

Contents lists available at [ScienceDirect](http://www.sciencedirect.com)

Journal of Informetrics

journal homepage: www.elsevier.com/locate/joi

The measurement of production efficiency in scientific journals through stochastic frontier analysis models: Application to quantitative economics journals



Francisco J. Ortega, Jose M. Gavilan*

Department of Applied Economics I, University of Seville, Faculty of Economics and Business Studies, Avenida Ramón y Cajal n° 1, 41018 Seville, Spain

ARTICLE INFO

Article history:

Received 19 July 2013
 Received in revised form
 20 September 2013
 Accepted 24 September 2013

MSC:
 62J99
 62F10
 90B30

JEL classification:

C46
 C51
 D24.

Keywords:

Production
 Productivity
 Efficiency
 Scientific production
 Frontier production models

ABSTRACT

The importance of a scientific journal is usually established by considering the number of citations received by the papers that the journal publishes. In this way, the number of citations received by a scientific journal can be considered as a measure of the total production of the journal. In this paper, in order to obtain measures of the efficiency in the production process, the approach provided by stochastic frontier analysis (SFA) is considered, and econometric models are proposed. These models estimate a frontier production, which is the maximum achievable number of citations to the journal based on its resources. The efficiency can then be measured by considering the difference between the actual production and the estimated frontier. This approach is applied to the measurement of the productive efficiency of the journals of the JCR social sciences edition database, which belong simultaneously to the areas of “economics” and “social sciences, mathematical methods”.

© 2013 Elsevier Ltd. All rights reserved.

1. Introduction

The content of a scientific document is commonly supported through references to other previously published scientific documents. In general, the importance of a specific written document is established on the principle that the more times the document is cited by the scientific community, the more important it becomes. As a consequence, the scientific journals receiving a high quantity of citations are considered to be the most significant.

It is clear that the evaluation of a journal based on the number of citations received presents certain issues, derived from the fact that citations to a paper are not always associated to the usefulness of its content, but can be motivated by other reasons (Callon, Courtial, & Penan, 1995; Ortega, 2003). In practice, however, this is the criterion most commonly used.

* Corresponding author. Tel.: +34 954 556 970; fax: +34 954 551 636.
 E-mail addresses: fjortega@us.es (F.J. Ortega), gavi@us.es (J.M. Gavilan).

Generally speaking, a production process involves the use of a series of resources (called inputs) in order to obtain another series of products (called outputs), which constitute the production. The productivity is defined as the ratio between the obtained production and the resources used.

One of the main objectives of a scientific journal is to diffuse knowledge. The number of citations received during a specific period of time can be used as a proxy for knowledge diffusion, and as a consequence, the number of citations can be considered as a measure of production. Scientific research as an input–output system is also described in other publications, such as that by [Liang and Rousseau \(2008\)](#).

The measurement of productivity in relation to one single factor or input, in the form of the total number of published papers, is also widely employed. To this end, the impact factor ([Basulto & Ortega, 2005](#); [Garfield, 1955](#); [Moed, Van Leeuwen, & Reedijk, 1998](#)) is used, which is calculated by dividing the total number of citations received by a journal in a 2-year period (production) by the total number of papers that have been published in the journal during that time (input). When analysing the productivity, more determinant factors of the production can be considered. In that case, a journal could, compared to another journal, present greater or lesser productivity according to the input taken into account. One possible solution to this situation is to construct aggregate indices of productivity ([Coelli, Rao, & Battese, 1998](#)).

In the fields of economics, mathematics and econometrics, models have been developed in order to study the aforementioned problem from a different perspective: from a series of observations of several companies (items or firms) concerning their total production (through one or more outputs) and their resources (through several productive factors or inputs), the purpose of these types of models is to identify which firms make better use of their available resources, that is to say, which companies carry out the production process with a higher efficiency.

There exist two alternative approaches to the problem of measuring the efficiency: data envelopment analysis (DEA) and stochastic frontier analysis (SFA). In [Coelli et al. \(1998\)](#), a detailed exposition of the two methodologies is offered. In an informal way it can be stated that the aim of these models is to establish a frontier production from the observed set of data that determines the maximum attainable output using the given inputs. This goal provides the reason for the generic name frontier production models. In this way, for each firm, the value of the maximum attainable production is estimated on the basis of “its current possibilities”. The determination of the difference between the actual production and the maximum possible production enables indicators of the efficiency of the production process (in the sense that the nearer the actual production is to the estimated maximum attainable production, the more efficient a firm is).

It is important to point out that these efficiency measures have to be understood in relative terms with respect to the group analysed. A firm may well appear to be highly efficient when analysed among one group of companies, however, if this same firm is analysed among another different group of firms, it could appear to have a much lower level of efficiency.

In the framework of scientific documentation, the DEA approach has been widely utilised. As a matter of fact, all the papers mentioned below use this approach.

[Abbott and Doucouliagos \(2003\)](#) carry out an analysis of the efficiency of Australian universities. Similar studies include [Abramo and D’Angelo \(2009\)](#) and [Abramo, Cicero, and D’Angelo \(2011\)](#), where Italian universities are analysed, and [Bonaccorsi and Daraio \(2003\)](#), who consider institutes of the French INSERM and biomedical research institutes of the Italian CNR.

[Ruiz et al. \(2010\)](#) examine the efficiency in the scientific production of a sample of Colombian research groups. [Wang and Guan \(2005\)](#) also study the efficiency of research groups, in this case from China. [Agasisti, Catalano, Landoni, and Varganti \(2012\)](#) analyse the production of 69 academic departments located in Italy.

The DEA approach has also been applied to studies of efficiency in scientific production in a number of countries and regions. In [Rousseau and Rousseau \(1997, 1998\)](#), this approach is applied to a sample of 18 countries of the world, while in [Guan and Chen \(2010\)](#), 30 Chinese provinces are considered.

In relation to the analysis of the efficiency applied to a group of journals, [Lozano and Salmerón \(2005\)](#) show the results of a DEA analysis applied to a group of journals of operations research/management sciences in two aspects: the duration of the process of revision/publication and the relation between the impact and the length of the papers. [Petridis, Malesios, Arabatzis, and Thanassoulis \(2013\)](#) provide an evaluation of 54 forestry journals.

The main objective of this paper is to use the SFA approach in order to make an analysis of the production efficiency of a set of scientific journals (all of which belong to a homogeneous area) and to establish which journals produce at a higher level of efficiency (that is, making the most of their available inputs). Therefore, the goal is to identify which journals of the group, within their capabilities, obtain production close to their maximum, and which journals are currently far from such a maximum. The main innovation of this paper in relation to the aforementioned work is the use of the SFA approach.

To this end, in Section 2, the journals included in the present study and the factors selected to establish the frontier production (estimated maximum number of attainable citations for the journal) are presented. In Section 3, the statistical model and the set of data used in this study are described. In Section 4, the estimated model and the interpretation of the results obtained are presented. Finally, in Section 5, the main conclusions drawn from the study are discussed.

2. Journals included and variables selected

In order to select a homogeneous set of journals, the JCR social sciences edition database has been used. In this database, the journals belonging simultaneously to the areas of “economics” and “social sciences, mathematical methods” that appear

Download English Version:

<https://daneshyari.com/en/article/10358575>

Download Persian Version:

<https://daneshyari.com/article/10358575>

[Daneshyari.com](https://daneshyari.com)