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Scholarly journal evaluation based on panel data analysis

Liping Yu[a,*], Xiaoming Shen[b], Yuntao Pan[a], Yishan Wu[a]

[a] *Institute of Scientific & Technical Information of China, Beijing 100038, China*
[b] *Jiangsu Polytechnic University, Changzhou 213016, China*

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ABSTRACT

This paper proposes a new method for indicator selection in panel data analysis and tests the method with relevant data on agricultural journals provided by the Institute of Scientific & Technical Information of China. An evaluation exercise by the TOPSIS method is conducted as a comparison. The result shows that panel data analysis is an effective method for indicator selection in scholarly journal evaluation; journals of different disciplines should not be evaluated with the same criteria; it is beneficial to publish all the evaluation indicators; unavailability of a few indicators has a limited influence on evaluation results; simplifying indicators can reduce costs and increase efficiency as well as accuracy of journal evaluation.

1. Introduction

Research on journal evaluation methods is an important component of bibliometric studies. It tries to disclose regularities in the distributions of publications in disciplinary journals and quantitatively analyses developments and growth trends of scholarly journals so as to improve journal utilization. Journal evaluation exercises can, moreover, improve the quality of scholarly journals and promote their healthy development. In the 1960s Eugene Garfield, the founder and one-time president of the Institute for Scientific Information, conducted several large-scale statistical analyses of journal citations and reached the conclusion that the majority of citations were attributed to relatively few journals, while a minority of citations was spread over many journals. His work can be viewed as the origin of journal evaluations.

The journal impact factor was first proposed in 1963 as a spin-off from the science citation index (SCI) which was launched that year by Garfield (1972, 1976). Studies on performance evaluation often focus on the identification of research of the "highest quality", "top research" or "scientific excellence". This focus on top quality has led to the development of a whole series of bibliometric methodologies and indicators (van Leeuwen, Visser, Moed, Nederhof, & van Raan, 2000). Representative indicators are the Relative Citation Rate (Schubert, Glänzel, & Braun, 1983), the Relative Subfield Citedness (Vinkler, 1986), the Normalized Mean Citation Rate (Braun & Glänzel, 1990), the Field Citation Score (Moed, De Bruin, & van Leeuwen, 1995), the Hirsch Index (Hirsch, 2005), the Article-Count Impact Factor (Markpin et al., 2008), etc.

Methods of journal evaluation usually consist of single index evaluation or Multiple Attribute Evaluation (MAE). As research performance is multidimensional it is clear that it cannot be evaluated by a single indicator (Martin, 1996). In MAE, indicators are combined into a single index. Such an approach is widely used by statistical officers and national or international organizations to convey information in many fields. Examples of well-known MAE include the UN's Human

* Corresponding author. Tel.: +86 13901454433.
E-mail address: chinayangzhou@yahoo.com.cn (L. Yu).

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Development Index (Sagar & Najam, 1998) and the environmental performance index produced by a joint effort of Yale, Columbia, the World Economic Forum and the Joint Research Center of European Commission (Esty et al., 2006). MAE is essentially concerned with the problem: how to evaluate and rank a finite set of alternatives in terms of a number of decision criteria. Most popular MAE methods currently used are: Weighted Sum Model (WSM), Weighted Product Model (WPM), Technique for Order Preference by Similarity to Ideal Solutions (TOPSIS), Data Envelopment Analysis (DEA) and ELECTRE. Yue and Wilson (2004) constructed a framework for the analysis of journal impact based on the principle of structural equations. Although composite indicators are frequently used for analyzing social or economic activities, they are seldom used in the scientometric literature (Vinkler, 2006).

In those evaluations, people often pay a lot of attention to the comparison of different indicators in the same year. In our opinion they, however, fail to consider the variation of indicators as time evolves. They also fail to notice how the gap in indicator values between excellent journals and ordinary journals may influence the selection of indicators. This paper explores the indicator selection issue by using the CSTPC (China Scientific and Technical Papers and Citation) database built by ISTIC (the Institute of Scientific & Technical Information of China). For more information about this database the reader is referred to (Wu et al., 2004). An improved method of Panel Data Analysis is presented for indicator selection. Then an evaluation exercise using the TOPSIS method is conducted as an illustration of our approach.

2. Data selection

Data used in this paper are derived from ISTIC's CSTPC database. Evaluation is performed on agricultural journals as an example. Since 1987 ISTIC has been doing annual statistical analyses on the quantity and quality of publications by Chinese scientists and has maintained the CSTPC database ever since. The Chinese Scholarly Journals Citation Report is released every year. In order to analyze the dynamic change of journal evaluation indicators, relevant data for agricultural journals over the period 2005–2006 are selected. Our analysis is based on panel data of a total of 96 agricultural journals. For these journals, data for 13 indicators in 2005 and 2006 are available. For instance, the impact factor in 2005 is equal to the number of citations received in 2005 to articles published in 2003–2004, divided by the total number of articles published in 2003–2004. The impact factor in 2006 is the number of citations in 2006 of articles published in the period 2004–2005, divided by total number of articles published in 2004–2005.

For each journal the following 13 evaluation indicators are examined: Total Cites, Impact Factor (standard two year synchronous impact factor), Immediacy Index, Ratio of Other Citations, Diffusion Factor (number of cited periodicals divided by number of citations per 100 times, Disciplinary Impact Indicator (ratio of number of within-discipline journals citing the evaluated journal over the total number of journals within the same discipline as to which the evaluated journal belongs, Disciplinary Diffusion Factor (ratio of number of all journals citing the evaluated journal to total number of journals within the same discipline as to which the evaluated journal belongs), Citing half-life, Cited half-life, Ratio of Funded Papers (ratio of papers sponsored by funds to total papers), Average Number of Authors per Paper, Average Citations per Article, Share of Overseas Contributions in Total Papers. The indicators mentioned above are the main CSTPC indicators. They reflect the different aspects of journal quality and impact. Here it should be noticed that overseas contribution refers to the articles whose first author does not have a Mainland China institutional address. The h-index is not taken into account because data needed for its calculation are unavailable for calculation.

How should indicator selection be conducted? As some indicators are neither 'good' or 'bad' (they can considered to be neutral), are influenced by many factors and have little practical value, it is difficult to accept or reject them theoretically. In this paper indicator selection is conducted according to the following two criteria: the yearly data change and the relative data gap in the same year.

In order to evaluate scholarly journals properly data must be normalized. The maximum value of each indicator is set to be 100 and other normalized values are calculated accordingly. Since Cited half-life and Citing half-life are "negative" indicators (the smaller the better for the evaluation result), an appropriate adjustment process is needed. The adjustment method we adopt is that the normalized values for these indicators are subtracted from 100, and then the difference is normalized again. In this way, the two indicators are changed into positive indicators (the larger the better for the result).

3. Indicator selection

3.1. Dynamic selection of indicators

As a rule, one expects that the results of an evaluation exercise performed on scholarly journals increase gradually (unless there is a clear outside reason), similar to the growth of the national economy or the income of the inhabitants of a country. Certainly, individual indicators for some journals may occasionally decrease. Such a decrease should, however, be considered a normal phenomenon provided the decrease is not heavy. On the contrary, if an indicator shows a sudden drastic decrease over time, the reason behind this must be carefully analyzed. If this happens frequently such indicators should not be selected for evaluation. It should be noticed that Citing half-life and Cited half-life are two "negative" indicators so that the method for judging whether their development trend is normal or not is just opposite to the method for positive indicators. Table 1 shows the changes of 13 evaluation indicators for 96 journals in the years 2005–2006.