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Comparative Analysis between Impact Factor and *h*-Index for Psychiatry Journals

Analyse comparative du facteur d'impact et de l'indice *h* dans les revues de psychiatrie

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Abstract: In order to strictly compare their impact factor (IF) and *h*-index, we wanted to work on all citations obtained in 2006 by the articles published in 2004–5 in the fifty journals of our Web of Science sample of psychiatry.

We obtained a high correlation coefficient between the IF 2006 and *h*-index 2006. The rating of journals starting from the *h*-index may represent a complementary alternative to the rating based on the IF. The *h*-index rating proposes a categorization of journals making it possible to create classes of journals with the same *h*-index.

Keywords: journal impact factor, Hirsch index, journal ranking, psychiatry journals

Résumé : Afin de comparer rigoureusement le facteur d'impact (FI) et l'indice *h*, nous avons travaillé sur l'ensemble des citations reçues en 2006 par les articles publiés en 2004–2005 dans les 50 revues provenant de notre échantillon de la catégorie « Psychiatry » du Web of Science.

Nous avons obtenu un coefficient de corrélation élevé entre le FI 2006 et l'indice *h* 2006. Le classement des revues à partir de l'indice *h* peut représenter une alternative complémentaire au classement basé sur le FI. Le classement *h*-index propose une catégorisation des revues permettant de créer des classes de revues ayant le même indice *h*.

Mots-clés : facteur d'impact de revue scientifique, indice de Hirsch, classement des revues, revues de psychiatrie

The Thomson Scientific journal impact factor (IF) of Garfield is well known for being the document measure of journal impact (Garfield

1955). IF is often used to rank scientific journals, despite several recognized limitations well summarized by Curtis and Hunter (2006), Delavalle et al. (2007), Dong, Loh, and Mondry (2005), and Hecht, Hecht, and Sandberg (1998). First, IF looks only at two years retrospectively. Second, review articles are summaries of the field and are much more frequently cited. Third, the denominator of the equation relates to the number of citable items, including original manuscripts, letters, case reports, and literature reviews published; the journal that publishes very few citable items annually will have an advantage, despite infrequent citation. Fourth, some journals encourage self-citation. Fifth, different specialties may indeed have different standards for the number of articles cited per manuscript. The ISI recognizes the shortcomings of their methodology and have agreed that it is but one measure of a journal's quality.

Hirsch recently suggested a new research performance indicator for application at the micro level (Hirsch 2005). The Hirsch index, or *h*-index, quantifies as a single-number criterion the scientific output of a single researcher. The *h*-index is a very simple new measure incorporating both quantity and visibility of publications (Bornmann and Daniel 2007): "A scientist has index h if h of his or her N_p papers have at least h citations each and the other $(N_p - h)$ papers have fewer than $\leq h$ citations each" (Hirsch 2005, 16569). For example, an *h*-index of 20 means that the scientist has published twenty papers that each had at least twenty citations.

Braun, Glanzel, and Schubert (2006) proposed that the *h*-index could be usefully applied to the citation analysis of journals as well. The *h*-index for evaluating the scientific impact of journals as a robust alternative indicator can be an advantageous complement to journal IF. The journal *h*-index is calculated as follows: "Retrieving all source items of a given journal from a given year and sorting them by the number of times cited, it is easy to find the highest rank number, which is still lower than the corresponding 'Times Cited' value. This is exactly the *h*-index of the journals for the given year" (Bornmann and Daniel 2007, 1382).

In order to progress in the IF / *h*-index comparison analysis, this study compares IF and *h*-index using exactly and strictly the same parameters (identical two publication years [2004–5] and identical one-year citation window [2006]). Hence, we propose here to compare IF 2006 and what we call *h*-index 2006 for one sample of fifty psychiatry journals taken from the *Journal Citation Reports* (*JCR*) 2006. Moreover, the field of psychiatry (using both social and scientific methods) would be interesting

to compare to one more classical medical field such as pharmacology (that publishes many literature reviews) recently studied (Bador and Lafouge 2010).

Methods

Constitution of the sample

We ranked the ninety-four journals of the "Psychiatry" section of the *JCR* 2006 drawn from the Web of Science in descending order of IF, and we took the first fifty journals as our sample.

In order to strictly compare their IF and *h*-index using the same data, we wanted to work on all the citations obtained in 2006 by the articles published in 2004–5 in the fifty journals of our sample of psychiatry. So we had to calculate a Hirsch-type index for journals that agrees with the definition by Braun, Glanzel, and Schubert (2006) of the *h*-index of a journal for a given year. Our given year being 2006, we wanted to compare IF 2006 and what we logically called *h*-index 2006.

Calculation of h*-index 2006*

The IF was easily extracted from the *JCR* 2006, whereas *h*-index 2006 was calculated manually for each of the fifty journals of our sample in the following way:

1. Articles of 2004 were searched.
2. We displayed the references, citing each article obtained ("Times Cited" link)
3. Using the window obtained and the "Refine Results" function, we extracted the number of articles of 2006 (Citations 2006) from the "Publication Years" menu.
4. The same procedure was followed for the articles of 2005.

Thus, for each of the fifty journals, we compiled table 1 for the *Journal of Psychiatry and Neuroscience*. We then identified the *h*-index 2006 corresponding to the number *h* of articles published in 2004–5 and cited at least *h* times during 2006.

Table 1: Calculation of the *h*-index 2006, *Journal of Psychiatry and Neuroscience* (*h*-index = 10)

Articles 2004*	Citations 2006	Articles 2005*	Citations 2006
1	1	1	0
2	**13**	2	0
3	0	3	2
4	**13**	4	1
5	1	5	0
6	4	6	1
7	3	7	0
8	3	8	2
9	0	9	0
10	3	10	1
11	0	11	1
12	7	12	0
13	1	13	0
14	0	14	0
15	**15**	15	0
16	**17**	16	1
17	5	17	0
18	2	18	1
19	5	19	4
20	**15**	20	0
21	8	21	0
22	1	22	0
23	**11**	23	0
24	**15**	24	4
25	0	25	2
26	**19**	26	5
27	1	27	0
28	2	28	1
29	7	29	1
30	1	30	3
31	3	31	1
32	1	32	1
33	0	33	6
34	0	34	3
35	1	35	1
36	2	36	5
37	0	37	5
38	5	38	1
39	**12**	39	**12**
		40	0
		41	0
		42	1
		43	0
		44	5
		45	3
		46	0
		47	2
		48	1

Table 1 (Continued)

Articles 2004*	Citations 2006	Articles 2005*	Citations 2006
		49	0
		50	1
		51	5
		52	1
		53	0
		54	1
		55	2
		56	3
9 papers cited at least 10 times Total: 10 papers 2004–5 cited at least 10 times		1 paper cited at least 10 times	
9 papers cited at least 11 times Total: 10 papers 2004–5 cited at least 11 times		1 paper cited at least 11 times	

* Order of the articles given by the Web of Science

Also, for all the articles of 2004–5 published in the fifty journals, we identified the number of "Reviews" using the "Refine Results" function and the "Document Types" menu. We thus calculated the percentage of Reviews compared with the total number of articles published in 2004–5.

Correlation between the h*-index 2006 and the impact factor 2006*

We studied the statistical correlation between the IF 2006 and *h*-index 2006. For this, we calculated Pearson's correlation coefficient.

Results

Table 2 presents the data obtained (IF 2006, *h*-index 2006, IF ranking, *h*-index ranking, IF / *h*-index ranking difference, number of articles published in 2004–5, percentage of articles that are reviews) for the fifty psychiatry journals ranked in descending order of *h*-index 2006 and compared to the ranking based on IF 2006. Except for the group of the first seven journals for which the two rankings are very close, table 2 shows significant differences between the two rankings. For example, the journal *Psychopharmacology* ranked twenty-fourth with IF 2006 (IF 2006 = 3.625), was ranked seventh with *h*-index 2006 (*h*-index 2006 = 15), equal to the journals *British Journal of Psychiatry* (whose IF

Table 2: *h*-index 2006 ranked list of the first 50 psychiatry journals

h-index 2006 ranking	Journal title	IF 2006	*h*-index 2006	IF ranking	*h*-index ranking	IF / *h*-index ranking difference	No. articles 2004–5	% Reviews
1	*Arch Gen Psychiat*	13.936	**27**	1	1	0	233	3
2	*Am J Psychiat*	8.250	**25**	3	2	+1	592	49
3	*Biol Psychiat*	7.154	**22**	4	3	+1	635	5
4	*Mol Psychiatry*	11.804	**21**	2	4	−2	204	49
5	*Neuropsychopharmacol*	5.889	**16**	5	5	0	468	6
5	*J Clin Psychiat*	5.533	**16**	6	5	+1	552	19
7	*Brit J Psychiat*	5.436	**15**	7	7	0	326	25
7	*Schizophr Res*	4.264	**15**	14	7	+7	503	3
7	*Psychopharmacology*	3.625	**15**	24	7	+17	801	5
10	*Am J Med Genet B*	4.463	**14**	11	10	+1	298	1
11	*J Am Acad Child Psy*	4.767	**13**	9	11	−2	287	41
11	*J Neurol Neurosur Ps*	3.630	**13**	23	11	+12	700	3
13	*J Affect Disorders*	3.138	**12**	28	13	+15	456	4
14	*CNS Drugs*	4.210	**11**	15	14	+1	157	50
14	*Addiction*	4.088	**11**	17	14	+3	319	11
14	*ACTA Psychiat Scand*	3.857	**11**	18	14	+4	258	13
14	*Psychosom Med*	3.857	**11**	18	14	+4	287	6
14	*Psychol Med*	3.816	**11**	20	14	+6	299	5
14	*Bipolar Disord*	3.494	**11**	25	14	+11	156	23
14	*Prog Neuro-Psychoph*	2.584	**11**	35	14	+21	320	94
21	*J Clin Psychopharm*	4.561	**10**	10	21	−11	171	4
21	*J Psychiatr Neurosci*	4.100	**10**	16	21	−5	70	26
21	*Euro Neuropsychopharm*	3.794	**10**	21	21	0	160	6
21	*Drug Alcohol Depen*	3.213	**10**	27	21	+6	300	8
25	*Int J Neuropsychoph*	5.184	**9**	8	25	−17	114	10
25	*Schizophrenia Bull*	4.352	**9**	12	25	−13	122	11
25	*Psychother Psychosom*	4.333	**9**	13	25	−12	93	4
25	*J Psychiatr Res*	3.700	**9**	22	25	−3	140	2
25	*Dement Geriatr Cogn*	2.511	**9**	38	25	+13	223	3
25	*Psychiat Serv*	2.430	**9**	41	25	+16	316	0
25	*J Int Neuropsych Soc*	2.367	**9**	43	25	+18	188	7
25	*Psychiat Res*	2.310	**9**	46	25	+21	303	1
33	*J Psychopharmacol*	3.255	**8**	26	33	−7	149	14
33	*Int Clin Psychopharm*	3.080	**8**	29	33	−4	113	5
33	*Eur Arch Psy Clin N*	3.042	**8**	30	33	−3	120	5
33	*Am J Geriat Psychiat*	2.894	**8**	31	33	−2	198	5
33	*Psychiat Res-Neuroim*	2.755	**8**	33	33	0	151	2
33	*Ment Retard Dev D R*	2.671	**8**	34	33	+1	82	100

Table 2 (Continued)

h-index 2006 ranking	Journal title	IF 2006	*h*-index 2006	IF ranking	*h*-index ranking	IF / *h*-index ranking difference	No. articles 2004–5	% Reviews
33	*Depress Anxiety*	2.549	**8**	36	33	+3	113	5
33	*J Psychosom Res*	2.322	**8**	45	33	+12	273	0
33	*Epilepsy Behav*	2.026	**8**	50	33	+17	345	14
42	*Gen Hosp Psychiat*	2.500	**7**	39	42	−3	118	0
42	*J Child Adol Psychop*	2.486	**7**	40	42	−2	148	8
42	*Hum Psychopharm Clin*	2.386	**7**	42	42	0	127	19
42	*Neuropsychobiology*	2.367	**7**	43	42	+1	158	2
42	*Comp Psychiat*	2.181	**7**	47	42	+5	138	2
42	*CNS Spectrums*	2.051	**7**	49	42	+7	175	53
48	*Pharmacopsychiatry*	2.849	**6**	32	48	−16	119	7
48	*Can J Psychiat*	2.531	**6**	37	48	−11	192	23
50	*World J Biol Psychia*	2.094	**5**	48	50	−2	53	30

ranking, seventh, did not change, IF 2006 = 5.436) and *Schizophrenia Research* (itself ranked fourteenth in the IF 2006 ranking, IF 2006 = 4.264).

The two journals ranked eleventh with *h*-index 2006 (*h*-index 2006 = 13) were ranked respectively ninth (IF 2006 = 4.767) and twenty-third (IF 2006 = 3.630) with IF 2006.

Among the seven journals ranked fourteenth with *h*-index 2006 (*h*-index 2006 = 11), the best IF 2006 ranking was fifteenth and the worst was thirty-fifth. However two journals had exactly the same IF 2006 (IF 2006 = 3.857) and the same *h*-index 2006 (*h*-index 2006 = 11), and therefore the same rankings!

Table 2 also shows the saving or loss of places in the two rankings. We can see that for example the journals *Progress in Neuro-Psychopharmacology and Biological Psychiatry* and *Psychiatry Research* are up twenty-one places (which is the record) in *h*-index 2006 ranking, the journal *International Journal of Neuropsychopharmacology* loses seventeen places in *h*-index 2006 ranking.

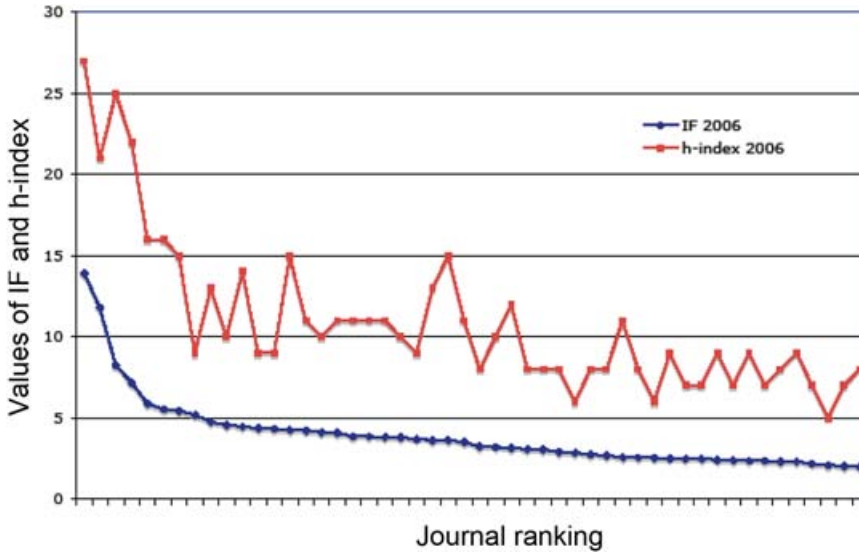

Figure 1: Comparison of IF 2006 and *h*-index 2006 for psychiatry journals (IF 2006 ranking)

As a complement, to illustrate the data in table 2 in graph form, we present figure 1, which shows the ranking of the sample in descending order IF 2006.

Figure 1 shows an overall decrease in *h*-index 2006, revealing sixteen steps (each step having an identical *h*-index 2006, as also shown in table 2) and therefore sixteen groups of psychiatry journals whose *h*-index varies from 27 to 5. The *h*-index 2006 is always, and without exception, much higher than the IF 2006 (up to four times higher for the journals *Psychopharmacology* and *Progress in Neuro-Psychopharmacology and Biological Psychiatry*).

Overall, our sample of psychiatry journals publishes quite few articles in the form of reviews. Only two journals (4%) are specialized in the publication of this type of article: *Mental Retardation and Developmental Disabilities Research Reviews* and *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, respectively published 100% and 94% of reviews.

For the psychiatry journals, we obtained a high Pearson's correlation coefficient of .88. In figure 2, we show the scatter plot and the associated linear regression line.

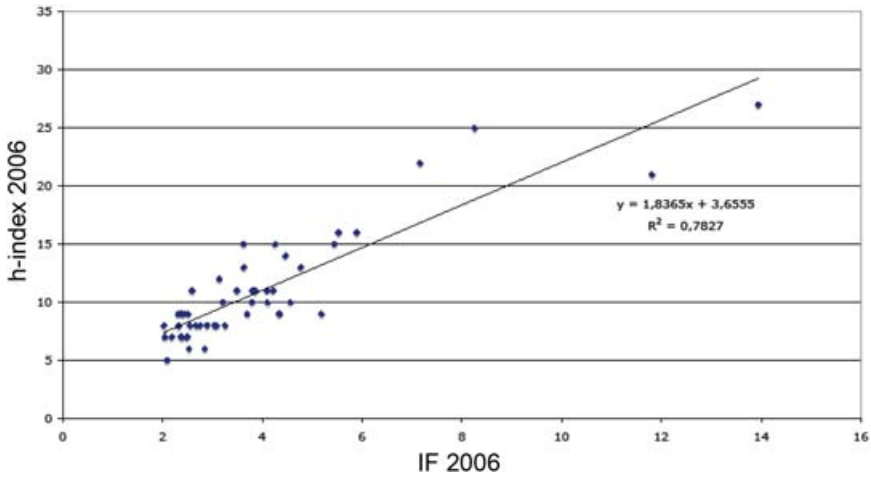

Figure 2: Pearson's correlation of IF 2006 and *h*-index 2006 for psychiatry journals

Discussion

The interest and originality of our study were to compare rankings based on IF 2006 and *h*-index 2006, using strictly the same data based on the usual definition of IF (identical two publication years 2004–5 and identical one-year citation window 2006) for one sample of journals of a health field such as psychiatry. The study by Schubert and Glanzel (2007) is based on strictly the same parameters as well, but particularly on one publication year and on a three-year citation window beginning with the publication year for both the journal impact measure and the *h*-index.

The results given in table 2 show that, for the psychiatry journals, the two rankings are quite different. The IF allows a ranking using a customary descending order, starting from the values of the *JCR* given to the nearest thousandth. However, the *h*-index offers a decreasing ranking, starting from values that are integers. Therefore, the *h*-index ranking is much less fine and precise and reveals sixteen steps (figure 1), each corresponding to a group of journals with the same *h*-index. Also, the amplitude of the fifty *h*-index values (amplitude = 22) is higher than that for the fifty IF values (amplitude = 12). Furthermore, we must note that for a given journal of our sample the *h*-index is always higher than the IF (up to four times higher).

The "Psychiatry" section has very few journals specializing in the publication of reviews, which makes this type of data not very important for comparing the IF and *h*-index. So for our sample the rankings based on the IF and the *h*-index are not very sensitive to the percentage of reviews published. This is not what we observed with the "Pharmacology and Pharmacy" section, which has the characteristic of having a very big percentage of journals specializing in the publication of reviews. It is not surprinsing that these journals often present the best IF, since their review articles are more often cited than the original articles. However, ranking based on the *h*-index is not very sensitive to the percentage of reviews published (Bador and Lafouge 2010).

If we study the relative ranking (in table 2) of our fifty psychiatry journals in the two types of ranking analyzed here, we can see that six journals have identical rank: *Archives of General Psychiatry* first, *Neuropsychopharmacology* fifth, *British Journal of Psychiatry* seventh, *European Neuropsychopharmacology* twenty-first, *Psychiatry Research-Neuroimaging* thirty-third, and *Human Psychopharmacology: Clinical and Experimental* forty-second. Among the forty-four other journals, twenty-three won between one and five places, and seventeen journals won between ten and twenty-one places. Two journals having the same *h*-index 2006 ranking have the same IF 2006 (IF 2006 = 3.857), which is very rare in a given section of the *JCR*. They have, of course, an identical IF 2006 ranking. For a given journal, the possibly high difference between the two rankings may be explained by the fact that the high IF (and then the good IF ranking) is the result from one or several outstandingly highly cited articles for which the journal *h*-index is not sensitive.

The second part of this comparative study of the IF and *h*-index concerned the analysis of their Pearson's correlation coefficient. Thus, we noted a high Pearson's correlation coefficient (.88) for the psychiatry sample. This is well illustrated by the group of the first seven journals whose two rankings are very close, as seen in table 2. This was not what we observed with the Pharmacology and Pharmacy section, which obtained a low Pearson's correlation coefficient (.59) (Bador and Lafouge 2010).

More generally, and as shown in our study of one very small sample, the rating of journals starting from the *h*-index may represent an interesting and complementary alternative to the well-known rating based on the IF. In fact, the *h*-index rating proposes a categorization of journals (several journals capable of having the same *h*-index) making it possible to create

classes of journals with the same *h*-index: e.g., class 5, class 6, class 7 . . . class 19, class 25. It is evident that, to have meaning, this ranking must be made as for IF, within a collection of comparable journals of the same well-identified scientific discipline. In order to put this new type of ranking into perspective, we could certainly propose to display beside the value of each class the maximum value found for the journal obtaining the best *h*-index for the discipline studied, using the following model:

$$\text{journal X} \rightarrow h\text{-index} = 6/25$$

$$\text{journal Y} \rightarrow h\text{-index} = 19/25$$

meaning that journal X is characterized by an *h*-index of 6 and journal Y by an *h*-index of 19, with the note that the journals rated first of the discipline studied have an *h*-index of 25.

This type of ranking by classes of journal is often appreciated and used by experts and scientific committees of evaluation, as shown by Vanclay in the study proposing a ranking of forestry journals based on an evaluation of the journals by experts and also on their *h*-index (Rousseau 2006).

The use of ranking by classes of journal based on the *h*-index is interesting in disciplines in which the amplitude of *h*-index is high in order to have the maximum number of classes to compare. This is the case of scientific, technical, and medical fields where authors cite a lot of articles. Nevertheless in other types of disciplines such as social sciences, arts, and humanities in which scientific collaboration and citations of articles by authors are less developed, the method of journal *h*-index may be less significant and more difficult to use.

As shown by Braun, Glanzel, and Schubert (2006), for a given journal the *h*-index presents different and useful characteristics compared with the IF. First, *h*-index is insensitive to an accidental excess of uncited papers and also to one or several outstandingly highly cited papers; second, it combines the effects of "quantity" (number of publications) and "quality" (citation rate) in a rather specific balanced way that should reduce the apparent "overrating" of some review journals.

The *h*-index could be very interesting and a complementary tool of IF if it would not be calculated for a "lifetime contribution," as suggested by Hirsch (2005) for individual scientists, but for a definite period, as we

did in this study with the same parameters as IF 2006 (articles published in 2004–5 and cited in 2006). In our study, IF and *h*-index were exactly and strictly comparable and thus complementary in the rating of journals of the same discipline.

Nevertheless we must point out a limitation in the use of the journal *h*-index. The journal *h*-index cannot be higher than the number of articles published, so it disadvantages journals that may have a high IF but with a smaller journal *h*-index as a result. Braun, Glanzel, and Schubert (2006), who worked on 2001 as source year (one publication year), had to eliminate the first and second journals of the 2001 IF list. Since these journals published twenty-four and twenty-three papers, respectively, in 2001, they had no chance to compete with the chart-toppers (obviously the *h*-index cannot be larger than the number of papers it is based on). So if we take a two publication year period as in our study, all journals will have published enough articles (probably at least fifty), and this will avoid having to possibly eliminate some journals having very high IF because they published a very low number of articles.

As suggested by Rousseau (2006), one might also consider calculating a relative *h*-index by dividing it by the yearly number of articles of the journal, which could be another research lead for the assessment of the different ranking methods of scientific journals.

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