DESIDOC Journal of Library & Information Technology, Vol. 40, No. 1, Jan 2020, pp. 359-365, DOI : 10.14429/djlit.40.1.14866
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Analysis of Percentiles of Computer Science, Theory and Methods Journals: CiteScore Versus Impact Factor

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ABSTRACT

Impact factor (Web of Science, Clarivate Analytics) and CiteScore (Scopus, Elsevier) are the two leading metrics for journal evaluation, assessment and ranking. The relationship between the two is now established, using their respective percentile in this paper for 105 journal in the Computer science, theory and methods (CSTM) subject category. The available studies did not consider the quartile comparison of the journal percentiles of the two database (Scopus and Science Citation Index expanded). The mean impact factor and CiteScore are 2.08 and 2.67 respectively. Pearson correlation coefficient between the impact factor and CiteScore is (0.919, p = 0.000) and between their respective journal percentiles is (r = 0.804, p = 0.000). Analysis of variance revealed that the means of the impact factor and CiteScore of the 105 CSTM journals are the same (F = 3.64, P = 0.058) but different (F = 38.94, P = 0.00) for their respective percentiles. The median test contradicts the ANOVA as the medians of impact factor and CiteScore are different at 0.05 level of significance. The median journal percentiles are the same for only 2 journal titles. The median journal percentile (SCIE) is greater than the median journal percentile (Scopus) for 5 journal titles and less than the median journal percentile (Scopus) for 98 journal titles. The same result was obtained when the percentiles were converted to quartiles, but in this case, the median journal quartiles are the same for 37 journal titles. The median journal quartile (SCIE) is greater than the median journal quartile (Scopus) for 67 journal titles and less than the median journal quartile (Scopus) in only one journal title. Only 37 (35 %) journals are in the same quartile of the two metrics. Caution is recommended in journal evaluation as conflicting different results can be obtained using the same metric.

Keywords: Scopus; Science citation index expanded; Web of science; CiteScore; Impact factor; Median test; Journal percentile; Statistics.

1. INTRODUCTION

Academic journals are hosts to new scientific ideas and insights from the published works continue to push back the boundaries of knowledge. Astronomical increases in research activities among researchers have led to an increase in the volume of research manuscripts and consequently, an increase in the publication outlets. The publication outlets are responsible for managing paper publications. To assess the quality, relevance, prestige and impact of published papers, bibliometric parameters were created. Mathematical, statistical and data mining tools are used in journal evaluation. Impact Factor (IF) was the first bibliometric parameter created by Thomson Reuters now Clarivate Analytics[1]. Clarivate analytic now manages the web of science database, of which science citation index expanded (SCIE) is one of the indexes. Impact factor is exclusive only to SCIE, Arts and Humanities citation index and Social science citation index. Emerging sources citation index and Conference proceedings Citation index are example of indexes without impact factors.

Received : 27 July 2019, Revised : 23 December 2019
Accepted : 17 January 2020, Online published : 14 February 2020

Currently, the two most widely used metrics are the number of citations and the Hirsch index for author evaluation. The Hirsch index has been extended to journal evaluation and CiteScore (Scopus, Elsevier) was created to be an alternative to the impact factor. Other metrics are but not limited to the SCImago Journal Rank Indicator (SJR), immediacy index, Eigenfactor score, Source Normalised Impact per Paper (SNIP), Journal Percentile, number of citable documents, percentage cited and i10-index.

Two metrics often seem as the most important in journal evaluation are impact factor and CiteScore with their corresponding Journal Percentiles. These two metrics are highly revered and they stand out against some misleading or predatory metrics[2]. However, opinions are split on the adoption of IF and CiteScore as the most important metric[3] because, information obtained from them is very vital and widely used in academic discipline in assessment of researchers, academic staff and grant evaluation. The academic discipline should be in the same subject area for the metrics judgement to be effective[4]. Although, some researchers have warned of the risk of dependence on one metric and the use of multiple metrics is recommended to reduce the risk of bias[5] and to achieve a high degree of precision in journal and researchers' evaluation and assessments[6]. Another use can be seen in research output evaluation[7-9], journal auditing[10-13] and university rankings[14-16]. The issue of transparency, coverage, computational accuracy, integrity and reliability of the metrics are constantly being debated especially, for journal impact factor[17-20]. A clear example is that different and conflicting bibliometric metrics could exist in the same journal title[21-22]. Some indicators may indicate the growth of the journal's impact and prestige while some may point to the opposite[23]. The competing views converge to the fact that the two metrics are predictors of a journal's quality[24]. Technically, the measurement of the impact of citations constitutes most of the journal quality and prestige[25]. Surprisingly, the two metrics are yet to fully evaluate the impact of conferences, books, book chapters and trade publications[26-27].

The aim of this paper is to present the statistical analysis of percentiles of computer science, theory and methods (CSTM) journals indexed in both Scopus and Science Citation Index Expanded. CSTM journals are reputable academic journals that publishes articles on core computer science, the theory behind computing, emerging methods of computing and other related themes. Researchers from other academic field depend on CSTM journals for computational methodologies that can be implemented and applied to different scopes. Within the same field, other subfields such as data mining and artificial intelligence also depends on CSTM outputs for new methodologies and theories. Few works in this context has been discussed, for example; regression analysis has been used to establish a model for predicting the CiteScore using the journal percentile[28], however, journals with extreme values of CiteScore and percentile were excluded from that analysis, and subject classification was not followed.

2. LITERATURE REVIEW

CiteScore and IF are the products of calculated attempts to evaluate the prestige and impact of research articles and the researchers. Authorised journal outlets supplied data (indexing materials such as author details, abstract, article bibliography, references, source of funding) to indexing databases (Scopus and Web of Science). CiteScore for a journal in 2019 for example, is the citations of the articles from 2016 to 2018 divided by the total number of articles from 2016 to 2018. However, impact factor uses 2 years. The CiteScore and the IF determine the quartiles and percentiles of journals based on subject classifications. Both metrics are the measure or an indication of qualify peer review and effective editorial management of journals[29]. Although, advanced publication known as "article in press" appears to affect both metrics. The use of citations of advanced publications to determine the impact is still controversial and models have been proposed to handle such scenarios[30]. Retractions and self-citations have also been implicated in changing the dynamics of the metrics. Correcting models have been proposed to handle them[31-32].

Table 1. Descriptive statistics of IF, JP(SCIE), CiteScore and JP(Scopus) for 105 journals of CSTM subject category

	IF	JP(SCIE)	CiteScore	JP(Scopus)
Mean	2.0799	48.1714	2.665	69.5048
Standard Error	0.1941	2.6714	0.2372	2.1331
Median	1.333	47	1.88	75
Mode	1.819	79	0.7	99
Standard Dev.	1.9890	27.374	2.4308	21.8575
Sample Variance	3.9561	749.3357	5.9087	477.7524
Kurtosis	8.2431	-1.1040	5.9539	-0.0192
Skewness	2.5945	0.1880	2.3477	-0.7766
Range	11.266	96	12.07	92
Minimum	0.417	3	0.25	7
Maximum	11.683	99	12.32	99
Sum	218.386	5058	279.82	7298

Table 2. Correlation between IF and Citescore

	Value	Significance (2-sided)	Coefficient of Determination
Pearson's correlation	0.919	0.000	0.845
Kendall's tau	0.753	0.000	0.567
Spearman's rank	0.915	0.000	0.837

Table 3. Correlation between JP (SCIE) and JP (Scopus)

	Value	Significance (2-sided)	Coefficient of Determination
Pearson's correlation	0.804	0.000	0.646
Kendall's tau	0.673	0.000	0.453
Spearman's rank	0.846	0.000	0.716

Table 4. ANOVA between IF and Citescore

Source of Variation	SS	Df	MS	F	P-value	F criteria
Between Groups	17.97208	1	17.97208	3.643661	0.05766	3.886555
Within Groups	1025.944	208	4.932424			
Total	1043.916	209				

Subject classification and impact differ from each database. CiteScore appears to have more subject classifications than impact factor. History, for instance, is lowly cited in both databases because of the nature of the subject[33]. This partly explains why some fields are disproportionally cited more or less than others[34]. Some of the reasons are research interest, relevance, current research trend, funding, training, experimentation, institution and advance research equipment and facilities[35].

Despite the observed differences between CiteScore and IF using the total cites for example[36], suggestions have been made to combine the two metrics into one which is expected to reduce the weaknesses and improve the strength of the two metrics[37]. The output is to apportion a fair impact on citation received by articles for journals and researchers. Nonetheless, researchers continue to prefer one metric to another based on their judgement and disposition[38]. In addition to the suggestion of harmonising the metrics, new metrics have been proposed[39]. Although, some are to measure the impact of a specific area often neglected by the traditional metrics[40]. Unfortunately, they are yet to gain widespread acceptance currently enjoyed by CiteScore and IF.

3. METHODOLOGY

A search of computer science, theory and method (CSTM) Journals indexed in Science Citation Index (SCIE) was carried out on the Web of Science database. The search yielded 105 journal titles of which their impact factor (IF) and journal percentile (JP(SCIE)) were extracted. The 105 journal names were queried in the Scopus database and the CiteScore and Journal percentile (JP(Scopus)) were extracted for analysis. The data are for journals indexed in the databases for 2018. The Scopus data was obtained from www.scopus.com while the web of science data was extracted from www.ebofknowledge/WOS.

Descriptive statistics, correlation analysis, analysis of variance, median tests (Wilcoxon and sign) and Chi-square test of independence were applied to the data.

4. RESULT AND DISCUSSION

4.1 Descriptive Statistics

The descriptive statistics of IF, JP(SCIE), CiteScore and JP(Scopus) are as presented in Table 1. The mean and sum of the impact factor and CiteScore of the 105 CSTM journals are 2.0799, 218.386, and, 2.665 and 279.82 respectively. The higher value of the CiteScore indicates that the journals received more citations in Scopus than in web of science. This is expected since Scopus contains more journals than web of science. The positive skewness is an indication that some substantial number of the journals have IF and CiteScore less than the average values. The same result was obtained for the journal percentiles although some substantial numbers of the journals have percentile more than the average Journal percentile in Scopus. The least recorded IF, JP(SCIE), CiteScor and JP(Scopus) are 0.417, 3, 0.25 and 7 respectively.

The distribution of JP(SCIE) is approximately normal because the skewness is close to zero. The high values of the Kurtosis for IF and CiteScore corroborates the result for the range that show that some journals within the same classification are highly cited than others.

4.2 Correlation Analysis

The correlation between impact factor and Citescore is as presented in Table 2. The result implies that impact factor is strongly positively correlated with CiteScore. The relationship is valid between 56.7 per cent to 84.5 per cent of all the instances.

The correlation between the journal percentiles of the two metrics are not as strong as obtained for the impact factor and CiteScore, although, a significant positive correlation was obtained. That can hold for between 45.3 per cent and 71.6 per cent of all the 105 journals. Details are as presented in Table 3.

The implication is that the impact factor and CiteScore of CSTM journals are highly positively correlated with high coefficient of determination.

4.3 Analysis of Variance

Analysis of variance showed that the mean of the impact factor and CiteScore are the same at 0.05 level of significance. However, the means are different for their respective percentiles These are as presented in Table 4 and Table 5. The result corroborated the descriptive statistics presented in Table 1. Most of the CSTM journals have different CiteScore and impact factor.

4.4 Non Parametric Tests

Median tests were conducted after the ANOVA results showed that the means of the JP(SCIE) and JP(Scopus) are different. Median tests are conducted to determine where the journal percentiles are the same and different for SCIE and Scopus. Wilcoxon and Sign tests were significant (Table 6).

The median journal percentiles are the same for only 2 journal titles. The median journal percentile (SCIE) is greater than the median journal percentile (Scopus) for 5 journal titles. The median journal percentile (Scopus) is greater than the

Table 5. ANOVA between JP(SCIE) and JP(Scopus)

Source of Variation	SS	Df	MS	F	P-value	F criteria
Between Groups	23893.33	1	23893.33	38.94314	0.0000	3.886555
Within Groups	127617.2	208	613.544			
Total	151510.5	209				

Table 6. Median tests between the JP (SCIE) and JP (Scopus)

Test	Negative Ranks	Positive Ranks	Ties	Test Value	P-value
Wilcoxon	5	98	2	-8.502	0.0000
Sign	5	98	2	-9.065	0.0000

Remarks: Negative ranks = JP(Scopus) < JP(SCIE),
Positive ranks = JP(Scopus) > JP(SCIE), Ties = JP(Scopus) = JP(SCIE)

Table 7. Journal quartiles and percentiles

Quartile	Percentile
Q1	75 – 99
Q2	50 – 74
Q3	25 – 49
Q4	0 – 24

Table 8. Median tests between the JP (SCIE) and JP (Scopus) quartiles

Test	Negative Ranks	Positive Ranks	Ties	Test Value	P-value
Wilcoxon	67	1	37	-7.351	0.0000
Sign	67	1	37	-7.882	0.0000

Remarks: Negative ranks = JP(Scopus) < JP(SCIE), Positive ranks = JP(Scopus) > JP(SCIE), Ties = JP(Scopus) = JP(SCIE)

Table 9. Cross tabulation of JP(SCIE) and JP(Scopus) quartiles

		SCOPUS				Total
		1	2	3	4	
SCIE	1	24	0	0	0	24
	2	20	6	0	0	26
	3	10	13	5	1	29
	4	0	11	13	2	26
Total		54	30	18	3	105

Table 10. Chi-square tests

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	69.354	9	0.000
Likelihood Ratio	90.039	9	0.000
Linear-by-Linear Association	55.582	1	0.000
McNemar-Bowker Test	64.286	5	0.000

Table 11. Symmetric measures

	Value	Asymptotic Standardised Error	Approximate T	Approximate Significance
Pearson's R (interval by interval)	0.731	0.035	10.874	0.000
Spearman correlation	0.770	0.032	12.245	0.000
Kappa (measure of agreement)	0.145	0.050	2.869	0.004

median journal percentile (SCIE) for 98 journal titles. This also corroborates the descriptive and ANOVA results and the result is trusted because the median is a robust and resistant statistic.

4.5 Quartile Analysis

Scopus and Web of Science corroborate the journal percentiles as quartiles, Q1 to Q4. The summary of the quartiles and their corresponding percentiles are as presented in Table 7.

The percentiles were converted to their respective quartiles using Table 7 as a guide. The conversion is important because most journals are rated based on quartiles; hence, Q1 journals are highly desired. The median tests are applied and the results are as shown in Table 8.

The median journal percentiles are the same for 37 journal titles, their actual values not withstanding. The median journal percentile (SCIE) is greater than median journal percentile (Scopus) for 67 journal titles. The median journal percentile (Scopus) is greater than the median journal percentile (SCIE) for only one journal title. The true picture is obtained via cross tabulation as presented in Table 9.

Agreement is in only 37 (35 %) of the journals, that is; 24, 6, 5 and 2 are Q1, Q2, Q3 and Q4 in the two database. This corroborates the ties in Table 8. The accompanying Chi-Square test showed that there is a significant association between the percentiles at 0.05 level of significance as presented in Table 10. Symmetric measures as presented in Table 11 also confirm a significant association between the percentiles of the different databases.

5. CONCLUSIONS

The paper has presented the relationships between the impact factor and CiteScore of 105 journal of computer science theory and methods subject category. Impact factor is highly positively correlated with CiteScore, which is contrary to the findings of Villaseñor-Almaraz et al.[41]. The reason is that journals of the same subject category are most likely to have similar bibliometric features. Correlation between subjects category is likely to be similar to the findings of[41]. CiteScore values are most likely to be higher than the impact factor because of citation differences, which has been reported by[42] in their bibliometric analysis of the journal 'Remote Sensing'. The elevation of one metric over the other is most likely to yield undesirable results, for example, the use of quartiles are most likely to favour some metrics to the determent of the other[43]. No metric is a cure-all[44], the 37 per cent agreement between the quartiles of impact factor and CiteScore as shown is an indication that they are other latent variables that can better explain the metrics[45]. Maybe in the future, the metrics can converge to a universal indicator that can best describe the quality, prestige, relevance and impact of academic journals.

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