Journal of Informetrics 8 (2014) 421–430

Contents lists available at ScienceDirect

Journal of Informetrics

journal homepage: www.elsevier.com/locate/joi

Do Article Influence scores overestimate the citation impact of social science journals in subfields that are related to higher-impact natural science disciplines?

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ARTICLE INFO

Article history:
Received 15 December 2013
Received in revised form 4 February 2014
Accepted 10 February 2014
Available online 5 March 2014

Keywords:
Bias
Eigenfactor
Interdisciplinary
Journal Citation Reports
Multidisciplinary
Web of Science

ABSTRACT

Unlike Impact Factors (IF), Article Influence (AI) scores assign greater weight to citations that appear in highly cited journals. The natural sciences tend to have higher citation rates than the social sciences. We might therefore expect that relative to IF, AI overestimates the citation impact of social science journals in subfields that are related to (and presumably cited in) higher-impact natural science disciplines. This study evaluates that assertion through a set of simple and multiple regressions covering seven social science disciplines: anthropology, communication, economics, education, library and information science, psychology, and sociology. Contrary to expectations, AI *underestimates* 5IF (five-year Impact Factor) for journals in science-related subfields such as scientific communication, science education, scientometrics, biopsychology, and medical sociology. Journals in these subfields have low AI scores relative to their 5IF values. Moreover, the effect of science-related status is considerable—typically 0.60 5IF units or 0.50 SD. This effect is independent of the more general finding that AI scores underestimate 5IF for higher-impact journals. It is also independent of the very modest curvilinearity in the relationship between AI and 5IF.

1. Introduction

From 1964 to 2004, Science Citation Index (SCI) and Social Sciences Citation Index (SSCI) were the only sources of reliable, large-scale citation data (Garfield, 2007). The Impact Factor (IF), based on data from SCI and SSCI, was recognized by both scholars and practitioners as a standard indicator of citation impact. In recent years, however, a number of alternative indicators have been introduced. These include the Article Influence (AI) score, which is calculated from SCI and SSCI data (Bergstrom, 2007), and the Source Normalized Impact per Paper (SNIP) indicator, which draws on data from Elsevier's Scopus database (Moed, 2010).

Aside from their dates of introduction, there are three major differences between the Impact Factor and the Article Influence score (Bergstrom, West, & Wiseman, 2008; Franceschet, 2010b; West, Bergstrom, & Bergstrom, 2010b). First, IF data are available only to institutions that subscribe to Thomson Reuters' Journal Citation Reports (JCR). In contrast, AI scores are freely available online at http://www.eigenfactor.org/.

A second difference lies in the weighting of citations. Impact Factors give equal weight to every citation; a citation in *PNAS* contributes no more to the IF than a citation in a regional specialty journal. In contrast, AI scores give greater weight

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http://dx.doi.org/10.1016/j.joi.2014.02.001
1751-1577/

Table 1
Average Article Influence scores and five-year Impact Factors of journals in 35 JCR subject categories (2012).

Subject area	AI	5IF	*N*
Developmental biology	1.83	4.12	37
Evolutionary biology	1.54	4.00	47
Psychology, biological	1.58	3.98	14
Genetics and heredity	1.57	3.97	153
Biochemistry and molecular biology	1.44	3.91	284
Chemistry, physical	1.17	3.68	134
Medicine, research and experimental	1.15	3.40	106
Medicine, general and internal	1.10	3.02	129
Psychology, experimental	1.20	2.75	78
Chemistry, organic	0.67	2.60	56
Management	1.11	2.55	115
Public, env. and occupational hlth.—SCI	0.85	2.46	134
Psychology, clinical	0.83	2.43	99
Psychology (all subfields combined)	0.97	2.38	497
Biology	0.90	2.38	76
Health care sciences and services	0.83	2.24	73
Health policy and services	0.80	2.07	53
Public, env. and occupational hlth.—SSCI	0.70	2.01	107
Physics, nuclear	0.82	1.92	21
Computer science, artificial intelligence	0.71	1.85	107
Geography	0.66	1.79	60
Social sciences, biomedical	0.59	1.70	32
Business, finance	1.34	1.60	59
Economics	1.24	1.51	276
Information science and library science	0.49	1.41	68
Communication	0.65	1.39	55
Urban studies	0.58	1.36	34
Sociology	0.70	1.34	115
Computer science, software engineering	0.68	1.33	94
Social work	0.43	1.30	31
Anthropology	0.54	1.26	70
Education, scientific disciplines	0.37	1.26	28
Education and educational research	0.51	1.23	145
Political science	0.77	1.15	116
Mathematics	0.93	0.81	258
Avg. of avg. values for 25 subject areas	0.92	2.23	—
SD of avg. values for 25 subject areas	0.37	0.98	—
SD/avg.	0.40	0.44	—

to citations that appear in highly cited journals. "The [AI] ranking system accounts for difference in prestige among citing journals, such that citations from *Nature* or *Cell* are valued highly relative to citations from third-tier journals with narrower readership" (West et al., 2012a).

A third difference is that AI scores, unlike IFs, are normalized to account for differences in impact among academic disciplines. It is well known that articles in the natural sciences and in fields with more authors tend to be cited more often. Differences in citation impact persist even among subdisciplines. (See, for example, Althouse, West, Bergstrom, & Bergstrom, 2009; Franceschet, 2010a; Leydesdorff, 2008; Postma, 2007; Smolinsky & Lercher, 2012; So, 1998.) Impact Factors do not account for these disciplinary differences, and users of the IF are cautioned not to compare journals in different subject areas. In contrast, AI scores are normalized to minimize disciplinary differences in citation rates. According to its creators, the AI algorithm "automatically accounts for these differences and allows better comparison across research areas" (West et al., 2012c).

The AI algorithm does not completely eliminate disciplinary differences in citation impact, however. As Table 1 shows, subject areas differ considerably in their average AI scores—only slightly less than they differ in their average IFs. The average AI score of a medical journal, for instance, is far higher than the average AI score of an anthropology or sociology journal. This may pose a problem for the comparison of journals within fields such as anthropology and sociology, since certain subfields—biological anthropology and medical sociology, for instance—may be especially likely to be cited in the journals of biology, medicine and other high-impact disciplines. Arguably, this gives those science-related subfields an unfair advantage in terms of their AI scores, since a citation in a mid-ranked medical journal is likely to increase the AI score more than a citation in a top social science journal. After all, more than 40% of the journals in the SCI *medicine* category have AI scores higher than that of *American Anthropologist*, the flagship journal of the American Anthropological Association. There is nothing unfair about the AI score itself, since any subfield-related differences in AI reflect real differences in impact among subdisciplines. However, unfairness can easily result if differences in impact among subfields are interpreted as differences in scholarly quality, as they sometimes are.