Bibliometric assessment of world scientific corpus of journals and fields of knowledge presented in JCR DBs: Science Edition 1998-2002[1]

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Abstract

The present paper is devoted to discussion of results of bibliometric analysis of a large set of scientific journals (more than 6 thousand) and scientific fields of knowledge (more than 170) in JCR:SE DBs in 1998-2002 period. The idea of normalized impact factor (K) for evaluation of journals was to compare the traditional impact factor (Ip) of a journal, as indicated in JCR DB, with the average impact factor of the corresponding field of knowledge (Ig). The results of this study are given in tabular form. The tables reflect dynamics of impact factors of fields of knowledge (Ig) and world scientific journals ranked by K.

1 Introduction and method

The aim of this study was to apply a special measure – normalized impact factor (K) to the data bases of Journal Citation Report (JCR) Science Edition. The data bases cover about 170 fields of science and include six thousand scientific journals. It is well known that level of citedness differs significantly across various fields of science: it very high e.g. in biology and medicine and very low in mathematics or engineering. Therefore the traditional impact factor (Ip) of a journal, as indicated in JCR DB, would be valid only within a certain large field of science. To facilitate cross-field evaluation particular journals a new measure is introduced. The Ip of a journal is divided by the standard impact factor (Ig) of the field, to which this journal belongs. The technique of calculation of the standard impact factor for a field (Ig) is an inherent part of the method. For each field of science 5 journals with the highest Ip values were selected. If the total number of papers in those journals (for the two preceding years) was less than 500, the list was extended until the threshold of 500 was reached. The ratio of the total number of citations (in ISI source journals) of articles in the list journals to the total number of source items in those journals (Ig) should represent the field as a whole and is called standard impact factor of the field. It should reminded that the calculation of both Ip and Ig include current year citations of the items in two preceding years.

Once standard impact factor of the field is obtained, the numerical assessment of a particular journal becomes evident. The most obvious and simple indicator would be the ratio of the two measures:

$$K = \frac{Ip}{Ig} \cdot 100\% \qquad (1)$$

the normalized impact factor of a journal.

If a journal belongs to two or more fields the arithmetic mean of the two or more Igs may be

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used like in Marshakova-Shaikevich (1996) or Marshakova-Shaikevich (2007).

This procedure was applied to the database of Journal Citation Report: Science Edition for 1998-2002.

2 Results

Main results are presented in huge tables: the table of Igs has 170 lines, each of the annual table of journals with normalized impact K for 1998-2002 period has about six thousand lines.

General statistics of scientific journals in the world journal corpus of 2002, including 5876 journals, is shown in Table 1.

Table 1: Distribution of K

	Normalized impact K	Number of journals
1	$200 < K$	24
2	$100 < K \leq 200$	173
3	$70 < K \leq 100$	315
4	$50 < K \leq 70$	533
5	$20 < K \leq 50$	2067
6	$10 < K \leq 20$	1407
7	$1 < K \leq 10$	1211
8	$0 < K \leq 1$	62
9	$K = 0$	84

3 Discussion

Standard impact factor (K), though based on traditional impact factor (Ip), differs markedly from the latter. That became clear, when the new measure was introduced for the first time. Figure 1 shows that the two measures are correlated, but coefficient of determination (R^2=0.34) is rather low, which means that K gives a great amount of new information, not present in Ip.

The difference between those two measures becomes more prominent, if we compare Table 2 with Table 3, where 50 journals with highest Ip are given.

While Table 3 covers 23 fields of science, the range of fields in Table 2 is much wider (45 fields, see Table 4). Physical Chemistry is not present in Table 2, there are 4 journals of that field in Table 2 (Surface Science Reports, Chemistry and Physics of Carbon, Advances in Catalysis, Ann. Rev. of Physical Chemistry). Advances in Physics comes first in Table 2 and only 45th in Table 3. Many fields with moderate level of citedness appear in Table 2: fluid mechanics, entomology, computer science, etc. Certainly, this is not meant to prejudice the efficiency of Ip. There are 6 journals in immunology (code NI) in Table 3 and only one in Table 2 (Annual Review of Immunology), of the ten journals with codes CQ and DR (biochemistry, molecular and cell biology) there is none left in Table 2. Those 'hot' fields remain in both lists among first hundred journals.

Table 4 shows that journals from group I belong to life sciences (biological and medicinal categories) on the whole, and some physical and chemical categories. As a rule all those categories have high values of Ig. Journals from group II belong to a larger spectrum of fields of knowledge with quite different Ig values: (from 17 to 1.3).

The list of 50 journals with highest K includes some narrow or peripheral categories, such as Andrology (AZ), History and Philosophy of Science (MQ), Computer Science, Cybernetics (ER), Chemical Engineering (II), Entomology (IY), Energy & Fluid (ID), Engineering & Aerospace (AI) and others.

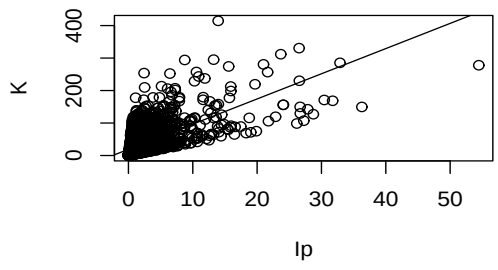

Figure 1: Correlation between K and Ip 2002

Table 2: JCR:SE 2002, 50 journals ranked by normalized impact factor K

Journal_title	Categories	Ip	Ig	K
ADVANCES IN PHYSICS	UK	13.95	3.37	414.50
PHYSIOLOGICAL REVIEWS	UM	26.53	8.02	330.70
REVIEWS OF MODERN PHYSICS	UI	23.67	7.59	311.93
SURFACE SCIENCE REPORTS	EI	13.24	4.49	295.03
CHEMISTRY AND PHYSICS OF CARBON	ID II EI	8.75	2.98	294.02
CA-A CANCER JOURNAL FOR CLINICIANS	DM	32.89	11.54	285.10
CHEMICAL REVIEWS	DY	20.99	7.48	280.51
ANNUAL REVIEW OF IMMUNOLOGY	NI	54.46	19.59	277.99
ANNUAL REVIEW OF ASTRONOMY AND ASTROPHYSICS	BU	15.58	5.68	274.22
ADVANCES IN NUCLEAR PHYSICS	UN	10.57	4.11	257.33
ENDOCRINE REVIEWS	IA	21.64	8.44	256.59
ESA BULLETIN-EUROPEAN SPACE AGENCY	AI	2.43	0.96	253.70
ANNUAL REVIEW OF FLUID MECHANICS	UF PU	6.45	2.56	252.40
ADVANCES IN CATALYSIS	EI	10.92	4.49	243.44
MATERIALS SCIENCE & ENGINEERING R-REPORTS	UB PM	11.89	5.01	237.24
PHARMACOLOGICAL REVIEWS	TU	26.57	11.54	230.15
ANNUAL REVIEW OF PHYSICAL CHEMISTRY	EI	10.26	4.49	228.55
ANNUAL REVIEW OF PHARMACOLOGY AND TOXICOLOGY	YO TU	19.68	8.97	219.28
ANNUAL REVIEW OF ENTOMOLOGY	IY	5.15	2.42	213.20
ACCOUNTS OF CHEMICAL RESEARCH	DY	15.90	7.48	212.47
USER MODELING AND USER-ADAPTED INTERACTION	ER	2.52	1.20	209.63
PARASITOLOGY TODAY	TI	7.25	3.51	206.87
REVIEWS OF GEOPHYSICS	GC	6.08	2.95	205.92
PROGRESS IN POLYMER SCIENCE	UY	7.28	3.61	201.58
ANNUAL REVIEW OF PHYSIOLOGY	UM	15.93	8.02	198.57
SOLID STATE PHYSICS-ADVANCES IN RESEARCH AND APPLICATIONS	UK	6.60	3.37	196.08
MASS SPECTROMETRY REVIEWS	XQ	6.75	3.64	185.69
ARCHIVES OF GENERAL PSYCHIATRY	VE	11.62	6.47	179.60
ANNUAL REVIEW OF NUTRITION	SA	7.92	4.41	179.44
JOURNAL OF MACHINE LEARNING RESEARCH	AC EP	3.82	2.14	178.75
PROGRESS IN NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY	RY UH XQ	4.81	2.69	178.67
SOCIAL STUDIES OF SCIENCE	MQ	1.12	0.63	177.90
MICROBIOLOGY AND MOLECULAR BIOLOGY REVIEWS	QU	15.69	8.84	177.49
WHO TECHNICAL REPORT SERIES	NE	7.90	4.49	176.02
JOURNAL OF ANDROLOGY	AZ	2.37	1.38	171.64
PROGRESS IN MATERIALS SCIENCE	PM	11.60	6.77	171.47
NATURE	RO	30.43	17.79	171.02
NEW ENGLAND JOURNAL OF MEDICINE	PY	31.74	18.82	168.66
ANNUAL REVIEW OF PSYCHOLOGY	VI	7.90	4.72	167.40
PHYSICS REPORTS-REVIEW SECTION OF PHYSICS LETTERS	UI	12.65	7.59	166.62
ALDRICHIMICA ACTA	EE	6.33	3.81	166.18
ANNUAL REVIEW OF MICROBIOLOGY	QU	13.98	8.84	158.16
ANNUAL REVIEW OF NEUROSCIENCE	RU	24.09	15.43	156.16
NATURE REVIEWS NEUROSCIENCE	RU	24.05	15.43	155.88
ANNUAL REVIEW OF NUCLEAR AND PARTICLE SCIENCE	UN UP	7.18	4.62	155.37
ANNUAL REVIEW OF PLANT BIOLOGY	DE	13.68	8.84	154.69
PROGRESS IN RETINAL AND EYE RESEARCH	SU	5.50	3.57	154.02
PROGRESS IN ENERGY AND COMBUSTION SCIENCE	DT ID IU II	3.06	1.99	153.78
GASTROENTEROLOGY	KI	13.44	8.75	153.58
TRENDS IN PARASITOLOGY	TI	5.38	3.51	153.31

Table 3: JCR:SE 2002, 50 journals ranked by impact factor Ip

Journal title	Category	Ip	Ig	K
ANNUAL REVIEW OF IMMUNOLOGY	NI	54.46	19.59	277.99
ANNUAL REVIEW OF BIOCHEMISTRY	CQ	36.28	24.26	149.53
CA-A CANCER JOURNAL FOR CLINICIANS	DM	32.89	11.54	285.10
NEW ENGLAND JOURNAL OF MEDICINE	PY	31.74	18.82	168.66
NATURE	RO	30.43	17.79	171.02
NATURE MEDICINE	QA CQ DR	28.74	22.58	127.29
NATURE IMMUNOLOGY	NI	27.87	19.59	142.26
CELL	CQ DR	27.25	25.42	107.20
NATURE GENETICS	KM	26.71	20.60	129.65
SCIENCE	RO	26.68	17.79	149.95
PHARMACOLOGICAL REVIEWS	TU	26.57	11.54	230.15
PHYSIOLOGICAL REVIEWS	UM	26.53	8.02	330.70
NATURE REVIEWS MOLECULAR CELL BIOLOGY	DR	26.17	26.59	98.44
ANNUAL REVIEW OF NEUROSCIENCE	RU	24.09	15.43	156.16
NATURE REVIEWS NEUROSCIENCE	RU	24.05	15.43	155.88
REVIEWS OF MODERN PHYSICS	UI	23.67	7.59	311.93
ANNUAL REVIEW OF CELL AND DEVELOPMENTAL BIOLOGY	HY DR	22.87	19.21	119.06
NATURE REVIEWS GENETICS	KM	21.76	20.60	105.63
ENDOCRINE REVIEWS	IA	21.64	8.44	256.59
CHEMICAL REVIEWS	DY	20.99	7.48	280.51
TRENDS IN CELL BIOLOGY	DR	19.88	26.59	74.78
ANNUAL REVIEW OF PHARMACOLOGY AND TOXICOLOGY	YO TU	19.68	8.97	219.28
CURRENT OPINION IN CELL BIOLOGY	DR	19.02	26.59	71.55
GENES & DEVELOPMENT	HY KM	18.77	16.22	115.76
NATURE CELL BIOLOGY	DR	18.29	26.59	68.78
IMMUNITY	NI	17.47	19.59	89.17
JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION	PY	16.59	18.82	88.14
MOLECULAR CELL	CQ DR	16.47	25.42	64.79
ANNUAL REVIEW OF BIOPHYSICS AND BIOMOLECULAR STRUCTURE	DA CQ	15.95	17.43	91.49
ANNUAL REVIEW OF PHYSIOLOGY	UM	15.93	8.02	198.57
ACCOUNTS OF CHEMICAL RESEARCH	DY	15.90	7.48	212.47
JOURNAL OF EXPERIMENTAL MEDICINE	QA NI	15.84	18.24	86.83
MICROBIOLOGY AND MOLECULAR BIOLOGY REVIEWS	QU	15.69	8.84	177.49
ANNUAL REVIEW OF ASTRONOMY AND ASTROPHYSICS	BU	15.58	5.68	274.22
TRENDS IN IMMUNOLOGY	NI	15.51	19.59	79.16
LANCET	PY	15.40	18.82	81.82
NATURE NEUROSCIENCE	RU	14.86	15.43	96.31
JOURNAL OF THE NATIONAL CANCER INSTITUTE	DM	14.50	11.54	125.70
TRENDS IN NEUROSCIENCES	RU	14.47	15.43	93.82
TRENDS IN BIOCHEMICAL SCIENCES	CQ	14.40	24.26	59.35
NATURE REVIEWS IMMUNOLOGY	NI	14.06	19.59	71.77
JOURNAL OF CLINICAL INVESTIGATION	QA	14.05	16.89	83.19
ANNUAL REVIEW OF MICROBIOLOGY	QU	13.98	8.84	158.16
ADVANCES IN PHYSICS	UK	13.95	3.37	414.50
NEURON	RU	13.85	15.43	89.75
ANNUAL REVIEW OF PLANT BIOLOGY	DE	13.68	8.84	154.69
NATURE REVIEWS CANCER	DM	13.63	11.54	118.12
GASTROENTEROLOGY	KI	13.44	8.75	153.58
TRENDS IN PHARMACOLOGICAL SCIENCES	TU	13.28	11.54	115.00

Table 4: Two groups of journals with categories

Groups	Number of categories	Categories
Group I: 50 journals ranked by Ip (Ip > 13.2)	23 (number of journals 2358)	BU (Astronomy and Astrophysics), CQ (Biochemistry & Molecular Biology), DA (Biophysics), DE (Plant Sciences), DM (Oncology), DR (Cell Biology), DY (Chemistry, multidisc), EI (Chemistry Physical), HY (Development Biology), IA (Endocrinology & Metabolism), KI (Gastroenterology & Hepatology), KM (Genetics & Heredity), NI (Immunology), PY (Medicine, General & Internal), QA (Medicine, Research & Experimental), QU(Microbiology), RO (Multidisciplinary Sciences), RU (Neurosciences), TU (Pharmacology & Pharmacy), UI (Physics, multidisc), UK (Physics, Condensed matter), UM (Physiology), YO (Toxicology)
Group II: 50 journals ranked by K (K > 153)	45 (number of journals 3181)	AI (Engineering Aerospace), AC (Automation & control systems), AZ (Andrology), BU*(Astronomy & Astrophysics), DE*(Plant Sciences), DM (Oncology), DT (Thermodynamics), DY*(Chemistry, multdisc), EE (Chemistry Organic), EI (Chemistry ,Physical), EP (Computer science, AI), ER (Computer Science, Cybernetics), GC (Geochemistry & Geophysics), IA*(Endocrinology & Metabolizm), ID (Energy & Fuels), II (Engineering Chemical), IU (Engineering, Mechanical), IY (Entomology), KI*(Gastroenterology & Hepatology), MQ (History & Phylosophy of Science), NE (Public, Env.& Occup.Health), NI (Immunology), PM (Material Sci, multidisc), PU (Mechanics), RO*(Multidisc.Sci), RU*(Neurosciences), RY (Nuclear Sci & Technology), QU (Microbiology), SA (Nutrition & Dietics), SU (Ophthalmology), TI (Parasitology), TU*(Pharmacology & Pharmacy), UB (Physics, Applied), UF (Physics, Fluids & Plasma), UH (Physics, At, Mol,& Chem), UI* (Physics, multidisc), UK*(Physics, Condensed Matter) , UM* (Physiology), UN (Physics, Nuclear), UP (Physics, Part and fields), UY (Polymer Sci), XQ (Spectroscopy), YO*(Toxicology), VE (Psychiatry), VI (Psycology).

An interesting aspect of the present study is the analysis of dynamics of Ig in particular fields. One should analyze the figures for single fields keeping in mind the overall growth of standard impact factor in the period under consideration (see Table 5).

Table 5: Average Ig (1998-2002)

Year	Average Ig
1998	3.48
1999	3.65
2000	3.74
2001	3.95
2002	4.06

The 17 per cent growth may be explained in different ways. One explanation is the general intensification of research. Another explanation takes into account social aspects of present day situation: the Internet revolution in communications facilitates access to all sources of information, the lists of cited literature grow.

Three groups of fields of science were selected from the list of 171 fields: those with steady increase in Table 6a, fields with steady decline in Table 6b and fields with non-monotonous development in Table 6c.

Minor source of information noise may be due to reclassifications in data bases JCR:SE. One example is the category *Emergency Medicine and Critical Care*, with 23 journals in 1999 was divided in 2000 into two categories - *Critical Care Medicine* (17 journals) and *Emergency Medicine* (12 journals). Another example is *Marine Engineering* with 20 journals in 1999 which was split next year into *Marine Engineering* with only 4 journals and *Ocean Engineering*, *ocean* with 15 journals. The Igs changed accordingly seen in Table 6d.

Table 5a: Categories with increasing Ig

Code	Category	1998	1999	2000	2001	2002
AM	AGRONOMY (Agriculture)	1.34	1.66	2.08	2.21	2.07
MU	HORTICULTURE	0.64	0.66	1.77	1.81	1.88
CN	BEHAVIORAL SCIENCES	3.28	3.49	3.48	5.69	4.62
CO	BIOCHEMICAL RESEARCH METHODS	3.04	3.75	3.40	4.12	4.63
DB	BIOTECHNOLOGY & APPLIED MICROBIOLOGY	7.59	8.16	8.39	8.71	9.77
QU	MICROBIOLOGY	7.09	7.63	7.78	9.34	8.84
DX	CHEMISTRY, MEDICINAL	3.67	3.88	4.27	4.41	4.82
EC	CHEMISTRY, INORGANIC & NUCLEAR	3.61	3.46	3.48	5.07	5.11
II	ENGINEERING, CHEMICAL	1.79	1.64	1.95	2.82	2.67
EP	COMPUTER SCIENCE, ARTIFICIAL INTELLIGENCE	1.95	2.38	2.34	2.45	2.60
EX	COMPUTER SCIENCE, THEORY & METHODS	1.48	1.88	1.89	2.13	2.29
UE	IMAGING SCIENCE & PHOTOGRAPHIC TECHNOLOGY	0.84	1.07	1.31	1.42	1.67
KV	GEOGRAPHY, PHYSICAL	1.10	1.30	1.34	1.61	2.22
LE	GEOSCIENCES, MULTIDISCIPLINARY	2.65	2.86	2.83	3.19	3.33
PY	MEDICINE, GENERAL & INTERNAL	14.26	13.72	14.7	17.12	18.82
QA	MEDICINE, RESEARCH & EXPERIMENTAL	12.28	12.65	13.06	14.44	16.89
KI	GASTROENTEROLOGY & HEPATOLOGY	6.56	6.70	7.10	7.90	8.75
DM	ONCOLOGY	8.81	9.15	9.45	10.60	11.54
AQ	ALLERGY	2.68	3.02	3.07	3.64	4.14
LI	GERIATRICS & GERONTOLOGY	2.62	2.56	3.07	3.07	3.69
ZD	PERIPHERAL VASCULAR DISEASE	7.07	7.88	8.45	9.11	9.27
UM	PHYSIOLOGY	5.95	6.32	6.22	7.50	8.02
WH	RHEUMATOLOGY	3.53	4.03	4.26	4.11	5.39
YO	TOXICOLOGY	3.65	3.96	4.37	5.81	6.40
TI	PARASITOLOGY	2.48	2.69	2.89	3.10	3.51
TU	PHARMACOLOGY & PHARMACY	7.19	7.69	8.06	9.74	11.54
BU	ASTRONOMY & ASTROPHYSICS	4.05	4.54	4.36	5.57	5.68
AC	AUTOMATION & CONTROL SYSTEMS (Robotics & AC)	1.03	1.38	1.39	1.42	1.67
YE	TELECOMMUNICATIONS	1.49	1.81	1.57	1.82	2.34
YR	TRANSPORTATION SCIENCE & TECHNOLOGY	0.47	0.56	0.57	0.69	1.09

Table 5b: Categories with decreasing Ig

Code	Category	1998	1999	2000	2001	2002
CQ	BIOCHEMISTRY & MOLECULAR BIOLOGY	34.76	33.28	28.27	28.73	24.26
DR	CELL BIOLOGY	30.09	30.50	28.56	27.57	26.59
DY	CHEMISTRY, MULTIDISCIPLINARY (Chemistry)	9.73	9.66	10.23	7.48	7.48

Table 5c: Categories with non-monotonous development of Ig

Code	Category	1998	1999	2000	2001	2002
RT	CLINICAL NEUROLOGY	5.90	7.16	6.94	6.69	6.12
IA	ENDOCRINOLOGY & METABOLISM	8.94	8.38	7.51	8.40	8.44

Table 5d: Categories with reclassification and development of Ig

Code	Category	1998	1999	2000	2001	2002
DS	CRITICAL CARE MEDICINE	-	-	4.12	4.21	4.33
FF	EMERGENCY MEDICINE	4.04	4.31	1.59	1.43	1.57
IL	ENGINEERING, MARINE	0.81	0.81	0.06	0.04	0.07
IO	ENGINEERING, OCEAN	-	-	0.95	0.86	0.99

4 Conclusion

This study, based on JCR DB 1998-2002, shows, that standard impact factor of field of science Ig is growing in science as a whole. The growth of citedness is due both to the progress of science proper and of means of communication, facilitating access to information.

Normalized impact factor (K) is a tool for comparison of journals across fields of knowledge, which is very important in assessing national contributions to world science.

The traditional impact factor favours such disciplines as biology and medicine and can hardly be used in reference to fields with low level of citedness (such as mathematics or technology). Introduction of K will help to remedy that unfairness.

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