Research program: "Indicators for the measurement of citation impact for evaluation of the research"

Annex Code 3

Department of Management, Economics and Quantitative Methods

Tutor: Lucio Bertoli Barsotti

Description

The evaluation of research is an important theoretical problem, well known within the global scientific community, with important consequences of a practical nature of extraordinary interest, for example, for the government of academic research in Italy (see ANVUR). From a technical point of view, this is an issue that definitely involves interdisciplinary skills, but which originates from the characteristics of the empirical data. Today, the existence of large databases such as Web of Science (WoS), Scopus, Google Scholar, etc.., allows one to access to a large amount of "citation data"- typically the primary source for the evaluation of individual products. In the database, we can refer to a particolar item by relying on different search fields, such as a) the individual author, but also 2) the structure (Research Center, Department, University) or, more generally, 3) the country. The comparison of aggregate data at the collective level (basically aimed at producing rankings) raises statistical problems still little explored.

In Scientometrics some diverse interpretations have been developed about how the term "impact" should be understood, with consequential definitions of a plethora of different indicators, the most famous of which is probably the Hirsch h-index ([6]).

The goal of this research is to define, and empirically test, models for the measurement of citation impact that are useful for comparisons of different sources (authors, institutions, journals) of scientific products. Conceptually, the key stages of the research project are identified by: i) identification of a collective target, as a case study; ii) data collection concerning this collective, from WoS or Scopus databases (reliable database and easily accessible online via the University portal); iii) comparative analysis of different models; iv) theoretical analysis of the results and discussion.

Expected results

In the field of Scientometrics, models of indicators closest to this approach, based on a joint measure of "impact and concentration", have been proposed very recently by Prathap ([9]). We intend to proceed along these lines of approach, with the objective of correcting - innovatively - some distortions typical of these indicators (eg, the p-index and the z-index), such as the unexpected tendency to decrease if one adds (to the citation pattern) a document with a number of citations below a given positive threshold. Our first objective is to define a set of specific characteristics of the measures as a list of axioms. Indeed, suitable indicators should be regarded as build up by mathematical deduction from axioms. Regarding the above step (iii), we intend to proceed in the context of the study of classes of functionals and models of indicators along the lines of a study conducted by myself with publication in international journals, even very prestigious, reflecting the scientific relevance of these issues (see [1], [2], [3], [4], [5], [7], [8], [10]).

References

[1] Bertoli-Barsotti, L., 2001,' Some remarks on the Lorenz ordering-preserving functionals, Statistical Methods and Applications, 10(1-3),99-112.

[2] Bertoli-Barsotti, L., 2013, Improving a Decomposition of the h-Index, Journal of the American Society for Information Science and Technology, 64(7), 1522.

[3] Bertoli-Barsotti, L., Lando, T., 2014, A Relative Dissimilarity Ordering in the Space of Distribution Functions, with Statistical Applications, in Miroslav Culik (Ed.), Managing and Modelling of Financial Risks, Proceedings of the 7th International Scientific Conference, 8th-9th September 2014, Ostrawa, p. 33-37.

[4] Bertoli-Barsotti, L., Lando, T., 2015, Informetric models for citation frequency data: an empirical investigation, in Nikos E. et al. (Eds.), New Developments in Pure and Applied Mathematics - Proceedings of the MMSSE 2015, p. 37-39.

[5] Bertoli-Barsotti, L., Lando, T., 2015, A geometric model for the analysis of citation distributions, International Journal of Mathematical Models and Methods in Applied Sciences, 9, p. 315-319. ISSN: 1998-0140.

[6] Hirsch, J.E. (2005). An index to quantify an individual's scientific research output. Proceedings of the National Academy of Sciences USA, 102, 16569-16572.

[7] Lando, T., Bertoli-Barsotti, L., 2014, A New Bibliometric Index Based on the Shape of the Citation Distribution, PLoS One, Vol. 9, Issue 12: e115962.

[8] Lando, T., Bertoli-Barsotti, L., 2014, Statistical Functionals Consistent with a Weak Relative Majorization

Ordering: Applications to the Mimimum Divergence Estimation, WSEAS Transactions on Mathematics, Vol. 13, p. 666-675.

[9] Prathap, (2014). Measures for impact, consistency, and the h- and g-indices, Journal of the American Society for Information Science and Technology, 65(5),1075-1078.

[10] Bertoli-Barsotti, L., Lando, T., 2015, On a formula for the h-index, Journal of Informetrics. ISSN: 1751-1577. DOI: 10.1016/j.joi.2015.07.004