

A simple alternative to the h-index

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ERIM REPORT SERIES <i>RESEARCH IN MANAGEMENT</i>	
ERIM Report Series reference number	ERS-2009-043-LIS
Publication	July 2009
Number of pages	5
Persistent paper URL	http://hdl.handle.net/1765/16556
Email address corresponding author	lwaltman@ese.eur.nl
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Free Keywords	bibliometric indicator, h-index, highly cited publications, consistency
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Abstract

The h -index is a popular bibliometric performance indicator. We discuss a fundamental problem of the h -index. We refer to this problem as the problem of inconsistency. There turns out to be a very simple bibliometric indicator that has similar properties as the h -index and that does not suffer from the inconsistency problem. We argue that the use of this indicator is preferable over the use of the h -index.

Keywords

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1 Introduction

Within a short period of time, the h -index proposed by Hirsch (2005) has become a very popular bibliometric performance indicator. The following properties of the h -index seem to be the main reason for its popularity:

- The h -index is relatively insensitive to large numbers of lowly cited publications.
- The h -index is relatively insensitive to a few very highly cited publications.

- The calculation of the h -index is easy to understand.

Researchers have also identified various weak points of the h -index. Most of these weak points can be dealt with relatively easily without the need to abandon the basic ideas underlying the h -index. This has resulted in a large number of h -index variants. In this note, we focus on a more fundamental problem of the h -index. We refer to this problem as the problem of inconsistency. The problem of inconsistency cannot be solved by introducing yet another variant of the h -index. In fact, the problem is shared by all h -index variants. However, there turns out to be a very simple (and well-known) indicator that has similar properties as the h -index and that does not suffer from the inconsistency problem. We argue that the use of this indicator is preferable over the use of the h -index.

2 The problem of inconsistency

To illustrate the problem of inconsistency, consider the following example. Suppose that researchers A and B both have four publications. Researcher A has three publications with five citations each and one publication with zero citations. Researcher B has four publications with four citations each. Suppose next that researchers A and B both achieve the same performance improvement. More specifically, suppose that they both obtain two new publications with five citations each. Researcher A's h -index then increases from three to five, while researcher B's h -index remains equal to four. This means that the ranking of researchers A and B relative to each other has reversed. Initially researcher A was ranked below researcher B, but after adding the new publications the situation is exactly the other way around. We regard this as a highly undesirable outcome. Researchers A and B have both achieved the same performance improvement, but despite of that their ranking relative to each other has reversed. In our opinion, this is unnatural and very difficult to justify.

Because of the above problem, we call the h -index an inconsistent indicator (for a formal definition of the notion of consistency, see Waltman & Van Eck, 2009). The inconsistency problem of the h -index has also been recognized by Marchant (2009a, 2009b) (see also Rousseau, 2008). Marchant (2009a, p. 335) concludes that because of the inconsistency problem “the ranking based on the h -index is in many circumstances probably not reasonable”. We fully agree with this conclusion.

The following example provides another illustration of the inconsistency problem of the h -index. Suppose that the h -index is used to compare the performance of two research groups, research group A and research group B. Research group A consists of five researchers. Each researcher in research group A has five publications with five citations each. Hence, in total research group A has 25 publications with five citations each. Research group B also consists of five researchers. Each researcher in research group B has two publications with ten citations each. Hence, in total research group B has ten publications with ten citations each. It is clear that each researcher in research group A has an h -index of five while each researcher in research group B has an h -index of two. This means that according to the h -index each researcher in research group A outperforms each researcher in research group B. Based on this result, it seems natural to expect that research group A as a whole outperforms research group B as a whole. However, this is not the case. Research group A has an h -index of five, while research group B has an h -index of ten. Hence, the h -index indicates that research group A is outperformed by research group B rather than the other way around. This means that the h -index calculated at the level of research groups contradicts the h -index calculated at the level of individual researchers. We regard this as a rather odd result.

3 An alternative indicator

To avoid the problem of inconsistency, we propose a simple alternative to the h -index. This alternative is the number of highly cited publications, that is, the number of publications for which the number of citations exceeds a certain threshold. The number of highly cited publications is a well-known indicator (e.g., Plomp, 1990) that has a number of similar properties as the h -index, namely insensitivity to large numbers of lowly cited publications, insensitivity to a few very highly cited publications, and an easy-to-understand calculation. There is one very important difference between the highly cited publications (HCP) indicator and the h -index. This difference is that unlike the h -index the HCP indicator does not suffer from the problem of inconsistency (Marchant, 2009a; Waltman & Van Eck, 2009). Because of this difference, we believe that the use of the HCP indicator is preferable over the use of the h -index.

In his proposal for the h -index, Hirsch (2005) also discusses the possibility of using the number of highly cited publications as a bibliometric performance indicator. According to

Hirsch, the HCP indicator has a significant disadvantage. This disadvantage is that the threshold for determining what counts as highly cited and what does not “is arbitrary and will randomly favor or disfavor individuals” (Hirsch, 2005, p. 16569). We agree with Hirsch that this is a weak point of the HCP indicator. However, unlike what Hirsch claims, the h -index has a similar weak point. As we all know, the h -index is defined as follows: A researcher has h -index h if h of his n publications have at least h citations each and the other $n - h$ publications have fewer than $h + 1$ citations each. This definition involves some arbitrariness because the h -index could equally well have been defined in, for example, the following way: A researcher has h -index h if h of his n publications have at least $2h$ citations each and the other $n - h$ publications have fewer than $2(h + 1)$ citations each. Or the following definition of the h -index could have been given: A researcher has h -index h if h of his n publications have at least $h/2$ citations each and the other $n - h$ publications have fewer than $(h + 1)/2$ citations each. Hirsch does not provide any argument why his definition of the h -index would be better than alternative definitions such as those given above. Because of this, the way in which Hirsch defines the h -index is somewhat arbitrary (Van Eck & Waltman, 2008). The arbitrariness of the definition of the h -index is also pointed out by Lehmann, Jackson, and Lautrup (2006, 2008), who note that the h -index is based on a comparison of two quantities that have different units (publications vs. citations). Because not only the use of the HCP indicator involves arbitrariness but the use of the h -index does so as well, we do not consider arbitrariness an important factor in the choice between the h -index and the HCP indicator.

4 Conclusion

The h -index and the HCP indicator have quite similar properties. However, the h -index suffers from a fundamental problem, namely the problem of inconsistency. Because the HCP indicator does not suffer from this problem, we consider the use of this indicator preferable over the use of the h -index. The use of the HCP indicator indeed involves some arbitrariness, as noted by Hirsch (2005), but the same holds for the use of the h -index. Arbitrariness is therefore not a valid argument for rejecting the HCP indicator in favor of the h -index.

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