Jointly published by Elsevier Science Ltd, Oxford and Akadémiai Kiadó, Budapest

Scientometrics, Vol. 41, Nos 1–2 (1998) 255–271

INTERNATIONALIZATION OF SCIENTIFIC JOURNALS: A MEASUREMENT BASED ON PUBLICATION AND CITATION SCOPE

M. ZITT,*,** E. BASSECOULARD*

**LERECO, INRA, BP 71627, F-44316 Nantes Cedex 03 (France)*
***Observatoire des Sciences et des Techniques (OST), 93 rue de Vaugirard, F-75006–Paris (France)*
E-mail: zitt@nantes.inra.fr

(Received August 30, 1997)

Although impact factor and related measurements are the best-known features of scientific journals, other characteristics are of particular interest. The way a journal reflects the internationalized nature of science may be determined by many methods, one of which is based on the distribution of authoring and citing countries. This can be systematically measured either by a comparison of these distributions with averages profiles of a discipline or specialty, or by concentration indexes on the other. This paper focuses on the first approach. As the average profile of science drifts with the level of visibility, stratification by impact level is discussed. In this study, experimental internationalization indexes were calculated on the SCI for journals belonging to Earth&Space and Applied Biology. Convergence of measurements (types of indexes, type of normalization, publication vs citation scope) is adressed. Internationalization indexes may have a variety of applications, including characterization of the scientific publishing market and sampling of the SCI for science indicators.

Introduction

The scientific journal is still an important means of communication, despite questions about its future role in an era of electronic publication. The journal is in fact a central object in library science as well as bibliometrics, and its visibility through impact (*Garfield*[1]) or influence (*Narin et al.*[2]) is a major concern. The journal remains a basis for most classifications of science, including recent ones (*Katz & Hicks*[3]), and a relevant unit for studies in science dynamics (*Leydesdorff & Cozzens*[4]). Journals and their scientific and commercial publishers are also essential nodes in the power scheme in science, and journal level of analysis reflects the international nature of science. Various dimensions of these processes have already been investigated:

0138–9130/98/US $ 15.00

a) the *national distribution of authors*. This is the most straightforward approach, and one that has gained attention from small countries, in particular as a means of testing the internationalization of their national-based journals (*Christensen & Ingwersen,*[5] who refer to *Sivertsen*[6]). National profile of journals has also been addressed by many micro-level studies (for example *Sigogneau,*[7] p. 114-117);
b) the *national distribution of users*, a logical complement to the author spectrum. The users include readers, subscribers and citers. *Christensen & Ingwersen*[5] consider the third set as a feasible representation of the first two, which are less directly accessible to bibliometric means. A kindred measurement based on referencing by prescriptors would be, for instance, the *spectrum of international databases including the journal*;
c) the *co-authorship linkages*, generally addressed at the paper level (*Luukkonen et al.*[8]). These are also appealing at the journal level, e.g. to detect the proportion of co-authorship within and outside the country to which the journal belongs;
d) internationalization through publishing choices in terms of *language and commercial publishers*, which is more linked to the power structure in science (*Zitt et al.*[9]);
e) the *national structure of editorial boards*, which constitutes a direct expression of the power structure ("scientific gatekeeping," *Braun & Bujdoso*[10]).

The present paper will focus on the first two aspects of internationalization and attempt to (1) select a satisfactory index for the internationality of journals, with a special attention to relative (i.e. normalized) measures; (2) explore some aspects of this measure in two large disciplines (Earth&Space, Applied Biology: Animal & Vegetal) (3) mention a few applications of internationalization indexes, such as sampling within the SCI for indicator building.

Sources and methods

Sources

This study was carried out on the ISI's Science Citation Index database, namely a simplified version of the "Integrated Citation File". This work [i] uses 3-years cumulations for publications and citations, recommended for contributions profiles; following examples are on 1991-1993 figures (noted 1992). Aggregations and classifications follow OST current standards; in particular, only the major four types of documents are considered (proceedings excluded). A journal may appear in several aggregates, specialties (ISI's subject categories), sub-disciplines or disciplines (OST

aggregates). For comparisons involving impacts, these have been normalized at the specialty level, using the median impact of journals in the specialty. The following results were obtained using a selection of the 60 leading countries in science: the last country in this selection represents about 0.02% of total SCI publications.

Absolute or relative internationalization

We shall focus here on the distribution of authoring countries, on the one hand, and citing countries, on the other. A first extreme situation is that of a journal reflecting the international variety of its discipline, whereas national-based journals mainly attract authors and readers from the country concerned. A variety of measurements (examples given in Table 1) can be used to define the degree of 'internationality' of a journal. Depending on the type of information they require, they can be classified as local versus global and direct versus normalized.

Table 1
Some types of measures of national orientation

Information required	One predetermined country's share Local measure	All countries profile Global measure	
		Extremum country value	Synthetic index
one journal (direct measure)	publisher's country share	maximum share	concentration
field aggregate (normalized measure)	publisher's country ratio	maximum difference	profile distances

Local measures only require information about the share of one fixed country (in practice the country of scientific or commercial origin of the journal). Global measures need the whole profile of country contributions in the journal, either to extract some particular value, or to mobilize the complete profile in the measurement.

Direct or 'absolute' measures only require information on the spectrum of the journal itself. A typical absolute/global measure is the Gini-type concentration index on the country profile of the journal. Normalized or 'relative' measures require to define aggregates (specialty, sub-discipline, discipline, all science) giving the reference spectrum: the closer a journal's profile is to the average profile, the more international it is [ii]. Conversely, a journal with equidistributed countries, top-ranked by a concentration index, would not generally be considered as strongly international on this

relative measure. Figure 1 shows an example of a journal national profile against a reference (namely an impact stratum inside a sub-discipline).

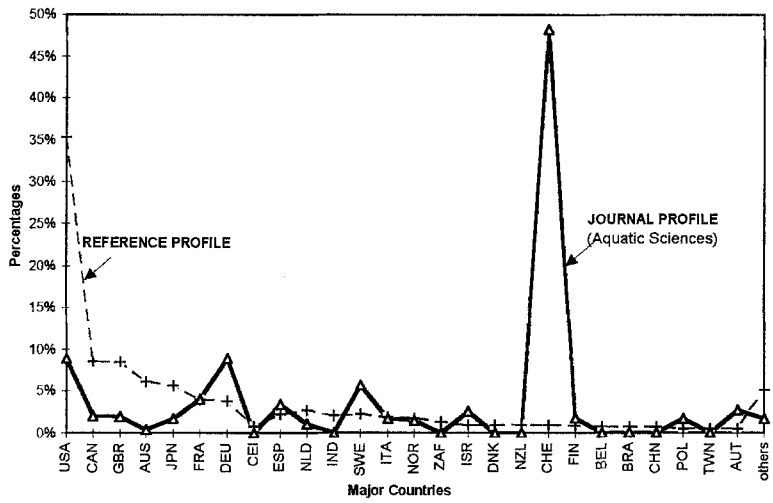

Fig. 1. Distribution of authors countries. Reference: subdiscipline of the journal for the corresponding impact stratum

Absolute and relative approaches have distinct advantages: absolute methods require few information and dispense from somewhat arbitrary definitions of science fields contours; relative methods are not classification-free but take into account the actual structure of science in the journal's (sub)field, instead of considering that a 80%United States/20%United Kingdom journal and a 80%Ukraine/20%Belarus journal are equivalent. We will focus here on relative measures, even though direct ones are very valuable to provide a complementary view.

Measuring the relative internationalization

We shall first consider (1) the choice of the aggregation level for the reference profile used to normalize the measurement, (2) the possible stratification of the reference profile by impact level, (3) the choice of internationalization indexes, with a prior test on a fictitious set, and (4) the application to citation distributions.

1) *The choice of the reference profile: aggregation level.* With respect to well-known specialization effects in science, the reference profile for measuring deviations may be chosen at the discipline or specialty level rather than at the all-science level. A possible basis for specialty definition is the ISI "subfield" ("subject category class") which may be aggregated into larger sets. For large disciplines (8+1), we shall employ the OST definition. Though the lowest level of normalization (the ISI subfield or specialty) may seem the sounder basis for the reference, strong country biases that cannot be excluded in some particular specialties due to SCI coverage or sample size may jeopardize judgments about internationality. For instance, any maverick journal within a small club of mainly U.S.-oriented journals will automatically appear as "domestic-oriented." However, a strong aggregation level will have symmetrical adverse effects, possibly underrating the internationalization of U.S.-oriented journals in specialties where American science is really dominant. The reference profiles are obtained here by mere aggregations of journals, without fractional assignment. A given journal may contribute to several specialties, and in this case be rated in each one.

A major caveat is the size of classes and individuals. To avoid self-fulfilling mechanisms (for dominant journals mechanically attracting the barycenter of their subfield), thresholds can be set, for example a minimum of 20 journals per specialty and a maximum journal weight not greater than 10% of all publications in the subfield [iii]. Under such constraints most specialties defined by ISI subfields are questionable bases for normalization. For the sake of comparison in this exploratory work, we have maintained both levels of normalization: specialty and discipline.

2) *Normalizing by impact strata.* The profile of world science is also likely to change with impact level within a given discipline/specialty. Highly visible countries achieve their citation performance partly by publishing in highly visible journals (on « expected citations » and the complementary mechanism of over-visibility measured by the "relative citation ratio", see *Schubert et al.*[11]). Thus, it may be expected when journals are classified by quantiles of impact level – either based on the number of journals or the number of publications - that the world share of the United States or United Kingdom will show a decreasing trend over quantiles. An example is shown Fig. 2 in the sub-discipline Geosciences, namely on publications-based quartiles. Another striking phenomenon is the particular structure of the 4th quartile, which is partly due to the role of some national-oriented journals.

The question arises whether this drift has to be taken into account when chosing the reference profile of the discipline or a specialty. If not, the simple aggregation at the discipline or specialty level is used; if one considers that the appropriate reference is a set of journals with homogeneous impact levels – that is the science of comparable

visibility in the discipline or specialty, then an impact stratification should be practiced. An absence of stratification by impact level may be seen, for example, as leading to underestimate the internationalization of high-impact journals with high U.S. participation. An over-stratification may also lead to an unfair treatment, especially in the rather irregular lower quartile.

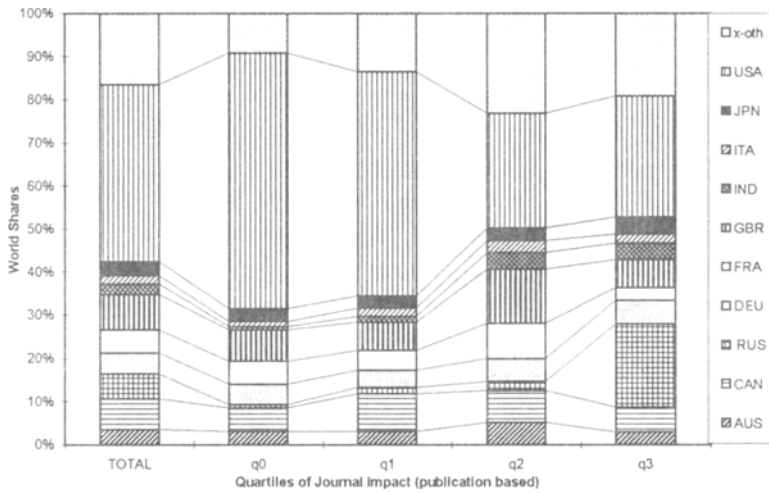

Fig. 2. Distribution of authors countries in geosciences by impact stratum, 1992

In addition, impact stratification encounters the problem of size of individual journals, already mentioned. In particular, ISI specialties can hardly be split into impact quantiles. In the following results, a crude two-level categorization is used for large disciplines. Current studies at the sub-discipline level use a moving 2-quartiles reference.

3) *The choice of internationalization indexes.* The simplest example of measurement is local and not normalized: the proportion of "self-authoring" or "self-citing" LOCMAX=x_a which requires information about the journal's country (in terms of scientific rather than commercial publishing), e.g. the proportion of Ukrainian authors in a Ukrainian journal. Such local measurement does not indicate anything about the relative contributions of other countries. An example of global and not

normalized measurement can be based on concentration indexes of the national authoring distribution of the journal.

We will investigate normalized indexes in this study. Let x_i be the proportion of the country i in the journal x, and m_i the proportion of the country in the aggregate (discipline, specialty) to which the journal belongs. The domestic orientation of the journal may then be assessed in several ways:

Self-authoring indexes may be appropriate when the journal's country, a, is known:

LOCRAT=x_a/m_a, a ratio of activity index type.

LOCDIF=$x_a-m_{a,}$, a simple difference.

Maximum deviation indexes are more general:

MAXVAL= $\max_i (x_i)$.

MAXPRO= $\max_i (x_i/m_i)$, maximum of the activity index. In this particular case, the measurement is too sensitive to small contributors.

MAXDIF=$\max_i(x_i-m_i)$. The maximum will often be reached for the journal's country (then MAXDIF=LOCDIF). MAXABD=$\max_i(|x_i-m_i|)$, an index which, contrary to the preceding one, takes a country's under-representation into account.

Deviation to the average. All the following indexes consider the gap between the journal profile and the average profile as a mark of domestic orientation:

EUCLID= $(\Sigma_i(x_i-m_i)^2)^{1/2}$

CHISQ=$(\Sigma_i((x_i-m_i)^2/m_i))^{1/2}$

CITYBL=$\Sigma_i(|x_i-m_i|)$

COSINE=$\Sigma_i(x_i*m_i)/ (\Sigma_i x_i^2 *\Sigma_i m_i^2)^{1/2}$

The plain euclidian distance seems to be a natural choice. A journal is considered as fully international if it locates at the barycenter of its category. However, weighted euclidian, City-block or Salton should also be examined. To illustrate the way these indexes reflect internationalization, we constructed a set of fictitious journals with a typical nature, (national or international) compared to a realistic all-science profile (1991). Typical journals were defined by a local self-authoring index, conventionally set at 100, 80 and 50 levels, crossed with five origins (US, France, Ghana, European-Countries, Small-Countries). For a journal at the 50 or 80 level originating in a given country, the rest of the distribution was set homothetical to all-science distribution. The shares in the European and Small-Countries journals were also set proportional to actual shares of corresponding countries in world science. Then journals were ranked on every index, allowing for instance to assess the sensitivity of the comparative internationalization of a 100% european-countries journal and a 80% US journal to the type of measure.

Without going into details, given in *Zitt & Bassecoulard*[12], the resulting view is contrasted. By definition, LOCMAX (or MAXVAL) equalizes internationalization for a Ghanaian journal with 80% Ghanaian authors and a U.S. journal with 80% US authors, without consideration for the world profile (concentration indexes, though more complete, follow a similar logic). On the contrary, several indexes (MAXPRO, SALTON, CHISQ) consider that even a journal with 100% U.S. authors is strongly international because of the high position of the U.S. in world science. Obviously, such extremes are unacceptable, especially if a single measure is used. A satisfactory measurement scheme should not only characterize U.S. journals as "domestic-oriented," when justified, but also differentiate clearly between the U.S. and Ghanaian cases above. It may be noted that in the presence of a distribution in which larger discrepancies are likely to appear for small contributors, chi-square weighting is not appropriate.

It seemed to us that plain euclidian metrics was the most satisfactory from a practical point of view. In the real-size study, for comparison sake, we also calculated city-block, maximum distance and maximum absolute distance which, with respect to their maximum range, suggest the following form for the "relative internationalization indexes: authoring (RIA)," standardized on]0,1]:

RIA(EUCLID)= 1 - EUCLID/sqrt(2)
RIA(CITYBL)= 1 - CITYBL/2
RIA(MAXDI)= 1-MAXDIF
RIA(MAXABD)= 1-MAXABD

4) *Citation scope.* Internationalization can be assessed from the complementary point of view of user distribution, determined here in terms of the citations received by journals. In the reflexive scheme of science, received citations depend on the country distribution of readers who are often themselves academic authors, and of their willingness to cite. A certain degree of linkage is expected between the authoring and citing profiles of a journal because of thematic coherence (country specializations on given topics) and self-citation mechanisms. However, within the process of transformation of information, citing and authoring universes may be largely different. In some cases, journals from small countries may be read and cited worldwide. Thus, the differences between internationalization indexes in authoring and citation are worth studying. Relative Internationalization Indexes on Citations (RIC) are calculated in the same way as RIA. The size constraint leads to the same choices: no impact stratification when the reference profile is constructed at the specialty level, and 2-level impact stratification when the reference profile is built at the discipline level.

Results and applications

Three main types of results were obtained: (1) convergence of the various types of indexes and normalization, (2) relationship between RIA (authoring side) and RIC (citing side), and (3) relationship between internationality and impact. Small journals are excluded (they did not modify the overall results).

Convergence of measurements: type of index, level of normalization

The correlation of various types of deviation measurements showed that in the real context of both disciplines (Applied Biology and Earth&Space) RIA (EUCLID), with either a specialty or discipline reference profile, was very close to RIA(MAXABD) (Pearson r=0.99), RIA(MAXDIF) ($r \geq 0.96$), and RIA(CITYBL) ($r \geq 0.94$). We retained RIA(EUCLID), abridged below to RIA, as the main measurement, although simple RIA(MAXABD) or RIA(MAXDIF) indexes would have provided comparable results in most real situations.

For a given index, the measurements based respectively on discipline and specialty normalization for reference profiles were also very close ($r \geq 0.95$ for the four indexes). Spearman rank correlations were slightly better for Applied Biology than Earth&Space, probably reflecting the stronger homogeneity of the former. With respect to normalization and related size problems, a spurious dependency of RIA on journal size is possible: however the strongest correlation (Spearman rank r) did not exceed 0.29 (reached for Applied Biology, using specialty normalization), a value very close to the correlation between the impact and size of journals.

RIA distributions were very similar for both disciplines, being skewed with a slight indication of bimodality (Fig. 3, both disciplines together; the bimodality appears very distinctly at the sub-discipline level). The heavy tail of the distribution gathers the 'domestic-oriented' journals, below RIA 0.5 or 0.6 (in the present data ca 15% of journals have $RIA<0.5$).

Table 2 gives examples of the groups of most- and least-internationalized journals, after RIA measure, in a large ISI specialty, Marine Biology, with a normalization at specialty level.

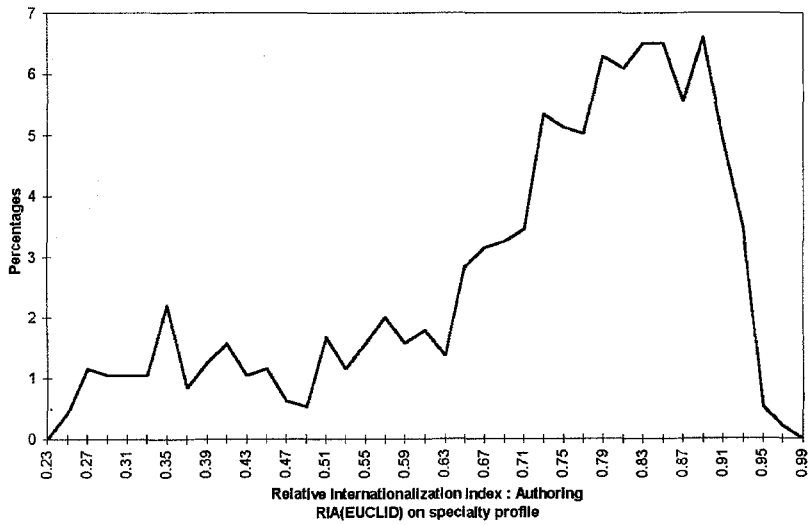

Fig. 3. Distribution of journals by level of relative internationalization (Earth & Space + Applied Biology)

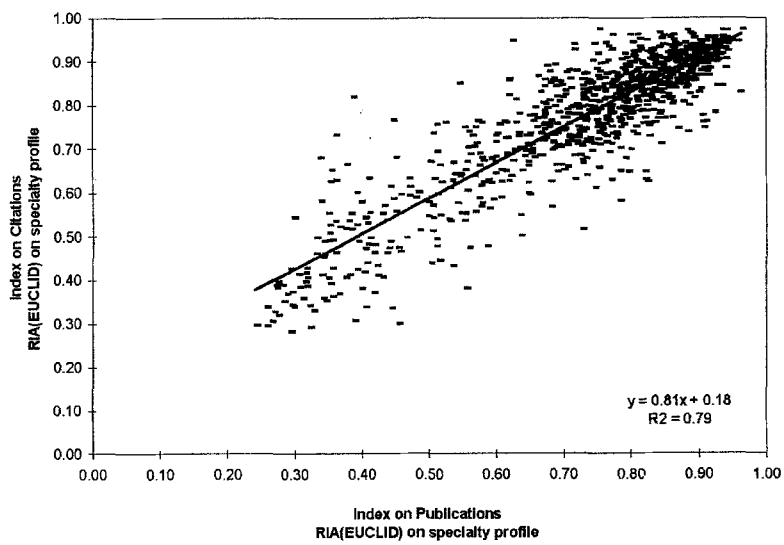

Fig. 4. Relative internationalization on citations and publications (Earth & Space + Applied Biology)

Table 2
Marine Biology: Groups of most- and least-internationalized journals
(specialty normalization – alphabetical order inside each group)

Highest RIA	Lowest RIA
Aquaculture	Advances in Marine Biology
Aquatic Botany	Aquatic Sciences
Freshwater Biology	Australian J. of Marine&Freshwater Research
Hydrobiologia	Biologiya Morya-Marine Biology
Journal of Exp Marine Biology&Ecology	Estuaries
Journal of Plankton Research	Helgolander Meeresuntersuchungen
Marine Biology	Journal of Aquatic Plant Management
Marine Ecology Progress Series	Journal of Conchology
Microbial Ecology	J of the Marine Biological Assoc of the UK
Phycologia	Netherlands Journal of Sea Research
Highest RIC	**Lowest RIC**
Aquatic Toxicology	Australian J.of Marine&Freshwater Research
Freshwater Biology	Biologiya Morya-Marine Biology
Hydrobiologia	Estuaries
Journal of Crustacean Biology	European Journal of Phycology
Journal of Exp Marine Biology&Ecology	Helgolander Meeresuntersuchungen
Journal of Phycology	Internat Revue der Gesamten Hydrobiologie
Journal of Plankton Research	Journal of Aquatic Plant Management
Marine Biology	Journal of Conchology
Marine Ecology Progress Series	J of the Marine Biological Assoc of the UK
Marine Mammal Science	Netherlands Journal of Sea Research
Oceanography&Marine B	Reviews in Fish Biology&Fisheries
Phycologia	Sarsia

Convergence of indexes based on publication and citation

Results for RIC indexes were very similar to those for RIA, showing convergences in measurement relative to the choice of index and the normalization level. However, the tail of the distribution of RIC(EUCLID) was noticeably lighter than that of RIA.

The main point here is the convergence of measurements based on publication and citation distribution. As noted above, a fairly close agreement can be expected. For Applied Biology, the Pearson r was 0.91 for both specialty and discipline normalization, whereas for Earth&Space it was respectively 0.84 and 0.82. The scatterplot in Fig. 4 combines the two disciplines (specialty level normalization) giving r = 0.89. The tail of the 'cometary cloud' shows a deviation from the diagonal in the expected direction: for low values, the internationalization index tends to be stronger for citation than publication scope.

Individual discrepancies are particularly noteworthy when global agreement is fairly good - for example journals in which the international audience is considerably broader for citation than publication scope (possibly national journals backed by national institutions or societies with high quality standards).

Table 3 shows a few journals in the same subfield as above, with an especially large discrepancy between the two measurements:

Table 3
Marine biology: Journals with marked discrepancies between RIA and RIC
(specialty normalization – alphabetical order inside each group)

RIC >> RIA	RIA >> RIC
Aquatic Sciences	European Journal of Phycology
Helgolander Meeresuntersuchungen	Internat Revue der Gesamten Hydrobiologie
	Reviews in Fish Biology&Fisheries

Internationality indexes versus impact

Impact is a central characteristic for a scientific journal, but the degree of internationalization provides a useful complementary information. For most journals, a link might be expected between these two criteria, whereas the overall correlation between the two measurements is actually moderate. Pearson r between RIA and log(impact) is about 0.41 for both types of normalization in Applied Biology, and about 0.46 in Earth&Space. The table below lists journals belonging to the first or last decile of discrepancies between RIA and impact for the subfield Marine Biology. For example, the *Netherland Journal of Sea Research*, published by the Netherland Institute of Sea Research, ranks much higher in impact than in relative internationalization.

Table 4
Marine biology: Journals with marked discrepancies (rank) between RIA and impact
(specialty normalization – alphabetical order inside each group)

impact >> RIA	RIA >> impact
Canadian J of Fisheries&Aquatic Sciences	Crustaceanea
Netherlands Journal of Sea Research	Hydrobiologia
	Journal of Shellfish Research
–	Marine Behaviour&Physiology
–	Undersea and Hyperbaric Medicine

Discussion

Measures of internationalization

This report was especially devoted to relative measures: the principal difficulty is the choice of a satisfactory reference. Another candidate is the absolute measure based on concentration indexes; it has the distinct technical advantage of being reference-free, at the risk of puzzling results in some situations. To put it short, normalized measures generally tend to produce high rates of internationalization for US journals closer to a world reference largely shaped by US science and conversely to penalize any journal with low american participation; on the contrary, concentration measures can rate favorably any internationalized scheme, independently from the structure of science in the field. For example, the *International Journal of Food Science and Technology*, published in the United Kingdom and attracting a variety of authoring countries, is far more 'international' after Gini index than after normalized measures. A systematic comparison of these indexes is under examination, and association or combination of both approaches is likely to capture at best the various aspects of the internationalization phenomenon.

Let us recall that the publication/citation scope is only one access to internationalization. The ability of a journal to promote international collaboration, in particular through co-authorship not involving its own country, is also of interest, as well as the national structure of editorial boards.

Type of index and normalization options

Further studies are required to assess normalization options of relative indexes. The rationale of the impact stratification of journals may be discussed. We also mentioned the size problems, and the dubious structure of low-impact quantiles. As far as fields are concerned, normalization at the discipline level presents the risk of mixing disparate activities and can only be recommended for homogeneous fields. Subdiscipline normalization, intermediary between ISI subfields and large disciplines, is currently under study and should prove to be a promising approach. Even though the precise rank of a given journal may be sensitive to normalization conditions, it is quite unlikely that different sensible choices lead to different judgments about the international or domestic nature of a particular journal. Anyway excessive precision of the measurement would be misleading: the objective is rather an approximate but reliable characterization.

Further sampling of SCI

ISI Citation Indexes have raised more discussion in the specialized literature than any other bases in terms of coverage, technical biases, uses and misuses (see, for example, *Moed et al.*[13]). The statistical status of SCI is not completely clear. Coverage is surely a major point, and many small countries could complain about their underrepresentation and related biases [iv]. However, a contrasting view has been expressed, for instance by *Sivertsen*[14]. In a study of the Scandinavian situation, this author made a strong argument for excluding many domestic-oriented journals from bibliometric databases intended for international comparisons: "*the SCI is too wide in journal coverage for bibliometric purposes. A better control over the contents of a bibliometric database could be gained if the number of journals were reduced by leaving out those that are less significant in the international research communication.*" The problem of further sampling within the SCI for indicator production is clearly raised. Internationalization indexes of both publication and citation can be mobilized, together with impact studies, especially for analysing of the tail of the SCI. As indicated below, the justification for such a process depends on the goals.

The question as to whether additional sampling within the SCI is desirable or not lies beyond the scope of the paper and will be considered only briefly. The more visible and international research is, the easier measurement becomes, i.e. the first deciles of impact in the SCI practically constitute a census of the high prestige journals. Conversely, the last deciles of impact or internationalization indexes in the SCI are likely to be extremely sensitive to decisions made by the ISI. Including or excluding a particular journal may have considerable consequences for the reliability and time-series stability of national indicators, especially for small countries.

The easiest way to increase stability would be to drop the last fraction when calculating international indicators [v]. This would perhaps be appropriate for investigations of highly internationalized subfields. However, for many other purposes the problem is to get a fair representation of large areas of scientific activity, including balanced sets of nationally- or regionally-oriented journals.

Prudence is also necessary to prevent systematically positive acceptions of strong internationalization indexes. A warning can be derived from *Leydesdorff & Cozzens*[4], who have suggested that internationalization might increase for older journals or specialties, while for new fields, journals might show higher level of participation of smaller groups of leading scientific countries [vi].

Other applications

A quantitative appraisal of the international nature of scientific journals can be useful in other several contexts: positioning of communication media in the world scientific publishing scene, library management. The changing structure of journals is also part of science dynamics aspects.

Conclusion

This paper discusses a quantitative approach to the international nature of scientific journals, involving two dimensions: the national scope of their publications and the national scope of their audience after received citations. Relative measures were more particularly discussed: journals are considered as international if their spectrum is close to the average country distribution in their specialty or discipline. An index based on plain Euclidian distances is recommended, showing a good practical convergence with kindred measurements. Convergence is also satisfactory on the two types of normalization: specialty and discipline level. However, the size of ISI specialties and individual journals considerably limits the possibilities of stratification based on impact. An intermediate level of 'sub-disciplines' as aggregates of SCI specialties (or other) is a promising way. Further steps of the study include extension to all SCI disciplines. Field dependences and changes over time will be investigated.

At this stage, three major conclusions can be drawn from this exploratory work:

(1) relative measure internationalization of journals proved to be praticable, with a clear characterization of 'domestic-oriented' journals either by publication or citations. An association/combination with the direct approach based on concentration measures would give a more comprehensive view;

(2) the linkage between authoring internationalization and citation internationalization is fairly strong, but not sufficient to allow one of these factors to be neglected. These are distinct phenomena, that a full characterization must address;

(3) the linkage between internationalization indexes and journal impact is only moderate, indicating quite clearly that multicriterion assessment of journals is needed to address a wide range of questions.

*

The authors wish to thank C. *Hennequet* (INRA) and N. *Teixeira* (OST) for their valuable collaboration.

References

1. E. GARFIELD, Citation as a tool in journal evaluation, *Science*, 178 (4060) (1972) 471–479.
2. F. NARIN et al., *Evaluative Bibliometrics: the use of publication and citation analysis in the evaluation of scientific activity*, Report prepared for the National Science Foundation, Contract NSF C-627, 1976, 456 p.
3. S. KATZ, D. HICKS, The classification of interdisciplinary journals: a new approach, In: *5th International Conference on Scientometrics and Informetrics*, M.E.D. KOENIG and A. BOOKSTEIN (Eds), Learned Information Inc., Medford, 1995, pp. 245-254.
4. L. LEYDESDORFF, S. COZZENS, The delineation of specialties in terms of journals using the dynamic journal set of the SCI, *Scientometrics* , 26 (1) (1993) 135-156.
5. F. H. CHRISTENSEN, P. INGWERSEN, Online citation analysis. A methodological approach, *Scientometrics,* 37 (1) (1996) 36-92.
6. G. SIVERTSEN, Nar er et tidsskrift internatasjonalt, In:*Det Vitenskapelige tiddskrift*, Gleditsch, TemaNord, 1994, pp. 37-51.
7. A. SIGOGNEAU, *Approche scientométrique de la définition d'un domaine de recherche par des revues scientifiques,* Thèse Information Scientifique et Technique, Université Paris VII, Paris, 1995, 275 p.
8. T. LUUKKONEN, R.J.W. TIJSSEN, O. PERSSON, G. SIVERTSEN, The measurement of international scientific collaboration, *Scientometrics*, 28 (1) (1993) 15-36.
9. M. ZITT, F. PERROT, R. BARRÉ, The transition from "national" to "transnational" model and related measures of countries performances, to be published in *Journal of the American Society for Information Science* , November 1997, p. 13.
10. T. BRAUN, E. BUJDOSO, Gatekeeping patterns in the publication of analytical chemistry research, *Talanta,* 30 (3) (1983) 161-167.
11. A. SCHUBERT, W. GLÄNZEL, T. BRAUN, Scientometrics datafiles. A comprehensive set of indicators on 2649 journals and 96 countries in all major science fields and subfields, 1981-1985, *Scientometrics,* 16 (1989) 3-478.
12. M. ZITT, E. BASSECOULARD, Internationalization of scientific journals: a measurement based on publication and citation scope, In: Proceedings of the *Sixth Conference of the International Society for Scientometrics and Informetrics*, B.C. PERITZ and L. EGGHE (Eds), The Hebrew University, Jerusalem, 1995, pp. 517-529.
13. H. F. MOED, R. E. DE BRUIN, T. N. VAN LEEUWEN, New bibliometric tools for the assessment of national research performance: Database description, overview of indicators and first applications, *Scientometrics*, 33 (3) (1995) 381-422.
14. G. SIVERTSEN, Should a new bibliometric database for international comparisons be more restricted in journal coverage?, In:*Science and Technology in a policy context, Selected Procceedings of the Joint EC-Leiden Conference on Science & Technology Indicators*, DSWO Press, 1992, pp. 35-50.

Notes

[i] The text of the original conference proceedings *(Zitt & Bassecoulard*[12]), which contains another mistake in Fig. 1, p. 528 (Structure of science by level of impact, in this case journal-base quartiles): the series 'other' is incorrect. Besides, a clerical error p. 521 for RIA-EUCLID formula: the division slash has been skipped.

[ii] If the question is put only as 'is this journal profile similar to expected (aggregate) profile', statistical tests may be used in the same line, however with some difficulties in interpretation. For chi-square e.g., H0 will tend to be rejected in most cases because of the high number of articles in most journals.

[iii] A few examples of the weighting effect of such huge journals on specialty averages: *Journal of Agricultural & Food Chemistry* and *Bioscience Biotechnology & Biochemistry* (in both Agriculture and Food Science & Technology specialties), *Journal of Dairy Science* (Food Science & Technology), *Phytochemistry* (Botany), *Aquaculture* (Marine and Freshwater Biology), *Journal of Geophysical Research* and *Space Physics and Advances in Space Research* (both in Geosciences), *Water Resources Research* (Environmental Sciences).

[iv] This is well-known; for instance, very few Rumanian journals are present in the SCI, but, as these are all chemistry journals the activity index of Rumania is very high in this field.

[v] By coming back to internationalization, this might trigger a short iterative process in order to build the reference profiles discussed above.

[vi] Relative measures will not be appropriate to capture such a diffusion process if a journal and the aggregate of reference change simultaneously.