Assessing the Citation Impact of Book-Based Disciplines: The Role of Google Books, Google Scholar and Scopus

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Abstract
Although peer review is likely to dominate quality assessment of research in the future UK Research Excellence Framework (REF), citation indictors will also be used in some subject areas to support the peer-review process. However, traditional journal-based citation indexes may be inadequate for the citation impact assessment of book-based disciplines. This article examines whether online citations from Google Books and Google Scholar can provide an alternative. We compared the citation counts to books submitted to 2008 Research Assessment Exercise (RAE – the forerunner of the REF) from Google Books and Google Scholar with Scopus citations across seven book-based disciplines (archaeology, law, politics and international studies, philosophy, sociology, history, and communication, cultural and media studies) based upon a sample of 1,000 authored books. Google books and Google Scholar citations to authored books were 1.4 and 3.2 times bigger than Scopus citations and their medians were also more than twice and three times as high as Scopus citations respectively. This large number of citations is evidence that in book-oriented disciplines in the social sciences, arts and humanities, online book citations are needed to support the peer-review process in the UK REF.

Introduction
The UK REF is the successor to the RAE, the national periodic research evaluation to allocate public research funds to higher education institutions. The main outcome is "quality profiles for each submission of research activity" (RAE 2008 Guidance, 2005, p.5). In 2008, there were "67 units of assessment (UOAs)" or subject areas within which research is assessed and "over 1,000 panel members" scored the submitted research outputs against a five-point scale criteria for excellence from four-star (world-leading) to unclassified (below the national standard) (RAE 2008 panels).

The Higher Education Funding Council for England (HEFCE) is in charge of the new framework for assessing the quality of research, the Research Excellence Framework, which was set to be used in 2014. Although peer review will continue to be the main factor in the quality assessment of research outputs in the REF and has its own advantages and controversies (for an in-depth review see Bence & Oppenheim, 2004), citation information (from the Thomson Reuters Web of Science (WoS) and Elsevier's Scopus) will also be used in some subject areas to assist the peer-review process. Several previous investigations reported significant correlations between citation measures and the RAE scores in different subject areas such as library and information science (Oppenheim, 1995), genetics, anatomy and archaeology (Oppenheim, 1997), psychology (Smith & Eysenck, 2002), archaeology (Norris & Oppenheim, 2003) and music (Oppenheim & Summers, 2008). Furthermore, the significant correlations found between other types of expert review and citation indicators, for instance in library and information science (Li, Sanderson, Willett et al., 2010), mathematics (Korevaar & Moed, 1996), chemistry (van Raan, 2006) and condensed matter physics (Rinia, van Leeuwen, van Vuren, & van Raan, 1998), indicate that citation data is relevant for research evaluation.

Despite this evidence there are criticisms about supplementing peer review with citation analysis and criticisms of citation analysis itself (e.g., Warner, 2000). For instance, a recent study revealed that correlations between citations (from WoS) and RAE peer review scores are not statistically significant in several social science and humanities units of assessment (e.g., history, sociology, education, social policy and administration, politics and international studies), but are significant in most sciences (Mahdi, D'Este & Neely, 2008, p. 16). One explanation might be the low WoS coverage of the journals in these disciplines (see Moed, 2005, p. 119) or that other types of research outputs (e.g., books and monographs) are significant in the scholarly communication (see below).

Recently, a pilot study reported that "bibliometrics are not sufficiently robust at this stage to be used formulaically or to replace expert review in the REF. However there is considerable scope for citation information to be used to inform expert review" (HEFCE, 2009a, p.3). Because the value of citations varies across disciplines and the main journal-based citation indexes (WoS and Scopus) may not be adequate for citation information in some subject areas, it is expected that citation data will be applied in "medicine, science and engineering panels", but not in "the arts, humanities and a number of other panels" (HEFCE, 2009b, p.3). A research report showed that although about "80% of journal articles submitted to the RAE 2001 could be found in the Web of Science" (Mahdi, D'Este & Neely, 2008, p. 9), this varies across disciplines and is much lower in many social sciences, arts and humanities units of assessment (e.g., 24% in law; 29% in arts and design; about 30% in theology divinity and religious studies and 39% in education). In fact, in the social sciences, arts and humanities, broader types of publications and sources of citation data may also be needed to identify research excellence. For instance, books and monographs are primary research outputs in the arts and humanities and in many social science disciplines (for reviews see: Glänzel & Schoepflin, 1999; Hicks, 2004; Nederhof, 2006; Huang & Chang, 2008), but seem less significant in many hard sciences. Moreover, the absence of most book citations in the WoS and Scopus (to be used in the next UK REF) for impact assessment of the social sciences, arts and humanities research has been discussed (e.g., Cronin, Snyder & Atkins, 1997; Hicks, 1999; Moed, 2005) and the need for a "Book Citation Index" has been claimed (Garfield, 1996), as well as counting library holdings as a way of estimating the reach of books (White, Boell, Yu et al., 2009). Moreover, it seems that it is difficult even for subject experts to evaluate the quality of books on a five-point scale because books tend to be much longer than journal articles and, although good academic book publishers may be widely recognised in a discipline, publisher reputation seems likely to be a weaker indicator of quality than journal reputation for academic articles. Taylor and Walker (2009) discussed that "given the time constrains facing panel members, it is obvious that not all publications could be considered in detail, and certainly not by more than one panel member in the majority of cases" (Taylor & Walker, 2009, p. 3). Hence it is hard to see how REF reviewers can fairly evaluate large numbers of books. For instance there were more than 14,000 monographs overall in the 2008 RAE, 14 per reviewer, but in book oriented disciplines there may be about 100 books per reviewer (e.g., there were 1,665 monographs for History, a panel with 17 members).

Given the apparent difficulty of the task of assessing books and the absence of a "comparable index for assessing the quality of books, chapters in books or other forms of publication" in the RAE (Taylor, 2010, in press, p. 6), the question is can the citation impact of books be assessed in any way to inform expert review? Our initial study showed that while 16.5% of the submissions to 67 units of assessment in the 2008 RAE were related to books (including authored and edited books and chapters), the proportion of book submissions in the 38 social sciences and arts & humanities disciplines was 31%. However, the percentage of book submissions varied from 1.3% in psychology to 68% in theology, divinity and religious studies (Appendix A). Furthermore, 12.4% of the submissions in the 38 social sciences, arts

and humanities disciplines were 'authored books' (excluding edited books and chapters), indicating that authored books (i.e., monographs) form significant portion of the research outputs and therefore new bibliometric indicators should be developed and evaluated for assessment in book-based disciplines (Table 1).

Previous studies have suggested that Google Scholar (e.g., Bar-Ilan, 2008; Bornmann, Marx, Schier et al., 2009; Franceschet, 2010; Kousha & Thelwall, 2008; Meho & Yang, 2007; Shaw & Vaughan, 2008) and Google Books (Kousha & Thelwall, 2009; Kousha, Thelwall & Rezaie, 2009) contain a wide range of publication types outside of WoS and Scopus and therefore might be potentially useful for impact assessment, especially outside of the hard sciences. The main objective of the current study is to assess the citation impact of books submitted to the 2008 RAE in seven selected book-oriented disciplines (see methods) based on additional web sources of citation data. For this purpose, we compared the citation counts to books from Google Scholar and Google Books with Scopus in archaeology, law, politics and international studies, philosophy, sociology, history, and communication, cultural and media studies by extending possible application of online citations to the REF social sciences and arts and humanities panels.

Research question

We compare Google Scholar and Google Book citations with Scopus citations to 1,000 sampled books submitted to the 2008 RAE in seven book-based disciplines. We do not assess the value of the citations but only whether they are sufficiently numerous to be an alternative or a compliment to traditional citation indexes. Google scholar is used because it encompasses a wide range of non-traditional academic sources and Google Books is used because it is logical to check books for citations to other books. We selected Scopus instead of WoS to compare conventional against web-extracted citations because 1) Scopus would be one of the key sources of citation data for the future Research Excellence Framework (see, HEFCE, 2009a) 2) it is also more comprehensive than WoS in terms of indexed peer-reviewed journal titles (about 17,000 vs. 10,000) and other types of publications, especially in social sciences and art & humanities (see, Scopus content coverage guide, 2010) and 3) it has an effective search option to locate citations to books in the references of journals and other publications. The 'Cited Reference Search' field in the WoS was problematic for locating exact citation counts, especially for books with very general titles. In fact, the WoS cited reference search does not display the full bibliographic information of cited work in the context of the reference section and hence it was not possible to manually check the accuracy of citation counts (e.g., citations to different editions of books). Moreover, we think that the large overlap in active journals between two citation databases (e.g., 84% of the WoS is indexed by Scopus) (see Gavel & Iselid, 2008, p.17) and strong correlation of impact indicators between the two databases (see, Archambault, Campbell, Gingras, & Larivière, 2009), suggest that the Scopus results in this study might also be helpful to estimate the value of WoS against Google Scholar and Google Books. The following research questions drive this research.

1. Is the number of Google Scholar and Google Book citations to the books submitted to 2008 RAE in book-based disciplines sufficiently numerous for research impact assessment? This is a heuristic evaluation but if these sources yielded enough citations to be approximately comparable to Scopus then they could claim to at least be an alternative to Scopus.
2. Do Google Books and Google Scholar citations to authored books correlate with Scopus citations (as one of the main sources of citation data in the REF) in book-based disciplines?

Methods

To answer the research questions, we first took a proportional random sample of 1,000 books submitted to the RAE 2008 from seven disciplines with a high number of book submissions (see Table 1). For Google Scholar, Google Books and Scopus citation counts, we searched the books titles (as phrase searches) and typically added the first author's name of all 1,000 books in each database to trace citations to the books (see below). We also manually checked the results to avoid false matches and duplicate citing sources and compared the number, percentage, mean and median of citation counts from above sources.

Research Population

In order to identify book-based disciplines to be sampled, we referred to the 2008 RAE website (http://www.rae.ac.uk) and downloaded all submission profiles in 67 units of assessments (UoA). We then used the "output type" label for each submission and manually recorded the number and percentage of the main submission types including authored books, edited books, chapters in books, journal articles, conference contributions and others (other types of submissions). Consequently, we calculated the proportion of each main type of submission for each unit of assessment (see Appendix A). As shown in Table 1, 16.5% of total submissions to all 67 units of assessments of 2008 RAE were book items (including authored books, edited books and chapters). However, there are obvious broad disciplinary differences in the extent of book submissions in 38 social sciences and arts and humanities compared to the 29 hard sciences. For instance, the proportion for all types book submissions was 31% in social sciences and arts and humanities subject areas, whereas this was much lower (1.2%) in the hard sciences. In contrast, the proportion of journal article submissions was 94% in the 29 hard science disciplines, but this was lower in the 38 social sciences and arts and humanities subject areas (about 58%). The primary results confirms previous findings that books and monographs are a major research communication platform in arts and humanities and in many social science disciplines (e.g., Glänzel & Schoepflin, 1999; Hicks, 2004; Nederhof, 2006; Huang & Chang, 2008), but less significant in many hard sciences and confirms the importance of examining new bibliometric measures for evaluating research in book-oriented disciplines (e.g., Kousha & Thelwall, 2009; White, Boell, Yu et al., 2009).

Table 1. Statistics for the main 2008 RAE submission types for the 67 units of assessment.

UoA	*Authr. book*	*Edit. book*	*Chap. in book*	*All book types*	*Jour. article*	*Conf. output*	*Other*	*Total*
	No. %	No. %	No. %	No. %	No. %	No. %	No. %	
SS, A&H* (38 UoA)	13,795 12.38%	2,915 2.62%	17,486 15.69%	34,196 30.68%	64,531 57.90%	1,510 1.35%	1,1216 10.06%	111,453
Science (29 UoA)	410 0.40%	59 0.06%	785 0.76%	1,254 1.22%	96,732 94.06%	2,467 2.40%	2,383 2.32%	102,836
Total (67 UoA)	14,205 6.63%	2974 1.39%	18,271 8.53%	35,450 16.54%	161,263 75.25%	3,977 1.86%	13,599 6.35%	214,289 100%

* Social sciences and arts & humanities

In order to study the citation impact of book-based disciplines, we selected seven major subject areas with a high percentage of 'authored book' submissions (excluding edited books and chapters). The two factors considered when selecting the book-based disciplines were: 1) at least 15% of submissions were 'authored books' 2) the selected areas were relatively representative of major social sciences and art & humanities subject areas. We selected seven

units of assessments to make the project manageable. For each selected units of assessment, we took a random sample approximately proportional to the total number of authored book submissions in each discipline. Our sample included 1,000 authored books from seven RAE 2008 units of assessment (Table 2).

Table 2. Statistics for the sampled authored books in seven units of assessments submitted to 2008 RAE.

Units of assessment	*Authored books*	*Sampled books*
Archaeology	376 (17.5%)	100
Law	996 (15.9%)	170
Politics and international studies	1,028 (21.8%)	170
Sociology	619 (16.6%)	160
Philosophy	326 (15.7%)	100
History	1,665 (23.9%)	200
Communication, cultural and media studies	410 (18.8%)	100
Total	**5,420**	**1000**

Google Books

Previous studies have shown that Google Books can be used for the impact assessment of academic articles and it produces more citations in social sciences and the humanities than the WoS, but less in most sciences (see Kousha & Thelwall, 2009; Kousha, Thelwall & Rezaie, 2010). In this study we used Google Books to assess the citation impact of 'authored books' rather than 'research articles'. Google Books (http://books.google.com) supports full text searching of its database and displays where the keywords occur in the matching texts. Hence, it is possible to search the bibliographic information of books and to locate citations in the full text of many digitised books.

To locate Google Books citations to authored books, we searched the titles of all 1,000 sampled books as phrase searches (e.g., "Political Leadership and the Northern Ireland Peace Process"). However, for books with very short or general titles, additional bibliographic information was added to the query such as the first author's name, publisher's name or publication year to reduce the number of false matches (e.g., "Political Constitutionalism" "Cambridge University Press" Bellamy 2007). Furthermore, sometimes we conducted several searches to get more accurate citation counts (e.g., omitting non-alphanumeric characters such as :, -, or / from book tiles). Another important task was to manually check the results with the Google Books 'preview' (of the whole book) or 'snippet view' (a few sentences displaying the search terms in context) to check for false matches and to check whether the bibliographic information of books had been mentioned as a citation, such as in a reference list or a footnote. Nevertheless, for 'no preview' books within the Google Books search results we couldn't find a practical method to manually check the citation motivations and therefore we excluded all such results from the citation counts. Although the manual checking was time-consuming, it was useful because in some cases we found bibliographic data that was not created for citation reasons, such as annotated bibliographies or advertisements for new or future publications - usually at the end of books.

Because in most cases we couldn't find the first author names in the RAE book submissions, we generally used Google Books itself and sometimes the Library of Congress Online Catalogue to locate first author names, after checking bibliographic information (e.g., ISBN, pages, co-authors etc.) against the original submissions in the RAE. Moreover, in some cases we found incorrect, incomplete or modified bibliographic information in RAE submissions

which were different from the original book titles, such as misspellings (e.g., "Marsilius of Padua and 'the Truth of History&#39") or slight modifications (e.g., using '&' instead of 'and' or '17th-century' instead of 'seventeenth-century' and vice versa). In such cases, we tried to identify the correct citation information and used it for all searches in Google Books, Google Scholar and Scopus.

Another important issue in the manual checking process was the existence of various editions of the same book. For instance, the book "Legal Problems of Credit and Security" by Royston Miles Goode has three different editions published in 1982 (133 pages), 1988 (218 pages) and 2003 (343 pages). Consequently, we found citations in the Google Books search results to different editions. However, the 2003 edition was submitted to 2008 RAE and as shown above it seems that there are significant changes in the 2003 edition based on additional page numbers. Thus, we decided to ignore citations counts to other editions (both 1982 and 1988) as irrelevant to the intellectual impact of the submitted research.

Note that since manual checking of citations from both Google Books and Google Scholar citations was very time consuming, two LIS master students were also consulted for two months (October –November 2010), after their participation in the tutorial for identifying accurate online citations.

Google Scholar

There is now a considerable body of research on comparisons between Google Scholar and conventional citation indexes (e.g., WoS and Scopus) for impact assessment in different subject areas (e.g., Bar-Ilan, 2008; Bornmann, Marx, Schier, Rahm, Thor, & Daniel, 2009; Franceschet, 2010; Harzing & van der Wal, 2009; Kousha & Thelwall, 2007; Kousha & Thelwall, 2008; Meho & Yang, 2007; Norris & Oppenheim, 2007; Shaw & Vaughan, 2008). The overall results indicate that Google Scholar indexes a wider range of publications (e.g., journal and conference papers, theses, preprint repositories) and typically gives higher citation counts than WoS or Scopus.

For Google Scholar searches we used a similar method to that explained above for Google Books. Thus, we again searched the exact titles of books as phrase searches and combined them with other bibliographic data such as first authors' names, publishers or publication years if necessary. We then recorded the number of Google Scholar citations by selecting the 'cited by' option below each displayed record. We did not consider the citation counts reported by Google Scholar, because in many cases it includes either duplicate citing items or false matches. For this reason we again manually checked the full text of open access citing documents through either "view as HTML" and "cached" options below some retrieved records or preprint/postprints links (e.g., "[PDF] from cornell.edu"). Otherwise, we followed the link in Google Scholar to the full-text of the citing documents through our institutional subscriptions to major journal publishers (e.g., Elsevier, Springer, Wiley, InformaWorld, Emerald, Sage, Oxford, JSTOR). Nevertheless, in some cases it was not possible to check the citations in the context of retrieved documents through these methods. Therefore, the only practical method was to recognise the formal citation reasons for using books based on brief textual information below each retrieved record in Google Scholar search results. Our initial observation revealed that if the citation information of a book appeared in brief records in bold and looked liked a cited reference (e.g., APA or Chicago citation styles), then it was likely to be a formal citation, otherwise it may be a false match. Moreover, in some cases there were citation counts from books (usually with [BOOK] at the beginning of the record). We checked such cases with our Google Books search results to avoid counting duplicate citations in two databases.

All Google Books, Google Scholar and Scopus Searches (see below) were conducted during two months (October –November 2010) consecutively for each book to lessen the potential impact of the time window on the citation counts.

Scopus Search

For Scopus citation searches, we searched the book titles as phrase searches in the reference source title field (REFTITLE). However, for general book titles we again used additional bibliographic information such as the first author's name or the publisher to generate more effective searches.

Results

Table 3 compares the number, mean and median of Google Books and Google Scholar with Scopus citations across seven book-based disciplines based upon the sample of 1,000 authored books submitted to 2008 RAE. It shows that Google Book and Google Scholar citations were 143% and 318% of Scopus citations respectively and therefore seem numerous enough to support the peer-review process for the social sciences, arts and humanities panels in the UK REF, perhaps in conjunction with additional citation information from Scopus.

Google Books vs. Scopus citations

The results indicate that Google Books has relatively good coverage of book sources for citation impact in book-based disciplines. Surprisingly, the median of the Google Books citations (not overlapping with Scopus citations) is more than double (median 9) the Scopus citations (median 4), suggesting that Google Book Search could be considered as the interesting source of citation impact for book-based disciplines in the REF, although follow up investigations would be needed for quality assessment of book citations. Moreover, the medians of the Google Books citations are much higher in three humanities panels, including law, history (both about three times higher than Scopus) and communication, cultural and media studies (about four times higher than Scopus). Thus, it seems that Google Book Search citations can be a complimentary impact source in book-oriented panels in the REF for expert peer-review, because Google Books citations are unique (citations from books to books) and cannot be detected using the main journal-based citation indexed (WoS and Scopus).

Most interestingly, in history the median number of Google Books citations (11.5) is higher than both Google Scholar (7) and Scopus (4) citations, suggesting that in some arts and humanities subject areas book citations are more significant than other sources of citations (e.g., journal and conference papers).

Appendix B reports the top five highly cited books in the 2008 RAE in the seven selected book-oriented disciplines based on Google Books Searches.

Google Scholar vs. Scopus citations

Table 3 also compares Google Scholar and Scopus citations of authored books submitted to 2008 RAE. It shows that Google Scholar citations were about 3.2 times more numerous than Scopus citations with a median of 13 whereas the Scopus median was 4, confirming previous studies (reviewed above) showing that Google Scholar is more comprehensive and includes broader types of citation data. Most notably, in communication, cultural and media studies and law the median citations for Google Scholar (5) was 4 times higher than the median of Scopus, suggesting that Google Scholar can be a helpful source of citation data especially when other types of non-journal publications are important for evaluating social science, arts and humanities research.

Note that since in most cases the distributions of citations are highly skewed, the median is reported to compare Google Books, Google Scholar and Scopus citations.

Table 3. Comparisons between Google Books, Google Scholar and Scopus Citation counts for authored books submitted to seven social sciences and humanities disciplines in the 2008 RAE.

Units of assessment	*No. of Sampled Books*	*Google Books Citations*		*Google Scholar Citations*		*Scopus Citations*
		No. Mean Median	*% of Scopus*	*No. Mean Median*	*% of Scopus*	*No. Mean Median*
Law	170	1,687 9.9 6	254.4%	2,838 16.7 8	428.1 %	663 3.9 2
History	200	3,723 18.6 11.5	281%	2,851 14.3 7	215.2%	1,325 6.6 4
Sociology	160	4,512 28.2 14	91.7%	15,648 97.8 37	318 %	4,920 30.8 11
Philosophy	100	1,668 16.7 9	115.1%	4,553 45.5 17	314.2%	1,449 14.5 6.5
Archaeology	100	1,225 12.3 6.5	174.3%	2,028 20.3 8	288.5%	703 7 3
Politics and International Studies	170	3,469 20.4 11	143.5%	8,267 48.6 20	341.9%	2,418 14.2 6
Communicati-on, Cultural and Media Studies	100	1,621 16.2 11.5	164.7%	3,548 35.5 16	360.6%	984 9.8 3
Total	**1000**	**17,905 17.9 9**	**143.7%**	**39,733 39.7 13**	**318.8%**	**12,462 12.5 4**

Patterns of Similarity

The correlation tests in Table 4 were performed for each unit of assessment using the individual sampled authored books submitted to the 2008 RAE as the data points. Spearman correlation tests were applied instead of Pearson because in all cases the frequency distributions of citations were highly skewed. As shown in Table 4, there is a significant correlation between the both Google Books and Google Scholar citation counts with Scopus citations in all of the subject areas studied ($p < 0.01$). The correlations are stronger between Google Scholar and Scopus citations and relatively weaker between Google Books and Scopus citations. One explanation might be that both Google Scholar and Scopus measure similar patterns of citation impact mostly based upon journal citation counts, whereas a weaker relationship is expected between Google Books and Scopus because they index completely different sources of citations: books vs. journals and conference papers. Furthermore, it seems reasonable that authored books with more citations from journals in the

Scopus database also received more citations from books indexed by Google Books. Hence, it suggests that both Google Books and Google Scholar citations measure a similar aspect of intellectual impact and can be used for monitoring research performance.

Table 4. Correlations between Google Books, Google Scholar and Scopus citation counts to authored books submitted to 2008 RAE for each studied discipline.

Units of assessment	*Sampled Books*	GB and Scopus	GS and Scopus	GB and GS
Law	170	0.616**	0.740**	0.746**
History	200	0.683**	0.778**	0.744**
Sociology	160	0.833**	0.944**	0.833**
Philosophy	100	0.726**	0.934**	0.771**
Archaeology	100	0.684**	0.793**	0.798**
Politics and International Studies	170	0.731**	0.873**	0.814**
Communication, Cultural and Media Studies	100	0.732**	0.791**	0.773**

** Significant at the p = 0.01 level.

Conclusions

The failure to use citation information to inform expert reviewers about the quality of research outputs in the REF in "the arts, humanities and a number of other panels" (see HEFCE, 2009b, p.3), may be a drawback in quality assessment of UK research because of the difficulty in reading and assessing large numbers of books. The challenge is that in arts and humanities and many social sciences subject areas books are a major research platform and therefore broader sources of citation information (e.g., citations from books to books) may also be required to effectively identify research excellence. Moreover, it seems that it is difficult for REF subject experts to score for the quality of books on a five-point scale because 1) our initial study revealed that the proportion for all types book submissions in 2008 RAE was 31% in 38 social sciences, arts and humanities units of assessment (Table 1) 2) In contrast to journal and conference papers, most books are much longer and it seems that it is much difficult for reviewers to evaluate the large numbers of books submitting to the REF based on peer-review (e.g., reading all contents). Table 5 reports the number of 'authored books' (excluding edited books and chapters) per panel member in the 2008 RAE.

Our study indicates that it may possible to use new bibliometric measures for evaluating research in book-oriented disciplines because there are substantial numbers of such citations and they are relatively easy to access. Most notably, the possibility to locate cited references in the large number of academic books through Google Books Searches has provided new opportunities to assess citations from books to books (but see the limitations below) that were not traceable before through common journal-based bibliometric tools (e.g., WoS and Scopus). These new online bibliometric tools and contents have provided the prospect to identify highly-cited books, inspired by Garfield's (1996) Book Citation Index.

Table 5. The proportion of 'authored books' per panel members in seven book-based units of assessment in the 2008 RAE.

Units of assessment	*Authored books*	*No. Panel members*	*Author. books per panel members*
Archaeology	376 (17.5%)	11	34
Law	996 (15.9%)	14	71
Politics and international studies	1,028 (21.8%)	16	64
Sociology	619 (16.6%)	16	38
Philosophy	326 (15.7%)	16	20
History	1,665 (23.9%)	17	97
Communication, cultural and media studies	410 (18.8%)	13	31
Total	**5,420**	**103**	**52**

In this study the results from Google Books and Google Scholar search citations were manually checked to assure that they were mentioned for citation reasons. This study has only used quantitative methods to assess book citations but follow-up studies of motivations for book citations are also needed to validate their use for research quality assessment. Another limitation is that the data had to be collected manually which makes large scale analyses impractical although it should still be cost-effective for the UK REF. The challenging issue for automatic extraction is the same as for bibliometrics: Data cleaning. For instance, the mean and median Google Book search citations were 28.3 and 17 but after manual checking they these numbers decreased to 17.9 and 9 respectively. Nevertheless, the unique content of Google Books (citations from books to books) for impact assessment of book-based disciplines over conventional citations indexes and better coverage of citation information for research assessment (median 9 for GB vs. 4 for Scopus) might be a motivating factor for the development of Garfield's (1996) Book Citation Index.

Finally, our study has implications for future UK research assessment policy. Since journal-based bibliometric indicators (WoS and Scopus) are inadequate for some units of assessment for research evaluation, broader types of publications and citation data are needed for measuring research performance in the UK. Thus, a future practical step would be developing and assessing methods for the automatic submission and checking of most or all UK research outputs in social sciences, arts and humanities to the Google Books API (http://code.google.com/apis/books) in order to avoid manual searching with a huge number of submissions.

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References

Archambault, É., Campbell, D., Gingras, Y. and Larivière, V. (2009). Comparing bibliometric statistics obtained from the Web of Science and Scopus. *Journal of the American Society for Information Science and Technology*. 60(7), 1320-1326.

Bar-Ilan, J. (2008). Which h-index? A comparison of WoS, Scopus and Google Scholar. *Scientometrics*, 74(2), 257-271.

Bence, V. & Oppenheim, C. (2004). The influence of peer review on the research assessment exercise. *Journal of Information Science*, 30(4), 347-368.

Bornmann, L., Marx, W., Schier, H., Rahm, E., Thor, A., & Daniel, H.-D. (2009). Convergent validity of bibliometric Google Scholar data in the field of chemistry citation counts for papers that were

accepted by Angewandte Chemie International Edition or rejected but published elsewhere, using Google Scholar, Science Citation Index, Scopus, and Chemical Abstracts. *Journal of Informetrics*, 3(1), 27-35.

Cronin, B., Snyder, H. & Atkins, H. (1997). Comparative citation rankings of authors in monographic and journal literature: A study of sociology. *Journal of Documentation*, 53(3), 263–273.

Franceschet, M. (2010). A comparison of bibliometric indicators for computer science scholars and journals on Web of Science and Google Scholar. *Scientometrics*, 83(1), 243-258.

Garfield, E. (1996). Citation Indexes for Retrieval and Research Evaluation. *Consensus Conference on the Theory and Practice of Research Assessment*, Capri.

Gavel Y. & Iselid, L. (2008). Web of Science and Scopus: A journal title overlap study. *Online Information Review*. 32(1), 8-21.

Glänzel, W. & Schoepflin, U. (1999). A bibliometric study of reference literature in the sciences and social sciences. *Information Processing & Management*, 35(1), 31-44.

Harzing, A.-W., & van der Wal, R. (2009). A Google Scholar h-index for journals: An alternative metric to measure journal impact in economics and business. Journal of the American Society for Information Science and Technology, 60(1), 41-46.

HEFCE (2009a). *Report on the pilot exercise to develop bibliometric indicators for the Research Excellence Framework*. Retrieved December 11, 2010 from: http://www.hefce.ac.uk/pubs/hefce/2009/09_39/09_39.pdf

HEFCE (2009b). *The Research Excellence Framework: A brief guide to the proposals*. Retrieved December 11, 2010 from: http://www.hefce.ac.uk/research/ref/resources/REFguide.pdf

Hicks, D. (1999). The difficulty of achieving full coverage of international social science literature and the bibliometric consequences. *Scientometrics*, 44(2), 193-215.

Hicks, D. (2004). The four literatures of social science. In H. Moed (Ed.), H*andbook of quantitative science and technology research* (pp. 476–496). Dordrecht, The Netherlands: Kluwer.

Huang, M. & Chang, Y. (2008). Characteristics of research output in social sciences and humanities: from a research evaluation perspective. *Journal of the American Society for Information Science and Technology*, 59(11), 1819-1828.

Li, J., Sanderson, M., Willett, P., Norris, M., & Oppenheim, C. (2010). Ranking of library and information science researchers: Comparison of data sources for correlating citation data, and expert judgments. *Journal of Informetrics*, 4(4), 554-563.

Korevaar, J. C., & Moed, H. F. (1996). Validation of bibliometric indicators in the field of mathematics. *Scientometrics*, 37(1), 117-130.

Kousha, K, Thelwall. M. & Rezaie, S. (2010). Using the web for research evaluation: The Integrated Online Impact indicator. *Journal of Informetrics*, 4(1), 124-135.

Kousha, K. & Thelwall, M. (2008). Sources of Google Scholar citations outside the Science Citation Index: a comparison between four science disciplines. Scientometrics, 74(2), 273-294.

Kousha, K. & Thelwall. M. (2009). Google Book Citation for Assessing Invisible Impact? *Journal of the American Society for Information Science and Technology*. 60(8), 1537-1549.

Mahdi, S., D'Este, P. & Neely, A. (2008). *Citation counts: Are they good predictors of RAE scores?* London: Advanced Institute of Management Research. Retrieved 6 Jan, 2011, from: http://ssrn.com/abstract=1154053

Meho, L. I. & Yang, K. (2007). Impact of data sources on citation counts and rankings of LIS faculty: Web of Science vs. Scopus and Google Scholar. Journal *of the American Society for Information Science and Technology*. 58(13), 2105-2125.

Moed, H. (2005). *Citation analysis in research evaluation*. New York: Springer.

Nederhof, A. (2006). Bibliometric monitoring of research performance in the social sciences and the humanities: A review. *Scientometrics*, 66(1), 81-100.

Norris, M. & Oppenheim, C. (2003). Citation counts and the Research Assessment Exercise V: archaeology and the 2001 RAE. *Journal of Documentation*, 59(6), 709-730.

Norris, M. & Oppenheim, C. (2007). Comparing alternatives to the Web of Science for coverage of the social sciences literature. *Journal of Informetrics*, 1(2), 161-69.

Oppenheim, C. (1995). The correlation between citation counts and the 1992 Research Assessment Exercise ratings for British Library and Information Science university departments. *Journal of Documentation*, 51(1), 18-27.

Oppenheim, C. (1997). The correlation between citation counts and the 1992 Research Assessment Exercise ratings for British research in genetics, anatomy and archaeology. *Journal of Documentation*, 53(5), 477-487.

Oppenheim, C. & Summers, M. (2008). Citation counts and the Research Assessment Exercise, part VI: Unit of assessment 67 (music). *Information Research*, 13(2). Retrieved 3 Jan, 2011 from: http://InformationR.net/ir/13-2/paper342.html

RAE 2008 guidance on submissions (2005). Retrieved December 25, 2010 from: http://www.rae.ac.uk/pubs/2005/03/rae0305.pdf

RAE 2008 panels. Retrieved December 19, 2010 from: http://www.rae.ac.uk/aboutus/panels.asp

Rinia, E. J., van Leeuwen, T. N., van Vuren, H. G., & van Raan, A. F. J. (1998). Comparative analysis of a set of bibliometric indicators and central peer review criteria: Evaluation of condensed matter physics in the Netherlands. *Research Policy*, 27(1), 95-107.

Scopus content coverage guide (2010). Retrieved December 1, 2010 from: http://www.info.sciverse.com/documents/files/scopus-training/resourcelibrary/pdf/sccg0510.pdf

Shaw, D. & Vaughan, L. (2008). A new look at evidence of scholarly citation in citation indexes and from web sources. *Scientometrics*, 74(2), 317-330.

Smith, A. & Eysenck, M. (2002). The correlation between RAE ratings and citation counts in psychology. June 2002. Retrieved January 6, 2011 from: http://cogprints.org/2749/1/citations.pdf

Taylor, J. (2010, in press). The Assessment of Research Quality: Peer Review or Metrics? *British Journal of Management*. DOI: 10.1111/j.1467-8551.2010.00722.x

Taylor, J. & Walker, I. (2009). *Peer assessment of research: how many publications per staff?* Lancaster University Management School, Working Paper 2009/035. http://eprints.lancs.ac.uk/31757/1/006236.pdf

van Raan, A. F. J. (2006). Comparison of Hirsch-index with standard bibliometric indicators and with peer judgment for 147 chemistry research groups. *Scientometrics*, 67(3), 491-502.

Warner, J. (2000). A critical review of the application of citation studies to the Research Assessment Exercises. *Journal of Information Science*, 26(6), 453-459.

White, H.D., Boell, S.K., Yu, H., Davis, M., Wilson, C.S., & Cole, F.T. (2009). Libcitations: A measure for comparative assessment of book publications in the humanities and social sciences. *Journal of the American Society for Information Science and Technology*, 60(6), 1083-1096.

Appendix A. Number and percentage for the main types of 2008 RAE submissions to the 67 units of assessment

See http://cybermetrics.wlv.ac.uk/paperdata/Book-BasedDisciplinesAppendix.docx

Appendix B. Top five highly cited books in 2008 RAE based on Google Books Searches

See http://cybermetrics.wlv.ac.uk/paperdata/Book-BasedDisciplinesAppendix.docx