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Can the journal impact factor be used as a criterion for the selection of junior researchers? A large-scale empirical study based on ResearcherID data

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ABSTRACT

Early in researchers' careers, it is difficult to assess how good their work is or how important or influential the scholars will eventually be. Hence, funding agencies, academic departments, and others often use the Journal Impact Factor (JIF) of where the authors have published to assess their work and provide resources and rewards for future work. The use of JIFs in this way has been heavily criticized, however. Using a large data set with many thousands of publication profiles of individual researchers, this study tests the ability of the JIF (in its normalized variant) to identify, at the beginning of their careers, those candidates who will be successful in the long run. Instead of bare JIFs and citation counts, the metrics used here are standardized according to Web of Science subject categories and publication years. The results of the study indicate that the JIF (in its normalized variant) is able to discriminate between researchers who published papers later on with a citation impact above or below average in a field and publication year – not only in the short term, but also in the long term. However, the low to medium effect sizes of the results also indicate that the JIF (in its normalized variant) should not be used as the sole criterion for identifying later success: other criteria, such as the novelty and significance of the specific research, academic distinctions, and the reputation of previous institutions, should also be considered.

1. Introduction

Processes for selecting researchers are prevalent in science. Promising candidates are selected for fellowships, post-doctoral positions, professorships, etc. As a rule, the peer review process is used to separate the wheat from the chaff (Bornmann, 2011). For example, the European Molecular Biology Organization's (EMBO) Long-Term Fellowships support postdoctoral research visits to laboratories worldwide (see http://www.embo.org/funding-awards/fellowships/long-term-fellowships). All applications are evaluated by the EMBO Fellowship Committee, which bases its funding decision on (1) previous scientific achievements, (2) novelty and

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significance of proposed research, and (3) appropriateness of the host laboratory for the proposed research (see http://www.embo.org/funding-awards/fellowships/long-term-fellowships#selection) (Bornmann, Wallon, & Ledin, 2008). As is common in many other selection processes, bibliometrics is a decisive factor in the EMBO selection process: applicants for a fellowship "must have at least one first (or joint first) author research paper accepted for publication, in press or published in an international peer-reviewed journal at the time the EMBO Long-Term Fellowships application is complete" (see http://www.embo.org/documents/LTF/LTF_Guidelines_for_Applicants.pdf).

In order to assess the importance, quality or impact of publications, many reviewers and administrative staff of funding organizations use the Journal Impact Factor (JIF, Clarivate Analytics, formerly the Intellectual Property & Science business of Thomson Reuters) of the journals in which the applicants have published their papers (Wouters et al., 2015). The JIF is available in the Journal Citation Reports (JCR) and measures the average citations in one year (e.g., 2014) of the journal's papers that were published in the two preceding years (e.g., 2012 and 2013). Since the JIF is easily accessible for many researchers (and beyond), and since evaluated units (e.g., scientists) have, as a rule, published more than one paper in a journal, the use of the JIF for impact measurement is attractive. Thus, JIFs often serve as a proxy for paper-level citation statistics for evaluating professionals. The results of van Dijk, Manor, and Carey (2014) show that the JIF is an important factor in becoming a principle investigator in biomedicine. From the point of view of Elsevier (the provider of the Scopus database), the JIF is such an important journal metric in research evaluation that they introduced the CiteScore which resembles the JIF (https://journalmetrics.scopus.com/, https://www.cwts.nl/blog?article=n-q2y254).

In recent years, the practice of basing funding decisions (mainly) on the JIF has been heavily criticized – also by the inventor of the JIF (Garfield, 2006). The most important reasons given are that (1) the JIF measures citation impact for a very short time period only; and (2) since the JIF is an average value that is based on skewed citation distributions, it cannot represent the citation impact of most of the journal's papers (Seglen, 1992). Recently, the *San Francisco Declaration on Research Assessment* (see http://www.ascb.org/dora) appeared as a statement against the use of the JIF for the evaluation of individual papers and their authors (Garwood, 2013). By November 28, 2016, 12,583 individuals and 916 institutions had signed the declaration. However, according to Hutchins, Yuan, Anderson, and Santangelo (2016) "a groundswell of support for the San Francisco Declaration on Research Assessment . . . has not yet been sufficient to break this cycle. Continued use of the JIF as an evaluation metric will fail to credit researchers for publishing highly influential work." Reich (2013) reports that publishing in high-impact journals leads to bonuses or salary increases for researchers in some developing countries.

Based on a large data set with many thousands of individual researchers' publication profiles, this study investigates whether the practice of using the JIF in research evaluation processes makes sense or whether the JIF should be eliminated from these processes. To answer these questions, the researchers' publication profiles are separated into a starting block of publication activity at the beginning of their careers (the first five years) and a subsequent block of about ten years as a senior researcher. The study tests whether the ability of researchers to publish in high-impact journals (during the first five years) is related to the citation impact of the papers published after the initial period. In other words, do researchers who started their career by publishing in high-impact journals perform outstanding research later on as measured by field- and time-normalized citation scores of individual publications?

This study follows initiatives like that of Waltman and Traag (2017) who try to link the JIF discussion with sound theoretical and empirical analyses. Their computer simulations point out that the JIF "is a more accurate indicator of the value of an article than the number of citations the article has received".

2. Literature overview

Since the current study is intended to investigate the relationship between different metrics for individual researchers, the literature overview refers to studies that examine the relationship of several metrics at the level of individual researchers. Only a small portion of these studies compare the metrics at different points in time (e.g., at the beginning and end of the academic career). Several studies investigating individual researchers' careers deal with the relationship between productivity (proxy of quantity) and citation impact (proxy of quality). Most of these studies demonstrate that there is a strong correlation between quantity and quality (see an early overview in Hemlin, 1996). Researchers who publish frequently seem to write the best papers, and vice versa: "highly cited researchers are also highly productive" (Parker, Allesina, & Lortie, 2013, p. 469). Abramo, D'Angelo, and Costa (2010) were able to show in a large-scale study including 26,000 researchers working in the Italian university system, that "scientists who are more productive in terms of quantity also achieve higher levels of quality in their research products" (p. 139). Also, van den Besselaar and Sandström (2015) report a positive correlation between number of publications and number of highly cited papers for researchers in the Swedish science system. The positive correlation exists not only on the size-dependent level (number of publications and citations), but also on a mix of size-dependent and size-independent levels: number of publications and citations per publication (Diem & Wolter, 2013).

According to the results of Larivière and Costas (2016), the positive "quantity-quality" correlation can be observed especially for biomedical and health sciences, and for social sciences and humanities. Costas, Bordons, van Leeuwen, and van Raan (2009) concretise the positive "quantity-quality" correlation using the publication profiles of 1064 researchers working as scientific staff at the Consejo Superior de Investigaciones Científicas (CSIC): they found that "researchers in low field-citation-density regions and those whose impact is below world class tend to benefit the most from an increase in number of publications" (p. 750). The positive "quantity-quality" correlation reported in several studies might confirm the cumulative advantage theory of Merton (1968) and the reinforcement theory of Cole and Cole (1973). Both theories claim