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Does quality and content matter for citedness? A comparison with para-textual factors and over time

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ABSTRACT

Using (binomial) regression analysis, we run models using citation windows of one to ten years with both annual citation and cumulative citations as dependent variables, and with both bibliometric and quality indicators (judgments of peers) as independent variables. The bibliometric variables are the Journal Impact Factor (JIF) of the publication medium, the numbers of authors and pages, and the statistical citedness of the references used within the paper. We find that the JIF has a larger influence on the citation impact of a publication than the quality (measured by judgments of peers). However, the number of pages and the quality of the references are less influential. The influence of JIF peaks after three years and then declines (in most regression analyses), but remains higher than the influence of quality judgments even after ten years. These results call into question a discrepancy between the algorithmically based indicators and the qualitative judgments by experts. The latter seems less predictive for future citation than a combination of algorithmic constructs. The results of this study can contribute to the empirical specification of the relevance of a normative versus a constructivist theory of citation.

1. Introduction

During the last decade, citation analysis in evaluative bibliometrics has invested in refining the methods of measuring and comparing among different document sets in terms of their "citedness" and therefore perhaps "impact" after appropriate normalization for differences among fields of science, document types, and over time. Factors which influence the citedness of papers, such as the publication venue, the number of co-authors, the length of a paper, the quality of its references, have been studied using different databases: Web-of-Science (WoS), Scopus, and Google Scholar. In an overview of multivariate analyses of predictors of citations Onodera and Yoshikane (2014) summarized these independent variables as possibly strong predictors of citedness: the Journal Impact Factor (JIF) appeared as a strong predictor in 12 out of the 13 studies analyzed; but the number of references and other features of references were equally strong predictors. The number of authors was a strong predictor in only five out of 13 studies, and the length of the papers only in four.

From the perspective of a normative theory of citation (Small, 2004), one would expect that the intellectual quality of a paper becomes increasingly important in determining the respective citation rates the longer the citation window is

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(see also Bornmann, Leydesdorff, & Wang, 2014). But how would one measure intellectual quality and its influence on citation? Referee reports preceding publication are confidential and cannot easily be compared across journals and fields. However, a quality assessment system based on peer review is available in the bio-medical sciences: F1000 (Du, Tang, & Wu, 2015; Waltman & Costas, 2014; Wouters & Costas, 2012). F1000 provides a post-publication peer review system of the biomedical literature in terms of papers from medical and biological journals. This service is part of the Science Navigation Group, a group of independent companies that publish and develop information services for the professional biomedical community and the consumer market.

F1000 Biology was launched in 2002 and F1000 Medicine followed in 2006. The two services were merged in 2009 and today constitute the F1000 database. Submissions to F1000 are selected by peer-nominated global "Faculty" of leading scientists and clinicians who then rate the papers and explain their importance (F1000, 2012). This means that only a relatively small set of papers from the medical and biological journals is reviewed, while most of this literature is actually not rated (Kreiman & Maunsell, 2011; Wouters & Costas, 2012).

The Faculty of F1000 nowadays consists of more than 5000 experts worldwide, assisted by approximately 5000 associates, who are organized into more than 40 subjects (which are further subdivided into more than 300 sections). On average, 1500 new recommendations are contributed by the Faculty each month (F1000, 2012). Faculty members can choose and evaluate any paper that interests them; however, "the great majority pick papers published within the past month, including advance online papers, meaning that users can be made aware of important papers rapidly" (Wets, Weedon, & Velterop, 2003, p. 254). Although many papers published in popular and high-profile journals (e.g. *Nature*, *New England Journal of Medicine*, *Science*) are evaluated, 85% of the papers selected come from specialized or less known journals (Wouters & Costas, 2012).

The papers selected for F1000 are rated by the expert-members as "good," "very good," or "exceptional," which is equivalent to the recommendation scores (RSs) of 1, 2, or 3, respectively. In many cases, a paper is not rated only by one single member, but by several.

In this study, we use the RSs as an independent variable in the regression analysis on a par with the other independent variables (JIF, number of authors, number of pages, and quality of the references) for the prediction of citations over time. Since the independent variables are on different measurement scales, the coefficients of the binomial regression analysis cannot be directly compared. We use (i) the marginal effects of changing each independent variable holding all other variables constant, and (ii) the increments in the variance explained (R^2) by adding independent variables as measures for the contribution to the prediction.

Both citation rates and accumulated citations during a ten-year period have been tested in a series of models, but in this study we are able to address the question of how the relative influences of independent variables change over time. The main findings are that the quality of the *journal* (measured as JIF), in which the paper was published, significantly contributes to the citation more than the quality of the paper as rated by F1000. The numbers of pages and the normalized citedness (mean normalized citation score, MNCS) of the references in each paper have less effect on citation than RS. In most of the regression analyses, the effects of the JIF and the numbers of authors diminish with time beyond two or three years.

2. Methodology

2.1. Data

In January 2014, F1000 provided one of us with data on all recommendations (and classifications) made, and the bibliographic information for the corresponding papers in their system ($n = 149{,}227$ records). This dataset contained a total of 104,633 different digital object identifiers (DOI), among which all are individual papers (with incidental exceptions). The approximately 30% reduction of the dataset by the identification of unique DOIs can be attributed to the fact that many papers received more than a single recommendation from Faculty members, and therefore appeared more than once in the dataset.

For bibliometric analysis in the current study, citation counts (between the date of publication and the end of 2013) and other bibliometric variables (such as the JIF) were matched at the paper level using an in-house database of the Max Planck Society (MPG) based on the WoS and administered by the Max Planck Digital Library (MPDL). In order to create a link between the individual papers and the bibliometric data, two procedures were used: (1) A total of 90,436 papers in the dataset could be matched with a single paper in the in-house database using the DOI as a key; (2) in the case of 4205 papers of the 14,197 remaining papers (in which no match could be achieved using the DOI), the name of the first author, the journal, the volume and issue numbers could be matched. Thus, bibliometric data is available for 94,641 papers of the 104,633 total (91%). This percentage approximately agrees with the value of 93% found by Waltman and Costas (2014), who used a similar procedure to match data from F1000 with the bibliometric data using the in-house database of the Centre for Science and Technology Studies (CWTS) in Leiden.

In order to obtain a ten-year citation window, we include in this study only papers which were published between 2000 and 2004. This reduces the data set to $n = 9898$ papers; none of the variables used in this study are missing for any of these documents. This step thus ensures that annual citations over ten years are available for all the papers. Here the publication year of the paper is taken as the first year, and citations are available for papers up to the year 2013 in the in-house database of MPDL mentioned above.