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Self-citations as strategic response to the use of metrics for career decisions

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ABSTRACT

There is limited knowledge on the extent to which scientists may strategically respond to metrics by adopting questionable practices, namely practices that challenge the scientific ethos, and the individual and contextual factors that affect their likelihood. This article aims to fill these gaps by studying the opportunistic use of self-citations, i.e. citations of one's own work to boost metric scores. Based on sociological and economic literature exploring the factors driving scientists' behaviour, we develop hypotheses on the predictors of strategic increase in self-citations. We test the hypotheses in the Italian Higher Education system, where promotion to professorial positions is regulated by a national habilitation procedure that considers the number of publications and citations received. The sample includes 886 scientists from four of science's main disciplinary sectors, employs different metrics approaches, and covers an observation period beginning in 2002 and ending in 2014. We find that the introduction of a regulation that links the possibility of career advancement to the number of citations received is related to a strong and significant increase in self-citations among scientists who can benefit the most from increasing citations, namely assistant professors, associate professors and relatively less cited scientists, and in particular among social scientists. Our findings suggest that while metrics are introduced to spur virtuous behaviours, when not properly designed they favour the usage of questionable practices.

1. Introduction

The practice of allocating resources and linking career advancement to research productivity is intended to break the old-boys network and promote meritocracy in academia. Yet in recent years concern has grown over the downsides of the resulting pressure to publish. Studies have shown that the 'publish or perish' culture and the use of metrics for research evaluation can have several detrimental effects, like the promotion of strategic game-playing and the decline of shared information (Anderson et al., 2007), a decrease in creativity (Azoulay et al., 2011; Heinze et al., 2009), an increase in plagiarism (Honig and Bedi, 2012), a surge in the production of redundant publications (Jefferson 1998), fads (Van Dalen and Klamer, 2005) and elitist research topics that are detached from practical and societal concerns (De Rond and Miller, 2005); they also discourage non-paradigmatic or a-theoretical research, and favour ex-post hypothesizing (Miller, 2007), inflate the number of submissions (Franzoni et al., 2011), reduce the appearance of negative results (Fanelli, 2012), and promote the emergence of predatory journals (Xia et al., 2015).

The traditional belief that malpractice and misbehaviour are due to scientists who are not sufficiently socialized into the norms of science, e.g. junior researchers, is challenged by survey results suggesting that malpractice is rather common (Bedeian et al., 2010; Martinson et al., 2005) and retractions related to scientific misconduct is growing (Steen, 2010; Fang et al., 2012). Some scholars argue that due to academic competition and the use of performance indicators, an increasing number of scientists may be changing the conception of what constitutes appropriate research behaviour (Martin, 2013) by engaging in questionable practices to the point that they become embedded in the professional academic culture (Edwards and Roy, 2017).

However, despite evidence on the unintended effects of the pressure to publish, it is not yet clear the extent to which scientists adopt questionable practices as a strategic response to metrics (Fang et al., 2012). Moreover, we have little knowledge of what individual and contextual factors affect the likelihood of such behaviours among individual scientists (de Rijcke et al., 2016), and whether there are any disciplinary variations or not.

This article addresses these gaps by studying the behaviour of Italian academics in response to the introduction of a national habilitation procedure that regulates the promotion to professorial positions. While metrics have been employed for institutional evaluation and to *inform* decisions on individual career paths, this procedure *directly* links the possibility to become an associate professor and a full professor to the number of publications and citations (Marini, 2016). Hence, doing

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well according to the metrics is a pre-condition for moving up the academic career ladder. In particular we study the use of self-citations, i.e. citations to one's own work, as a shortcut to boost metric scores. We focus on the practice of inflating self-citations, for they represent a typology of the emerging 'post-production misconducts' aimed at enhancing a publication's impact; while these misconducts do not generate false results, they nevertheless erode the credibility of the publication system (Biagioli, 2016). Moreover, inflating self-citations is at odds with the norm of disinterestedness that is central to the ethos of science (Merton, 1973). As such, opportunistic self-citations can signal that the norms of the scientific community are not effectively guarded, which is possibly conducive to increasing the number and severity of infringements.[1] Finally, self-citations can be exploited in a rather short period of time, by adding citations to the articles in the pipeline – meaning that an increase in self-citations can be easily detected. Therefore, self-citations represent a fast and visible indication on the extent to which scientists can opportunistically respond to the use of citations to drive career decisions, not to mention their role as a precious 'canary in a coal mine'.[2]

We build on sociological and economic studies of science to develop hypotheses on the factors that drive scientists to increase self-citations in response to the introduction of metrics-based career decision-making. We test the hypotheses considering the scientific production of 886 scientists from four disciplinary sectors from science's main research areas, which employed different metrics approaches, within an observation period that began in 2002 and ended in 2014.

In Section 2 we review the literature on the drivers of scientists' behaviour, and develop hypotheses on the adoption of questionable practices, namely increasing self-citations in response to metrics-based habilitation procedures. In Section 3 we present the data and method, while the empirical analysis is presented in Section 4. In the final section we discuss the article's main findings, the theoretical and policy implications, and advance proposals to counteract some of the potentially unintended effects of using of metrics.

2. Strategic responses to metrics

2.1. Quantitative indicators for research evaluation

In recent decades, quantitative indicators have proliferated and are widely used to assess scientific output, to drive the allocation of funds, and for the hiring and promotion of staff (Miller et al., 2005; Van Fleet et al., 2000; Harzing, 2010; Lissoni et al., 2011; de Rijcke et al., 2016). In parallel to their diffusion, a debate emerged regarding their conceptual and empirical validity as well as their unintended effects (MacRoberts and MacRoberts 1989; Garfield, 2003; Costas and Bordons, 2007). The use of indicators is based on the assumption that publications and the citations received are proxies of a scientist' contribution to the advancement of science (Merton, 1988; Moed, 2005; Haustein and Larivière, 2015). A crucial issue, therefore, is whether these indicators are reliable proxies or not.

In the case of publications, scientific journals must closely assess whether an article merits publishing, as the selection of low quality articles would endanger their reputation. On the other hand scholars have criticized the use of a journal impact factor as a proxy for the quality of articles, because the correlation between a journal impact factor and the citations received by an individual article is very low (Lozano et al., 2012).

For citations, scientists judge whether a published contribution is useful and necessary to be cited; for self-citations, an author assesses whether her/his past works were relevant when citing the article. In the case of citations and self-citations, there are slight gains or losses depending on whether authors are truthful or not. In fact, despite most scholars believing that citation counts are a poor representation of scientific contribution (Saha et al., 2003; Aksnes and Rip, 2009), at the article level there is evidence of a positive correlation between citation rates and qualitative judgement by peers (Cole and Cole, 1974; Zuckerman, 1987; Aksnes, 2006).

However, employing quantitative indicators for allocating resources or making decisions on careers enhances the risk that they become unreliable. In the case of publications, for instance, predatory journals, which do not have a reputation to protect and exchange publications for money, have emerged. In case of citations, the likelihood of a deceptive citation arguably grows with the proximity between the citing and the cited authors, as they can more easily collude and produce so-called citation rings. In the case of self-citations, the citing and cited authors are the same person, and so the risk that citations are aimed to game the system of indicators is even higher. Despite such limitations, there is no consensus on whether self-citations should be excluded for the sake of research evaluation, and only recently have some experts explicitly suggested their removal (Wouters et al., 2015).

2.2. Strategic responses to metrics

The response of scientists to metrics arguably depends on their motivations for action.

Classical sociological accounts depicted scientists' behaviour as being driven by the enjoyment derived from solving 'puzzles' as well as by the recognition from peers for achieving a discovery (Eiduson, 1962; Hagstrom, 1965). The scientists' social context was perceived as being dominated by an ethos of science – characterized by prescriptions of communalism, universalism, disinterestedness and organized scepticism (Merton, 1973; Hagstrom 1974; Zuckerman, 1977). Overall, scientists' motivations and the normative environment contributed to the efficiency of the scientific enterprise. Post-World War II research policies in Western countries developed under similar beliefs that scientists, left free to pursue their curiosity, would naturally provide the knowledge that a nation needed (Bush, 1945).

While sharing the importance of curiosity and peers' recognition, since the early nineties economists have argued that scientists are also interested in more mundane returns, namely money, and that their behaviour is not merely driven by ethical concerns, but that they are strategic in pursuing their goals (Levin and Stephan, 1991; Stephan, 1996). In a similar period, research policies have increasingly aimed to increase efficiency and performance through competition and the assessment of results (Auranen and Nieminen, 2010). Therefore, at least implicitly, policies have also experienced a similar shift in their assumptions about what drives scientists' behaviours, e.g. assuming that they are not necessarily interested in their own job and must therefore be spurred via incentives and controls.

Different perspectives on the nature of scientists lead to different interpretations and expectations on the adoption of questionable practices. Consistently with a Mertonian view of an ethical and disinterested scientist, early studies tended to blame the individual. Offenders were described as a few black sheep with peculiar psychological profiles, affected by anomie or alienation (Anderson et al., 1994; Hackett 1994). Adopting a more strategic perspective, subsequent studies paid attention to systemic, undesirable behaviours induced by an improper system of incentives (Stephan, 2012). Franzoni et al. (2011),

[1] Such a mechanism is central in the "broken windows theory", which states that when people observe that others violate a certain norm or rule, they are more likely to violate other norms or rules, which causes violations to spread (Wilson and Kelling, 1982; Keizer et al., 2008).

[2] The expression describes an item that serves as an early indicator for a coming greater danger. It alludes to the use of caged canaries that miners carried into mines, and if dangerous gases collected, the canary was killed, thus warning the miners to exit immediately.