A Google Scholar h-Index for Journals: An Alternative Metric to Measure Journal Impact in Economics and Business

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We propose a new data source (Google Scholar) and metric (Hirsch's h-index) to assess journal impact in the field of economics and business. A systematic comparison between the Google Scholar h-index and the ISI Journal Impact Factor for a sample of 838 journals in economics and business shows that the former provides a more accurate and comprehensive measure of journal impact.

Introduction

Although the creation of rankings of academic journals is common practice, the activity is not without contention or critique (cf. McDonald & Kam, 2007). Whilst recognizing and sympathizing with this position, the present article takes a pragmatic stance: As long as journal rankings are considered to be part of academic life, it is important to ensure that they are as comprehensive and objective as possible. We can distinguish two approaches to ranking journals: stated preference and revealed preference (Tahai & Meyer, 1999). Stated preference involves members of a particular academic community ranking journals on the basis of their own expert judgements. There are hundreds of individual university journal rankings, and collated journal ranking lists have sprung up (cf. the ABS Journal Quality Guide, Association of Business Schools, 2007, and Harzing's Journal Quality List, Harzing, 2007). Rankings might be based on anything from a large-scale worldwide survey of academics to a small group of individuals with decision-making power, but will always contain some element of subjectivity. Revealed preference rankings are based on actual publication behavior and generally measure the citation rates of journals using ISI's journal impact factors (JIFs). The JIF is defined as the mean number of citations received in a particular year to articles published in the journal in the preceding 2 years. As the selection of article titles in Table 1 shows, this statistic is by no means undisputed.

Mingers and Harzing (2007) report a high degree of correlation between journal rankings based on stated and revealed preference. However, stated preference studies have long memories and perceptions of journals normally change very slowly (Tahai & Meyer, 1999). Revealed preference studies therefore provide a fairer assessment of new journals or journals that have recently improved their standing, and are argued to present a more accurate picture of journal impact. The few revealed preference studies published in the field of economics and business (cf. Baumgartner & Pieters, 2003; Dubois & Reeb, 2000; Tahai & Meyer) focused on a very limited group of journals. This article therefore presents a revealed preference study for more than 800 journals in the broad field of economics and business. It also introduces a new data source (Google Scholar) and a new citation metric (Hirsch's h-index; Hirsch, 2005) to accommodate the critique levelled at ISI's JIFs and provides a benchmarking exercise of the two data sources and metrics.

Data Source and Metrics

ISI Web of Knowledge Versus Google Scholar

Seglen (1997) and Cameron (2005) provide good overviews of the problems with the ISI Web of Knowledge as a data source. These problems mainly revolve around ISI's limited coverage, especially in the social sciences and humanities. Previous studies have highlighted issues such as the lack of coverage of citations in books, conference papers, and working papers, as well as citations in journals not included in ISI; the lack of inclusion of journals in languages other than English in the ISI database; and the U.S. bias in the journals

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TABLE 1. Selection of article titles dealing with the journal impact factor.

"Why the impact factor of journals should not be used for evaluating research" (Seglen, 1997)
"Sense and nonsense of science citation analyses: Comments on the monopoly position of ISI and citation inaccuracies" (Reedijk, 1998)
"Citation analysis and journal impact factors: Is the tail wagging the dog?" (Gisvold, 1999)
"The citation impact factor in social psychology: A bad statistic that encourages bad science?" (McGarty, 2000)
"Trends in the usage of ISI bibliometric data: Uses, abuses, and implications" (Cameron, 2005)

included in the database (Harzing & van der Wal, 2008; Kousha & Thelwall, 2007, 2008; Sanderson, 2008). Overall, there is considerable agreement that Google Scholar is a worthwhile alternative source of citation data, in particular in the social and information sciences. Disadvantages of Google Scholar are its inclusion of nonscholarly citations, double counting of citations, less frequent updating, uneven coverage across disciplines, and less comprehensive coverage of older publications/citations (Harzing & van der Wal). The problem of nonscholarly citations and double counting is found to be fairly limited and attenuated by the use of robust citation metrics such as the h-index (Harzing & van der Wal; Meho & Yang, 2007; Vaughan & Shaw, 2008). The last three limitations are not relevant for this article as we focus on a discipline that has good Google Scholar coverage and on citations to papers between 2000 and 2005.

Citations Metrics Used

Several commonly mentioned problems (for a summary see Seglen, 1997 and Cameron, 2005) with the ISI JIF are the use of a 2-year citation window, which for many disciplines is too short (Leydesdorff, 2008) and various technical issues related to the calculation of the JIF. First, while the denominator in the JIF (the number of articles published) only includes normal articles (so called "source" items) , the numerator includes citations to all publications in the journal in question, including editorials, letters, and book reviews (Cameron). This means that citations in these latter publications are "free" as the increase in the numerator is not matched by an increase in the denominator. Second, the JIF calculates the mean number of citations to an article in the journal in question. However, many authors have found that citation distributions are extremely skewed (e.g., Seglen). Individual highly cited papers can have a very strong influence on the mean JIF.

In this article we use a relatively new citation metric: the h-index. The h-index was introduced by Hirsch (2005, p. 1) and is defined as follows: "A scientist has index h if h of his/her N_p papers have at least h citations each, and the other $(N_p - h)$ papers have no more than h citations each." Therefore, the h-index provides a combination of both quantity (number of papers) and quality (impact, or citations to these papers; Glänzel, 2006). The h-index has resulted in a flurry of articles in journals such as *Scientometrics* and *Journal of the American Society for Information Science and Technology*, including articles proposing further refinements (cf. Bornmann, Mutz, & Daniel, 2008) and has generally received a positive reception. Examples of the application of the h-index to journals are still scarce. Only brief notes have been published (cf. Braun, Glänzel, & Schubert, 2005; Saad 2006) and no study has covered more than a limited set of journals, or provided a systematic comparison between different data sources and metrics (though see Saad's 2007 working paper for a comparison between the eigenfactor, www.eigenfactor.org, and h-index).

The h-index has several advantages over the ISI JIF. First, it does not have a fixed time horizon. The metrics used in the present article were computed in October 2007 over a five-year period (2001–2005). However, any time horizon could be used, rather than focusing on citations in one particular year to the 2 preceding years as is the case with the ISI JIF. Second, the h-index attenuates the impact of one highly-cited article, because the h-index is not based on mean scores. Therefore, analogous to its use for authors, the h-index for journals provides a robust measure of sustained and durable performance of journals, rather than articles. Third, a journal that publishes a larger number of papers has a higher likelihood of generating a higher h-index, since every article presents another chance for citations. This is a disadvantage when evaluating the standing of individual articles in a journal (or an individual academic based on this metric) as this measure should not be dependent on the number of articles published in that journal. However, a journal that publishes a larger number of high-impact papers has a bigger impact on the field (see also Gisvold, 1999). Given that impact on the field is what we attempt to measure in this article, we argue this feature of the h-index is an advantage rather than a disadvantage.

Methods

Data Source

Since our aim was to cover a broader range of journals than in most previous studies we used Harzing's Journal Quality List (Harzing, 2007). This list includes a collation of 20 different rankings of 838 journals in the broad area of economics and business. It appears to be quite influential: A search for the terms "Journal Quality List AND Harzing" results in more than 500 Google hits, and the list has been cited more than 20 times in ISI-listed journals (data for April 2008). It is downloaded more than 10,000 times a year and draws interest from all over the world.

Procedures

The metrics used in this article were calculated using Publish or Perish (http://www.harzing.com/pop.htm), a software program that retrieves and analyses academic citations using Google Scholar as a data source. Searches were conducted in the first week of October 2007. We also searched for

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TABLE 2. Summary statistics.

Subfield	No. of journals in the JQL	No. of ISI-indexed journals	Spearman correlation between h-index and JIF
Economics	168	122 (74%)	0.732***
Finance and accounting	94	28 (30%)	0.721***
General management and strategy	63	27 (43%)	0.891***
Mgmt information systems and knowledge mgmt	81	61 (75%)	0.774***
Mgmt science; operations research/mgmt	87	70 (80%)	0.733***
Marketing	65	25 (38%)	0.841***
Organization behavior/studies; HRM and IR	71	45 (63%)	0.633***
Others	209	158 (76%)	0.764***
Total	838	536 (64%)	0.718***

*** $p < 0.000$.

spelling variations (e.g., British vs. American spelling, the use of "and" vs. the use of "&") and abbreviated journal titles (e.g., all SIAM journals). If a title included common words, as in, for instance, *Journal of Management*, we conducted searches with the ISSN. As Google Scholar's results for ISSN searches seem to be rather erratic, this alternative was only used if the ISSN search provided a comprehensive result. The results of all search queries were inspected for incomplete or inconsistent results. This left us with only 24 journals (out of 838) that had substantially incomplete coverage and for which metrics could not be calculated. For other journals our inspection might have overlooked occasional missing articles, but this is unlikely to influence robust measures such as the h-index unless the articles are highly cited. We have no reason to believe that this was the case.

Our Google Scholar searches included citations to articles published between 2001 and 2005. This timeframe was chosen to be comparable with a 5-year average for the JIFs of the last 5 available years (2003–2006). These JIFs refer to citations in articles published between 2001 and 2005. Supplementary analyses with regard to the extent of concentration of citations within a particular journal were conducted in October 2007 with the general search function of ISI, which allows the user to rank articles by citation.

Results of the Benchmarking Analysis

Overall Comparison of JIF and h-Index

There are 536 journals in the Journal Quality List that have both an ISI JIF for 2003–2006 and a Google Scholar (GS) h-index. The Spearman correlation between the ISI JIF and the h-index—used because both the JIF and h-index have non–normal distributions—is strong and very significant: 0.718 ($p < 0.000$). Given that these two sets of indices have different data sources (ISI Thomson JCR vs. Google Scholar) and provide different metrics (a mean citations-per-paper count over 2 years for the ISI JIF and a combined quantity/quality measure over 5 years for the h-index) this strong correlation is quite remarkable.

The Journal Quality List includes journals in 15 different subdisciplines. There are seven subdisciplines that have a substantial number (more than 60) of journals included in the JQL: economics, finance and accounting; general management and strategy; management information systems and knowledge management; management science and operations research/management; marketing; and organization studies/behavior and human resource management/industrial relations (HRM/IR). Taken together these seven subdisciplines cover 75% of the journals in the Journal Quality List.

Table 2 provides statistics for these seven subdisciplines and shows there is significant variability in terms of the proportion of ISI-indexed journals in the different fields, ranging from a low of 30–43% for finance and accounting, marketing, and general management and strategy, to a high of 74–80% for economics; management information systems/knowledge management; and management science and operations research/management. The subdisciplines also differ in terms of the strength of correlation between the h-index and the JIF, varying from 0.633 for organization behavior/studies and HRM/IR to 0.891 for general management and strategy, but in all cases this correlation was highly significant.

Many journals, especially in finance and accounting, marketing, and general management and strategy are not ISI-indexed. How do these journals compare with journals that *are* ISI-indexed? As expected, journals that are ISI-indexed have a significantly higher h-index (23.5 vs. 11.5; $t = 15.002$, $p < 0.000$). However, there are more than 50 journals that ranked in the top 50% (16 and above) in terms of h-index, but are not ISI-listed. These journals are present in all disciplines, but are more frequent in the subdisciplines that have a low ISI coverage. However, the single most distinguishing shared characteristic of these journals seems to be that they are published in Europe (usually by Blackwell, Elsevier, or Emerald) and generally have a European editor and a large proportion of non-U.S. academics on the editorial board. Overall, nearly three quarters of the non–ISI-indexed journals with a high h-index are European journals.[1]

[1]We do not wish to imply that the ISI selection process has a bias against European journals. European editors might display a self-selection bias by simply not submitting their journals for inclusion into ISI. Of course one reason for this could be the perceived bias against non-U.S. journals.

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Reasons for Divergence Between JIF and h-Index

Although there is a very strong correlation between the ISI JIF and the GS h-index, there are some notable cases where the two diverge. The reason for this divergence falls into five general categories, which provide a clear illustration of the advantages and disadvantages of the respective metrics.

Field-specific differences in immediacy index heavily influence the ISI JIF. Most of the major outliers with a high JIF in comparison to their h-index are psychology journals. Similar to science journals, they have a very high immediacy index, i.e., citations to these journals occur quickly after publication. For example, the 2006 immediacy index for the *Annual Review of Psychology* (4.091) is more than ten times as high as that of the *American Economic Review* (0.335). This means that when comparing these two journals over a 2-year period (as is done for ISI JIFs) the *Annual Review of Psychology* will always show a higher impact factor than the *American Economic Review*, whereas the difference will be much smaller if we consider a 5-year period (as is done for the GS h-index). Hence a clear advantage of the GS h-index (and any metric based on a longer time frame) is a fairer comparison across disciplines.

Individual highly cited papers heavily influence the ISI JIF. A key disadvantage of the JIF is that individual highly-cited papers can heavily influence the JIF in individual years and hence many journals with a concentrated citation pattern show high JIFs in comparison to their h-index. A good example is *SIAM Review*, which had an average JIF of 2.75 between 2001 and 2003 and a JIF of 2.67 in 2006. However, in 2004 and 2005 its JIF stood at 6.12 and 7.21 respectively, causing a very high average JIF between 2003 and 2006. The very high JIFs for 2004 and 2005 were nearly entirely caused by a very large number of citations to one particular journal article published in 2003 ("The structure and function of complex networks" by M.E.J. Newman). In October 2007 this particular article had been cited 998 times, 12 times more than the next highest cited article published in 2003. In fact, in October 2007 the Newman paper alone makes up for 80% of the citations to *SIAM Review* in 2003; the other twenty papers published in 2003 together have only 249 citations. This example clearly shows the danger of relying on mean-value metrics, such as the JIF, as they can be heavily influenced by individual outliers.

Citation in materials not covered by ISI increases the GS h-index. Google Scholar has a much broader coverage than ISI, including books conference and working papers, and a wide range of journals not included in ISI. As a result journals that garner a large proportion of their citations from these sources will generally have a relatively high GS h-index in comparison to their ISI JIF. Examples are abundant in all disciplines. Articles in journals such as *The American Economic Review* and *Research Policy* are cited very heavily in working papers (e.g., papers from the National Bureau of Economic Research or the Tinbergen Institute) and government policy documents. Articles in the various *IEEE Transactions* and *Communications of the ACM* are often cited in conference proceedings, which are the most important publication outlets in this field, but are not included in the ISI citation count. The *Journal of Business Ethics*, *Human Relations*, and *International Journal of Human Resources Management*, all published out of Europe, have a high number of citations in European journals not indexed in ISI. These examples clearly show that the GS h-index provides a more comprehensive picture of a journal's impact beyond the relatively narrow scope of ISI-listed journals.

Number of papers published limits the GS h-index. The h-index is influenced to some extent by the number of papers that a journal publishes. A journal that publishes a larger number of papers has a higher likelihood of generating a higher h-index since every article presents another chance for inclusion in the h-index. Hence journals that publish a limited number of papers will generally show a GS h-index that is low compared to their ISI JIF. One example is the *Journal of Economic Literature*, which publishes a relatively small number of articles per year (15–20), so that even though most of these are highly cited, it will be difficult for the journal to achieve a very high h-index.[2] This is almost an exact counter case to the *American Economic Review*, which publishes around 160–170 articles per year that on average are not as highly cited as articles in the *Journal of Economic Literature*. Overall, however, the *American Economic Review* has a much larger total number of articles that are highly cited. We therefore argue that the h-index correctly identifies the journal's more substantial contribution to the field of economics. On the other hand, when evaluating individual academics based on articles published in these two journals, one should clearly take this difference into account, and should probably assign a higher importance to publication in JEL. In this case, different metrics clearly serve different purposes.

Minor idiosyncratic reasons for divergence. ISI's rather idiosyncratic calculation of the JIF includes citations to non–source material in the numerator, but not in the denominator. Hence journals with lively editorial/letter/book review sections display an ISI JIF that is high in comparison to their GS h-index. For instance, more than half of the *Academy of Management Review* papers are classified as either editorials or book reviews. Normally, this would not result in a significant distortion of the JIF as non–source materials tend not to be highly cited in management journals (in contrast to, for instance, journals such as *Science* and *Nature*). However, the paper-length introductions to the many special

[2]It should be noted that the *Journal of Economic Literature* published 91 papers between 2001 and 2005. Therefore, the journal could have achieved an h-index close to that of the *American Economic Review*, or could be in the top-three journals in terms of h-index (the current 3rd ranked journal has a h-index of 80) if all of its papers were highly cited. In fact, JEL has a very respectable h-index in spite of its limited number of papers and is the 34th ranked journal and in the top 5% of journals by h-index.

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issues are also classified as editorials, and these pieces tend to be highly cited. Clearly, ISI's calculation method has the potential to lead to incomparable JIFs, and we would argue the GS h-index provides a more accurate measurement of impact.

One of the more striking cases of a journal with a high ISI JIF in comparison to its GS h-index is *Human Resource Management*. Thomson's search query for this journal's JIF was revealed to include a substantial number of homographs referring to *Human Resource Management Review* and *Human Resource Management Journal*, as well as books with "Human Resource Management" in the title. As a result the JIF for *Human Resource Management* had been erroneously inflated. At 0.64 the recently released 2007 JIF for *Human Resource Management* is very substantially lower than the 2002–2006 JIF average of 2.00. It is possible that equally generic journal titles might suffer from the same problem. This—admittedly idiosyncratic—example shows that a comparison of different sets of metrics can help to spot errors in either metric.

Discussion and Conclusions

We showed that there is substantial agreement between the ISI JIF and the GS h-index for most subdisciplines. Therefore, for those subdisciplines that have limited ISI coverage (finance and accounting, marketing, and general management and strategy) the GS h-index could provide an excellent alternative for the 56–70% of journals not covered in ISI. However, even for other subdisciplines the additional coverage provided by Google Scholar could be useful.

Where the ISI JIF and the GS h-index diverged this was generally caused by one of four factors. First, the 2-year time frame of the JIF artificially rewards journals with a high immediacy index. Second, the sensitivity of the JIF to individual highly cited papers artificially inflates the JIF in comparison to the h-index. Third, the broader coverage of Google Scholar caused h-indices to be higher than JIFs for journals that receive a large proportion of their citations from policy documents, working papers, books, or conference proceedings—none of which are included in ISI—or from journals that are not ISI-indexed. Finally, the h-index is influenced by the number of papers published; hence, journals that publish a lot of papers have a better chance of reaching a high h-index, reflecting their broader impact on the field. In sum, the GS h-index addresses some of the statistical limitations underlying the JIF, and is more suitable to measure a journal's wider economic or social impact rather than its impact on an academic audience only. As such we argue that the GS h-index provides a more accurate and comprehensive measure of journal impact and at the very least should be considered as a supplement to ISI-based impact analyses.

However, even though an assessment of journal impact based on the journal's GS h-index might be more accurate and comprehensive than relying only on an ISI-based impact analysis, we express strong caution against a single-minded focus on journal impact in evaluating individual scholars' research output. While journal impact can certainly be used as *one* of the criteria to evaluate research output, reducing the evaluation to one single number is unlikely to provide a complete picture of a scholar's real impact. Many studies have established that highly cited articles get published in journals that are not considered top journals in the field, and a substantial proportion of the articles published in top journals fail to generate a high level of citations (cf. Oswald, 2007; Singh, Haddad, & Chow, 2007; Starbuck, 2005). Hence using journal proxies to evaluate the impact of individual articles can lead to substantial attribution errors.

A more fundamental question is whether citation by other academics is the only relevant measure of impact. Another factor that could be considered in applied areas of research is whether the research in question "makes a difference" by providing insights into fundamental managerial or societal questions (cf. Adler & Harzing, in press). However, this assessment might be quite difficult to make and will always include some element of subjectivity. True managerial or societal impact might also not be apparent in the short term. Hence, although individual article impact and broader managerial and societal impact should be included in the evaluation of research output wherever appropriate and possible, most universities will by necessity place some emphasis on the use of journal-impact proxies. In this article, we provided a broader perspective on journal impact and hope this will lead to a more valid and equitable assessment of academics' research output.

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