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Short communication

Nemo iudex in causa sua?

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Dedicated to Professor Egon Matijević on his 90th birthday.

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ABSTRACT

Newly introduced bibliometric indices may be biased by the preference of scientists for bibliometric indices, in which their own research receives a high score. To test such a hypothesis, the publication and citation records of nine scientists who recently proposed new bibliometric indices were analyzed in terms of standard indicators, their own indicators, and indicators recently proposed by other scientists. The result of the test was negative, that is, newly introduced bibliometric indices did not favor their authors.

1. Introduction

The legal maxim cited in the title (no one should be a judge in their own cause) may also apply to bibliometric indicators. The scientists select and design bibliometric indices, and they are assessed in terms of those indices. This is a clear conflict of interest.

Recently a vice-rector of a university published two ranking lists of the scientists from his university on the university's Web page. In the both lists that vice-rector was number one. A dean of one department of the same university published two ranking lists of the scientists from his department on the department's Web page. The dean had rank two and tied rank one in those ranking lists, and the vice-rector (not considered in the dean's list) would have ranks 4 and 5, respectively. Both gentlemen used existing indices to construct their lists. More recently Ho (Fu, Wang, & Ho 2012) proposed a ranking of top surface-scientists of all times, in which he was number 6, ahead of Nobel laureates and of scientists having twice as high *h*-index as himself. Prof. Egon Matijević, to whom this paper is dedicated is among those high-*h* surface-scientists. The coincidence between the choice (or design) of a bibliometric indicator and the success of the author of the ranking list in those cases might have been accidental, but it can very well be that a selection (or design) of bibliometric indices are to some degree biased by the preference of scientists for bibliometric indices, in which their own research receives a high score. The personal gain is only one of possible motivations. For example, I am allergic to indices, in which my country is underrated. The same refers to my university, to my department and to scientists from other universities whom I especially appreciate (including Prof. Egon Matijević). However, motivations other than personal gain are difficult to quantify since scientists change their affiliations, and admiration and appreciation of other scientists are not as perpetual as narcissism. Therefore the present study is limited to possible correlation between the authorship of new bibiliometric indicators and the scores of the authors of those indicators. This does not imply than other motivations are non-existing or less important. The personal gain has a relative character, and it depends on the reference group. Namely, the same index may overrate or underrate the

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output of the same scientist when his/her achievements are compared with different groups of fellow-scientists. In other words, the choice of the tool depends on the audience the scientist is trying to impress.

To test the hypothesis of possible bias, the publication and citation records of nine scientists who recently proposed new bibliometric indices were analyzed in terms of standard indicators, their own indicators, and indicators recently proposed by other scientists. In view of the discussed above limitations, the results presented in this paper have an illustrative (rather than conclusive) character. The coincidence between the authorship of a new bibliometric indicator and high score of the author does not imply (or exclude) bad intentions. The ethical aspects of the design of indicators of scientific output "in one's own interest" are outside the scope of the present paper.

2. Case studies

The database Web of Science® provided by Thomson Reuters® was accessed on May 30, 2012 to receive publication and citation records of nine scientists who recently proposed new bibliometric indices. The indices for this study were selected according to the following principles:

- they were designed in a narrow time window (2005–2010);
- they were published in single-author papers (rather than in multi-author papers);
- no more than one index per author was considered (but several authors considered in this study have also designed other bibliometric indices);
- no more than one author per country;
- the papers of interest have attracted substantial attention of other scientists (have been cited many times).

The following nine indicators have been studied in detail.

- h-index (the maximum number, for which the hth most-cited paper has at least h citations) (Hirsch, 2005);
- h_{m}-index (the maximum sum of reciprocal numbers of authors in a set of most-cited papers, which does not exceed the number of citations of the least-cited paper in the set). This indicator is aimed at equalization of the chances of the authors who publish alone or with a few co-authors with respect to authors who publish with many co-authors. (Schreiber, 2008);
- t-index (the maximum number, for which the geometric average of the citation numbers of the top t papers is at least t) (Tol, 2009);
- $h(2)$-index (the maximum number, for which the $h(2)$th most-cited paper has at least $[h(2)]^2$ citations) (Kosmulski, 2006);
- g-index (the maximum number, for which the top g papers have together at least g^2 citations) (Egghe, 2006);
- π-index (0.01 of the number of citations of "elite papers" defined as the top square root of the total number of papers) (Vinkler, 2010);
- w-index (a sum of the numbers of papers having at least certain number of citations, which was arbitrarily set as 5,10,20,40,80, etc., multiplied by natural logarithm of that number) (Wohlin, 2009);
- s-index (one tenth of the number of citations divided by a sum of $1 - \exp[-0.1(\text{present year-publication year})]$ taken over all papers of the author) (De Visscher, 2010). This indicator is aimed at equalization of the chances of the younger authors with respect to older authors;
- 2nd component of multidimensional h (the h-index of the set of papers ranked at least $h+1$ in the number of citations) (Garcia-Perez, 2009).

The s-index has an intensive character, and it can decrease or increase in course of scientific career. Most other indices have an extensive character, and they never decrease in course of scientific career even when the scientist is not active any more. The 2nd component of multidimensional h can decrease or increase in course of scientific career, but the sum of h and 2nd component of multidimensional h never decreases in course of scientific career even when the scientist is not active any more.

The authors of the indices differ in their scientific and biological age, and in their productivity, and this may affect the studied correlations. Moreover, a few authors of the indices of interest have a substantial publication record in natural sciences, while the other authors published mainly in the field of library and information science. Different scientific disciplines have different citation cultures, and the citation records of representatives of different disciplines are not comparable.

The bias in scientific indices is a sensitive topic, and anonymization of authors of the above indices has been considered. Yet, the pros and cons of anonymization are balanced, and the final decision was to refer to real names in further text. The scientists are ordered by impact in Tables 1 and 3. The indices are ordered by impact of their authors in Tables 1–3.

Table 1 shows that 10 indices are highly correlated, that is, the most productive authors have also high citation counts and high ranks in terms of h_{m}, h, g, t, $h(2)$, w, 2nd component of multidimensional h and π, while the s-index is rather weakly correlated with other indices. Egghe received a marginally worse score in his own index than his average score. Seven scientists received marginally better scores (by up to 1.17 standard deviations in a set of 11 scores) in their own indices than their average scores. Only de Visscher received a substantially better score (by 2.62 standard deviations) in his own index than his average score. One substantial deviation (in a set of 9 authors and 9 indices) can be hardly considered as a proof for any bias.

Table 1
The ranking of scientists in terms of 11 indices.

Scientist/index	Rank in terms of index											Average rank		Own rank
	# papers	# citations	h	h_m	t	$h(2)$	g	π	w	s	2nd comp.	Value	st. dev.	
Hirsch/h	2	1	**1**	1	1	1	1	1	1	1	1	1.09	0.30	1
Schreiber/h_m	1	2	2	**2**	2	2	2	2	2	5	2	2.18	0.98	2
Tol/t	4	3	3.5	3	**3**	3.5	3	3	3	3	3	3.18	0.34	3
Kosmulski/$h(2)$	5	4	3.5	4	4	**3.5**	4	4	4	4	4.5	4.05	0.42	3.5
Egghe/g	3	5	5	5	5	6	**5**	5	5	6	4.5	4.95	0.79	5
Vinkler/π	8	6	6	6	6	6	6	**6**	6	7	7	6.37	0.67	6
Wohlin/w	6	7	7.5	7	8	8	8	8	**7**	8	6	7.32	0.78	7
de Visscher/s	9	8	7.5	9	7	6	7	7	8	**2**	9	7.23	1.99	2
Garcia-Perez/2nd comp.	7	9	9	8	9	9	9	9	9	9	**8**	8.64	0.67	8

Boldface: scientist's own index.

Table 2
The ranges of normalized indices.

	# papers	# citations	Range of normalized index								
			h	h_m	t	$h(2)$	g	π	w	s	2nd comp.
Max	324	12616	0.59	0.57	0.83	0.70	0.99	0.51	0.78	0.19	0.38
Min	36	471	0.48	0.23	0.69	0.48	0.77	0.36	1.13	0.33	0.20
Max:min	9	26.79	1.24	2.47	1.20	1.46	1.29	1.41	1.44	1.71	1.94

The ranking of 9 scientists based upon normalized indices is presented in Table 3.

The citation and publication counts in a set of 9 scientists differ by an order of magnitude (Table 2), and nonexistence of systematic effect of the authorship (of an index) on the score (in terms of that index) in Table 1 may be interpreted in terms of high correlations between the indices and large gaps between the scientists in terms of their citation counts. Therefore similar study was carried out for "normalized" indices. Originally, h, h_m, g, t, and 2nd component of multidimensional h were divided by square root of the citation count, $h(2)$ was divided by cubic root of the citation count, π was divided by 1% of citation count, and w was divided by the number of papers. This is because h is nearly proportional to square root of the citation count, etc. The s-index is intrinsically normalized to the number of papers, and apparently it does not need any further normalization. The normalized indices h, g, t, $h(2)$, and π of nine scientists fell in a narrow range (less than 50% difference between the highest and the lowest value in the set). Four other indices (normalized as discussed above) showed substantial differences (by factor of 2–7) in the set of 9 scientists. Therefore, attempts to find better normalizations were undertaken. Those attempts failed for h_m and 2nd component of multidimensional h. This is because scientists having similar publication and citation counts have very different h_m and 2nd component of multidimensional h, and scientists having similar h_m and 2nd component of multidimensional h have very different publication and citation counts. On the other hand w happens to be correlated with the (number of citations)$^{0.8}$, rather than with the number of papers as originally assumed, and s happens to be correlated with the (number of citations per paper)$^{0.88}$. Those normalizations seem somewhat counterintuitive, and they refer only to the studied dataset, and may fail with other datasets. However, they were used in further calculations rather than the originally assumed (and more intuitive) normalizations.

The ranges of normalized indices are summarized in Table 2.

The average ranks of all 9 scientists in Table 3 are close to 5, which is an average over all indices and all scientists. This result confirms that the normalization used in the present study did not systematically favor more productive or less productive scientists. After normalization, only Garcia-Perez received a substantially better score (by 1.79 standard deviations) in his own index than his average score. De Visscher received a marginally better score in his own index than his average score.

Table 3
The ranking of scientists in terms of 9 normalized indices.

Scientist/index	Rank in terms of normalized index									Average rank		Own rank
	h	h_m	t	$h(2)$	g	π	w	s	2nd comp.	Value	st. dev.	
Hirsch/h	**8**	6	5	4	2	3	9	7	8	5.78	2.44	8
Schreiber/h_m	9	**8**	8	6	9	9	1	8	4	6.88	2.76	8
Tol/t	5	5	**6**	8	5	7	2	1	3	4.67	2.29	6
Kosmulski/$h(2)$	4	2	3	**5**	3	5	3	3	7	3.89	1.54	5
Egghe/g	7	4	7	9	**6**	2	4	4	5	5.33	2.12	6
Vinkler/π	2	1	2	2	4	**8**	5	9	6	4.33	2.87	8
Wohlin/w	3	7	4	3	7	4	**6**	5	1	4.44	2.01	6
de Visscher/s	1	9	1	1	1	1	8	**2**	9	3.67	3.77	2
Garcia-Perez/2nd comp.	6	3	9	7	8	6	7	6	**2**	6	2.24	2

Boldface: scientist's own index.

All other scientists received worse scores in their own indices than their average scores. The analysis of normalized indices may suggest that the scientists design scientific indices against their own interest, which is opposite to the thesis suggested by the two examples coined in Section 1.

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References

De Visscher, A. (2010). An index to measure a scientist's specific impact. *Journal of the American Society for Information Science and Technology*, *61*(2), 319–328.
Egghe, L. (2006). Theory and practice of the *g*-index. *Scientometrics*, *69*(1), 131–152.
Fu, H. Z., Wang, M. H., & Ho, Y. S. (2012). The most frequently cited adsorption research articles in the Science Citation Index (expanded). *Journal of Colloid and Interface Science*, *379*(1), 148–156.
Garcia-Perez, M. A. (2009). A multidimensional extension to Hirsch's *h*-index. *Scientometrics*, *81*(3), 779–785.
Hirsch, J. E. (2005). An index to quantify an individual's scientific research output. *Proceedings of the National Academy of Sciences of the United States of America*, *102*, 16569–16572.
Kosmulski, M. (2006). A new Hirsch-type index saves time and works equally well as the original *h*-index. *ISSI Newsletter*, *#7*, 4–6.
Schreiber, M. (2008). To share the fame in a fair way, h_m modifies h for multi-authored manuscripts. *New Journal of Physics*, *10*, 040201.
Tol, R. S. (2009). The *h*-index and its alternatives: An application to the 100 most prolific economists. *Scientometrics*, *80*(2), 317–324.
Vinkler, P. (2010). The π_v-index: A new indicator to characterize the impact of journals. *Scientometrics*, *82*, 461–475.
Wohlin, C. (2009). A new index for the citation curve of researchers. *Scientometrics*, *81*(2), 512–533.