

The Lack of Stability of the Impact Factor of the Mathematical Journals

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Introduction

Although the 2-year Thomson-Reuters Impact Factor (IF) has become a usual tool for measuring the scientific productivity of all fields of the natural sciences (see Aleixandre-Benavent, Valderrama Zurián, & González Alcaide, 2007), its behavior in the particular case of the journals of pure mathematics (the area MATHEMATICS in the thematic directory of Thomson-Reuters) is far from being stable when its values in consecutive years are considered. If we consider the changes of the values of the IF of a given journal in the last decade, it can be easily seen that the variation of the values is surprisingly high if we compare with other disciplines. Mathematical journals seem to have the worst behavior regarding the time stability both of the IF and the position in the IF list.

A series analysis of a set of journals uniformly distributed in the IF list shows that the variations of the values of the IFs are very big when compared with other scientific disciplines, e.g., APPLIED PHYSICS and MICROBIOLOGY. The reader can see a representation of this behavior for three mathematical journals together with three journals of physics that have been chosen as representatives of these groups in the following graph (Fig. 1).

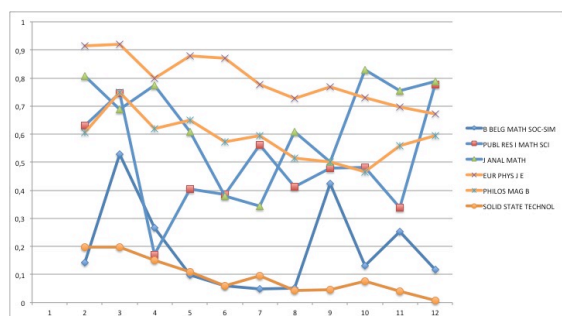


Figure 1. Variations of three journals of mathematics and three journals of physics.

In our study, we analyze the possible reasons for this fact, explaining some typical characteristics of the mathematical journals and of the research in mathematics, that make this science to have unusual properties from the point of view of the bibliometrics.

The research in pure mathematics

In general, mathematicians work in small groups of researchers from different parts of the world that are specialized in some topics, which have a long development period. For instance, it is usual that a group of mathematicians continue with some problems that appeared 50 years ago, or even before (see Behrens & Luksch, 2011). Although some of these topics were intensively studied some years ago, sometimes the research was left at that moment without having complete answers for some central questions, due to the fragility and the small size of the specialized group of researchers working on it. In this context, it is natural that after some years, a new group can recover the research and fruitfully continue with the investigation. The group of interested mathematicians is, almost in all cases, small. Even in new open topics, the size of the interested community of mathematicians is sparse and small. This of course changes when some particular theory becomes important due to the applications. But in these cases, the publication of the mathematical contents is redirected to more applied journals, or to journals of the fields where the theory finds applications.

This research dynamics is not usual at all, if we compare it with the pattern that can be observed in other fields. The main consequence is that the obsolescence of the scientific documents is faster in other sciences than in mathematics.

Mathematical journals

Classical journals that publish papers on pure mathematics follow also a different pattern that the

usual one in other scientific fields that are in some sense similar with respect to some descriptive parameters, as physics or other natural sciences. Although there are a lot of journals that are supported by big publishers—for example, Elsevier and Springer—, some of them preserve the editorial policy and the publication format that they used to have before. Another important group of journals is still published by national societies, universities and research institutes. Very often, these publications are small—in the sense that they publish a small number of papers per year—, but they are prestigious and serious papers are published in them.

This implies that the impact factor of these journals has a strong statistical variability, depending on the number of citations that a small number of papers can receive.

On the other hand, the publication of the papers is slow when compared with journals in other disciplines. Sometimes it takes more than two years for a paper from submission to publication. In general, this does not produce any problem for the dissemination and exchange of information, since the contents are often previously published by the authors in popular open access repositories as arXiv. Moreover, again the small size of the group of specialists interested in the topic reduces the pressure on the authors for a fast publication.

Conclusions: IF-based evaluation of the scientific productivity

The main direct consequence of the properties of the journals of mathematics together with the slow long-term activity in the research of the topics is the small rate of papers that are cited two years after their publication, when compared with other fields. This causes that the value of the IF of the journals is small even if they are prestigious and well-known in the field. For example, an IF of 0.5 is a reasonable impact factor for a journal, and enough to let it to be considered as a serious publication. This value is very small if we compare with other areas (see Bensman, Smolinsky & Pudovkin, 2010; Smolinsky & Lercher, 2012).

However, the 2-year IF is still the main tool in many countries—for example, Spain—to measure the production of a single mathematician or a research institute. This produces some fails in the evaluation systems, and lead the researchers to publish in journals that are considered by the community as less prestigious than others, as a consequence for example of the fact that these journals publish much more papers, and then have a better IF. Therefore, pure mathematics provides an example of a group of disciplines for which the IF-based evaluation clearly distorts the image of the scientific production.

Acknowledgments

This work has benefited from assistance by the National R+D+I of the Ministry of Economy and Competitiveness of the Spanish Government (CSO2012-39632-C02-01) and Prometeo Program for excellent research groups of Generalitat Valenciana (GVPROMETEO2013-041).

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