 5 |
| | —, 2me éd. | | 1759 | 3 |
| | —, 3me éd. | | 1759 | * |
| Turgot, A. R. J. | Réflexion sur la formation et la distribution des richesses. | Paris | 1770 | 100-200 |
| Le Mercier de la Riviere | L'Ordre naturel et essentiel des sociétés politiques. | Londres (i.e., Paris) | 1767 | 3,000 |
| Smith, A. | An Inquiry into the Nature and Causes of the Wealth of Nations. | London | 1776 | 500 |
| Godwin, W. | An Enquiry concerning Political Justice. | London | 1793 | 3,000 |
| Ricardo, D. | On the Principles of Political Economy, and Taxation, 1st ed. | London | 1817 | 700 |
| | —, 2nd ed. | | 1819 | 1,000 |
| | —, 3rd ed. | | 1821 | 1,000 |
| Say, J.-B. | Traité d'économie politique, 1er éd. | Paris | 1803 | 12,000 |
| | —, 2me éd. | | 1814 | |
| | —, 3me éd. | | 1817 | |
| | —, 4me éd. | | 1819 | |
| | —, 5me éd. | | 1826 | |

Source: Matsuda (1983).

Note: * estimated under 10 copies.

the total number of volumes was quite limited. He was a symbol of the institutionalization of economics in France. His books were regarded as standard textbooks in economics, and were used in the new higher educational institutions in France after the Revolution. The number of publications multiplied by the estimated number of copies of one edition or printing will be a rough approximation of the probable circulation of books on economics. Recent research on publication consortiums and publishers, such as Darnton's work (1979) on *Encyclopédie*, gradually revealed the total number of publications of certain works based on the documents reserved in the dossiers of publishers.

In our discussion, we treated two factors, major authors and important publishing places, in relation to the economic prosperity of cities and nation. By combining these two factors and identifying the translations of major authors' works to other languages, we can trace the influence of economic theories and thoughts over national boundaries. However, for such a refined analysis further elaboration of the database is required. One way of achieving such refinement is to extend the comprehensiveness of records of major authors using bio-bibliographies. Such extended files may contain all the works of major authors in economics, and their translation. Through our experimental analyses on Adam Smith (H. Matsuda, et al., 1979) and Saint-Simon and Saint-Simonians (Sato, 1973), our database is insufficient for such microscopic detailed analysis. At present, we will refrain from such overextension and simply show the workability of our database for generating publication statistics and the usefulness of the *REPLUG* system for macroscopic bibliometric analysis to determine major authors in economics.

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APPENDIX: WIDENER LIBRARY SHELFISTS DATABASE

| File no. | Class code | Subject contents | Number of records | Latest acquisition |
|----------|------------|---|-------------------|--------------------|
| 01 | ECON | Economics | 82, 148 | (1974. 04. 08) |
| 02 | ECONP | Economics Periodicals | 1, 461 | (1970. 02. 23) |
| 03 | AL | American Literature, General and to 1900 | 43, 600 | (1976. 10. 07) |
| 04 | ALA | American Literature, 1900-1950 | 11, 232 | (1976. 10. 07) |
| 05 | ALB | American Literature, 1950- | 3, 780 | (1976. 10. 14) |
| 06 | BR | British History | 46, 197 | (1976. 11. 15) |
| 07 | CAN | Canadian History and Literature | 13, 508 | (1976. 11. 04) |
| 08 | CRUS | Crusades | 1, 445 | (1970. 01. 02) |
| 09 | DN | Dante | 4, 674 | (1974. 03. 20) |
| 10 | EDUC | Education | 33, 101 | (1967. 10. 26) |
| 11 | EDUCP | Education Periodicals | 2, 070 | (1974. 03. 13) |
| 12 | ELB | English Literature, 1950- | 1, 593 | (1971. 03. 23) |
| 13 | FL | French Literature—supplement | 2, 404 | (1972. 08. 07) |
| 14 | GERL | German Literature—supplement | 2, 502 | (1973. 08. 14) |
| 15 | GOV | Government and Law | 7, 631 | (1969. 02. 19) |
| 16 | H | General History | 23, 083 | (1970. 03. 21) |
| 17 | HB | General History since 1939 | 11, 040 | (1970. 03. 21) |
| 18 | HP | History Periodicals | 887 | (1975. 03. 21) |
| 19 | ITAL | Italian History and Literature | 55, 951 | (1974. 02. 21) |
| 20 | ITDOC | Italian Documents | 263 | (1974. 06. 15) |
| 21 | MOL | Moliere | 1, 933 | (1972. 08. 07) |
| 22 | MON | Montaigne | 594 | (1972. 08. 07) |
| 23 | PZ | British & American Minor Fiction, 1900-50 | 6, 788 | (1971. 03. 23) |
| 24 | PZB | British & American Minor Fiction, 1950- | 1, 678 | (1971. 03. 23) |
| 25 | SOC | Sociology | 46, 246 | (1972. 09. 07) |
| 26 | SPAN | Spanish History & Literature | 28, 018 | (1971. 12. 28) |
| 27 | SPANDOC | Spanish Documents | 114 | (1971. 12. 28) |
| 28 | TDN | Ticknor Dante Collection | 100 | (1974. 02. 15) |
| 29 | US | American History | 99, 715 | (1973. 08. 17) |
| 30 | PHIL | Philosophy & Psychology | 55, 480 | (1972. 09. 07) |
| 31 | REF | Acquisitions Dept. Reference Collection | 664 | (1970. 02. 13) |
| 32 | RR | Reading Room Reference Collection | 5, 631 | (1974. 03. 27) |
| 33 | 02 | English Literature | 103, 163 | (1971. 05. 20) |
| 34 | 04 | French Literature | 48, 003 | (1973. 01. 24) |
| 35 | 05 | German Literature | 46, 188 | (1973. 06. 14) |
| Total | | | 792, 885 | |

Note: Selections as of January 1977.

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