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Recent growth of scientific journals published in India: Some publishing and citation-related characteristics

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ABSTRACT

Using bibliometric data collected from journal citation reports (JCRs) covering the period 2008-2011, trends of the growth of scientific journals published in India, self-citation characteristics of their 2-year impact factors (IF2s) with and without self-citations and the relationship between their 2- and 5-year impact factors (IF5) are examined. The main findings of the study are that: (1) A majority of the top Indian journals belong to medical and medicinal sciences and are published by dominating publishers like MedKnow, Indian Academy of Sciences, National Institute of Science Communication and Information Resources (NISCAIR), and Indian Council of Medical Research (ICMR), whereas most of the bottom journals were published by scientific societies, associations, centers and other individual publishers, (2) Many of the journals were included in the JCR indexing system only recently but their ranking in the IF2 order strongly depends on the publication duration, (3) With their increasing publication duration, the values of IF2 and IF5 of the top journals increase, whereas those of the bottom journals decrease, (4) the frequency $f_P = P/N$ of distribution of self-citation octiles $P = IF2_{nsc}/IF2$ and the frequence $f_F = F/N$ of IF2 octiles F for different years, where $IF2_{nsc}$ is the 2-year impact factor of a journal without self-citations and N is the number of journals with IF2 in a given year, follow exponential dependence, and (5) IF5 > IF2 for most of the journals but the proportion of journals where IF5 > IF2 varies enormously in different years.

Keywords: Impact factors, journal categories, journal self-citations

INTRODUCTION

Different aspects of the scientific publication behavior of researchers publishing in various national and international journals have been studied and differences between the citations of papers in English and nonEnglish languages on a global level have been recognized. Several studies have shown that citations per paper of nonEnglish journals are lower than those of English journals.[1-7] Sangwal[6] reported that: (1) the citability of papers published by physics, chemistry, and technical sciences professors in Poland decreases with increasing fraction of the papers in volumes/issues of journals as proceedings of conferences and in nonEnglish language journals and (2) technical sciences professors have a higher tendency of publishing papers in proceedings of conferences than physics and chemistry professors.

The scientific impact of journals is traditionally measured in terms of their impact factors calculated from the total number of citations, including self-citations, received by the papers published in them and the ranking of a journal in its scientific discipline is determined by the journal impact factor. These impact factors of journals are usually used by research funding agencies as an evaluation measure of scientific performance of individual researchers, faculties, and institutes. In fact, adoption of impact factors of journals as a measure of scientific performance has resulted in an omnipresent pressure on editors to improve the impact factors of their journals and on authors to publish in journals with high impact factors. Since the impact factors of journals undergo changes from year to year, it is interesting to examine the factors that lead to changes in the impact factors.

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Mueller *et al*.,[4] found that impact factor of journals is closely related to the language than with the country of their origin. From an analysis of the citation data of journals published in nine different countries, Sangwal[8] found that English-language journals, as a rule, have higher impact factors than nonEnglish-language journals. Although self-citations of journals are included in the calculation of their impact factors, no particular attention has been paid so far to analyze the distribution of self-citations of journals published in individual countries in relation to their impact factors. The aim of the present study is to examine the trends of the growth of scientific journals published in India, self-citation characteristics of their 2-year impact factors (IF2s) with and without self-citations and the relationship between their 2- and 5-year impact factors (IF5) using bibliometric data collected from Journal Citation Reports (JCRs) covering the period 2008-2011.

DATA FOR ANALYSIS

We used JCR (Science Edition) for the years 2008-2011 of Thomson Reuters' ISI Web of Knowledge database to collect appropriate bibliometric data about the journals published in India, their publishers, IF2s with journal self-cites, IF2s without journal self-cites ($IF2_{nsc}$), IF5s, journal categories (Q1-Q4) based on quartiles of categories, and journal self-citations. Some basic information about the journals collected from the JCR databases is given in Tables 1-3. All Indian journals included in the JCR lists are English-language journals. It should be noted that in Table 1 the categories of journals in a scientific field are listed in the decreasing order of IF2 and the corresponding publishers appear successively in that order. The abbreviations used for different publishers are explained in Table 2.

Here it is worthwhile to recall the procedure used in the JCR databases to calculate IF2 and IF5, respectively, and to assign a given journal to the category Q in a particular scientific research discipline, usually referred to as "subject category." Denoting the reference year by *Y*, IF2 and IF5 of a journal are defined as follows:

- IF2(*Y*) = total number of citations to papers published in the previous 2 years (*Y*-2) and (*Y*-1) divided by the number of papers published in the previous 2 years (*Y*-1) and (*Y*-2);
- IF5(*Y*) = total number of citations to papers published in the previous 5 years from (*Y*-5) to (*Y*-1) divided by the number of papers published in the previous 5 years from (*Y*-5) to (*Y*-1).

Table 1: Scientific fields of journals published in India, journal categories and their publishers*

Scientific field	Year	Category	Publisher
Agriculture, dairy, and animal sciences	2008	Q4, Q4	ICAR, other
	2009	Q3, Q4, Q4	assoc, other, ICAR
	2010	Q4, Q4, Q4, Q4	other, assoc, ICAR, center
	2011	Q3, Q4, Q4, Q4	T and F, assoc, ICAR, center
Agriculture, multidisciplinary	2008	Q4	ICAR
	2009	Q4, Q4	ICAR, other
	2010	Q4, Q4	ICAR, other
	2011	Q4, Q4	ICAR, other
Agronomy	2008	Q4	other
	2009	Q3, Q4	other, assoc
	2010	Q3, Q4, Q4, Q4, Q4	other, assoc, center, soc, center
	2011	Q3, Q4, Q4, Q4, Q4	other, soc, assoc, center, center
Anatomy and morphology	2010	Q4	soc
	2011	Q4	soc
Astronomy and astrophysics	2008	Q4	Springer
	2009	Q4, Q4	IAS, soc
	2010	Q2, Q4	soc, IAS
	2011	Q2, Q3	soc, IAS
Biochemistry and molecular biology	2008	Q4, Q4	NISCAIR, soc
	2009	Q4, Q4, Q4	NISCAIR, soc, other
	2010	Q4, Q4	NISCAIR, Springer India
	2011	Q4, Q4	NISCAIR, Springer India
Biology	2008	Q2, Q4	Springer, NISCAIR
	2009	Q2, Q4	IAS, NISCAIR
	2010	Q2, Q3, Q4	IAS, NISCAIR, NASI
	2011	Q2, Q3, Q4	IAS, NISCAIR, NASI
Biophysics	2008	Q4	NISCAIR
	2009	Q4	NISCAIR
	2010	Q4	NISCAIR
	2011	Q4	NISCAIR
Biotechnology and applied microbiology	2010	Q4, Q4	Springer, NISCAIR
	2011	Q4, Q4, Q4, Q4	NISCAIR, Springer India, other, other
Cardiology and cardiovascular system	2010	Q4	MedKnow
	2011	Q3	soc
Chemistry, applied	2008	Q4	NISCAIR
	2009	Q4	NISCAIR
	2010	Q4	NISCAIR
	2011	Q4	NISCAIR
Chemistry, medicinal	2010	Q4	other
	2011	Q4	other
Chemistry, multidisciplinary	2008	Q3, Q3, Q4, Q4	Springer, NISCAIR, SPI, other
	2009	Q3, Q3, Q4, Q4, Q4	IAS, NISCAIR, SPI, other, other

Contd...

Table 1: Contd...

Scientific field	Year	Category	Publisher
	2010	Q3, Q3, Q3, Q4, Q4, Q4	IAS, NISCAIR, other, SPI, other, other
	2011	Q3, Q3, Q4, Q4	IAS, NISCAIR, other, other
Chemistry, organic	2008	Q4, Q4	NISCAIR, other
	2009	Q4, Q4	NISCAIR, other
	2010	Q4, Q4	NISCAIR, other
	2011	Q4, Q4	NISCAIR, other
Clinical neurology	2010	Q4	MedKnow
	2011	Q4	MedKnow
Dermatology	2009	Q4	MedKnow
	2010	Q4	MedKnow
	2011	Q4	MedKnow
Ecology	2011	Q4	soc
Education, scientific discipline	2009	Q4	assoc
	2010	Q4	assoc
	2011	Q4	assoc
Endocrinology and metabolism	2010	Q4	Springer India
	2011	Q4	Springer India
Energy and fuel	2011	Q2	Elsevier
Engineering, aerospace	2009	Q4	center
	2010	Q4	center
	2011	-	center
Engineering, chemical	2008	Q4	NISCAIR
	2009	Q4	NISCAIR
	2010	Q4	NISCAIR
	2011	Q4	NISCAIR
Engineering, electrical and electronic	2009	Q4, Q4	MedKnow, inst
	2010	Q4, Q4	inst, MedKnow
	2011	Q3, Q4	inst, MedKnow
Engineering, mechanical	2010	Q4	other
	2011	Q4	other
Engineering, multidisciplinary	2008	Q4, Q4, Q4	Springer, NISCAIR, NISCAIR
	2009	Q3, Q4, Q4	NISCAIR, NISCAIR, IAS
	2010	Q3, Q3, Q4	NISCAIR, IAS, NISCAIR
	2011	Q3, Q4, Q4, Q4, Q4	NISCAIR, Hindawi, SPI, IAS, NISCAIR
Entomology	2008	Q4	other
	2009	Q4	other
	2010	Q4	other
	2011	Q4	T and F
Environmental sciences	2008	Q3, Q4	other, soc
	2009	Q4, Q4	other, soc
	2010	Q4	other
	2011	Q4, Q4, Q4	other, other, Springer
Fisheries	2011	Q4	inst
Food science and technology	2008	Q4	assoc
	2009	Q4	Springer India
	2010	Q4	Springer India
	2011	Q4	Springer India

Contd...

Table 1: Contd...

Scientific field	Year	Category	Publisher
Genetics and heredity	2008	Q4	Springer
	2009	Q4	IAS
	2010	Q4, Q4	IAS, KRE
	2011	Q4, Q4	IAS, KRE
Geology	2009	Q4	inst
	2010	Q4	inst
	2011	Q4	inst
Geosciences, multidisciplinary	2008	Q3, Q4	Springer, soc
	2009	Q4, Q4, Q4	IAS, Springer India, other
	2010	Q3, Q4, Q4	IAS, other, Springer India
	2011	Q4, Q4, Q4	IAS, other, Springer India
Hematology	2011	Q4	Springer India
Horticulture	2009	Q4	soc
	2010	Q4	soc
	2011	Q4	soc
Immunology	2008	Q4	ICMR
	2009	Q4	ICMR
	2010	Q4, Q4	ICMR, MedKnow
	2011	Q4, Q4	ICMR, MedKnow
Infectious diseases	2011	Q3	ICMR
Instruments and instrumentation	2009	Q4	soc
	2010	Q4	soc
	2011	Q4	soc
Materials science, ceramics	2009	Q4	soc
	2010	Q4	soc
	2011	Q3	soc
Materials science, interdisciplinary	2008	Q3, Q4	Springer, NISCAIR
	2009	Q3, Q4	IAS, NISCAIR
	2010	Q3, Q4	IAS, NISCAIR
	2011	Q3, Q4	IAS, NISCAIR
Mathematics	2008	Q3, Q4	Springer, INAS
	2009	Q4, Q4, Q4	other, IAS, SPI
	2010	Q3, Q4, Q4	other, assoc, IAS
	2011	Q3, Q4, Q4	Hindawi, SPI, IAS
Mathematics, applied	2009	Q3	other
	2010	Q2	other
	2011	Q2	Hindawi
Mechanics	2010	Q4	other
	2011	Q4	other
Medical laboratory technology	2010	Q4	MedKnow
	2011	Q4	MedKnow
Medicine, general and internal	2008	Q2, Q2, Q3	ICMR, MedKnow, AIIMS
	2009	Q2, Q2, Q3	ICMR, MedKnow, AIIMS
	2010	Q2, Q2, Q3	ICMR, MedKnow, AIIMS
	2011	Q2, Q2, Q3	ICMR, MedKnow, AIIMS
Medicine, research and experimental	2008	Q3	ICMR
	2009	Q3	ICMR

Contd...

Table 1: Contd...

Scientific field	Year	Category	Publisher
	2010	Q3, Q4	ICMR, SPI
	2011	Q3	ICMR
Metallurgy and metallurgical engineering	2010	Q4	Springer India
	2011	Q4	Springer India
Meteorology and atmospheric science	2009	Q4, Q4, Q4	dept, other, assoc
	2010	Q4, Q4, Q4	other, assoc, dept
	2011	Q4, Q4, Q4	other, dept, assoc
Microbiology	2010	Q4	Springer
	2011	Q4	Springer
Multidisciplinary sciences	2008	Q3, Q4, Q4	assoc, NASI, center
	2009	Q2, Q3, Q4, Q4	IAS, center, NASI, NASI
	2010	Q2, Q3, Q4, Q4	IAS, center, NASI, NASI
	2011	Q2, Q3, Q4, Q4, Q4	IAS, center, NASI, KRE, NASI
Neurosciences	2008	Q4	MedKnow
	2009	Q4	MedKnow
	2010	Q4	MedKnow
	2011	Q4	MedKnow
Oceanography	2008	Q4	NISCAIR
	2009	Q4	NISCAIR
	2010	Q4	NISCAIR
	2011	Q4	NISCAIR
Oncology	2010	Q4	MedKnow
	2011	Q4	MedKnow
Ophthalmology	2010	Q4	soc
	2011	Q3	soc
Orthopedics	2010	Q4	MedKnow
	2011	Q4	MedKnow
Otorhinolaryngology	2010	Q4	Springer
	2011	Q4	Springer
Parasitology	2011	Q4	ICMR
Pathology	2010	Q4	MedKnow
	2011	Q4	MedKnow
Pediatrics	2008	Q3, Q4	other, AIIMS
	2009	Q4, Q4	other, AIIMS
	2010	Q3, Q4	Springer India, AIIMS
	2011	Q3, Q4	Springer India, AIIMS
Pharmacology and pharmacy	2009	Q4, Q4	MedKnow, assoc
	2010	Q4, Q4, Q4	MedKnow, MedKnow, assoc
	2011	Q4, Q4, Q4	MedKnow, MedKnow, assoc
Physics, applied	2009	Q4	soc
	2010	Q4	soc
	2011	Q4	soc
Physics, multidisciplinary	2008	Q4, Q4, Q4	NISCAIR, Springer, assoc
	2009	Q4, Q4, Q4	IAS, NISCAIR, assoc
	2010	Q3, Q3, Q4	IAS, NISCAIR, assoc
	2011	Q3, Q3, Q4	NISCAIR, IAS, assoc
Plant sciences	2008	Q4	soc
	2009	Q4, Q4, Q4, Q4	soc, other, NISCAIR, soc
	2010	Q4, Q4, Q4, Q4, Q4	Springer India, other, NISCAIR, soc, soc
	2011	Q4, Q4, Q4, Q4, Q4	Springer India, NISCAIR, other, soc, soc
Polymer science	2008	Q4	other
	2009	Q4	other
	2010	Q4	other
	2011	Q4	other
Remote sensing	2008	Q4	soc
	2009	Q4	soc
	2010	-	-
	2011	Q4	Springer
Respiratory system	2010	Q4	MedKnow
	2011	Q3	soc
Statistics and probability	2010	Q4	other
	2011	Q4	other
Surgery	2010	Q4	Springer India
	2011	Q4	Springer India
Telecommunication	2009	Q4, Q4	MedKnow, inst
	2010	Q4, Q4	inst, MedKnow
	2011	Q3, Q4	inst, MedKnow
Tropical medicine	2011	Q4	ICMR
Veterinary sciences	2008	Q4, Q4	other, other
	2009	Q4, Q4	other, other
	2010	Q4, Q4	other, other
	2011	Q4	other
Virology	2009	Q4	soc
	2010	Q4	soc
Water resources	2009	Q4	other
	2010	Q4	other
	2011	Q4	other

*Categories of journals in a scientific field are listed in decreasing order and corresponding publishers appear successively in that order. ICMR=Indian Council of Medical Research, soc=Societies, NISCAIR=National Institute of Science Communication and Information Resources, inst=Institutes

Depending on the number of citations received by the papers published in a given journal in 2- and 5-year citation windows, IF2 and IF5 of the journal are usually different. However, the subject category Q of a journal belonging to a scientific area in the Thomson Reuters' JCR databases is determined on the basis of the distribution of the IF2s of all of the journals belonging to the scientific area in the percentile ranges 100-75%, 75-50%, 50-25%, and 25-0%, defined as quartiles Q1, Q2, Q3, and Q4, respectively, from the topmost subject category Q1 to the lowest subject category Q4. In cases when the scope of a journal

Table 2: Participation of different publishers of journals in India

Publisher	N_{jrnl}			
	2008	2009	2010	2012
Springer India	-	2	7	8
Springer	9	-	2	3
Taylor and Francis (T and F)	-	-	-	2
Elsevier	-	-	-	1
MedKnow	2	5	12	12
Hindawi	-	-	-	2
Indian Academy of Sciences (IAS)	-	10	10	10
National Institute of Science Communication and Information Resources (NISCAIR)	9	10	11	11
Indian Council of Agricultural Research (ICAR)	2	2	2	2
All India Institute of Medical Sciences (AIIMS)	2	2	2	2
Indian Council of Medical Research (ICMR)	1	1	1	2
Scientific Publishers, India (SPI)	2	1	3	2
National Academy of Sciences of India (NASI)	1	2	3	3
Kamla-Raj Enterprises (KRE)	-	-	1	2
Societies (soc)	3	8	10	11
Associations (assoc)	3	4	5	4
Research Institutes/Centers/Departments (inst, center, dept)	1	3	7	7
Others (other)	10	15	17	16
Sum	45	68	94	100

Table 3: Numbers N_{jrnl} of journals with IF2s, IF5 and different quartiles of categories Q

Year	Journals			Categories (%)				
	N_{jrnl}	IF2	IF5	Q1	Q2	Q3	Q4	ΣQ
2008	45	45	40	-	3 (5.8)	10 (19.2)	39 (75.0)	52
2009	68	68	41	-	4 (4.8)	11 (13.1)	69 (82.1)	84
2010	94	92	45	-	6 (7.2)	16 (14.4)	89 (80.2)	111
2011	100	99	47	-	8 (6.6)	22 (18.0)	92 (75.4)	122

covers more than one research area, it is assigned different Qs representing the ranking of the journal in the list of journals belonging to each area.

PUBLISHING TRENDS OF JOURNALS

It may be seen from Table 1 that during the 4-year period multidisciplinary research fields like agriculture, chemistry, engineering, geosciences and general sciences (multidisciplinary sciences), dairy and animal sciences-related agriculture, agronomy, biology, biotechnology and applied microbiology, and plant sciences have witnessed a steady increase in the number of journals. In other fields such as mathematics, pharmacology and pharmacy, and general and internal medicine there is an insignificant increase in the number of journals, whereas the number of journals in other fields has remained practically unchanged. In 2010 and 2011, new journals have been initiated, inter alia, in the fields of medical and medicinal sciences (e.g., in anatomy and morphology, cardiology and cardiovascular system, clinical neurology, hematology, medical laboratory technology, oncology, parasitology, and surgery), ecology, energy and fuel, and biotechnology and applied microbiology.

From Tables 1 and 2, it may be noted that in 2008 Springer and National Institute of Science Communication combined with Council of Scientific and Industrial Research (amalgamated later as National Institute of Science Communication and Information Resources (NISCAIR)) were the main publishers with nine journals each. However, in 2009 most of the journals published by Springer in the previous year and the journal "Current Science India," one of the topmost journals in multidisciplinary sciences, published previously by Current Science Association were acquired by Indian Academy of Sciences (IAS). In 2010 and 2011 some journals previously published by individual publishers were taken over mainly by Springer India, Taylor and Francis, and Hindawi.

Since 2008, Springer/Springer India, MedKnow, IAS, and NISCAIR have emerged as the main publishers of scientific journals in India, which publish about 40% of the journals. Individual societies, associations, research institutes, centers, and departments publish over 40% of the journals [Table 2]. There are also other publishers, usually with one journal listed in the JCR list in a given year, which publish the remaining 20% of the journals. Although multinational publishers like Elsevier as well as Taylor and Francis are also present since 2011, their contribution to the publication of journals is relatively small.

The number of Indian journals listed in the JCR reports has increased steadily from 45 in 2008 to 100 in 2011, showing an increase by a factor of 2.2 [Table 3]. However, the number of journals with IF5 has increased by a factor of 1.18 only. This means that most of the journals included in the JCR in 2010 and 2011 are new. The sum of the categories of the journals is higher by about 20% than their number in a given year because some journals are categorized in more than one JCR category. In all of the years considered here, there is no journal in category Q1 but the number of journals increases successively in categories Q2, Q3, and Q4 [Table 3]. The number of journals in a particular category also increases with the increasing number of journals included in the JCR list in

successive years but the fractional participation of journals belonging to different quartiles does not change drastically in different years.

Top 20 and bottom 20 Indian journals indexed in JCR 2011, together with their IF2 with and without self-citations and IF5, are compared in Table 4 with the journals indexed in 2009. The following features may be seen from this table:

1. In contrast to 55% of the top journals, only 15% of the bottom journals have their IF5. This means that many of the journals were included in the JCR indexing system only recently but their ranking in the IF2 order strongly depends on the publication duration. It is also interesting to note that 70% of the top journals were published by MedKnow, IAS, NISCAIR, and ICMR, which were the dominating publishers in 2011. However, most of the bottom journals were published

Table 4: Top 20 and bottom 20 Indian journals in 2011 compared with same journals in 2009[§]

No	Journal	IF2	IF5	$IF2_{nsc}$	Publisher
1.	B Astron Soc India	2.722 (0.310)		2.500 (0.310)	soc
2.	Indian J Med Res	1.837 (1.516)	2.193 (1.941)	1.724 (1.298)	ICMR
3.	J Biosciences	1.648 (1.956)	2.218 (1.876)	1.517 (1.923)	IAS
4.	Energy Sustain Dev	1.625		1.413	Elsevier
5.	Ann Thorac Med	1.617		1.400	soc
6.	Indian J Exp Biol	1.295 (0.550)	1.099	1.212 (0.520)	NISCAIR
7.	J Postgrad Med	1.263 (1.389)	1.586	1.222 (1.284)	MedKnow
8.	J Chem Sci	1.177 (0.993)	1.241 (1.206)	1.095 (0.954)	IAS
9.	J Vector Dis	1.177		1.094	ICMR
10.	Pharmacogn Mag	1.159		0.857	other
11.	Indian J Biochem Bio	1.142 (0.574)	0.911 (0.547)	1.110 (0.508)	NISCAIR
12.	J Genet	1.086 (0.762)	1.238 (0.738)	1.057 (0.714)	IAS
13.	Indian Pediatr	1.048 (0.962)	1.052	0.912 (0.793)	Springer India
14.	Indian J Ophthalmol	1.019		0.757	soc
15.	Indian J Med Microbi	0.988		0.870	MedKnow
16.	Indian J Dermatol Ve	0.979 (0.976)		0.878 (0.820)	MedKnow
17.	Neurol India	0.956 (0.796)	0.968 (1.106)	0.968 (0.707)	MedKnow
18.	Curr Sci India	0.935 (0.782)	1.110 (1.110)	0.782 (0.645)	IAS
19.	Ann Indian Acad Neur	0.928		0.681	MedKnow
20.	Indian J Chem A	0.891 (0.617)	0.710 (0.634)	0.776 (0.470)	NISCAIR
81.	P Indian AS Math Sci	0.165 (0.382)	0.314 (0.460)	0.165 (0.348)	IAS
82.	Res J Biotechnol	0.143 (0.174)		0.114 (0.151)	other
83.	Indian J Anim Sci	0.122 (0.137)	0.130 (0.146)	0.064 (0.054)	ICAR
84.	J Agrometeorol	0.114 (0.065)		0.057 (0.009)	assoc
85.	Indian J Pharm Educ	0.106 (0.150)		0.096 (0.140)	assoc
86.	Legume Res	0.088		0.029	center
87.	Indian J Surg	0.081		0.048	Springer India
88.	J Pure Appl Microbio	0.065		0.047	other
89.	J Camel Pract Res	0.061 (0.223)	0.123 (0.247)	0.030 (0.074)	other
90.	Indian J Hematol Bio	0.056		0.037	Springer India
91.	J Anat Soc India	0.056		0.056	soc
92.	Res Crop	0.050		0.036	center
93.	P Natl A Sci India A	0.044 (0.140)		0.044 (0.121)	NASI
94.	Indian J Fish	0.040		0.024	inst
95.	Vegetos	0.039 (0.030)		0.039 (0.015)	soc
96.	Indian J Otolaryngol	0.033		0.029	Springer
97.	Indian J Anim Res	0.020		0.020	center
98.	P Natl A Sci India B	0.019		0.009	NASI
99.	Int J Agric Stat Sci	0.013 (0.092)		0.000 (0.000)	other
100.	J Spacecr Technol	0.000 (0.034)		0.000 (0.034)	other

[§]Values without parentheses and in parentheses given in IF2, IF5 and $IF2_{nsw}$ columns are for 2011 and 2009, respectively

by scientific societies, associations, centers, and other individual publishers

2. With their increasing publication duration, the values of IF2 and IF5 of the top journals increase, whereas those of the bottom journals decrease. This observation is associated with the process of dissemination of contents of the journals and the difference in their scientific field. In the dissemination process established publishers have an advantage over small, individual publishers. However, the dissemination process of the journals can be different even among the dominating publishers. For example, the increase in the IF2 of the top journals from 2009 to 2011 is significantly higher for NISCAIR than that for MedKnow, which started its large-scale journal publication activities in 2009 [Table 1]. The situation in the case of journals published by Springer India, which also started its publication activities in 2009, is similar to that of MedKnow
3. A majority of the top journals belong to medical and medicinal sciences. Other top journals belong to astronomy and astrophysics (journal 1), energy and fuel (journal 4), biology (journal 6), multidisciplinary chemistry (journals 8 and 20), and multidisciplinary sciences (journal 18)
4. The $IF2_{nsw}$ for most of the journals differ no more than 30% from their corresponding IF2. This means that the editorial policy of most of the journals is to discourage journal self-citations to improve their IFs.

JOURNAL IF2 AND NONSELF-CITATION OCTILES

From the data of IF2 and $IF2_{nsc}$ for the journals compiled from the JRC files the parameter $P = IF2_{nsc}/IF2$ was calculated. The parameter P is a measure of the nonself-citations (NSCs) of a journal. The higher the value of P, the lower is the contribution of self-citations to its IF2. The distribution of the values of the parameter P of different journals as a function of their corresponding IF2 is shown in Figure 1 for the 4 years. It may be noted from Figure 1 that the value of IF2 of the top journal increases in successive years from 1.884 in 2008 to 2.722 in 2011 and is directly connected with the number N of the journals in different years.

In order to analyze the distribution of the parameter P of journals as a function of their IF2, the entire range

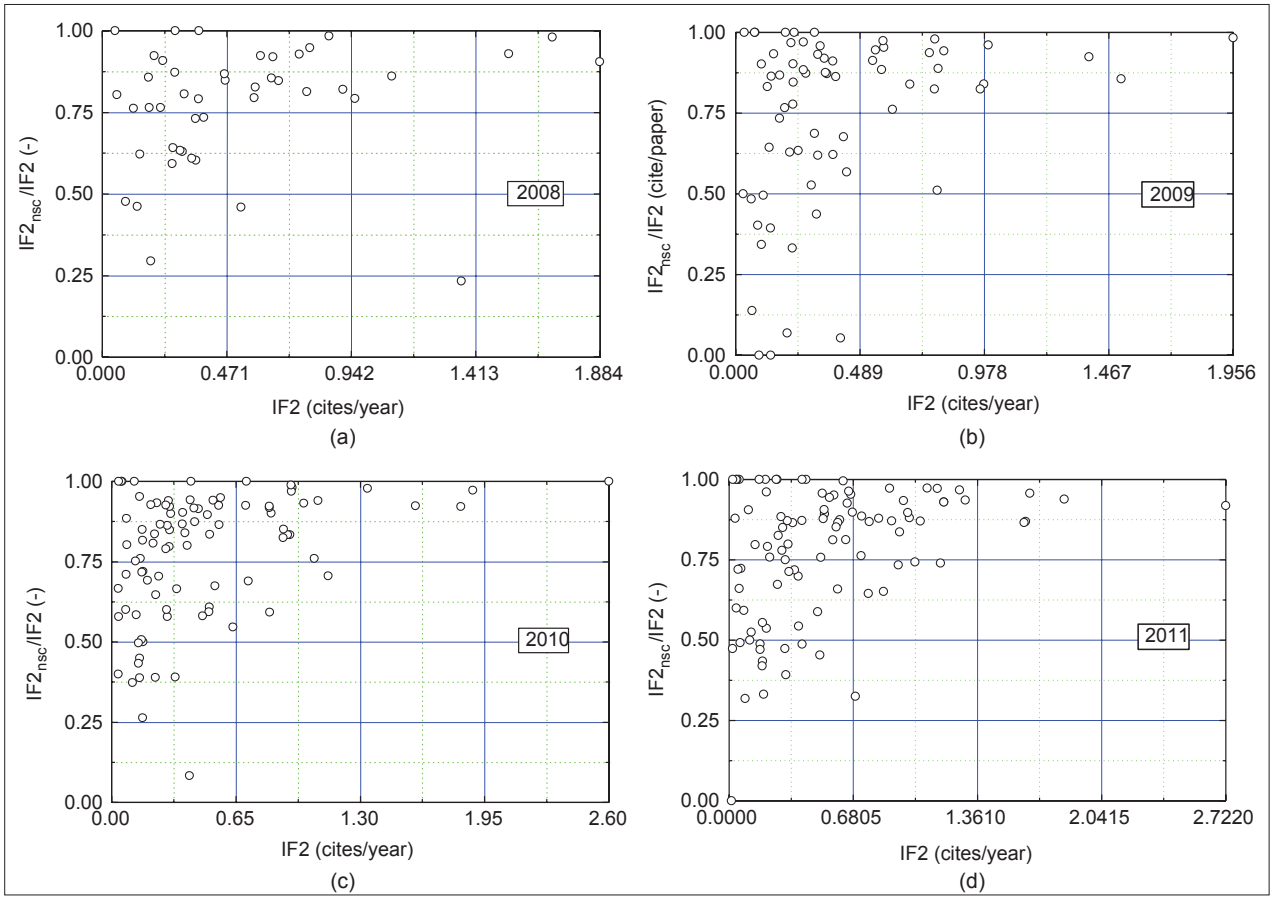

Figure 1: Distribution of ratio P of journals of various IF2 in different years: (a) 2008, (b) 2009, (c) 2010, and (d) 2011

$1 > P > 0$ was divided into eight groups, called hereafter as NSC octiles, in the order of decreasing P. This means that the lowest NSCs correspond to P close to unity, whereas the highest NSCs correspond to P close to zero. Obviously, NSC groups 1 and 8 correspond to $1 > P > 0.875$ and $0.125 > P > 0$, respectively, whereas other NSC groups 2-7 lie between the above groups. Similarly, considering the highest $IF2_{max}$ of IF2 of the top journal in a particular year as a normalization factor, the fraction F, defined as $F = IF2/IF2_{max}$, was calculated and the distribution of the values of the fraction F for different crystals was split into eight groups F on the basis of octiles in the order of increasing IF2. Obviously, in this case journals with IF2-based octiles 1 and 8 correspond to $0 < F < 0.125$ and $0.875 < F < 1$, respectively, but the other IF2-based octiles 2-7 lie between octiles 1 and 8. This type of division of the data of P of the journals corresponding to IF2 on the basis of octiles is illustrated in Figure 1.

It should be noted that the concept of octiles used in this paper is similar to that of quartiles used in Thomson Reuters' JCR databases for the categorization of journals belonging to different scientific disciplines. In the present case, the reference is the country of origin of journals (e.g., India here) instead of a scientific discipline and successive pairs of octiles form quartiles. For example, our NSC octile groups 1 and 2, 3 and 4, 5 and 6, and 7 and 8 may be considered as NSC quartiles 1, 2, 3, and 4, respectively. Similarly, our IF2-based octiles 1 and 2, 3 and 4, 5 and 6, and 7 and 8 are IF2-based quartiles 4, 3, 2, and 1, respectively.

From the plots of the parameter P against IF2 for different journals the numbers of the parameter P in different NSC octiles and the numbers of the fraction F in different IF2-based octiles were counted. The results are given in Table 5. Using the values of P and F in different octiles and the number N of journals published in a year the frequencies $f_P = P/N$ and $f_F = F/N$ of participation of NSC parameter P and IF2 fraction F in different NSC octiles and IF2-based octiles, respectively, were calculated. The data of f_P against NSC octiles P and f_F against IF2-based octiles F are presented in the histograms of Figure 2a and b, respectively. The histograms of Figure 2 suggest that f_P decreases with increasing P, whereas f_F increases with increasing F practically exponentially. The dependences of $\ln f_P$ on P and $\ln f_F$ on F are shown in Figure 3a and b, respectively. In the figures, the linear plots are drawn for the data of 2011.

With the exception of $\ln f_P$ data corresponding to octile 8 of NSC parameter P for 2009 and $\ln f_F$ data corresponding to F octiles 7 and 8 for 2008 and 2009, the entire data follow the linear dependence described by the usual exponential relation

$$f = f_0 \exp(-ax), \quad (1)$$

where f denotes f_P or f_F, x denotes P or F, a is a parameter characterizing a particular dependence, whereas f_0 is a

Table 5: Numbers of journals in different octiles of IF2 (F) and self-citation groups (P)

Year	Feature	1	2	3	4	5	6	7	8	Sum
2008	NSC (P)	13	19	4	4	3	1	1	1	45
	IF2 (F)	12	15	7	5	2	1	1	2	45
2009	NSC (P)	29	15	6	5	6	2	1	4	68
	IF2 (F)	29	20	7	7	2	1	1	1	68
2010	NSC (P)	36	23	11	11	8	2	0	1	92
	IF2 (F)	46	23	14	4	2	2	0	1	92
2011	NSC (P)	40	25	12	8	10	3	0	1	99
	IF2 (F)	43	28	15	8	3	1	0	1	99

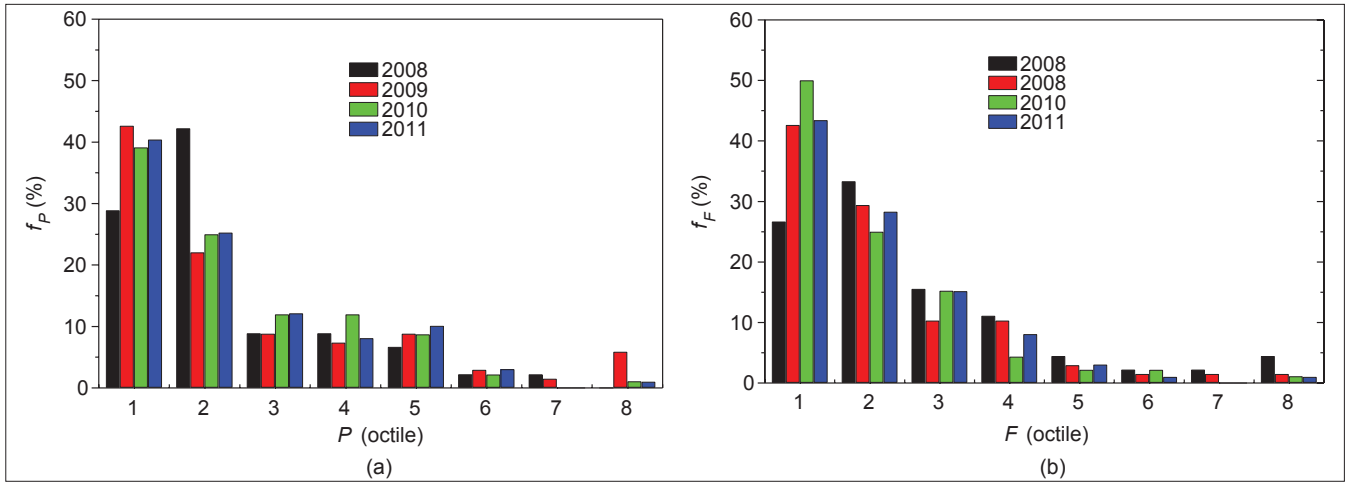

Figure 2: (a) Histogram of frequency f_P of distribution of journals of different nonself-citation octiles P for 4 years. (b) Histogram of frequency f_F of distribution of journals of different IF2 octiles F for 4 years

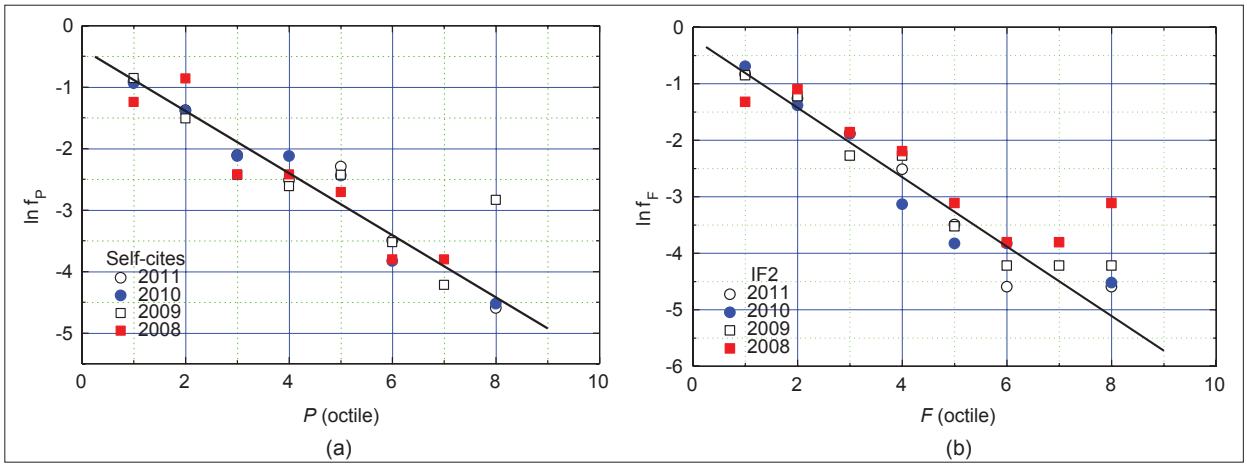

Figure 3: Dependence of (a) $\ln f_P$ on nonself-citation octile P and (b) $\ln f_F$ on IF2 octile F of journals.

normalizing frequency corresponding to $x = 0$ and is characteristic of the $f_P(P)$ and $f_F(F)$ data. The values of the constants are listed in Table 6.

For sufficiently large values of x, the relation between the number y of items and the rank x of the successive sources generating the items is described.[9-13]

$$y = y_0 \exp\left[-\left(\frac{x}{x_0}\right)^{\beta}\right], \qquad (2)$$

where y_0 denotes the number of items generated by the maximally active source, and β and n_0 are empirical constants. For real distributions of a variety of data sets of natural and economic phenomena such as radio and light emissions from galaxies, oilfield reserve sizes, agglomeration sizes, country population sizes, daily currency exchange variations, and citations of authors, it is found that the constant $\beta \leq 1$.[9-11,13] The case when $\beta = 1$ corresponds to the usual exponential distribution (1) with the constant $a = 1/x_0$. However, it is observed that stretched exponential relation (1) does not describe the data in the entire range of x and deviations often occur in the range of very low and high x. The exceptions occurring in octiles of high self-citation and high IF2 journals in Figure 2a and b may be explained in this way.

It should be mentioned that, apart from the exponential dependence, several other mathematical functions have been reported in the literature to describe the above type of $y(x)$ data. These functions are given by Sangwal.[12]

RELATIONSHIP BETWEEN IF2 AND IF5

Figure 4 shows the dependence of IF2 of journals published in India for 2008-2011 against their corresponding IF5,

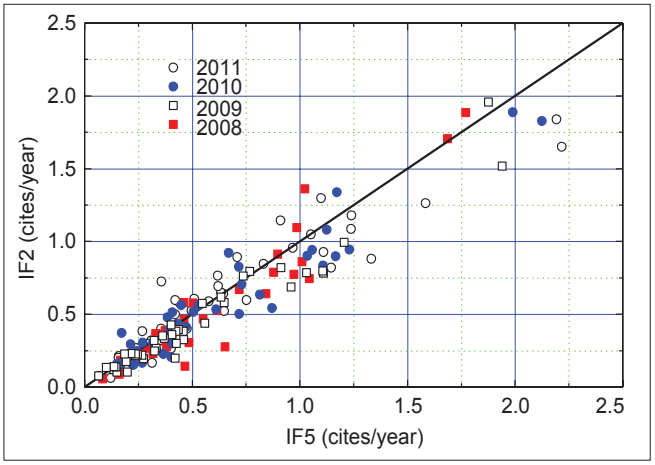

Figure 4: Relationship between IF2 and IF5 of journals

Table 6: Values of constants f_0 and a for f_P (P) and f_F (F) data

Data	Figure	$\ln f_0$	f_0	−a
f_P (P)	3a	−0.377±0.245	0.69	0.505±0.052
f_F (F)	3b	−0.196±0.338	0.82	0.614±0.072

whereas the linear plot represents a slope of unity when IF2 = IF5 for different journals. As seen from this figure, the maximum value of IF5 increases with an increase in the total number of the journals with IF5. This observation is similar to that of an increase in the value of IF2 with an increase in the number of journals published in successive years.

In Figure 4, a majority of the data points lie below the linear plot, implying that IF5 > IF2 for most of the journals. In fact, as seen from Table 7, IF5 > IF2 for most of the journals but the proportion of journals where IF5 > IF2 varies enormously in different years. For example, IF5 > IF2 for about 75% journals in 2009 and about 51%

Table 7: Number of Indian journals with IF2, IF5>IF2 and IF5<IF2

Year	N_{IF5}	IF5>IF2	IF5<IF2	IF2=IF5
2008	40	26	13	1
2009	41	31	9	1
2010	45	28	16	1
2011	47	24	23	0

journals in 2011. Similar observations have been reported previously in the literature.[14,15] From a comparison of IF2 and IF5 of top 20 international journals from Thomson Reuters' 2008 JCR database, Companario[14] found that IF5 > IF2 for most journals but the IF5 < IF2 for about a quarter of them.

Using the scientific publication output of Norwey, Aksnes and Sivertsen[16] found that: (1) there are large annual variations in the influence of highly cited papers on the average citation rate of the subfields and (2) the average citation rates of papers in major subfields are strongly determined by one or only a few highly cited papers. These observations are associated with the highly skewed distribution of citations of papers published in journals. Therefore, IF2 of a journal is increased primarily by the high-tank papers receiving high citations.[17,18] In view of this skewness of citation distribution of papers in journals, a huge number of citations received by an individual paper published in a journal can have a dramatic effect on its IF2.[18] The increase or decrease in the IF2 of journals observed in the present study may be attributed to relatively high or low citations received by high-rank papers published in the latest 2 years than in the previous years.

CONCLUSIONS

The main findings of the study are the following:

1. Since 2008, Springer/Springer India, MedKnow, IAS, and NISCAIR have emerged as the main publishers of scientific journals in India, which publish about 40% of the journals. Individual societies, associations, research institutes, centers, and departments publish over 40% of the journals. There are also other publishers, usually with one journal listed in the JCR list in a given year, which publish about 20% of the journals. Among the leading publishers, MedKnow and Springer/Springer India have consolidated their positions in 2010 and 2011
2. A majority of the top Indian journals belong to medical and medicinal sciences and are published by dominating publishers like MedKnow, IAS, NISCAIR, and ICMR
3. Comparison of the IF2 with and without self-citations and IF5 of top 20 and bottom 20 Indian journals indexed in JCR 2011 with those of the journals indexed in 2009 revealed that 55% of the top journals and 15% of the bottom journals have their IF5. This means that many of the journals were included in the JCR indexing system only recently but their ranking in the IF2 order strongly depends on the publication duration. Moreover, 70% of the top journals were published by MedKnow, IAS, NISCAIR, and ICMR, which were the dominating publishers in 2011, whereas most of the bottom journals were published by scientific societies, associations, centers, and other individual publishers
4. With their increasing publication duration, the values of IF2 and IF5 of the top journals increase, whereas those of the bottom journals decrease. This observation is associated with the process of dissemination of contents of the journals and the difference in their scientific field. In the dissemination process, established publishers have an advantage over small, individual publishers
5. The frequency $f_P = P/N$ of distribution of NSC octiles $P = IF2_{nsc}/IF2$ and the frequence $f_F = F/N$ of IF2 octiles F for different years, where $IF2_{nsc}$ is the 2-year impact factor of a journal without NSCs and N is the number of journals with IF2 in a given year, follow exponential dependence
6. IF5 > IF2 for most of the journals but the proportion of journals where IF5 > IF2 varies enormously in different years.

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