

APPENDIX A

IMPACT FACTORS

The Journal Impact Factors (JIFs) have evolved from an experimental bibliometric indicator to a leading quantitative measure of the quality of a journal, of the papers it publishes, of the authors of these papers, and of their institutions (Amin and Mabe, 2000). In the following, we describe the impact factors, their limitations and how they can be used.

An impact factor quantifies the citations a journal receives over time. The number of citations of a paper tends to follow a curve that is schematically shown in Fig. A.1. The number of citations in a given year first rises to a peak two to six years after publication, and then it declines. The general characteristics of such curves can be described by their amplitudes (or area under the curve), how close the peak of the curve is to the origin, and the rate of decline. These characteristics form a basis for determination of three ISI indicators: impact factor, immediacy factor, and cited half-life.

The impact factor is calculated by dividing the number of current citations a journal receives for articles published in the two previous years by the number of articles published in those same years. For example, the JIF for 1999 is the number of citations received in 1999 for articles published in 1997 and 1998, divided by the number of articles published in 1997 and 1998.

The immediacy index gives a measure of the skewness of the curve. It is calculated by dividing the citations a journal receives in the current year by the number of articles it published in that year, and it is proportional to the slope of citations per year versus time (Fig. A.1).

The cited half-life is a measure of the rate of decline of the citation curve. It is the number of years it takes to reach one half of the number of current citations, and it describes how long the articles in a journal continue to be cited after publication.

The values of JIFs are affected by the subject area of the journal, the type of journal (letters, full papers, reviews), the average number of authors per paper, the size of the journal, and the duration of the citation measurement window.

Figure A.2 illustrates the variations in JIF based on the subject field. Fundamental subject areas usually have higher average impact factors than specialized and applied subjects. The variation is very significant. A top journal in the field may have an impact factor lower than the bottom journal in another field. For 1998, for example, the mean JIF in material science and engineering was about 0.6, while for environmental sciences it was about 1.2.

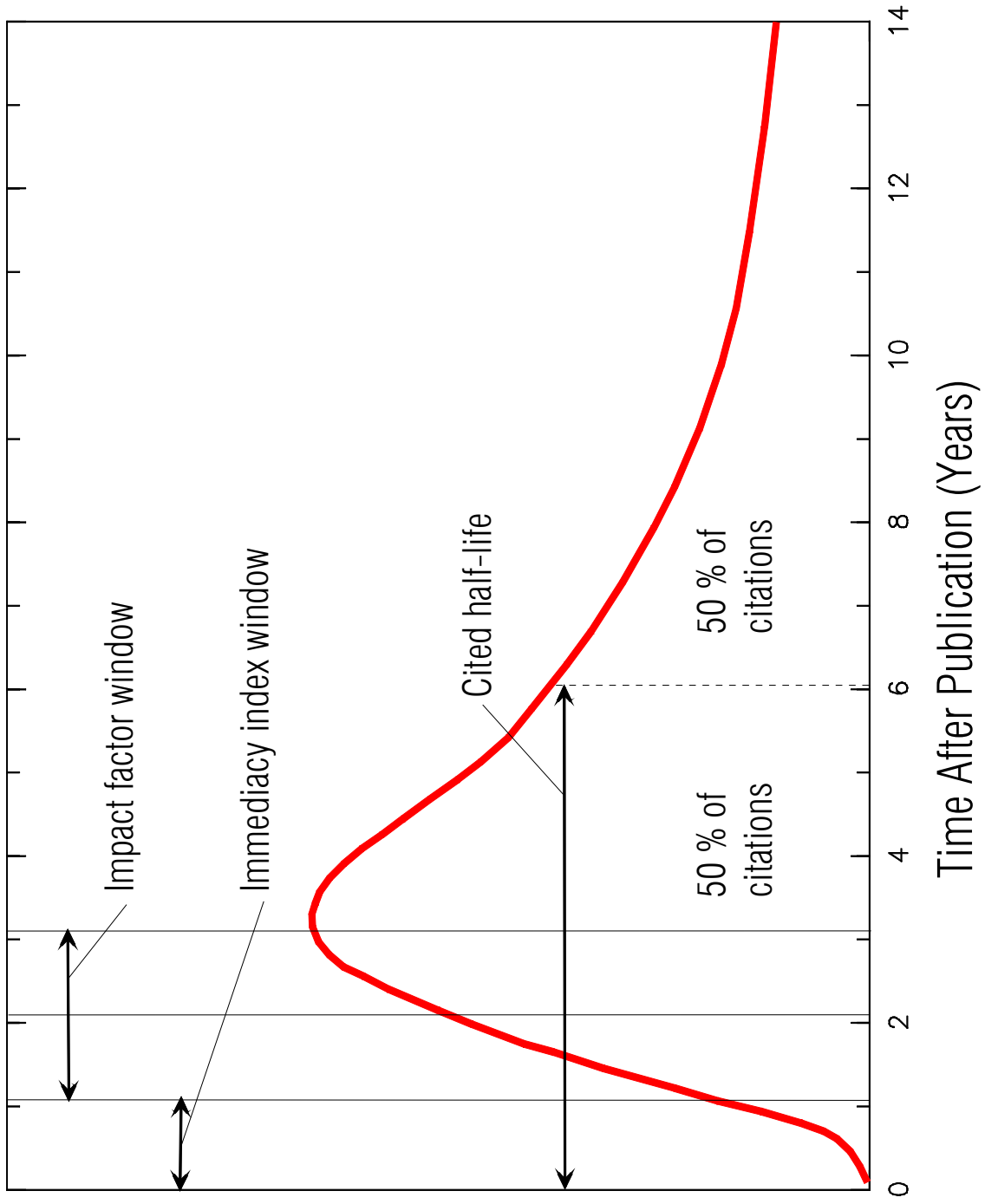


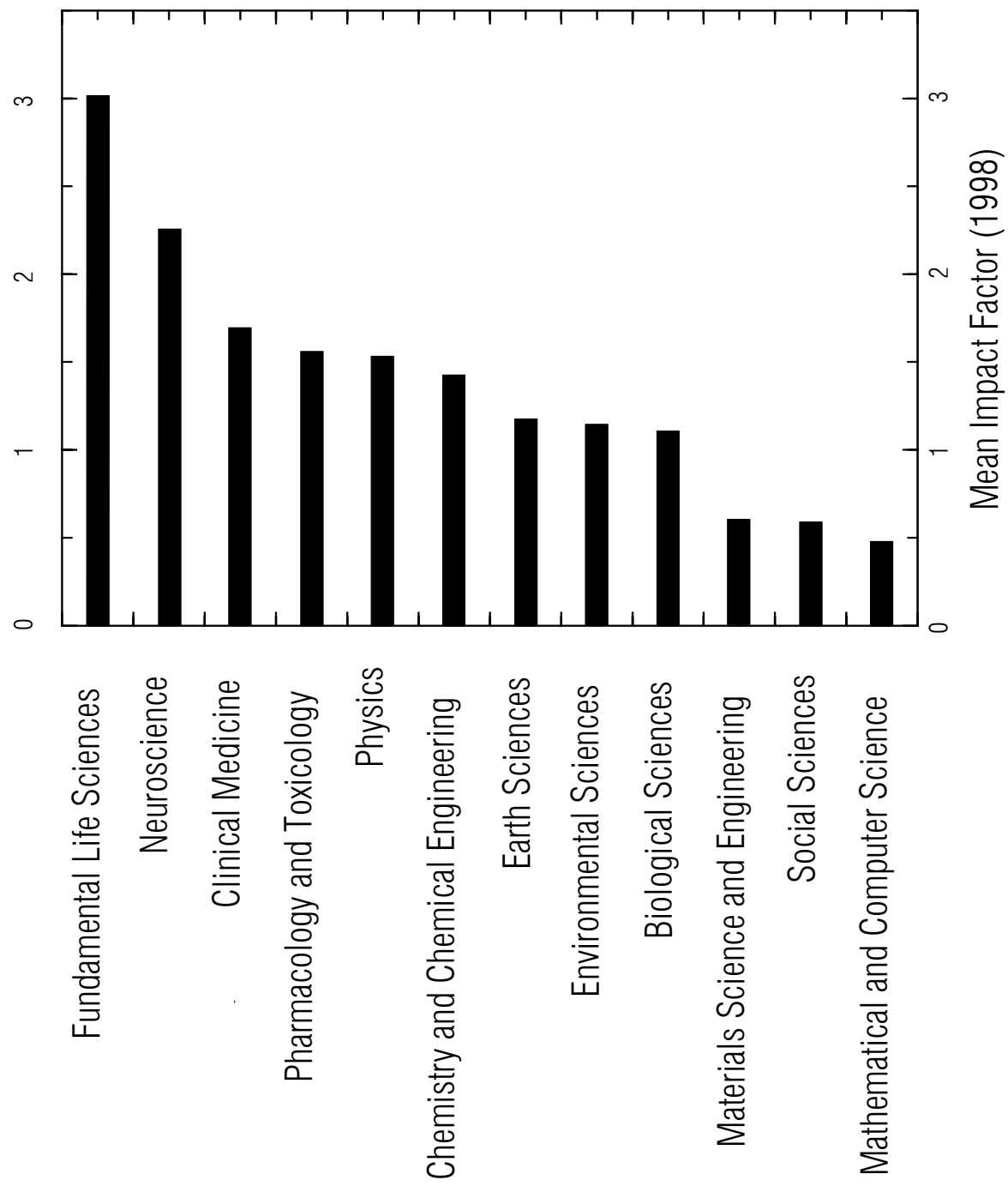
Fig. A.1: Generalized citation curves.

Related to the subject area variation is the effect of multiple authorship. The average number of co-authors varies according to the subject area, from the social sciences (with about two authors per paper), to the fundamental life sciences (with more than four authors per paper). With the tendency of authors to cite their own work, there is significant correlation between the average number of authors per paper and the average impact factors for the subject area (see Fig. A.3).

In Table A.1, we list the average number of authors per paper for the journal papers published by the twelve civil engineering faculty members at USC. These averages are also plotted in Fig. A.3. Because the mean impact factors are based on averages of "large" populations, we can only hypothesize that similar trends may apply also to the impact factors of individual authors and eventually to the number of citations they receive. This suggests that USC-11, USC-12, USC-5, and USC-9 probably receive about twice as many citations per paper as USC-1, USC-2, USC-7, and USC-3 because their papers have an average number of authors close to 3. USC-12, with a mean number of authors in his published papers equal to about 4, may expect to receive four times as many citations as USC-1, USC-2, USC-7, and USC-3.

Table A.1: Average number of authors per paper for twelve Civil Engineering faculty at USC.

Faculty	Average number of authors per paper
USC-7	1.69
USC-2	1.46
USC-4	2.18
USC-1	1.39
USC-9	3.06
USC-5	3.02
USC-6	2.15
USC-11	3.00
USC-12	4.15
USC-8	3.01
USC-3	1.83
USC-10	2.19



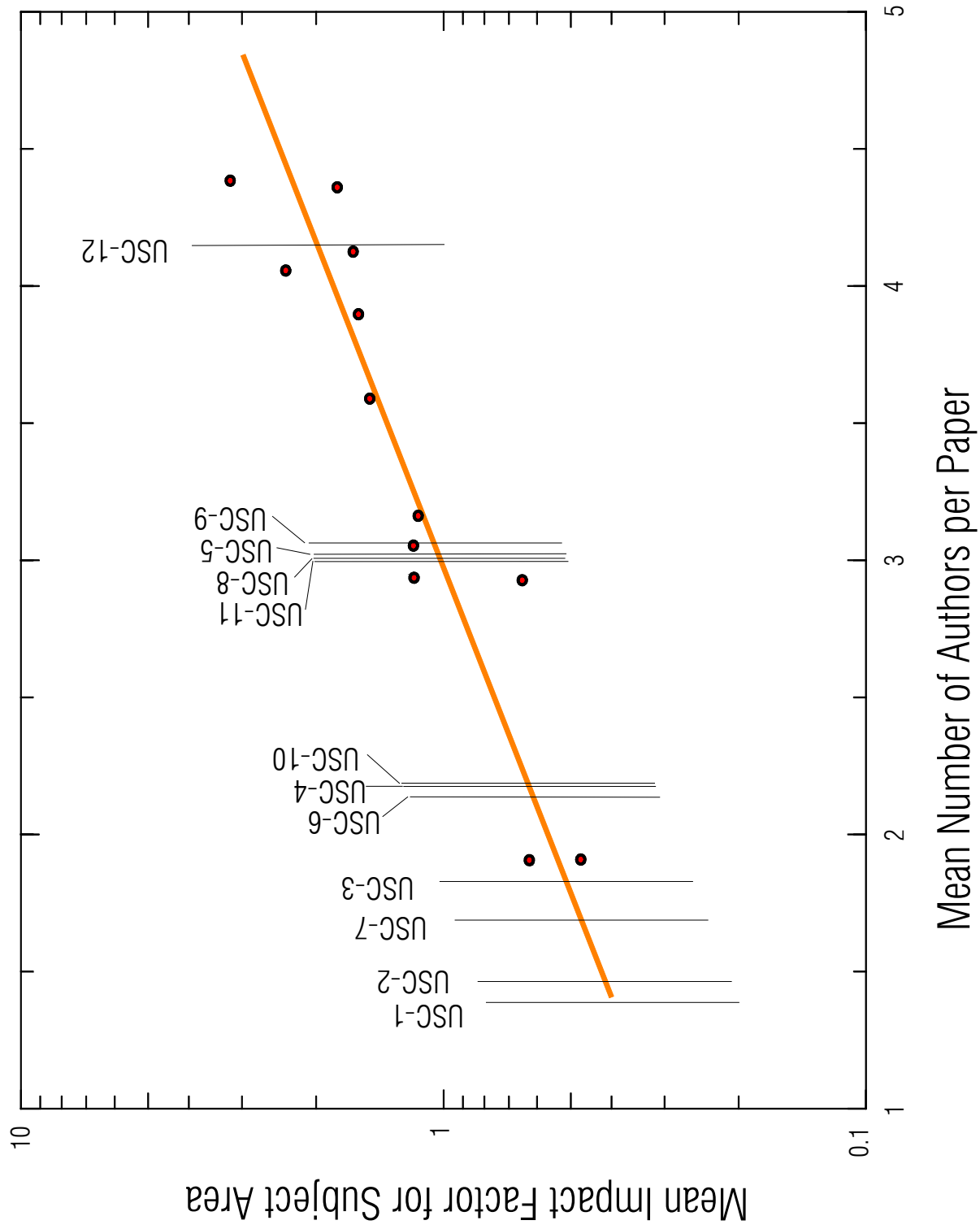


Fig. A.3: Impact factors and number of authors per paper.

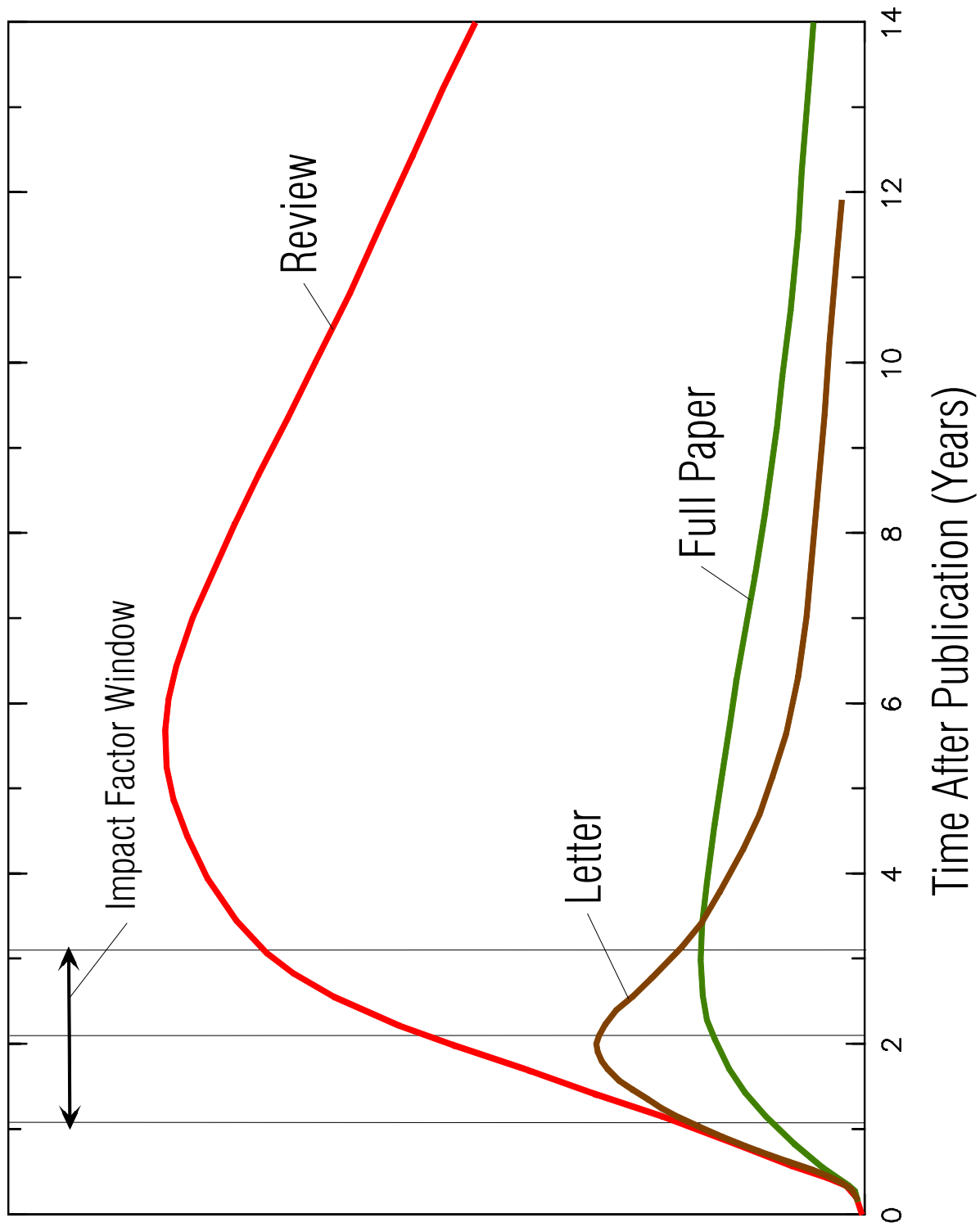


Fig. A.4: Impact factors and journal type.

Within the subject area, there is significant variation in the number of citations, depending upon the article type. This is illustrated in Fig. A.4. A short, rapid-publication journal (frequently called "letters," and publishing short papers) will have greater immediacy and a shorter citation half-life. A full-paper journal will have a citation peak near three years after publication, lower immediacy, and a longer citation half-life. For review journals, the immediacy index will be low, with citations rising to a peak many years after publication, and the citation half-life will also be correspondingly long.

The impact factor is an average value, and therefore it is subject to variations caused by the number of items being averaged (that is, the number of articles published in one year) and the measurement window, which is usually taken to be two years. ISI defines JIF in terms of a two-year window, a one-year citing window, and a two-year cited window. When a large number of journal impact factors are analyzed from one year to the next against the size of the journal, there is clear correlation between the fluctuations of JIF and the size of the journal. Small journals with less than 35 papers per year on average have impact factors that vary by up to 40%. Journals with 150 articles per year have fluctuations in JIF of about 15%.

Figures A.5 through A.7 illustrate fluctuations in JIF versus time for selected journals. Fig. A.5 shows variations for eight journals in which many earthquake engineering papers have been published. Figure A.6 shows the variations for eight journals in which many applied mechanics papers have appeared. Finally, Fig. A.7 shows variations in JIF for eight journals in the area of environmental engineering.

In Appendix B, the average impact factors of 6 fields (see Table 1 in Appendix B), 55 disciplines (Table 2 in Appendix B) and 5,762 journals (Table 3 in Appendix B) are presented for a 24 year window (1974 – 1998).

REFERENCES

1. Amin, A., and Mabe, B. (2000). Impact factors, use and abuse, *Perspectives in Publishing*, 1, 1 – 6.

Journal Impact Factors (JIFs) vs. Years for Selected Journals

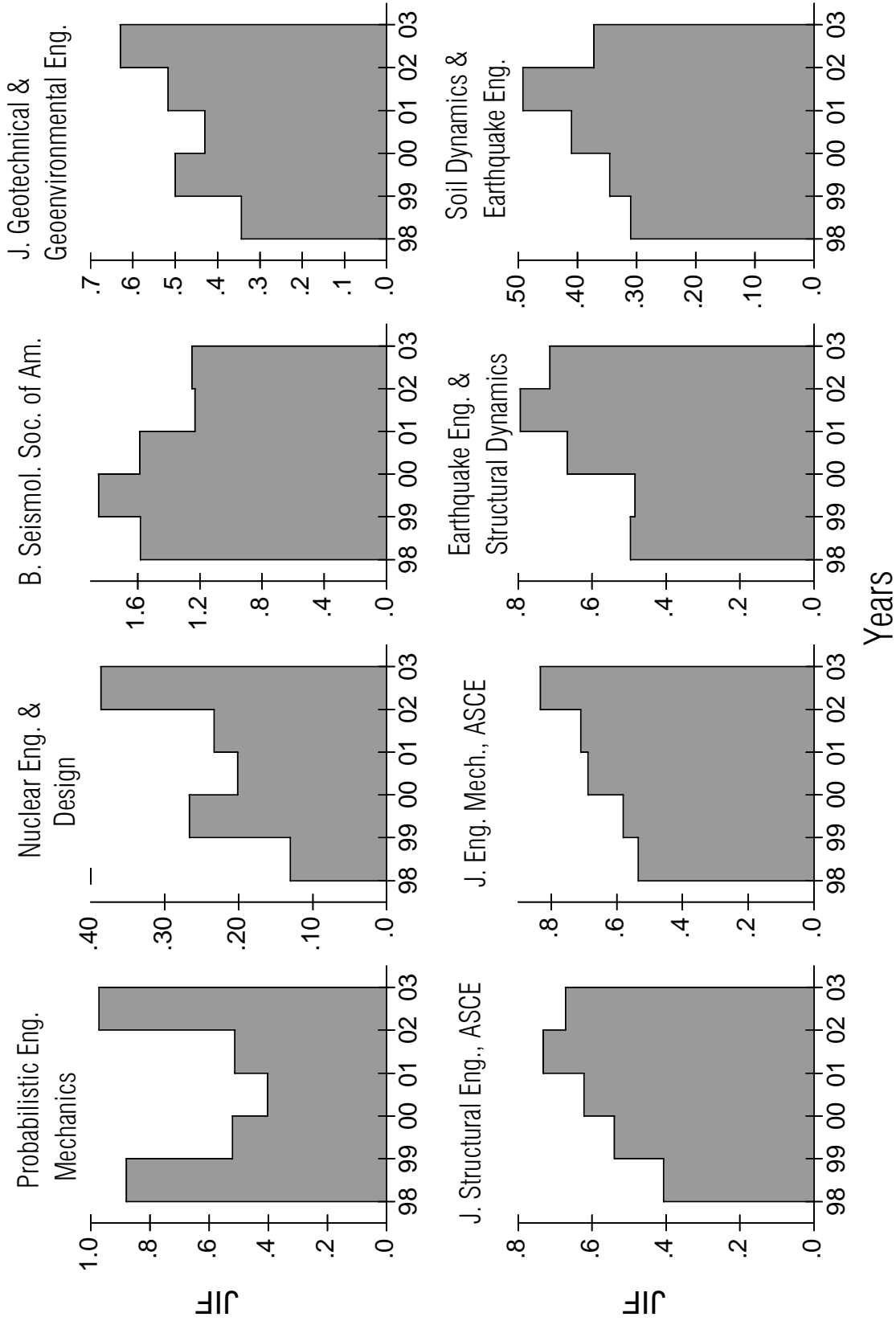


Fig. A.5: Journal impact factors (JIFs) versus years for selected journals.

Journal Impact Factors (JIFs) vs. Years for Selected Journals

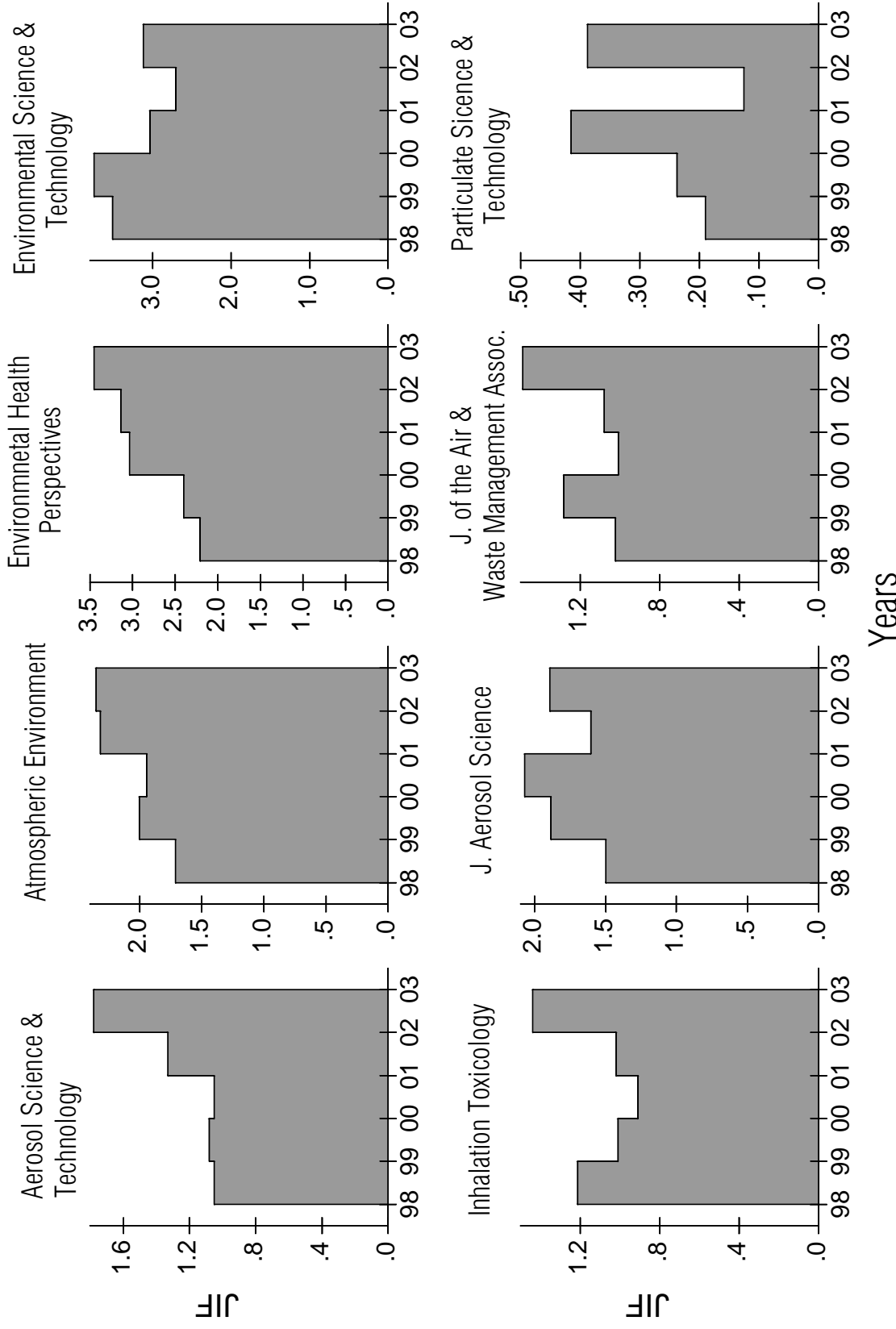


Fig. A.6: Journal impact factors (JIFs) versus years for selected journals.

Journal Impact Factors (JIFs) vs. Years for Selected Journals

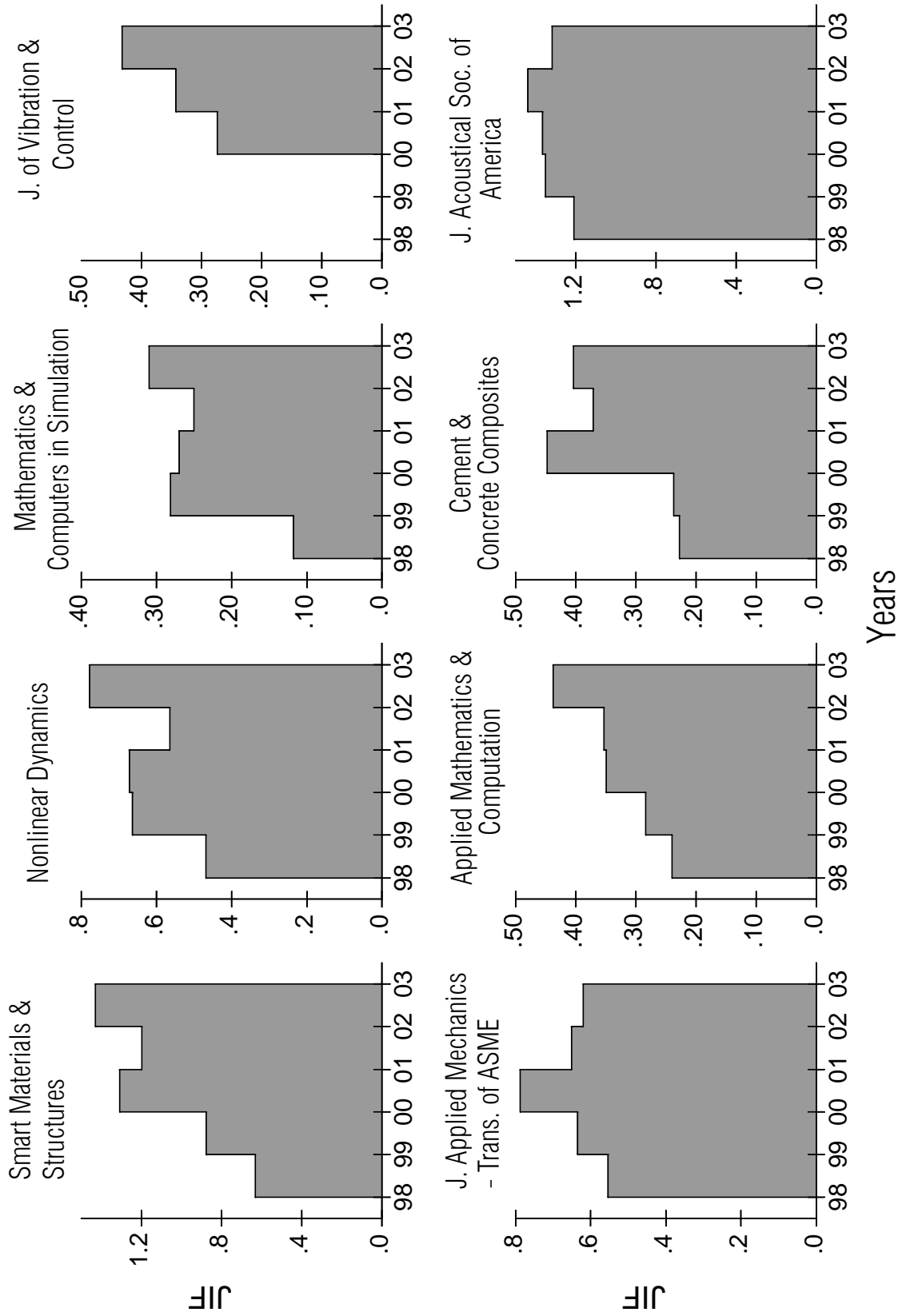


Fig. A.7: Journal impact factors (JIFs) versus years for selected journals.