



Regular article

Google Scholar and Web of Science: Examining gender differences in citation coverage across five scientific disciplines[☆]



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ARTICLE INFO

Article history:

Received 30 January 2018

Received in revised form 26 July 2018

Accepted 26 July 2018

Keywords:

Gender in research

Academic careers

Google Scholar

Web of Science

h-Index

ABSTRACT

Many studies demonstrate differences in the coverage of citing publications in Google Scholar (GS) and Web of Science (WoS). Here, we examine to what extent citation data from the two databases reflect the scholarly impact of women and men differently. Our conjecture is that WoS carries an indirect gender bias in its selection criteria for citation sources that GS avoids due to criteria that are more inclusive. Using a sample of 1250 U.S. researchers in Sociology, Political Science, Economics, Cardiology and Chemistry, we examine gender differences in the average citation coverage of the two databases. We also calculate database-specific *h*-indices for all authors in the sample. In repeated simulations of hiring scenarios, we use these indices to examine whether women's appointment rates increase if hiring decisions rely on data from GS in lieu of WoS. We find no systematic gender differences in the citation coverage of the two databases. Further, our results indicate marginal to non-existing effects of database selection on women's success-rates in the simulations. In line with the existing literature, we find the citation coverage in WoS to be largest in Cardiology and Chemistry and smallest in Political Science and Sociology. The concordance between author-based *h*-indices measured by GS and WoS is largest for Chemistry followed by Cardiology, Political Science, Sociology and Economics.

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1. Introduction

In 2004, weeks after the launch of Scopus, a new, freely accessible citation service, Google Scholar, challenged Web of Science's longstanding monopoly as the sole provider of bibliometric data for citation analysis (Bakkalbasi, Bauer, Glover, & Wang, 2006). Since then, the internal consistency between the databases has attracted much scholarly attention, and for good reasons. Citation metrics have become influential proxies for visibility and scholarly success in academic advancement decisions. Hence, the question of how the choice of citation database influences individual outcomes of bibliometric assessments deserves careful attention. This paper adds to the existing literature by examining whether a shift from Web of Science's "restrictive" citation index to Google Scholar's more "inclusive" citation tracker (Harzing & Mijnhardt, 2015) has any implications for the relative citation-performance of women and men. A growing literature demonstrates indirect gen-

[☆] The research presented here is the continuation of a research-in-progress paper presented at the 16th International Conference of the International Society for Scientometrics and Informetrics in Wuhan, China (Andersen & Nielsen, 2017). It has been substantially appended and modified since then.

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der effects of how bibliometric indices are used in individual performance assessments (see e.g. Brooks, Fenton, & Walker, 2014; Nielsen, 2017; Symonds, Gemmill, Braisher, Gorringer, & Elgar, 2006). Yet, we know little about the possible gender bias related to the selection of data sources in such assessments.

Web of Science claims to “provide access to the most reliable, integrated, multidisciplinary research”.¹ Compared to Google Scholar, the database is characterized by more systematic and transparent criteria for the selection of citation sources and more extensive quality assurance. The database receives its content directly from the journal publishers, and matches extracted citations to specific authors and publications via proprietary algorithms, after standardizing and validating the data (Kulkarni, Aziz, Shams, & Busse, 2009). Google Scholar’s automated citation tracker uses web-crawlers to extract citations from various types of online content.² The main criteria for selecting citation sources are that documents should look scholarly³ and be publicly available. While WoS describes its proprietary algorithm (DAIS) in some detail,⁴ GS’s algorithms remain unspecified. GS is criticized for not specifying its time range and update frequencies, for extracting citations from questionable sources such as power points and funding applications, and for failing to eliminate duplicate sources (Bornmann, Thor, Marx, & Schier, 2016; Meho & Yang, 2007). In contrast, bibliometricians have raised concerns about WoS’s limited coverage of anthology articles, conference proceedings and monographs, and its bias towards English-language journals (Harzing & van der Wal, 2009).

Studies comparing GS and WoS show large variations in content coverage depending on discipline and time period (Falagas, Pitsouni, Malietzis, & Pappas, 2007; Neuhaus, Neuhaus, Asher, & Wrede, 2006). Existing comparisons examining the coverage of citing publications, however, typically find that GS captures more unique citations than WoS, especially in the social sciences and humanities (Bosman, van Mourik, Rasch, Sieverts, & Verhoeff, 2006; Harzing & Alakangas, 2016; Kulkarni et al., 2009; Meho & Yang, 2007; Walters, 2007). This is not surprising given that GS includes many publication types not covered by Web of Science (e.g. doctoral theses, conference proceedings, anthology articles, monographs, regional and online journals, publication outlets in other languages than English, and research reports from policy-oriented think tanks). Some scholars therefore argue that Google Scholar is the most suitable source for measuring the economic and social impacts of scholarly activities (Harzing & van der Wal, 2009).

Research examining how the choice of database influences bibliometric assessments indicates that authors typically garner more citations and higher *h*-indices in GS than in WoS (Amara, Landry, & Halilem, 2013; Farhadi et al., 2013; Franceschet, 2010; Mikki, 2010; Minasny, Hartemink, McBratney, & Jang, 2013; Wildgaard, 2015). However, despite notable differences in coverage, most studies demonstrate good concordance in rankings of individual scholars’ citation impact. In a study of 512 authors, Wildgaard (2015) found that *h*-indices measured by WoS and GS correlated better for researchers in Public Health (Kendall’s $\tau = 0.82$), Astronomy (Kendall’s $\tau = .79$) and Environmental Science (Kendall’s $\tau = 0.79$) than for researchers in Philosophy (Kendall’s $\tau = 0.55$). Minasny et al. (2013) computed WoS- and GS-based *h*-indices for 340 Soil researchers and found very strong correlations (Spearman’s $\rho = 0.939$). Amara et al. (2013) demonstrated strong correlations between *h*-indices measured by WoS and GS for researchers in business and management ($N = 1286$, Spearman’s $\rho = 0.815$) (see also Saad, 2006). De Groote and Raszewski (2012) obtained similar results for nursing researchers ($N = 30$, Pearson’s $r = 0.835$). Finally, Franceschet (2010) found a moderate correlation between *h*-indices measured by GS and WoS for computer scientists (N : unspecified, Kendall’s $\tau = 0.52$).

Despite indications of good concordance between author-based citation metrics measured by GS and WoS (with studies of Philosophy and Computer Science as notable exceptions), evidence suggests that choice of database can have crucial implications for the internal ranking of sub-disciplines. Jacobs (2009), for instance, finds that Google Scholar, due to a better coverage of book publications, boosts the citation rates for articles published in the flagship journal for sociology of gender, *Gender & Society*, more than it does for articles in other highly ranked sociology journals. Meho and Yang (2007) compares the scholarly impact of researchers in library and information science (LIS) and find that authors publishing in sub-areas such as communities of practice, computer-mediated communication, data mining, data modeling, discourse analysis and gender and information technology benefit more from having their citation performance measured by Google Scholar than authors publishing in other LIS-related areas.

These findings raise concerns about the possible gender consequences of choice of citation database in individual performance assessments. Existing research demonstrates notable gender differences in primary areas of specialization within disciplines (Andersen, Schneider, & Nielsen, 2016; Dolado, Felgueroso, & Almunia, 2012; Elsevier, 2017; Light, 2013; Maliniak, Powers, & Walter, 2013; West, Jacquet, King, Correll, & Bergstrom, 2013). Studies also show that a disproportionate share of women researchers, especially in the social sciences, tend to engage in research topics and methodologies with a lower likelihood of being published in the most prestigious journals (measured by journal impact factors and scholarly rankings) (Dolado et al., 2012; Light, 2013).

Here, we add to this literature by examining to what extent citation data retrieved from WoS and GS reflect the scholarly impact of women and men differently. For this purpose we use a gender-disambiguated sample of 1250 randomly selected U.S. researchers in Sociology, Political Science, Economics, Cardiology and Chemistry. Our conjecture is that the traditional

¹ <https://apps.webofknowledge.com>.

² <https://scholar.google.com/intl/en/scholar/help.html>.

³ However, Google Scholar also receives some structured content directly from the journal publishers.

⁴ <https://clarivate.libguides.com/c.php?g=593069&p=4220414>.

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