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Impact-oriented science policies and scientific publication practices: The case of life sciences in Japan

Sotaro Shibayama[a,b,*], Yasunori Baba[a]

[a] University of Tokyo, Research Center for Advanced Science and Technology, 4-6-1 Komaba, Meguro-ku, Tokyo 153-8904, Japan
[b] University of Tokyo, Department of Technology Management for Innovation, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan

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ABSTRACT

The modern science system relies on intense evaluation of scientific publication, in which scientific impact is highly emphasized, but its contribution to the progress of science has been controversial. Focusing on two aspects of the science system, resource allocation and academic career design, this study explores whether these policies, presumably aiming at high-impact research, actually achieve the goal. Drawing on in-depth interviews and econometric analyses of Japanese biology professors, this study first shows that merit-based resource allocation can result in biased resource allocation, and that excessive resource concentration can facilitate low-impact publications. Second, results show that a lack of mobility, in particular inbreeding, increases low-impact publications, while international mobility decreases it. The latter effect is found to be mediated by fewer publications in low-impact journals, and thus, internationally mobile academics seem to decide the publication destination more strategically.

1. Introduction

During the last few decades, economic policies have emphasized the role of science in innovation and economic growth (Etzkowitz and Leydesdorff, 2000; Stephan, 2012). While this has substantially increased the investment in science, the academic sector has been subject to stricter pressure for accountability (Hagstrom, 1974). The performance of scientific research has been scrutinized increasingly on the basis of scientific publications, the primary and arguably measurable output of science (Geuna and Martin, 2003; Hicks, 2012). Academics and universities are evaluated and ranked with various metrics of publication performance (e.g., Hirsch, 2005; Narin and Hamilton, 1996), with which research budgets are distributed, and academic positions are allotted (Geuna and Martin, 2003; Hicks, 2012). Consequently, publication has been reduced to a means to survive the fierce competition, resulting in the academic culture often referred to as "publish or perish" (Dasgupta and David, 1994; Laband and Tollison, 2003).

Although the emphasis on publication-based evaluation may be justified for objectivity and transparency, whether it contributes to the advancement of science is not entirely clear. Indeed, the past decades have seen a significant boost in the volume of publications (Reich, 2013), but for example, Bohannon (2013) points out that this is partly due to numerous new journals with questionable scientific legitimacy. Anecdotes suggest that poorly designed policies can facilitate rent-seeking behavior, such as fragmented publications and redundant publications, and only improve superficial performance (e.g., Broad, 1981; Martin, 2013). The Australian funding system is an infamous example; the system was reformed so that research block grants should be awarded based partly on publication count, and this resulted in a greater number of publications but of lower quality in terms of journal impact (Butler, 2003).

In an attempt to facilitate valuable publications rather than only to inflate publication count, policymakers have been emphasizing the *impact* of publications (Geuna and Martin, 2003; Hicks, 2012). This is often implemented by evaluating some citation indices on the premise that highly cited papers offer an important foundation for subsequent research (Cole and Cole, 1972). Nevertheless, this approach is not immune to rent-seeking behavior. For example, some journal editors were found to coerce authors under peer review to cite the editors' papers (Wilhite and Fong, 2012), and some universities offer part-time employment to highly cited academics with the condition that the university name be added in their publications (Bhattacharjee, 2011). More commonly, academics are making considerable efforts to publish in so-called prestigious or high-impact journals that are likely to invite many

* Corresponding author at: University of Tokyo, Research Center for Advanced Science and Technology, 4-6-1 Komaba, Meguro-ku, Tokyo 153-8904, Japan. Tel.: +81 354525371; fax: +81 354525371.
E-mail address: shibayama@00.alumni.u-tokyo.ac.jp (S. Shibayama).

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citations, which may or may not be accompanied by contents of high impact (Frank, 1994; Gordon, 1984). Criticizing this situation, Holub et al. (1991) stated "*where* a scientist publishes has become much more important than *what* he is publishing." With all the painful efforts of academics, however, numerous papers remain uncited while only a tiny portion of papers are highly cited (Cole and Cole, 1972; Redner, 1998; Seglen, 1992).

Overall, the current science policies with extreme emphasis on publication could cause academics' strategic behavior, resulting in publications with limited scientific value and social benefit. This study aims to investigate how academics' publication practices are affected by science policies, particularly focusing on career system and resource allocation, two pivotal components of the science system that are increasingly subject to publication-based evaluation. Though academics' rent-seeking behavior, particularly misconduct, has attracted increasing scholarly attention (Martin, 2013), prior literature has been mostly descriptive or conceptual. A few lines of literature have studied the effect of science policies on publication performance (Baruffaldi and Landoni, 2012; Crespi and Geuna, 2008; Cruz-Castro and Sanz-Menendez, 2010; Jacob and Lefgren, 2011) but paid limited attention to academics' strategic reactions to the policies. To go beyond the prior literature, we draw on two approaches: (1) in-depth interviews to qualitatively illustrate academics' publication practices, and (2) econometric analyses based on a questionnaire survey and bibliometric data. For the latter, we analyze the publication portfolio, i.e., a combination of different types of publications, particularly in terms of publication impact, to infer academics' strategies. This study uses a sample of Japanese biology professors, which offers an interesting case in that the country is highly ranked in life sciences (Adams et al., 2010) and yet commonly produces low-impact publications (Appendix 1).

This paper is structured as follows: Chapter 2 reviews prior literature on scientific publication and the focal policies. Chapter 3 describes our data. Chapter 4 illustrates the policy context of our sample and presents qualitative results mainly from our interviews, and Chapter 5 presents the results of econometric analyses. Finally, Chapter 6 summarizes the results and discusses the implications.

2. Literature review

2.1. Incentive for publication and strategic publication

The advancement of science essentially relies on the publication of scientific papers. Academics are obliged to publish their findings to share among the scientific community for verification and reuse in subsequent research (David, 2004). Publication has been driven traditionally by an internal reward system based on peer reputation (Merton, 1973). As academic science has been incorporated as a core part of the innovation system, however, academics and universities have been subject to stricter external control, and their performance has been evaluated based on publication records (Geuna and Martin, 2003; Hicks, 2012). Publication records are easily accessible from public and commercial databases (e.g., Web of Science, Scopus, PubMed) and the metrics of publication performance are computed. With these metrics, academic institutions and countries are evaluated and ranked (e.g., Research Assessment Exercise in the UK and similar systems in other countries,[1] Academic Ranking of World Universities, etc.), further reinforcing the political pressure for publication.

A challenge in publication-based evaluation is that the value of each publication can differ significantly, and thus, simply counting publications does not usually suffice. Among multifaceted value of publications, the concept of *impact* — i.e., the extent to which a publication or a set of publications offers the basis for subsequent research — has been popularly used (Geuna and Martin, 2003; Hicks, 2012). On the grounds that influential discoveries are likely to be frequently cited (Cole and Cole, 1972), evaluation systems often draw on some forms of citation indices (e.g., H-index). Although academics are aware of limitations of this approach, impact-oriented evaluation is prevalent (Bornmann and Daniel, 2008; Macroberts and Macroberts, 1996; Van Raan, 2005).

Under the publish-or-perish academic culture, it is essential for individual academics to improve publication metrics to survive career filters throughout all career stages (Dasgupta and David, 1994; Laband and Tollison, 2003). Even after obtaining a tenured position, they have to keep fundraising to cover research expenses, for which excellent publication records are needed, and a lack of funds could mean an exit from a research career. This extreme pressure for publication seems to affect academics' practices in research in many ways. It could broadly induce questionable research practices and compromise scientific integrity (Anderson et al., 2007; Fanelli, 2010; Martin, 2013). Particularly as to publication, academics resort to various types of rent-seeking behavior such as fragmented publication, redundant publication, plagiarism, and other types of misconduct (Martin, 2013). A typical strategic behavior is also observed in the choice of journals for publications. Responding to the emphasis on impact, academics attempt to publish in prestigious journals that are likely to attract citations. This has led to the popular use of *journal impact*, on the basis of which academic journals are ranked (Garfield, 1972). Journal impact is known as one of the most important decision criteria when academics choose a journal for publication (Frank, 1994; Gordon, 1984). These observations imply that the policy emphasis on publication-based evaluation has changed academics' publication practices, although empirical evidence is lacking with few exceptions (Butler, 2003).

2.2. Publication for career development

As the phrase "publish or perish" implies, the academic career system is the primary source of pressure for publications. Junior academics such as PhDs and postdocs have to present appealing vita to win entry positions, and those who did have to further develop publication records within several years to attain tenured positions. The academic career system used to be (and still is, depending on countries) rather closed and less dynamic. Particularly during the early days of the university system, faculty members tended to be developed internally with limited mobility (Horta et al., 2011). In the modern science, however, immobility and inbreeding are generally perceived as an impediment to performance, and mobility is regarded as a career requirement in many countries (EC, 2010; OECD, 2008; Stephan, 2012). The rationale behind pro-mobility policies is that mobile academics can recombine their knowledge with that of other academics in host affiliations and find a research environment that best matches their skills (Agrawal et al., 2011; Hargadon and Sutton, 1997). Recent policies have particularly emphasized international mobility as a means to facilitate international collaboration and global competitiveness (Stephan, 2012). In fact, Franzoni et al. (2012) show that 40–80% of academics in most developed countries, except for the US, have international experience for one year or longer. Pro-mobility policies can also be popular for employers (e.g., universities) in that long-term employment commitment can be avoided and that faculty teams can be flexibly reorganized under varying social needs and severe budgetary constraints. Consequently, academic contracts have become shorter, and tenure contracts have been replaced by temporary

[1] The UK has been moving away from Research Assessment Exercise (RAE) to Research Excellence Framework (REF). Similar funding systems are observed in Australia and some European countries (Hicks, 2012).