Are scientists really publishing more?

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Introduction

The success of researchers and research institutions is increasingly determined by measurable aspects of their performance, in particular the quantity and citation-impact of their publications. The effects that these growing "pressures to publish" might have on publication and research practices are a matter of growing concern and increasing academic interest (de Winter & Dodou, 2014; Fanelli, 2010, 2012, 2013; Tijdink, Vergouwen, & Smulders, 2013; van Dalen & Henkens, 2012).

Much criticisms and concern has been expressed, in particular, for the risk of overemphasising the quantity of a scientist's publication record at the expense of its quality. In order to show a longer lists of publications in their CVs, it is commonly hypothesised, scientists might increasingly resort to questionable practices such as inappropriately subdividing ("salami slicing") their results, publishing trivial and incomplete studies, conducting research hastily and sloppily, selecting out of their findings those that are least "publishable", or even resorting to outright scientific misconduct in the form of duplicate publication, plagiarism and data fabrication (e.g. Angell, 1986; Hayer et al., 2013).

Performance-evaluation policies of institutions in various countries have responded to these concerns by formally removing any quantitative consideration from their performance assessments (e.g. VSNU, 2015). However, there is little evidence to support these policies. No study, in particular, has ever verified whether scientists are have actually responded to growing pressures by churning out more papers. We present preliminary results of a project aimed at filling this gap in the literature.

Methods

We identified individual researchers who published in the Web of Science across the 20th century by selecting all authors identified by three initials (first name and two middle names, plus surname, e.g. Vleminckx-SGE), which reduces the likelihood that these researchers have homonyms. From this initial sample we selected authors who had at least two publications, and from these we then selected authors whose publications spanned a period of at least 15 years. For each of these authors we then counted the total number of papers published in the first 15 years of activity – the period were pressures to publish are hypothesised to be stronger – and we also measured the average number of co-authors.

Results

The raw number of papers published by individual authors has grown very rapidly across the century (Fig. 1). Fractional productivity, however, as measured by dividing the author's total number of papers by the average number of co-authors, shows a net decline (Fig. 2).

Discussion

Although still preliminary, these results suggest that our beliefs about the effects of pressures to publish might be partially incorrect. Authors might have responded to growing performance expectations not, as commonly believed, by subdividing or trivializing their results or by multiplying their effort at the expense of other activities, but by enlarging their network of collaborations in order to make ever smaller contributions to a growing number of projects. Since neither publication nor citation metrics are counted fractionally, this strategy allows scientist to increase their measurable publication rate without necessarily increasing their total research effort.

If scientists' net effort devoted to research is not increasing, then concerns for growing "salami slicing" and other questionable practices might be unjustified. Explanations for recent evidence that retraction and correction rates are growing (Fang & Casadevall, 2011), that publication bias is growing (Fanelli, 2012) and that research bias might be higher in scientifically productive countries (Fanelli, 2010) might need revising. And policies that are currently de-emphasizing "quantity" in

favour of "quality" (e.g. VSNU, 2015) might not have a solid basis in evidence, and could therefore be ineffective or even damaging.

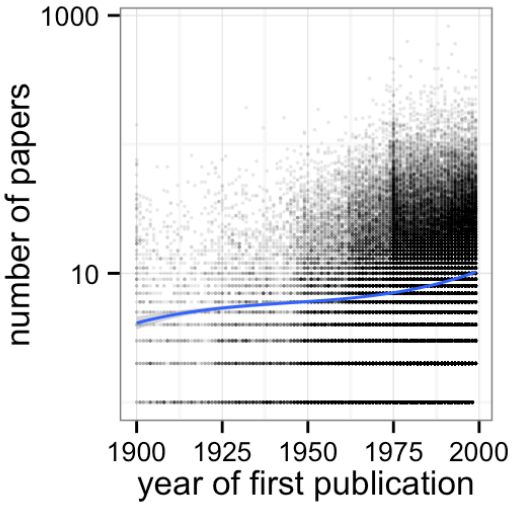

Figure 1. Total number of papers published during the first 15 years of career (N= 70,310). Blue line: cubic polynomial regression fit, with grey areas representing 95%CI.

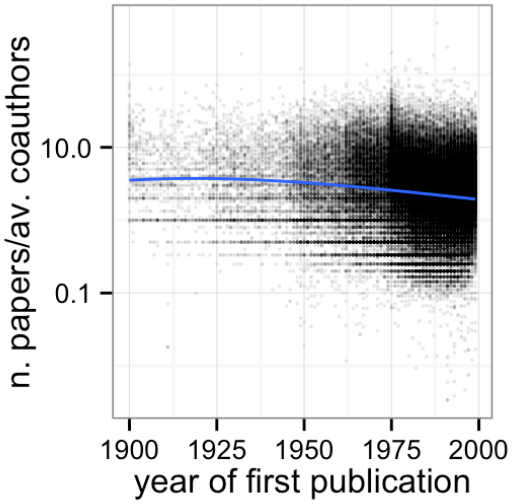

Figure 2. Ratio of total number of papers to average number of co-authors during the first 15 years of career (N= 70,310). Blue line: cubic polynomial regression fit, with grey areas representing 95%CI.

Several limitations to these results, however, remain to be addressed. First, since the likelihood of having two middle names is very unequally distributed amongst countries, our sample might not be sufficiently representative of the corpus of literature in the Web of Science. Second, our method might not be sufficiently robust against disambiguation errors for names from South-East Asian countries, a problem which might have skewed our results. Third, the Web of Science database does not cover a significant proportion of the literature, and its coverage varies by discipline and across the years. Future work will aim at adjusting for these factors, in order to verify whether scientists are actually publishing more or just collaborating more extensively.

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