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"Ranking Journal Quality by Harmonic Mean of Ranks:
An Application to ISI Statistics & Probability"

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Ranking Journal Quality by Harmonic Mean of Ranks: An Application to ISI Statistics & Probability*

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Abstract

As the preponderance of journal rankings becomes increasingly more frequent and prominent in academic decision making, such rankings in broad discipline categories is taking on an increasingly important role. The paper focuses on the robustness of rankings of academic journal quality and research impact using on the widely-used Thomson Reuters ISI Web of Science citations database (ISI) for the Statistics & Probability category. The paper analyses 110 ISI international journals in Statistics & Probability using quantifiable Research Assessment Measures (RAMs), and highlights the similarities and differences in various RAMs, which are based on alternative transformations of citations and influence. Alternative RAMs may be calculated annually or updated daily to determine When, Where and How (frequently) published papers are cited (see Chang et al. (2011a, b, c), Chang et al. (2012)). The RAMs are grouped in four distinct classes that include impact factor, mean citations and non-citations, journal policy, number of high quality papers, and journal influence and article influence. These classes include the most widely used RAMs, namely the classic 2-year impact factor including journal self citations (2YIF), 2-year impact factor excluding journal self citations (2YIF*), 5-year impact factor including journal self citations (5YIF), Eigenfactor (or Journal Influence), Article Influence, h-index, PI-BETA (Papers Ignored - By Even The Authors), 5YD2 (= 5YIF/2YIF) as a measure of citations longevity, and Escalating Self Citations (ESC) as a measure of increasing journal self citations. The paper highlights robust rankings based on the harmonic mean of the ranks of RAMs across the 4 classes. It is shown that focusing solely on the 2-year impact factor (2YIF) of a journal, which partly answers the question as to When published papers are cited, to the exclusion of other informative RAMs, which answer Where and How (frequently) published papers are cited, can lead to a distorted evaluation of journal quality, impact and influence relative to the more robust harmonic mean of the ranks.

Keywords: Research assessment measures, impact factor, IFI, C3PO, PI-BETA, STAR, Eigenfactor, Article Influence, h-index, 5YD2, ESC, harmonic mean of the ranks, Statistics & Probability, robust journal rankings.

JEL Classifications: C18, C43, C81, Y10.

1. Introduction

As the preponderance of journal rankings becomes increasingly more frequent and prominent in academic decision making, such rankings in broad discipline categories are taking on an increasingly important role. The perceived quality of academic journals is routinely based on a wide variety of bibliometric measures, including expert assessments of journal impact and influence, the number of high quality papers, journal policy, and quantitative or qualitative information about a journal, as well as quantifiable Research Assessment Measures (RAMs).

The leading database for generating RAMs to evaluate the research performance of individual researchers and the quality of academic journals is the Thomson Reuters ISI Web of Science (2011) database (hereafter ISI). Most RAMs are based on alternative transformations of data regarding journal citations, influence and policy. There are important caveats regarding the methodology and data collection methods underlying any database (see, for example, Seglen (1997) and Chang et al. (2011a, b, c, d) for caveats regarding ISI). Nevertheless, the ISI citations database is the oldest and most prestigious source of RAMs, and is undoubtedly the benchmark against which other general databases, such as SciVerse Scopus, Google Scholar and Microsoft Academic Search, social science open access repositories, such as the Social Science Research Network (SSRN), and discipline-specific databases, such as Research Papers in Economics (RePEc), are compared.

Based on alternative RAMs, journals have been compared on the basis of various functions of citations across a wide range of ISI disciplines, such as the 40 leading journals in Economics and the leading 10 journals in each of Management, Finance and Marketing (Chang et al. (2011a)), the leading 6 journals in each of 20 disciplines in the Sciences (Chang et al (2011b)), the leading journals in a sub-discipline of Economics, namely Econometrics, and Statistics (Chang et al. (2011c)), and the leading 26 journals in Neuroscience (Chang et al. (2011d)). Chang et al. (2012) seem to be the first to have considered a rankings analysis of all the journals in a specific ISI category, namely 299 journals in Economics, in terms of citations, quality and impact. To date, no other academic disciplines seem to have been analyzed in their entirety regarding journal citations analysis. There are 110 journals in the ISI category of Statistics & Probability, with 95 journals having been included in ISI for at least 5 years.

In respect of the classic impact factor, van Nierop (2009) analysed why statistics journals have (relatively) low impact factors relative to other disciplines by concentrating on the 2-year impact factor including journal self citations. He analyzed the diffusion patterns of papers in several journals in various academic disciplines using the Bass diffusion model to obtain insights into the diffusion of the citation counts of the papers. Using calculated values for the time-to-peak in order to compare the speeds of diffusion citations across different disciplines, van Nierop (2009) showed that it took significantly longer for statistics journals to reach their peak citations. He also computed the percentages of the total number of citations of a paper after 2 or 3 years, and showed that statistics journals have slower citation diffusion than journals in other disciplines. van Nierop (2010) extended the earlier analysis of the 2-year impact factor for a comparison with the 5-year impact factor including journal self citations. He investigated whether the traditionally low impact factors for statistics journals held also for the 5-year impact factor. van Nierop (2010) showed that the 5-year impact factors of statistics journals were typically higher than their corresponding 2-year impact factor counterparts. Although this result was also generally the case for most scientific disciplines examined, the statistics discipline ranked among the top 15 of 171 disciplines in this respect.

It is well known that any measure of journal quality, whether based on citations, journal policy, impact and influence, or the number of high quality papers published in a journal, should be interpreted carefully, otherwise misleading and unintended inferences may be drawn (see, for example, Seglen (1997)). Nevertheless, as quantified metrics, citations are necessary for evaluating the impact and visibility of high quality and significant scientific research output. Moreover, the perceived research performance of individual researchers is a key issue in hiring, tenure and promotion decisions. Embracing journal citations as a valid measure of scientific research output, Hirsch (2005) suggested a widely-used measure, the h-index, for quantifying an individual researcher’s scientific research output. The h-index is now widely used to evaluate both the research output of individual researchers and to quantify the impact or influence of highly cited publications in academic journals in both the sciences and social sciences.

As journal rankings based on perceived quality are increasingly seen as an important academic industry, it is important to fully appreciate the strengths of and limits to what RAMs can and cannot do. Among others, the paper is concerned with correct and incorrect decisions made by journal editors and referees. For example, convention has it that the acceptance of a paper for publication is based on the expertise of a very small number of editors and referees, who determine the explicit rejection rate of a journal before publication. As editors and referees are not immune from errors regarding the perceived quality and likely future impact of papers, acceptance and rejection of papers by journals are not necessarily correct decisions. Chang et al. (2011c) argue that there is an important implicit rejection rate after publication that relies on the worldwide scientific community. In particular, the proportion of published papers in a journal that is ignored by the profession, as well as by the authors themselves, is an important (non)citations impact performance measure after publication.

As most RAMs are static, in that they measure the citations performance of journals for a fixed time period, a dynamic RAM is used to address the different speeds at which citations are accrued in the sciences and social sciences, and hence the longevity of citations over time. Given the upsurge in journal self citations in recent years, the paper is also concerned with capturing the escalation of journal self citations over time, and also to mitigate such an effect.

Chang et al. (2012) suggest that RAMs may be classified according to four distinct classes, namely Class 1: “impact factor, mean citations and non-citations”, Class 2: “journal policy”, Class 3: “number of high quality papers”, and Class 4: “journal influence and article influence”. Together with the arithmetic and geometric means, the harmonic mean is one of the three Pythagorean means, and is defined as the reciprocal of the arithmetic mean of the reciprocals. Alternative weights can be used in calculating each of these means, with the most straightforward method based on equal weights. Chang et al. (2012) show that emphasizing the 2-year impact factor of a journal to the exclusion of other informative RAMs can lead to a distorted evaluation of journal quality, impact and influence relative to the weighted harmonic means of the ranks of 13 existing and 2 new dynamic RAMs across the 4 classes, with the weights varying according to the number of RAMs in each class.

This paper examines the importance of RAMs as viable rankings criteria in Statistics & Probability, and attempts to answer some important questions raised in Chang et al. (2011a, b, c, d) and Chang et al. (2012), namely When, Where and How (frequently) are published papers cited in leading journals in a discipline. In this paper, we evaluate the usefulness of 15 RAMs for 110 ISI Statistics & Probability journals, and suggest a robust rankings method of alternative RAMs using the harmonic mean of the ranks. As suggested in the papers mentioned above, the rankings based on any single RAM, such as the h-index or the 2-year impact factor, are placed in context. In particular, using a single RAM as an indicator of journal quality is an extreme as it is clearly subsumed by the harmonic mean of the ranks when all other RAMs are given zero weights, except the single RAM in question.

The plan of the remainder of the paper is as follows. Section 2 presents some key RAMs using ISI data that may be calculated annually or updated daily, including the most widely used RAM, namely the classic 2-year impact factor including journal self citations (2YIF), 2-year impact factor excluding journal self citations (2YIF*), 5-year impact factor including journal self citations (5YIF), Immediacy (or zero-year impact factor (0YIF)), Eigenfactor (or Journal Influence), Article Influence, C3PO (Citation Performance Per Paper Online), h-index, PI-BETA (Papers Ignored - By Even The Authors), 2-year Self-citation Threshold Approval Ratings (2Y-STAR), Historical Self-citation Threshold Approval Ratings (H-STAR), Impact Factor Inflation (IFI), Cited Article Influence (CAI), 5YD2 (5YIF Divided by 2YIF) as a measure of citations longevity, and ESC (Escalating Self Citations) as a measure of increasing journal self citations. Section 3 discusses and analyses 15 RAMs for 110 leading journals in the ISI category of Statistics & Probability, and provides a harmonic mean of the ranks as a robust rankings method of alternative RAMs. Section 4 summarizes the ranking outcomes and gives some practical suggestions as to how to rank journal quality and impact.

2. Research Assessment Measures (RAM)

A widely-used RAM database for evaluating journal impact and quality is the Thomson Reuters ISI Web of Science (2011). As discussed in a number of papers (for example, Chang et al. (2011a, b, c), Chang et al. 92012)), various static and dynamic RAMs are intended as descriptive statistics to capture journal impact and performance, and are not based on a mathematical model. Hence, in what follows, no optimization or estimation is required in calculating the static and dynamic RAMs.

As the existing RAMs that are provided by ISI and in several recent publications may not be widely known, this section provides a brief description and definition of 15 RAMs that may be calculated annually or updated daily to answer the questions as to When, and Where and How (frequently), published papers are cited (for further details, see Chang et al. (2011a, b, c), Chang et al. (2012)). The answers to When published papers are cited are based on the set {2YIF, 2YIF*, 5YIF, Immediacy}, and the answers to Where and How (frequently) published papers are cited are based on the set {Eigenfactor, Article Influence, CAI, IFI, 5YD2, H-STAR, 2Y-STAR, ESC, C3PO, h-index, PI-BETA}, as will be discussed below.

2.1 Annual RAM

With three exceptions, namely Eigenfactor, Article Influence and Cited Article Influence (CAI), existing RAMs are based on ISI citations data and are reported separately for the sciences and social sciences. RAMs may be computed annually or updated daily. The annual RAMs given below are calculated for a Journal Citations Reports (JCR) calendar year, which is the year before the annual RAM are released. For example, the most recent RAMs were released in late-June 2011 for the JCR calendar year 2010.

(1) 2-year impact factor including journal self citations (2YIF):

The classic 2-year impact factor including journal self citations (2YIF) of a journal is typically referred to as "the impact factor", is calculated annually, and is defined as "Total citations in a year to papers published in a journal in the previous 2 years / Total papers published in a journal in the previous 2 years". The choice of 2 years by ISI is arbitrary. It is widely held in the academic community, and certainly by the editors and publishers of journals, that a higher 2YIF is better than lower.

(2) 2-year impact factor excluding journal self citations (2YIF*):

ISI also reports a 2-year impact factor without journal self citations (that is, citations to a journal in which a citing paper is published), which is calculated annually. As this impact factor is not widely known or used, Chang et al. (2011c) refer to this RAM as 2YIF*. Although 2YIF* is almost never reported, for obvious reasons, a higher value would be preferred to lower.

(3) 5-year impact factor including journal self citations (5YIF):

The 5-year impact factor including journal self citations (5YIF) of a journal is calculated annually, and is defined as "Total citations in a year to papers published in a journal in the previous 5 years / Total papers published in a journal in the previous 5 years." The choice of 5 years by ISI is arbitrary. Although 5YIF is not widely reported, a higher value would be preferred to lower. [It is worth noting that 5-year impact factor excluding journal self citations is not presently available.]

(4) Immediacy, or zero-year impact factor including journal self citations (0YIF):

Immediacy is a zero-year impact factor including journal self citations (0YIF) of a journal, is calculated annually, and is defined as "Total citations to papers published in a journal in the same year / Total papers published in a journal in the same year." The choice of the same year by ISI is arbitrary, but the nature of Immediacy makes it clear that a very short run outcome is under consideration. Although Immediacy is rarely reported, a higher value would be preferred to lower. [It is worth noting that Immediacy excluding journal self citations is not presently available.]

(5) 5YIF Divided by 2YIF (5YD2):

Most RAM data are static in that they calculate metrics for a given period of time rather than changes in metrics for a given period of time. A measure of longevity of citations over time would be another useful indicator of journal quality. As both 2YIF and 5YIF include journal self citations, if it is assumed that journal self citations are uniformly distributed over the 5-year period for calculating 5YIF, their ratio should (i) eliminate the effect of journal self citations, and (ii) capture the increase in the citation rate over time. In any event, the impact of journal self citations should be mitigated with the ratio of 5YIF to 2YIF. Chang et al. (2012) define a dynamic RAM as 5YD2 as "5YD2 = 5YIF / 2YIF". In the natural, physical and medical sciences, where citations are observed with a frequency of weeks and months rather than years, it is typically the case that 5YIF < 2YIF (see Chang et al. (2011b, d)), whereas the reverse, 5YIF > 2YIF, seems to hold generally in the social sciences, where citations tend to increase gradually over time (see Chang et al. (2011a, c)). Thus, emphasizing the different speeds at which citations are accrued over time, a higher 5YD2 would generally be preferred to lower in Statistics & Probability.

(6) Eigenfactor (or Journal Influence):

The Eigenfactor score (see Bergstrom (2007), Bergstrom and West (2008), Bergstrom, West and Wiseman (2008)) is calculated annually (see www.eigenfactor.org), and is defined as: "The Eigenfactor Score calculation is based on the number of times articles from the journal published in the past five years have been cited in the JCR year, but it also considers which journals have contributed these citations so that highly cited journals will influence the network more than lesser cited journals. References from one article in a journal to another article from the same journal are removed, so that Eigenfactor Scores are not influenced by journal self-citation." Even though Eigenfactor does not check how much time researchers spend reading hard copies of journals, which would require extensive surveys across a wide range of disciplines, it does indicate how much time researchers might spend reading or scanning articles on a journal's website. Thus, Eigenfactor might usefully be interpreted as a "Journal Influence" measure (see Chang et al. (2012)). A higher Eigenfactor score would be preferred to lower.

(7) Article Influence:

Article Influence (see Bergstrom (2007), Bergstrom and West (2008), Bergstrom, West and Wiseman (2008)) measures the relative importance of a journal's citation influence on a per-article basis and, as the name suggests, is an "Article Influence" score. Article Influence is a standardized Eigenfactor score, is calculated annually, and is defined as "Eigenfactor score divided by the fraction of all articles published by a journal." A higher Article Influence would be preferred to lower.

(8) IFI:

The ratio of 2YIF to 2YIF* is intended to capture how journal self citations can inflate the impact factor of a journal, whether this is an unconscious self-promotion decision made independently by publishing authors or as an administrative decision undertaken by a journal's editors and/or publishers. Chang et al. (2011a) define Impact Factor Inflation (IFI) as "IFI = 2YIF / 2YIF*". The minimum value for IFI is 1, with any value above the minimum capturing the effect of journal self citations on the 2-year impact factor. A lower IFI would be preferred to higher.

(9) H-STAR:

ISI has implicitly recognized the inflation in journal self citations by calculating an impact factor that excludes self citations, and provides data on journal self citations, both historically (for the life of the journal) and for the preceding two years, in calculating 2YIF. Chang et al. (2011b) define the Self-citation Threshold Approval Rating (STAR) as the percentage difference between citations in other journals and journal self citations. If HS = historical journal self citations, then Historical STAR is defined as “H-STAR = [(100-HS) - HS] = (100-2HS)”. If HS = 0 (minimum), 50 or 100 (maximum) percent, for example, H-STAR = 100, 0 and -100, respectively. A higher H-STAR would be preferred to lower.

(10) 2Y-STAR:

H-STAR takes account of the self-citation threshold approval rating over the historical period for which data for a journal are available, whereas 2Y-STAR takes account of the self-citation threshold approval rating based on data for the preceding two years. If 2YS = journal self citations over the preceding 2-year period, then 2-Year STAR is defined as “2Y-STAR = [(100-2YS) – 2YS] = (100-2(2YS))”. If 2YS = 0 (minimum), 50 or 100 (maximum) percent, for example, 2Y-STAR = 100, 0 and -100, respectively. A higher 2Y-STAR would be preferred to lower.

(11) Escalating Self Citations (ESC):

As self citations for many journals in the sciences and social sciences have been increasing over time, Chang et al. (2012) argue that it is essential to present a dynamic RAM that captures such an escalation over time, and define 2YS – HS as measuring Escalating Self Citations in journals over the most recent 2 years relative to the historical period for calculating citations. This RAM is likely to differ across journals. Chang et al. (2012) define a dynamic RAM as “ESC = 2YS – HS = (H-STAR – 2Y-STAR) / 2”. As the range of both H-STAR and 2Y-STAR is (-100, 100), the range of ESC is also (-100, 100), with -100 denoting minimum escalation and 100 denoting maximum escalation. A lower ESC would be preferred to higher.

2.2 Daily Updated RAM

Some RAMs are updated daily, and are reported for a given day in a calendar year rather than for a JCR year.

(12) C3PO:

ISI reports the mean number of citations for a journal, namely total citations up to a given day divided by the number of papers published in a journal up to the same day, as the “average” number of citations. In order to distinguish the mean from the median and mode, the C3PO of an ISI journal on any given day is defined by Chang et al. (2011a) as “C3PO (Citation

Performance Per Paper Online) = Total citations to a journal / Total papers published in a journal." A higher C3PO would be preferred to lower. [Note: C3PO should not be confused with C-3PO, the Star Wars android.]

(13) h-index:

The h-index (Hirsch, 2005)) was originally proposed to assess the scientific research productivity and citations impact of individual researchers. However, the h-index can also be calculated for journals, and should be interpreted as assessing the impact or influence of highly cited journal publications. The h-index of a journal on any given day is based on historically cited and citing papers, including journal self citations, and is defined as "h-index = number of published papers, where each has at least h citations." The h-index differs from an impact factor in that the h-index measures the number of highly cited papers historically. A higher h-index would be preferred to lower. [Although several variations of the h-index have been recorded in recent years, their value relative to the original h-index has yet to be demonstrated in any convincing manner.]

(14) PI-BETA:

This RAM measures the proportion of papers in a journal that has never been cited, As such, PI-BETA is, in effect, a rejection rate of a journal after publication. Chang et al. (2011c) argue that lack of citations of a published paper, especially if it is not a recent publication, reflects on the quality of a journal by exposing: (i) what might be considered as incorrect decisions by the members of the editorial board of a journal; and (ii) the lost opportunities of papers that might have been cited had they not been rejected by the journal. Chang et al. (2011c) propose that a paper with zero citations in ISI journals be measured by PI-BETA (= Papers Ignored (PI) - By Even The Authors (BETA)), which is calculated for an ISI journal on any given day as "Number of papers with zero citations in a journal / Total papers published in a journal." As it would be reasonable to argue that journal editors and publishers would typically prefer a higher proportion of published papers to be cited rather than to be ignored, a lower PI-BETA would be preferred to higher.

(15) CAI:

Article Influence is intended to measure the average influence of an article across the sciences and social sciences. As an article with zero citations typically would not be expected to have any (academic) influence, a more suitable measure of the influence of cited articles would seem to be Cited Article Influence (CAI). Chang et al. (2011b) define CAI as "CAI = (1 - PI-BETA)(Article Influence)". If PI-BETA = 0, then CAI is equivalent to Article Influence; if PI-BETA = 1, then CAI = 0. As Article Influence is calculated annually and PI-BETA is updated daily, CAI may be updated daily. A higher CAI would be preferred to lower.

3. Analysis of RAM for 110 Leading Journals in Statistics & Probability

As no single RAM captures adequately the quality, impact and influence of a journal, Chang et al. (2012) argue that any general measure of journal quality and impact, such as a harmonic mean of the ranks as a robust rankings method of alternative RAMs, should depend on the following four distinct classes:

(i) **Class 1**: "impact factor, mean citations and non-citations" (2YIF, 2YIF*, 5YIF, Immediacy, C3PO, PI-BETA);
(ii) **Class 2**: "journal policy" (IFI, H-STAR, 2Y-STAR, 5YD2, ESC);
(iii) **Class 3**: "number of high quality papers" (h-index);
(iv) **Class 4**: "journal influence and article influence" (Eigenfactor, Article Influence, CAI).

As each of the four classes has equal weight in the calculation of the harmonic mean of the ranks, the h-index (Class 3) has the single highest weight of the 15 RAMs. For journals that have been included in ISI for less than five years, Class 1 does not include 5YIF, Class 2 does not include 5YD2, and Class 4 does not include Article Influence and CAI, in calculating the harmonic mean of the ranks of the RAMs. When RAM data for only Eigenfactor are available, Class 4 would be classified as a "journal influence" rather than "journal influence and article influence" class. With three exceptions, all RAMs rank journals from high to low. The three exceptions that rank journals from low to high are IFI, PI-BETA and ESC.

In the remainder of the paper, we compare the RAMs that are based on ISI citations data (see Tables 1-5). Only articles from the ISI Web of Science are included in the citations data, which were downloaded from ISI on 19 May 2012 for all journals. The ISI data set starts in 1899, so all data are from the inception of the respective journals, except for Journal of the American Statistical Association (from 1969), Biometrics (from 1985), Fuzzy Sets and

Systems (from 1986), and Statistics in Medicine (from 2002). The numbers in parentheses are the first years in which the numbers of articles in the respective journals were below 10,000, which is the upper limit for which daily RAM (namely, h-index, C3PO, PI-BETA and CAI) are reported in ISI. Of the 110 journals listed in ISI in Table 1, 95 journals have been included in ISI for less than 5 years, so that the RAMs for 5YIF, Article Influence, CAI and 5YD2 are available for 95 journals.

In Table 1 we evaluate 15 RAMs for the 110 leading journals in Statistics & Probability, which are ranked according to 2YIF. The means and ranges of 2YIF are, respectively, 1.083 and (0.035, 3.5), of 2YIF* are 0.972 and (0.014, 3.427), of 5YIF are 1.512 and (0.417, 5.33), and of Immediacy are 0.205 and (0, 1.458). Each of the most highly ranked journals has been included in ISI for at least 5 years. The Immediacy of ASTA – Advances in Statistical Analysis is rather high at 1.458, especially relative to the mean value of 0.205. In Table 1, the mean and range of 5YD2 are 1.282 and (0.722, 2.554), respectively, so that 5YIF is greater than 2YIF, on average, as might be expected. Thus, journals seem to have longevity in citations in Statistics & Probability. Both Multivariate Behavioral Research and Bayesian Analysis have very high 5YD2 values as compared with the mean value.

Journal self citations in Statistics & Probability do not seem to be particularly high, with a mean IFI of 1.155 and a range of (1, 2.5). On average, the 110 leading journals in Statistics & Probability have 2YIF that is inflated by a factor of 1.155 through journal self citations. It is worth mentioning that 7 of the 110 journals have zero self citations.

The h-index has a mean of 38 and a wide range of (2, 225), with the four highest h-index values being 225, 192, 179 and 150 for Econometrica, Journal of the American Statistical Association, Biometrika and Annals of Statistics, respectively. There are 17 journals with an h-index that is less than or equal to 10, with 14 of the journals with very low h-indexes having been included in ISI for less than five years. In terms of mean citations, C3PO has a mean of 7.99 and a range of (0.08, 42.24), with 11 journals having C3PO values that are less than one.

Eigenfactor has a mean of 0.006 and a range of (0, 0.046), with 4 journals, namely Econometrica, Journal of the American Statistical Association, Statistics in Medicine, and Annals of Statistics, clearly having the highest scores, and hence the greatest Journal

Influence. Article Influence has a mean of 1.214 and a range of (0.257, 8.812), with 2 journals, namely Econometrica and Journal of the Royal Statistical Society Series B – Statistical Methodology, having the greatest journal influence. Cited Article Influence (CAI) has a mean of 0.865 and a range of (0.138, 4.758), with thw same two journals as above having the greatest influence on the basis of cited journal articles.

The H-STAR and 2Y-STAR values for the 110 journals are not high, with a mean of 85 and a range of (-20, 100) for H-STAR, and a slightly lower mean of 77 and the same range of (-20, 100) for 2Y-STAR. The mean values of H-STAR and 2Y-STAR of 85 and 77 reflect journal self citations of 7.5% and 11.5%, respectively, historically and for the preceding two years. The ESC mean is 4 and with a range of (-48, 24), so that journal self citations have increased, on average, over the preceding two years as compared with historical levels. On average, self citations are escalating, with 6 journals having no change in the preceding 2 years relative to historical levels, 24 journals decreasing in self citations, and 80 journals increasing in self citations. Overall, 73% of the Statistics & Probability journals have escalating self citations relative to historical levels.

The PI-BETA scores are illuminating. The mean is 0.359 so that, on average, more than one of every 3 papers that are published in the leading 110 journals in Statistics & Probability is not cited. The range of (0.062, 0.931) suggests that the journal with the highest percentage of cited papers has one uncited paper for every 16 published papers, while the journal with the lowest percentage of cited papers has one cited paper for every 16 published papers. Of the 110 Statistics & Probability journals in Table 1, 1 journal has PI-BETA that exceeds 0.9, which means that more than 9 of every 10 published papers in the journal have zero citations. Two journals have PI-BETA in the range (0.8, 0.9), 4 journals lie in the range (0.7, 0.8), 5 journals lie in the range (0.6, 0.7), and 7 journals lie in the range (0.5, 0.6), so that 19 journals have at least one uncited paper for ever 2 papers that are published.

As 15 Statistics & Probability journals have been included in ISI for less than 5 years, and hence do not have corresponding RAMs for 5YIF, 5YD2, Article Influence and CAI, the simple correlations of 15 RAMs for the 95 leading journals in Statistics & Probability are given in Table 2, while the simple correlations of 11 RAMs for the 110 leading journals are given in Table 3.

There are 5 and 3 RAM pairs for which the correlations exceed 0.9 (in absolute value) in Tables 2 and 3, respectively, and 4 RAM pairs in Table 2 for which the correlations are in the range (0.8, 0.9), in absolute value. The correlations of 0.989 and 0.99 between 2YIF and 2YIF* in Tables 2 and 3, respectively, are extremely high, which suggests that the 2-year impact factors including and excluding self citations are very similar for leading journals in Statistics & Probability. A similar comment applies to the very high correlations for the pairs (2YIF, 5YIF), (2YIF*, 5YIF), (IFI, 2Y-STAR) and (Article Influence, CAI) in Table 2, and for the pairs (IFI, 2Y-STAR) and (h-index, 3CPO) in Table 3. The 2 dynamic RAMs, namely 5YD2 and ESC, are not highly correlated with each other or with any other RAMs in Tables 2 and 3, which suggests that they provide useful information about journal impact and influence compared with the 13 static RAMs.

As relying on a single RAM to the exclusion of numerous other RAMs can be misleading, one of the primary purposes of the paper is to determine if reliance on the classic 2-year impact factor of a journal, 2YIF, to the exclusion of the other RAMs can lead to a distorted evaluation of journal quality, impact and influence. In order to provide a more robust rankings measure based on the 11 RAMs, 6 of which, namely 2YIF, 2YIF*, IFI, Immediacy, C3PO and PI-BETA, are based on ratios, the robust rankings of the 299 leading journals in Statistics & Probability given in Table 4 are based on the equally weighted harmonic mean of the ranks.

The journals in Table 4 are ranked according to the harmonic mean of the ranks (given as Harmonic Mean). The number 1 ranked journal is Econometrica, which has moved up 1 place (given in the last column as Difference = 2YIF ranking – Harmonic Mean ranking) from 2 according to 2YIF. In comparison with the rankings in Table 1 that are based on 2YIF, only 3 journals remain in the top 10, namely Econometrica (at 1, up from 2 for 2YIF), Journal of the Royal Statistical Society Series B – Statistical Methodology (at 3, down from 1 for 2YIF), and Annals of Statistics (at 6, down from 3 for 2YIF). It is instructive that 2 journals in the top 10 according to the harmonic mean of the ranks, ASTA – Advances in Statistical Analysis and Stochastics, have been included in ISI for less than 5 years. Each of the top 10 journals is ranked number 1 for at least one RAM, with the top 10 journals (in descending order from Econometrica to Annals of the Institute of Statistical Mathematics) being ranked number 1 for 3, 4, 3, 3, 2, 1, 2, 2, 2 and 2 RAMs. It is interesting to note that no journal outside the top 10 according to the harmonic mean of the RAMs is ranked number 1 for any single RAM.

Many journals have had substantial shifts in rankings, with 11 journals having improved by at least 40 positions, 14 having improved by at least 30 positions, 14 having worsened by at least 30 positions, and 8 having worsened by at least 40 positions. The 5 biggest improvements were made by Stochastics (up 90, from 99 to 9), Computational Statistics (up 84, from 91 to 7), Statistics (up 82, from 90 to 8), ASTA - Advances in Statistical Analysis (up 74, from 76 to 2), and Statistica Neerlandica (up 71, from 104 to 33). The 4 largest drops were Stochastic Environmental Research and Risk Assessment (down 54, from 16 to 70), Electronic Journal of Statistics (down 47, from 46 to 93), Econometric Reviews (down 45, from 42 to 87), and Insurance Mathematics & Economics (down 43, from 39 to 82).

Of the leading 10 journals according to 2YIF in Table 1, as mentioned above 3 journals remain in the top 10 according to the harmonic mean of the ranks. The 7 journals to have slipped out of the top 10 are Journal of the American Statistical Association (from 10 to 12), Biostatistics (from 4 to 13), Statistics in Medicine (from 8 to 16), Journal of Statistical Software (from 5 to 18), Chemometrics and Intelligent Laboratory Systems (from 9 to 24), Statistical Science (from 7 to 25), and Journal of the Royal Statistical Society Series A – Statistics in Society (from 6 to 28).

As has been argued in previous research, the use of the harmonic mean of the ranks may be seen as rewarding or penalizing widely-varying rankings across alternative RAMs. The harmonic mean of the ranks tends to reward journals with strong individual performances according to one or more RAMs, so that even one very strong performance can lead to a greatly improved ranking. This could be seen by the huge jumps in the top 10 journals when a journal was ranked number 1 according to 2 RAMs, let alone for 4 RAMs. There may well be disagreement among the weights to be used, such as equal or different weights according to the number of RAMs in a particular class, as well as about whether the harmonic, geometric or arithmetic means of the ranks might be the most appropriate Pythagorean mean of the ranks. The RAMs provided in Tables 1 and 4 allow alternative weights to be used for different journals, with weights possibly varying according to the number of RAMs in each class. However, it should be clear that a concentration on 2YIF alone, with a zero weight for all other RAMs, is highly restrictive and likely to be misleading.

The results in Table 4 could also be used to rank journals in various sub-disciplines in Statistics & Probability, such as probability, theoretical statistics and applied statistics, as well as journals of various academic societies, using the harmonic mean of the ranks.

The simple ranking correlations of the 11 RAMs for the 110 leading journals in Statistics & Probability, based on the rankings in Table 4, are given in Table 5. The correlations in Table 5 are not very close (in absolute value) to the correlations in Table 3 for the original RAM scores. There are only 3 RAM pairs for which the correlations exceed 0.9 (in absolute value), with the 2 highest correlations being for the pair (IFI, 2Y-STAR) at 0.998, and (2YIF, 2YIF*) at 0.987. The third highest simple correlation is for the pair (h-index, C3PO) at 0.912. There is only one RAM pair for which the simple correlation is in the range (0.8, 0.9), in absolute value, namely C3PO, PI-BETA). The correlations of 0.998 and 0.987 for the pairs (IFI, 2Y-STAR) and (2YIF, 2YIF*), respectively, suggest that the rankings according to IFI and 2Y-STAR, as well as according to 2YIF and 2YIF*, would be virtually identical.

In Table 5, the 5 highest correlations with the harmonic mean of the ranks are for 2YIF* (at 0.669), IFI (at 0.617), 2YIF (at 0.614), C3PO (at 0.0.611), and 2Y-STAR (at 0.604), which suggests that the classic two-year impact factor including journal self citations (2YIF) is less highly correlated with the Harmonic Mean than are the two-year impact factor excluding journal self citations (2YIF*) and IFI. Thus, 2YIF would not seem to be the most appropriate or robust individual RAM to use if it were intended to capture the harmonic mean of the ranks. Indeed, using 2YIF as a single RAM to capture the quality of a journal would lead to a distorted evaluation of a journal's impact and influence.

4. Concluding Remarks

The preponderance of journal rankings has become increasingly more frequent and prominent in academic decision making, so that journal rankings in broad discipline categories are taking on an increasingly important role. The paper evaluated the ranking of academic journal quality and research impact using the Thomson Reuters ISI Web of Science (2011) citations database (hereafter ISI) for 110 journals in the Statistics & Probability category. In addition to 13 static RAMs, two recently developed dynamic RAMs that capture changes in impact factor over time (that is, longevity) and escalating journal self citations were used to rank journal quality.

This paper analysed the leading 110 journals in the ISI category of Statistics & Probability using 15 quantifiable RAMs. The 15 RAMs that may be calculated annually or updated daily were used to answer the questions as to When, and Where and How (frequently) published papers are cited. The answers to When published papers are cited are based on the set {2YIF, 2YIF*, 5YIF, Immediacy}, which are Class 1 RAMs, and the answers to Where and How (frequently) published papers are cited are based on the set {Eigenfactor, Article Influence, Cited Article Influence, IFI, 5YD2, H-STAR, 2Y-STAR, ESC, C3PO, h-index, PI-BETA}, which are RAMs from Classes 2, 3 and 4..

The paper highlighted the similarities and differences in alternative RAMs, and showed that several RAMs were highly correlated so that they had little informative incremental value in capturing the impact and citations performance of the highly-cited journals. Other RAMs were not highly correlated with each other, including two dynamic RAMs, namely 5YD2 and ESC, so that they provided additional information about journal impact and influence. The harmonic mean of the ranks of 11 RAMs for which data were available for all 110 leading journals in Statistics & Probability were also presented as a robust rankings method, and were compared with the 2-year impact factor including journal self citations.

It was shown that emphasizing the 2-year impact factor of a journal, which partly answers the question as to When published papers are cited, to the exclusion of other informative RAMs, which answer Where and How (frequently) published papers are cited, could lead to a distorted evaluation of journal quality, impact and influence relative to the harmonic mean of the ranks of RAMs across distinct classes containing several other RAMs. These distinct classes included the impact factor, mean citations and non-citations, journal policy, number of high quality papers, and journal influence and article influence.

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Table 1
15 Research Assessment Measures (RAMs) for 110 ISI Statistics & Probability Journals

Journal	2YIF	2YIF*	IFI	5YIF	Immediacy	5YD2	h-index	C3PO	PI-BETA	Eigenfactor	Article Influence	CAI	H-STAR	2Y-STAR	ESC
J R STAT SOC B	3.5	3.427	1.021	5.086	0.414	1.453	66	33.6	0.115	0.02067	4.822	4.267	100	96	2
ECONOMETRICA	3.185	2.954	1.078	5.33	0.846	1.673	225	42.24	0.46	0.04564	8.812	4.758	98	86	6
ANN STAT	2.94	2.573	1.143	3.274	0.475	1.114	150	32.53	0.062	0.03459	3.26	3.058	92	76	8
BIOSTATISTICS	2.769	2.615	1.059	3.303	0.625	1.193	39	19.14	0.198	0.01171	2.312	1.854	96	90	3
J STAT SOFTW	2.647	2.329	1.137	3.654	0.767	1.38	21	6.06	0.373	0.0071	1.735	1.088	84	76	4
J R STAT SOC A STAT	2.57	2.354	1.092	2.527	0.265	0.983	36	5.33	0.56	0.00732	1.822	0.802	96	84	6
STAT SCI	2.48	2.08	1.192	3.504	0.267	1.413	60	20.01	0.306	0.00807	3.383	2.348	96	68	14
STAT MED	2.328	2.072	1.124	2.334	0.336	1.003	66	10.02	0.092	0.03808	1.33	1.208	86	78	4
CHEMOMETR INTELL LAB	2.222	2.039	1.09	2.415	0.26	1.087	86	16.67	0.118	0.00717	0.645	0.569	86	84	1
J AM STAT ASSOC	2.063	1.929	1.069	3.439	0.198	1.667	192	30.52	0.182	0.04028	3.28	2.683	96	88	4
STATA J	2	1.757	1.138	3.142	0.243	1.571	20	4.81	0.489	0.00617	1.964	1.004	86	76	5
FUZZY SET SYST	1.875	1.533	1.223	2.25	0.365	1.2	115	16.4	0.097	0.01244	0.591	0.534	80	64	8
STAT COMPUT	1.851	1.743	1.062	2.339	0.526	1.264	38	13.58	0.281	0.00588	1.838	1.322	96	90	3
STAT APPL GENET MOL	1.842	1.705	1.08	2.182	0.405	1.185	15	5.39	0.271	0.00422	1.1	0.802	94	86	4
BIOMETRIKA	1.833	1.686	1.087	2.352	0.228	1.283	179	36.26	0.084	0.01782	2.393	2.192	98	84	7
STOCH ENV RES RISK A	1.777	1.154	1.54	1.7	0.196	0.957	23	5.14	0.244	0.00283	0.46	0.348	32	30	1
STAT METHODS MED RES	1.768	1.725	1.025	2.541	0.533	1.437	50	19.91	0.197	0.00474	1.535	1.233	98	96	1
BIOMETRICS	1.764	1.601	1.102	2.204	0.242	1.249	117	21.53	0.108	0.02032	1.594	1.422	96	82	7
ANN APPL STAT	1.746	1.674	1.043	2.443	0.261	1.399	15	3.66	0.444	0.00671	2.072	1.152	92	92	0
J BUS ECON STAT	1.693	1.667	1.016	2.433	0.275	1.437	77	20.1	0.189	0.00979	2.804	2.274	98	98	0

Journal	2YIF	2YIF*	IFI	5YIF	Immediacy	5YD2	h-index	C3PO	PI-BETA	Eigenfactor	Article Influence	CAI	H-STAR	2Y-STAR	ESC
IEEE ACM T COMPUT BI	1.664	1.619	1.028	2.171	0.333	1.305	27	5.79	0.402	0.00442	0.95	0.568	92	96	-2
ENVIRON ECOL STAT	1.645	1.645	1	1.641	0.444	0.998	28	7.44	0.274	0.0024	0.872	0.633	86	100	-7
PHARM STAT	1.63	1.556	1.048	1.467	0.194	0.9	15	3.5	0.38	0.0017	0.729	0.452	88	92	-2
J COMPUT BIOL	1.6	1.48	1.081	2.033	0.17	1.271	68	18.71	0.072	0.00841	0.907	0.842	92	86	3
PROBAB THEORY REL	1.59	1.484	1.071	1.625	0.45	1.022	57	12.21	0.104	0.01202	1.985	1.779	94	88	3
OPEN SYST INF DYN	1.566	1.453	1.078	1.13	0.333	0.722	18	4.15	0.32	0.00147	0.47	0.32	88	86	1
TECHNOMETRICS	1.56	1.387	1.125	1.985	0.206	1.272	121	23.42	0.264	0.00558	1.424	1.048	96	78	9
ANN PROBAB	1.47	1.342	1.095	1.665	0.268	1.133	87	16.12	0.064	0.01491	1.996	1.868	92	84	4
BIOMETRICAL J	1.438	1.278	1.125	1.273	0.302	0.885	34	3.81	0.338	0.00561	0.822	0.544	88	78	5
BRIT J MATH STAT PSY	1.419	1.274	1.114	1.413	0.412	0.996	55	12.08	0.331	0.00225	0.92	0.615	92	80	6
J CHEMOMETR	1.377	1.179	1.168	1.858	0.442	1.349	63	16.54	0.18	0.00332	0.539	0.442	86	72	7
J QUAL TECHNOL	1.377	1	1.377	2.132	0.462	1.548	68	16.53	0.179	0.00271	1.026	0.842	86	46	20
FINANC STOCH	1.326	1.065	1.245	1.87	0.217	1.41	25	9.34	0.199	0.00512	2.016	1.615	88	62	13
MULTIVAR BEHAV RES	1.29	1.177	1.096	3.295	0.083	2.554	74	22.55	0.145	0.00528	2.062	1.763	96	84	6
PROBABILIST ENG MECH	1.252	1.135	1.103	1.306	0.279	1.043	33	8.19	0.213	0.00306	0.721	0.567	82	82	0
BAYESIAN ANAL	1.213	1.098	1.105	2.756	0.31	2.272	16	5.21	0.44	0.00551	2.237	1.253	94	82	6
J COMPUT GRAPH STAT	1.206	1.137	1.061	1.848	0.389	1.532	40	12.14	0.199	0.00746	1.576	1.262	94	90	2
OXFORD B ECON STAT	1.182	1.13	1.046	1.622	0.000	1.372	49	11.24	0.314	0.00466	1.225	0.84	96	92	2
INSUR MATH ECON	1.178	0.739	1.594	1.451	0.152	1.232	44	5.55	0.618	0.00698	0.78	0.298	40	26	7
ANN APPL PROBAB	1.12	0.964	1.162	1.447	0.311	1.292	39	9.37	0.169	0.01219	1.595	1.325	82	74	4

Journal	**2YIF**	**2YIF***	**IFI**	**5YIF**	**Immediacy**	**5YD2**	**h-index**	**C3PO**	**PI-BETA**	**Eigenfactor**	**Article Influence**	**CAI**	**H-STAR**	**2Y-STAR**	**ESC**
COMPUT STAT DATA AN	1.089	0.815	1.336	1.363	0.293	1.252	49	5.9	0.228	0.02275	0.754	0.582	70	50	10
ECONOMET REV	1.088	0.947	1.149	1.40	0.074	1.287	14	4.5	0.379	0.00326	1.346	0.836	90	76	7
J BIOPHARM STAT	1.073	0.76	1.412	1.285	0.247	1.198	31	4.92	0.311	0.00397	0.602	0.415	72	42	15
EXTREMES	1.053	0.974	1.081	-	0.263	-	6	1.65	0.459	0.00163	-	-	68	86	-9
TEST	1.036	1.018	1.018	1.108	0.174	1.069	21	3.75	0.501	0.00274	1.176	0.587	96	98	-1
ELECTRON J STAT	1.025	0.907	1.130	1.208	0.036	1.179	11	2.44	0.451	0.00394	1.411	0.775	82	78	2
ECONOMET THEOR	1.015	0.847	1.198	1.264	0.152	1.245	54	9.47	0.364	0.00861	1.541	0.98	78	68	5
J MULTIVARIATE ANAL	1.01	0.816	1.238	1.180	0.218	1.168	54	8.15	0.134	0.01146	0.917	0.794	74	62	6
BERNOULLI	1	0.964	1.037	1.284	0.15	1.284	30	7.97	0.196	0.00829	1.577	1.268	94	94	0
COMB PROBAB COMPUT	0.99	0.924	1.071	1.008	0.15	1.018	23	4.93	0.282	0.00753	1.465	1.052	90	88	1
AM STAT	0.981	0.752	1.305	1.322	0.102	1.348	83	8.93	0.332	0.00412	0.924	0.617	96	54	21
PROBAB ENG INFORM SC	0.971	0.853	1.138	0.966	0.030	0.995	21	4.78	0.297	0.00257	0.754	0.53	88	76	6
ANN I STAT MATH	0.966	0.966	1	0.755	0.096	0.782	45	7.01	0.244	0.00284	0.665	0.503	94	100	-3
STAT SINICA	0.956	0.889	1.075	1.02	0.253	1.067	50	9.78	0.237	0.00739	0.969	0.739	94	88	3
STOCH PROC APPL	0.951	0.841	1.131	1.381	0.282	1.452	49	5.93	0.557	0.01497	1.368	0.606	92	78	7
ELECTRON J PROBAB	0.946	0.874	1.082	1.044	0.095	1.104	15	2.81	0.359	0.00834	1.343	0.861	82	86	-2
LIFETIME DATA ANAL	0.873	0.836	1.044	1.014	0.065	1.162	28	6.97	0.23	0.00241	0.857	0.66	84	92	-4
INT STAT REV	0.86	0.8	1.075	0.852	0.182	0.991	55	10.96	0.392	0.00164	0.625	0.38	94	88	3
SCAND J STAT	0.835	0.813	1.027	1.326	0.128	1.588	50	15.46	0.185	0.00581	1.354	1.104	98	96	1
APPL STOCH MODEL BUS	0.829	0.756	1.097	0.797	0.024	0.961	16	2.61	0.480	0.00177	0.476	0.248	92	84	4

Journal	2YIF	2YIF*	IFI	5YIF	Immediacy	5YD2	h-index	C3PO	PI-BETA	Eigenfactor	Article Influence	CAI	H-STAR	2Y-STAR	ESC
METHODOL COMPUT APPL	0.774	0.742	1.043	0.796	0.116	1.028	12	2.5	0.379	0.00195	0.684	0.425	90	92	-1
J APPL PROBAB	0.768	0.601	1.278	0.866	0.024	1.128	69	9.46	0.132	0.00655	0.767	0.666	92	58	17
ANN I H POINCARE-PR	0.759	0.694	1.094	0.9	0.192	1.186	36	7.76	0.191	0.00483	1.083	0.876	82	84	-1
ENVIRONMETRICS	0.75	0.707	1.061	0.986	0.241	1.315	33	6.66	0.252	0.00334	0.602	0.45	92	90	1
UTILITAS MATHEMATICA	0.743	0.662	1.122	0.562	0.027	0.756	18	2.16	0.497	0.00183	0.307	0.154	78	80	-1
REVSTAT-STAT J	0.733	0.7	1.047	-	0	-	6	1.39	0.623	0.00073	-	-	80	92	-6
J AGR BIOL ENVIR ST	0.722	0.667	1.082	1.22	0.147	1.69	25	6.09	0.25	0.00204	0.744	0.558	94	86	4
ADV APPL PROBAB	0.72	0.654	1.101	0.967	0.107	1.343	63	9.02	0.278	0.00511	0.98	0.708	94	82	6
STAT MODEL	0.714	0.686	1.041	1.021	0.095	1.43	15	4.26	0.305	0.00139	0.756	0.525	96	92	2
STOCH DYNAM	0.714	0.651	1.097	0.785	0.129	1.099	9	1.94	0.490	0.00215	0.743	0.379	88	84	2
ASTIN BULL	0.705	0.492	1.433	1.089	0.026	1.545	12	2.64	0.464	0.00179	0.682	0.366	68	40	14
ECONOMET J	0.691	0.691	1	1.166	0.176	1.687	11	3	0.341	0.00352	1.253	0.826	100	100	0
J STAT PLAN INFER	0.691	0.594	1.163	0.763	0.136	1.104	47	4.67	0.291	0.01741	0.604	0.428	76	72	2
CAN J STAT	0.689	0.676	1.019	1.175	0.05	1.705	34	6.18	0.281	0.00413	1.163	0.836	96	98	-1
QUAL QUANT	0.688	0.646	1.065	0.973	0.055	1.414	26	3.44	0.414	0.00243	0.431	0.253	88	90	-1
ASTA-ADV STAT ANAL	0.686	0.686	1	-	1.458	-	6	1.57	0.551	0.00078	-	-	4	100	-48
J TIME SER ANAL	0.678	0.632	1.073	0.888	0.054	1.31	22	4.81	0.296	0.00363	0.871	0.613	90	88	1
J R STAT SOC C-APPL	0.645	0.566	1.14	1.284	0.191	1.991	32	8.31	0.239	0.00375	0.961	0.731	98	76	11
AUST NZ J STAT	0.618	0.582	1.062	0.811	0.074	1.312	22	4.39	0.365	0.00193	0.625	0.397	98	90	4
SCAND ACTUAR J	0.613	0.548	1.119	-	0.158	-	3	0.71	0.679	0.00125	-	-	76	80	-2

Journal	2YIF	2YIF*	IFI	5YIF	Immediacy	5YD2	h-index	C3PO	PI-BETA	Eigenfactor	Article Influence	CAI	H-STAR	2Y-STAR	ESC
J THEOR PROBAB	0.6	0.57	1.053	0.615	0.164	1.025	23	4.33	0.276	0.00317	0.67	0.485	92	90	1
STAT PAP	0.595	0.579	1.028	0.553	0.077	0.929	14	2.1	0.436	0.00179	0.392	0.221	86	96	-5
INT J GAME THEORY	0.593	0.558	1.063	0.742	0.067	1.251	28	5.95	0.286	0.00396	1.052	0.751	82	90	-4
MATH POPUL STUD	0.593	0.481	1.233	-	0.333	-	13	3.48	0.374	0.00044	-	-	90	64	13
METRIKA	0.584	0.573	1.019	0.619	0.08	1.060	23	2.83	0.473	0.0021	0.453	0.239	92	98	-3
ADV DATA ANAL CLASSI	0.581	0.484	1.2	0.667	0.188	1.148	5	0.93	0.584	0.00029	0.332	0.138	64	68	-2
INFIN DIMENS ANAL QU	0.573	0.427	1.342	0.873	0.094	1.524	17	4.63	0.268	0.00252	0.718	0.526	86	50	18
ELECTRON COMMUN PROB	0.559	0.5	1.118	0.59	0.038	1.055	10	1.7	0.453	0.00308	0.7	0.383	88	80	4
SURV METHODOL	0.548	0.429	1.277	-	0.048	-	6	1.68	0.478	0.00149	-	-	64	58	3
STATISTICS	0.519	0.519	1	0.721	0.044	1.389	17	2.86	0.379	0.0018	0.471	0.292	98	100	-1
COMPUTATION STAT	0.5	0.5	1	0.613	0.047	1.226	21	3.76	0.37	0.0018	0.479	0.302	98	100	-1
J OFF STAT	0.492	0.458	1.074	-	0.03	-	5	0.73	0.734	0.00206	-	-	84	88	-2
J STAT COMPUT SIM	0.469	0.429	1.093	0.573	0.053	1.222	27	3.73	0.4	0.00314	0.416	0.25	88	84	2
J NONPARAMETR STAT	0.455	0.402	1.132	0.522	0.175	1.147	17	2.94	0.391	0.00207	0.473	0.288	84	78	3
STOCH MODELS	0.449	0.362	1.240	0.743	0.143	1.655	14	3.26	0.385	0.00199	0.573	0.352	76	62	7
STAT PROBABIL LETT	0.443	0.356	1.244	0.524	0.076	1.183	41	4.05	0.517	0.01137	0.387	0.187	84	62	11
STOCH ANAL APPL	0.419	0.333	1.258	0.617	0.085	1.473	25	3.47	0.366	0.00293	0.478	0.303	90	60	15
HACET J MATH STAT	0.385	0.308	1.25	-	0.082	-	5	0.58	0.731	0.00021	-	-	68	60	4
STOCHASTICS	0.369	0.369	1	-	0.148	-	5	0.93	0.591	0.0014	-	-	88	100	-6
STAT METHOD APPL-GER	0.367	0.317	1.158	-	0.125	-	3	0.61	0.707	0.00074	-	-	88	74	7

Journal	2YIF	2YIF*	IFI	5YIF	Immediacy	5YD2	h-index	C3PO	PI-BETA	Eigenfactor	Article Influence	CAI	H-STAR	2Y-STAR	ESC
COMMUN STAT-THEOR M	0.351	0.311	1.129	0.429	0.045	1.222	32	3.03	0.414	0.00555	0.272	0.159	80	78	1
COMMUN STAT-SIMUL C	0.343	0.293	1.171	0.417	0.038	1.216	22	2.62	0.436	0.00259	0.26	0.147	90	72	9
J KOREAN STAT SOC	0.325	0.273	1.19	-	0.043	-	6	0.62	0.709	0.00051	-	-	74	68	3
STAT NEERL	0.322	0.305	1.056	0.589	0.077	1.829	17	4.05	0.388	0.00148	0.522	0.319	98	90	4
THEOR PROBAB APPL+	0.318	0.215	1.479	0.493	0.153	1.55	37	2.84	0.601	0.00194	0.449	0.179	84	36	24
J APPL STAT	0.306	0.281	1.089	0.449	0.043	1.467	31	3.82	0.421	0.00215	0.257	0.149	92	84	4
SORT-STAT OPER RES T	0.25	0.2	1.25	-	0	-	2	0.62	0.683	0.00022	-	-	90	60	15
PAK J STAT	0.156	0.091	1.714	-	0	-	3	0.3	0.821	0.00015	-	-	66	18	24
REV COLOMB ESTAD	0.056	0.028	2	-	0.111	-	2	0.15	0.874	0.00002	-	-	40	0	20
INT J AGRIC STAT SCI	0.035	0.014	2.5	-	0	-	2	0.08	0.931	0.00002	-	-	-20	-20	0
Mean	1.083	0.972	1.155	1.512	0.205	1.282	38	7.99	0.359	0.006	1.214	0.865	85	77	4
Low	0.035	0.014	1	0.417	0	0.722	2	0.08	0.062	0	0.257	0.138	-20	-20	-48
High	3.5	3.427	2.5	5.33	1.458	2.554	225	42.24	0.931	0.046	8.812	4.758	100	100	24

Notes: The journals are ranked according to 2YIF. The journal acronyms are taken from ISI. Daily RAMs are not reported when there are more than 10,000 articles, so the data for Journal of the American Statistical Association are from 1969, Biometrics from 1985, Fuzzy Sets and Systems from 1986, and Statistics in Medicine from 2002. Data for all other journals are from their inception. The data were downloaded from ISI on 19 May 2012.

Table 2
Correlation of 15 RAMs for 95 ISI Statistics & Probability Journals

Journal	2YIF	2YIF*	IFI	5YIF	Immediacy	5YD2	h-index	C3PO	PI-BETA	Eigenfactor	Article Influence	CAI	H-STAR	2Y-STAR	ESC
2YIF	1														
2YIF*	0.989	1													
IFI	-0.088	-0.22	1												
5YIF	0.921	0.916	-0.086	1											
Immediacy	0.76	0.752	-0.05	0.724	1										
5YD2	-0.034	-0.031	0.047	0.319	0.031	1									
h-index	0.541	0.527	0.004	0.587	0.403	0.138	1								
C3PO	0.702	0.707	-0.119	0.771	0.537	0.236	0.889	1							
PI-BETA	-0.367	-0.368	0.151	-0.33	-0.284	-0.044	-0.451	-0.571	1						
Eigenfactor	0.598	0.589	-0.015	0.613	0.458	0.074	0.768	0.68	-0.353	1					
Article Influence	0.71	0.726	-0.168	0.83	0.579	0.294	0.641	0.757	-0.194	0.7	1				
CAI	0.748	0.767	-0.192	0.843	0.565	0.275	0.683	0.85	-0.422	0.729	0.949	1			
H-STAR	0.123	0.229	-0.731	0.209	0.101	0.248	0.208	0.313	-0.209	0.089	0.299	0.332	1		
2Y-STAR	0.077	0.209	-0.991	0.074	0.036	-0.049	-0.028	0.104	-0.126	-0.012	0.159	0.181	0.702	1	
ESC	0.007	-0.079	0.709	0.091	0.044	0.3	0.234	0.146	-0.018	0.1	0.056	0.055	-0.053	-0.748	1

Table 3
Correlation of 11 RAMs for 110 ISI Statistics & Probability Journals

Journal	2YIF	2YIF*	IFI	Immediacy	h-index	C3PO	PI-BETA	Eigenfactor	H-STAR	2Y-STAR	ESC
2YIF	1										
2YIF*	0.99	1									
IFI	-0.248	-0.316	1								
Immediacy	0.577	0.578	-0.176	1							
h-index	0.596	0.582	-0.125	0.303	1						
C3PO	0.735	0.738	-0.192	0.403	0.902	1					
PI-BETA	-0.509	-0.505	0.444	-0.244	-0.526	-0.603	1				
Eigenfactor	0.632	0.622	-0.115	0.345	0.787	0.708	-0.417	1			
H-STAR	0.266	0.315	-0.725	-0.124	0.283	0.339	-0.479	0.186	1		
2Y-STAR	0.227	0.318	-0.957	0.177	0.091	0.183	-0.387	0.085	0.652	1	
ESC	-0.004	-0.068	0.444	-0.36	0.188	0.13	-0.02	0.092	0.243	-0.578	1

Table 4
11 RAMs and Harmonic Mean of the Ranks for 110 ISI Statistics & Probability Journals

Journal	Harmonic Mean (HM)	2YIF	2YIF*	IFI	Immediacy	h-index	C3PO	PI-BETA	Eigenfactor	H-STAR	2Y-STAR	ESC	Difference (2YIF-HM)
ECONOMETRICA	1	2	2	41	2	1	1	84	1	3	41	74	1
ASTA-ADV STAT ANAL	2	76	66	1	1	96	98	94	100	109	1	1	74
J R STAT SOC B	3	1	1	12	12	16	3	9	6	1	12	41	-2
ECONOMET J	4	72	65	1	50	92	81	56	55	1	1	25	68
ENVIRON ECOL STAT	5	22	18	1	10	52	39	38	73	68	1	3	17
ANN STAT	6	3	4	77	7	4	4	1	4	36	73	90	-3
COMPUTATION STAT	7	91	85	1	92	68	71	61	86	3	1	17	84
STATISTICS	8	90	84	1	94	75	83	64	86	3	1	17	82
STOCHASTICS	9	99	95	1	61	101	100	98	97	57	1	4	90
ANN I STAT MATH	10	53	41	1	72	33	40	31	64	26	1	9	43
BIOMETRIKA	11	15	15	48	39	3	2	4	8	3	48	82	4
J AM STAT ASSOC	12	10	10	34	43	2	5	17	2	13	34	58	-2
BIOSTATISTICS	13	4	3	27	4	37	12	23	15	13	25	49	-9
J BUS ECON STAT	14	20	17	8	27	11	9	19	18	3	8	25	6
STAT METHODS MED RES	15	17	13	13	5	26	11	22	44	3	12	31	2
STAT MED	16	8	8	66	17	16	26	5	3	68	66	58	-8
ANN PROBAB	17	28	27	54	28	8	18	2	11	36	48	58	11
J STAT SOFTW	18	5	6	73	3	68	45	62	29	76	73	58	-13
BIOMETRICS	19	18	20	59	37	6	8	8	7	13	58	82	-1
SCAND J STAT	20	59	55	14	66	26	19	18	35	3	12	31	39

Journal	Harmonic Mean (HM)	2YIF	2YIF*	IFI	Immediacy	h-index	C3PO	PI-BETA	Eigenfactor	H-STAR	2Y-STAR	ESC	Difference (2YIF-HM)
J COMPUT BIOL	21	24	24	44	53	14	13	3	20	36	41	49	3
FUZZY SET SYST	22	12	22	88	16	7	17	6	12	88	88	90	-10
EXTREMES	23	44	40	44	31	96	97	83	93	100	41	2	21
CHEMOMETR INTELL LAB	24	9	9	50	33	9	14	10	28	68	48	31	-15
STAT SCI	25	7	7	85	29	20	10	49	23	13	84	99	-18
TECHNOMETRICS	26	27	26	67	42	5	6	35	37	13	66	92	1
STAT COMPUT	27	13	12	30	6	39	20	41	34	13	25	49	-14
J R STAT SOC A STAT	28	6	5	51	30	41	52	96	27	13	48	74	-22
PROBAB THEORY REL	29	25	23	35	9	21	21	7	14	26	34	49	-4
MULTIVAR BEHAV RES	30	34	31	55	77	12	7	13	40	13	48	74	4
AUST NZ J STAT	31	79	77	30	83	65	63	59	84	3	25	58	48
J R STAT SOC C-APPL	32	78	81	76	47	47	34	30	53	3	73	95	46
STAT NEERL	33	104	102	26	80	75	67	69	95	3	25	58	71
IEEE ACM T COMPUT BI	34	21	19	15	18	55	49	73	46	36	12	11	-13
TEST	35	45	38	9	52	68	72	92	66	13	8	17	10
CAN J STAT	36	74	68	10	90	43	43	41	48	13	8	17	38
METRIKA	37	85	79	10	79	61	85	86	77	36	8	9	48
J QUAL TECHNOL	38	31	39	102	8	14	16	15	67	68	102	106	-7
REVSTAT-STAT J	39	66	63	23	105	96	99	101	102	88	18	4	27
COMPUT STAT DATA AN	40	41	54	100	24	29	48	27	5	99	100	94	1

Journal	Harmonic Mean (HM)	2YIF	2YIF*	IFI	Immediacy	h-index	C3PO	PI-BETA	Eigenfactor	H-STAR	2Y-STAR	ESC	Difference (2YIF-HM)
J COMPUT GRAPH STAT	41	37	33	28	15	36	22	24	25	26	25	41	-4
STAT PAP	42	82	78	15	80	86	93	77	88	68	12	6	40
J CHEMOMETR	43	31	30	82	11	18	15	16	57	68	81	82	-12
LIFETIME DATA ANAL	44	57	52	21	86	52	41	28	72	76	18	7	13
STAT APPL GENET MOL	45	14	14	43	14	81	51	37	47	26	41	58	-31
BERNOULLI	46	49	42	17	59	51	37	21	22	26	17	25	3
ANN APPL STAT	47	19	16	19	32	81	74	80	31	36	18	25	-28
OXFORD B ECON STAT	48	38	35	22	105	29	24	51	45	13	18	41	-10
PHARM STAT	49	23	21	24	45	81	75	67	91	57	18	11	-26
ANN APPL PROBAB	50	40	42	80	21	37	30	14	13	82	79	58	-10
INT J GAME THEORY	51	83	82	32	85	52	46	44	51	82	25	7	32
BRIT J MATH STAT PSY	52	30	29	62	13	22	23	53	74	36	62	74	-22
STATA J	53	11	11	74	36	72	57	89	33	68	73	71	-42
STAT SINICA	54	54	47	39	34	26	27	29	26	26	34	49	0
J APPL PROBAB	55	62	75	98	104	13	29	11	32	36	97	104	7
AM STAT	56	51	59	99	71	10	33	54	49	13	99	108	-5
J MULTIVARIATE ANAL	57	48	53	90	40	24	36	12	16	96	90	74	-9
STAT MODEL	58	69	66	18	73	81	65	48	98	13	18	41	11
STOCH PROC APPL	59	55	51	71	25	29	47	95	10	36	66	82	-4
OPEN SYST INF DYN	60	26	25	41	18	73	66	52	96	57	41	31	-34

Journal	Harmonic Mean (HM)	2YIF	2YIF*	IFI	Immediacy	h-index	C3PO	PI-BETA	Eigenfactor	H-STAR	2Y-STAR	ESC	Difference (2YIF-HM)
ELECTRON J PROBAB	61	56	48	46	73	81	86	57	21	82	41	11	-5
PROBABILIST ENG MECH	62	35	34	60	26	45	35	26	62	82	58	25	-27
ANN I H POINCARE-PR	63	63	64	53	46	41	38	20	43	82	48	17	0
ENVIRONMETRICS	64	64	62	28	38	45	42	34	56	36	25	31	0
METHODOL COMPUT APPL	65	61	60	19	68	90	90	64	82	49	18	17	-4
J STAT PLAN INFER	66	72	76	81	64	32	60	45	9	93	81	41	6
INT STAT REV	67	58	56	39	49	22	25	71	92	26	34	49	-9
COMB PROBAB COMPUT	68	50	45	35	59	61	55	43	24	49	34	31	-18
ADV APPL PROBAB	69	68	71	58	70	18	32	40	42	26	58	74	-1
STOCH ENV RES RISK A	70	16	32	106	44	61	54	31	65	108	106	31	-54
BIOMETRICAL J	71	29	28	67	23	43	70	55	36	57	66	71	-42
J THEOR PROBAB	72	81	80	25	54	61	64	39	59	36	25	31	9
BAYESIAN ANAL	73	36	36	61	22	79	53	79	39	26	58	74	-37
ECONOMET THEOR	74	47	50	86	57	24	28	58	19	91	84	71	-27
FINANC STOCH	75	33	37	93	41	58	31	24	41	57	90	97	-42
QUAL QUANT	76	75	73	33	87	57	78	74	71	57	25	17	-1
J OFF STAT	77	92	90	38	100	101	102	107	79	76	34	11	15
J AGR BIOL ENVIR ST	78	67	69	46	62	58	44	33	80	26	41	58	-11
J TIME SER ANAL	79	77	74	37	88	65	57	46	54	49	34	31	-2
SCAND ACTUAR J	80	80	83	64	55	105	103	102	99	93	62	11	0

Journal	Harmonic Mean (HM)	2YIF	2YIF*	IFI	Immediacy	h-index	C3PO	PI-BETA	Eigenfactor	H-STAR	2Y-STAR	ESC	Difference (2YIF-HM)
ADV DATA ANAL CLASSI	81	86	88	87	48	101	100	97	105	104	84	11	5
INSUR MATH ECON	82	39	61	107	57	34	50	100	30	106	107	82	-43
STAT PROBABIL LETT	83	96	97	92	82	35	67	93	17	76	90	95	13
UTILITAS MATHEMATICA	84	65	70	65	102	73	92	91	85	91	62	17	-19
J BIOPHARM STAT	85	43	57	103	35	49	56	50	50	98	103	101	-42
MATH POPUL STUD	86	83	89	88	18	89	76	63	104	49	88	97	-3
ECONOMET REV	87	42	44	78	83	86	62	64	58	49	73	82	-45
COMMUN STAT-THEOR M	88	101	100	69	93	47	80	74	38	88	66	31	13
J STAT COMPUT SIM	89	93	91	52	89	55	73	72	60	57	48	41	4
J APPL STAT	90	106	104	49	95	49	69	76	75	36	48	58	16
PROBAB ENG INFORM SC	91	52	49	74	100	68	59	47	69	57	73	74	-39
APPL STOCH MODEL BUS	92	60	58	56	104	79	89	88	90	36	48	58	-32
ELECTRON J STAT	93	46	46	70	99	92	91	81	52	82	66	41	-47
STOCH DYNAM	94	69	72	56	65	95	94	90	75	57	48	41	-25
J NONPARAMETR STAT	95	94	94	72	51	75	82	70	78	76	66	49	-1
INFIN DIMENS ANAL QU	96	87	93	101	75	75	61	36	70	68	100	105	-9
ELECTRON COMMUN PROB	97	88	85	63	97	94	95	82	61	57	62	58	-9
STOCH ANAL APPL	98	97	98	96	76	58	77	60	63	49	94	101	-1
COMMUN STAT-SIMUL C	99	102	103	83	97	65	88	77	68	49	81	92	3
THEOR PROBAB APPL+	100	105	106	105	56	40	84	99	83	76	105	109	5

Journal	Harmonic Mean (HM)	2YIF	2YIF*	IFI	Immediacy	h-index	C3PO	PI-BETA	Eigenfactor	H-STAR	2Y-STAR	ESC	Difference (2YIF-HM)
STOCH MODELS	101	95	96	91	63	86	79	68	81	93	90	82	-6
INT J AGRIC STAT SCI	102	110	110	110	105	108	110	110	109	110	110	25	8
STAT METHOD APPL-GER	103	100	99	79	67	105	106	104	101	57	79	82	-3
SURV METHODOL	104	89	91	97	91	96	96	87	94	104	97	49	-15
J KOREAN STAT SOC	105	103	105	84	95	96	104	105	103	96	84	49	-2
ASTIN BULL	106	71	87	104	103	90	87	85	88	100	104	99	-35
HACET J MATH STAT	107	98	101	94	78	101	107	106	107	100	94	58	-9
SORT-STAT OPER RES T	108	107	107	94	105	108	104	103	106	49	94	101	-1
REV COLOMB ESTAD	109	109	109	109	69	108	109	109	109	106	109	106	0
PAK J STAT	110	108	108	108	105	105	108	108	108	103	108	109	-2

Notes: The journals are ranked according to the harmonic mean of the ranks (Harmonic Mean) of 11 RAMs. The difference reported in the last column is 2YIF – Harmonic Mean.

Table 5
Correlation of 11 RAMs and Harmonic Mean of the Ranks for 110 ISI Statistics & Probability Journals

Journal	2YIF	2YIF*	IFI	Immediacy	h-index	C3PO	PI-BETA	Eigenfactor	H-STAR	2Y-STAR	ESC	Harmonic Mean
2YIF	1											
2YIF*	0.987	1										
IFI	0.159	0.277	1									
Immediacy	0.714	0.71	0.099	1								
h-index	0.599	0.579	0.031	0.442	1							
C3PO	0.742	0.732	0.134	0.565	0.912	1						
PI-BETA	0.577	0.57	0.151	0.441	0.731	0.829	1					
Eigenfactor	0.669	0.654	0.026	0.472	0.771	0.755	0.634	1				
H-STAR	0.3	0.367	0.556	0.162	0.417	0.514	0.366	0.305	1			
2Y-STAR	0.156	0.275	0.998	0.086	0.029	0.131	0.147	0.026	0.554	1		
ESC	-0.035	0.054	0.745	-0.074	-0.271	-0.218	-0.087	-0.197	-0.022	0.75	1	
Harmonic Mean	0.614	0.669	0.617	0.541	0.521	0.611	0.53	0.468	0.537	0.604	0.291	1