

# **Open Access effect on uncitedness: A large-scale study controlling by discipline, source type and visibility**

Pablo Dorta-González \*

Universidad de Las Palmas de Gran Canaria, TiDES Research Institute, Campus de Tafira, 35017 Las Palmas de Gran Canaria, Spain. *E-mail:* pablo.dorta@ulpgc.es

\* Corresponding author

Rafael Suárez-Vega

Universidad de Las Palmas de Gran Canaria, TiDES Research Institute, Campus de Tafira, 35017 Las Palmas de Gran Canaria, Spain. *E-mail:* rafael.suarez@ulpgc.es

María Isabel Dorta-González

Universidad de La Laguna, Departamento de Ingeniería Informática y de Sistemas, Avenida Astrofísico Francisco Sánchez s/n, 38271 La Laguna, Spain. *E-mail:* isadorta@ull.es

## **Abstract**

There are many factors that affect the probability of being uncited during the first years after publication. In this study, we analyze three of these factors for journals, conference proceedings and book series: the field (in 316 subject categories of the Scopus database), the access modality (open access vs. paywalled), and the visibility of the source (through the percentile of the average impact in the subject category). We quantify the effect of these factors on the probability of being uncited. This probability is measured through the percentage of uncited documents in the serial sources of the Scopus database at about two years after publication. As a main result, we do not find any strong correlation between open access and uncitedness. Within the group of most cited journals (Q1 and top 10%), open access journals generally have somewhat lower uncited rates. However, in the

intermediate quartiles (Q2 and Q3) almost no differences are observed, while for Q4 the uncited rate is again somewhat lower in the case of the OA group. This is important because it provides new evidence in the debate about open access citation advantage.

*Keywords:* uncitedness ratio; uncited rate; open access; differences by field; CiteScore

## **1. Introduction**

Uncited research has received wide attention in the literature because of the relevance of the phenomenon of uncitedness to research policy. Some authors claim that uncited publications have no influence on future research and might be a waste of resources (Van Noorden, 2017). However, the phenomenon of uncitedness needs to be better understood and characterized before it can be used in an assessment of productivity.

Authors have focused on estimations of the frequency and characterization of uncited papers. Some authors have even used a control group of highly cited papers (Yamashita and Yoshinaga, 2014; Kamat, 2018). The measure of uncitedness has been recently reviewed by Nicolaisen and Frandsen (2019). It has been observed that the uncitedness ratio (the fraction of uncited papers in a collection) strongly depends on the observation time window, the discipline, and the document type (Van Leeuwen and Moed, 2005; Wallace, Larivière and Gingras, 2009; Thelwall, 2016).

Although citedness is typically the focus of bibliometric analyses, empirical studies are affected by uncited publications. Thelwall (2016) showed there was a correlation between the uncitedness ratio and the shape of the citation distribution. Some authors have provided uncited rates for journals with their impact factor, which is the mean number of citations per paper in the first two years after publication (Van Leeuwen and Moed, 2005; Hsu and Huang, 2012; Burrell, 2013; Egghe, 2013).

Uncitedness refers to the status of academic publications, authors or fields that do not receive any citation within a time window (Liang, Zhong and Rousseau, 2015). Consequently, the concept of uncitedness depends to a large extent on the length of the time window (Hu and Wu, 2014). However, the fact that a publication is currently uncited does not mean that it will never be cited (Van Raan, 2015; Ho and Hartley, 2017).

Uncitedness can be analyzed at author level. Using Nobel laureates and Fields medalists, Egghe, Guns and Rousseau (2011) found uncitedness rates of over 10%. Heneberg (2013), however, argued that the high uncited ratios were motivated by the inclusion of uncitable document types in the analyses and, focusing only on papers and reviews, reported uncited rates below 1%.

Uncitedness can also be analyzed at field level (Mavrogenis et al., 2018; Rosenkrantz, Chung and Duszak, 2018). Liang, Zhong and Rousseau (2015) found that low numbers of pages, references, and authors per paper were associated with uncitedness in library and information science. Lou and He (2015) found a weak negative correlation between affiliation reputation and uncitedness in six subject areas.

Previous studies have shown the need to analyze uncitedness with the inclusion of two explanatory factors: discipline and document typology. However, no studies have been published that analyze the possible influence on the uncited rate of access modality (open access (OA) and paywalled). Open access citedness has recently been studied in the case of journals (Dorta-González, González-Betancor and Dorta-González, 2017; Dorta-González and Santana-Jiménez, 2018; González-Betancor and Dorta-González, 2019). However, as previously stated, uncitedness is a different phenomenon that needs to be better understood and characterized before it can be used in an assessment of productivity.

With the above in mind, in this paper we conduct a large-scale analysis of the influence on the uncited rate of field, document type, access modality, and journal visibility. We use the percentage of uncited documents in a serial collection (journals, conference proceedings, and book series) as a better measure of the frequency of low-impact documents within that collection than the CiteScore ranking which measures the average impact of all published documents in the same collection.

## **2. Methodology**

The following information for each serial title (excluding trade journals as our interest is only the analysis of original research) was downloaded from the Scopus database (February 2020) to an Excel file: the number of documents published in the years 2015 to 2017, and the citations received by the same documents in the year 2018. The following variables were also obtained from this database:

- Source typology: Qualitative (journal, conference proceeding, book series)
- Access modality: Qualitative (OA, paywalled)
- Subject category: Qualitative (316 disciplines with 5 or more journals). Note that each serial title is in one or more discipline. The list of disciplines can be consulted in Appendix A.
- Subject area: Qualitative (27 in total). Note that each serial title is in one or more subject areas. The list of subject areas and their categories can be consulted in Appendix A.
- Branch of knowledge: Qualitative (Health Sciences; Life Sciences; Physical Sciences; Social Sciences & Humanities).
- CiteScore (citations per document): Continuous (range 0-160.19). CiteScore calculates the average number of citations received in a calendar year by all items published in a serial title in the preceding three years. In this study, CiteScore calculates the average number of citations received in year 2018 by all items published in that serial title in the years 2015, 2016, and 2017.
- Percentile in the subject category: Integer (range 0-99). The CiteScore percentile indicates the relative impact of a serial title in its subject category. Each subject category is divided into 100 equal-sized percentiles based on the number of serial titles, and a serial title is assigned to a percentile based on its CiteScore. For example, a serial title that has a CiteScore percentile of 90% is ranked according to CiteScore as higher than 90% of the serial titles within that category (i.e. in the top 10% of the subject category). Note that a percentile of 75% or above is considered as being in the first quartile (Q1), between 50% and 75% in the second quartile (Q2), between 25% and 50% in the third quartile (Q3), and below 25% in the fourth quartile (Q4).
- Uncited rate: Integer (range 0-100). This indicates the consistency with which the documents in a serial title are uncited. In the context of CiteScore, the uncited rate is the proportion of documents considered in the denominator of the CiteScore calculation that have not received any citations in the CiteScore numerator. Note that in the case of some documents three full years will have elapsed since publication whereas for others only one full year will have passed. Therefore, the uncited rate is a measure that corresponds on average to a date two years after publication.

### 3. Results

#### 3.1 Field and access modality effects for journals

The mean of the uncited rate for the 316 disciplines (Scopus subject categories) with five or more journals can be seen in Appendix A. This information is disaggregated by access modality (OA vs. paywalled). Note that there are no OA journals in 9 of the disciplines. In half of the disciplines, the average uncited rate for journals is higher than 47% at two years after publication (median = 47). The uncited rate ranges from a minimum value of 23% to a maximum of 89%. Although there is a high degree of variability in uncitedness (standard deviation = 11.87), the average uncited rate for journals is 48.96% at two years after publication (see Table 1). This same information but aggregated by subject area and access modality is shown in Figure 1.

[Figure 1 about here]

Journals with uncited rates below 25% are found in only two disciplines: Cellular and Molecular Neuroscience (23%) in the area of Neuroscience, and Catalysis (24%) in the area of Chemical Engineering. Most disciplines with lower uncitedness correspond to the branches of Life Sciences (especially in Chemistry and Materials) and Health Sciences. Of the 37 disciplines with ratios below 35%, 12 are in Biochemistry, Genetics and Molecular Biology; 9 in Neuroscience; 4 in Chemistry; 4 in Chemical Engineering; 3 in Immunology and Microbiology; 2 in Environmental Science; 1 in Materials Science; 1 in Medicine; and 1 in Pharmacology, Toxicology and Pharmaceutics.

Conversely, uncited rates above 85% are obtained in four disciplines in Arts and Humanities: Literature and Literary Theory (89%), Classics (87%), Visual Arts and Performing Arts (87%), and Religious Studies (85%). A total of 12 out of 14 disciplines in Arts and Humanities have uncitedness rates above 73%. The other two are History and Philosophy of Science (68%), and Arts and Humanities -miscellaneous- (52%). Above 70% there are only two disciplines from other areas: Pharmacology (81%) in Nursing, and Cultural Studies (78%) in Social Sciences.

The central tendency and variability measures for the average uncited rate, disaggregated by access modality, are shown in Table 1. In half of the 316 disciplines the average

uncited rate for OA journals is higher than 51% at two years after publication (median = 51). The uncited rate ranges from a minimum value of 18% to a maximum of 93%. Although there is a high degree of variability in uncitedness (standard deviation = 13.69), the average uncited rate for journals is 51.32% at two years after publication. In the case of paywalled journals, in half of the disciplines the average uncited rate for this type of access is higher than 46.5% at two years after publication. This is 4.5 percentage points less than the median in the case of OA journals. The uncited rate ranges from a minimum value of 23% to a maximum of 89%. This is 9 percentage points less in the variation range in comparison with the OA group. Although there is also a high degree of variability in uncitedness (standard deviation = 12.22), the average uncited rate for the paywalled journals is 48.57% at two years after publication. This is three percentage points below uncitedness in the OA group.

[Table 1 about here]

The distribution of the mean uncited rate in the disciplines is shown in Figure 2. The information is disaggregated by access modality. The box diagram shows for each access modality the atypical values, the maximum and minimum values, as well as the median and quartiles. The mean is also represented by a cross.

[Figure 2 about here]

As can be seen in Figure 2, the uncited rates in the group of OA journals are generally higher than those in the group of paywalled journals. This is because the boxes in the data distribution are slightly displaced upwards in the diagram. Both the median and the cross that represents the mean are also clearly higher in the case of OA journals. However, there are two outliers that correspond to disciplines in which the uncited rate is significantly lower in the case of OA journals compared to paywalled ones. These are the points represented at an uncited rate of around 20%: Cellular and Molecular Neuroscience in the area of Neuroscience, and Immunology and Microbiology -miscellaneous- in the area of Immunology and Microbiology. However, in the latter discipline there are only 5 journals, two of which are OA with an uncited rate of 18% in comparison with 60% for the three paywalled ones.

The differences between access modality by discipline can be seen much better in Figure 3. This representation shows the difference in the mean uncited rate (OA minus

paywalled) by discipline. Note that Appendix A also shows this difference with colors that represent the magnitude of the subtraction.

[Figure 3 about here]

In Figure 3, it can be observed that in a majority of the disciplines the uncited rate is higher in the group of OA journals (and therefore the subtraction is positive). Specifically, in 206 out of 316 disciplines, the difference is positive (65% of cases), which represents a greater proportion of cases in which the uncited rate is higher within OA journals. In another 93 of the 316 disciplines, the difference is negative (29% of cases), corresponding to those disciplines in which the uncited rate is higher in paywalled journals. In the other 17 disciplines, the uncited rate either coincides for the two access modalities or there is no OA journal with which to compare.

The maximum values for the difference in the positive sign group are around 25 percentage points, but this difference exceeds 20 percentage points in only 11 cases. These disciplines correspond to Arts and Humanities -miscellaneous- (27 points of difference for 20 OA journals), Periodontics (27 points for 5 OA journals), Logic (25 points and 3 OA journals), Tourism, Leisure and Hospitality Management (24 points for 14 OA journals), Environmental Chemistry (24 points for 8 OA journals), Life-span and Life-course Studies (24 points and 5 OA journals), Oral Surgery (23 points for 12 OA journals), Nursing -miscellaneous- (21 points but only 1 OA journal), Social Sciences -miscellaneous- (21 points for 35 OA journals), Numerical Analysis (20 points for 7 OA journals), and Developmental and Educational Psychology (20 points for 20 OA journals).

Although there is a smaller proportion of disciplines for which the uncited rate is higher within the paywalled group, and therefore the subtraction is negative, the magnitude of these differences is larger in some cases. In 11 disciplines the difference exceeds 20 percentage points, but note that in 5 of these cases the difference exceeds 30 percentage points, and even 40 points in 2 cases. However, the cases where this difference is greater corresponds to disciplines with few OA journals with which to compare (two or even only one). These disciplines are Immunology and Microbiology -miscellaneous- (42 points of difference for 2 OA journals), Podiatry (40 points but only 1 OA journal), Fundamentals and skills (32 points for only 1 OA journal), Maternity and Midwifery (31 points for 2 OA journals), Pharmacology, Toxicology and Pharmaceuticals -miscellaneous- (31 points

for 4 OA journals), Biochemistry, Genetics and Molecular Biology -miscellaneous- (22 points for 10 OA journals), Complementary and Alternative Medicine (21 points for 19 OA journals), Family Practice (21 points for 19 OA journals), Issues, Ethics and Legal Aspects (21 points for 4 OA journals), Statistical and Nonlinear Physics (21 points for 3 OA journals), and Small Animals (21 points of difference but for only one journal).

The above can be seen graphically in Figure 4. This box diagram shows the distribution for the difference of uncited rates for journals in the disciplines of Figure 3. It can be seen that the boxes are slightly displaced towards the positive part of the axis, with both the median and the mean clearly located above zero. Outliers correspond to the disciplines mentioned in the previous paragraph.

[Figure 4 about here]

### *3.2 Visibility and access effects for journals, conference proceedings and book series*

A box diagram for the distribution of uncited rate for journals by access modality and average impact ranking (CiteScore percentile) is shown in Figure 5. Although there are outliers in all quartiles, even within the group of journals located in the top 10% of the most cited, the following results and trends can be clearly observed. In general, the uncited rate decreases as journal average impact increases. As for access modality, when comparing journals of similar impact, the differences that were observed previously for aggregated data of visibility, are reduced. It even seems that the amplitude of the variation range excluding the outliers is somewhat less in the case of OA journals. Within the group of the most cited journals (Q1 and top 10%), OA journals generally have somewhat lower uncited rates. However, in the intermediate quartiles (Q2 and Q3) almost no differences are observed, while for Q4 the uncited rate is again somewhat lower in the case of the OA group.

[Figure 5 about here]

It is also surprising that within the group of top 10% of the most cited journals, some have uncited rates greater than 50% at two years after publication, and even 80% for some paywalled journals. These journals correspond to the field of Humanities as previously



indicated. In contrast, within the group of journals with the lowest average impact (Q4) some have uncited rates of less than 40%.

The box diagram for the distribution of uncited rates in the case of conference proceedings and book series is shown in Figure 6. Note that there are no OA conference proceedings. There is greater variability for the paywalled conference proceedings than in the case of journals. The uncited rate ranges from 5% to 100%, much wider than that observed in the case of journals (see Figure 2). In half of the proceedings, the uncited rate is greater than 60%. This is significantly higher than that obtained for journals, 45% and 50% for OA and paywalled, respectively (see Figure 2).

[Figure 6 about here]

In the case of book series, the first thing that stands out is a lower tail for the distribution which is much longer in the case of paywalled book series, indicating that, surprisingly, OA does not guarantee better visibility and impact. In general, OA books have higher uncited rates than paywalled ones.

Note that uncited rates for book series are much higher than for journals and conference proceedings. However, in the areas in which the use of books is most widespread as a channel of communication for the results of the research (Humanities), the maturation time of citations is much longer, and therefore a citation window of two years after publication may be too short to measure the real impact in the medium and long term. This is quite different to the case of journals where, in the vast majority of cases, the maximum citation distribution is attained between two and three years after publication.

A box diagram for the distribution of CiteScore for journals (by access modality and visibility) is shown in Figure 7. In this case, the outliers are not shown to allow better visualization of the vast majority of cases. It can be observed that in the group of journals with the greatest impact (Q1 and Top 10%) both the mean and the median are close between access modalities, although it is true that the upper tail is somewhat longer in the case of the paywalled journals. In the intermediate quartiles (Q2 and Q3) there are practically no differences in the measures of central tendency and variability, with no significant differences being observed between the two journal types. In contrast, within the group of journals with the lowest impact (Q4) the measures of central tendency are superior in the case of OA. This indicates that OA facilitates citations for journals with

worse visibility, which usually corresponds to those journals for which many institutions do not have a subscription.

[Figure 7 about here]

### *3.3 Correlation between uncited rate and average impact (CiteScore and Percentile) according to field and access modality*

A scatter plot between the uncited rate and the percentile is shown in Figure 8. Six disciplines (subject categories) with different document types are used as case studies. In the case of the journals, the four disciplines considered as case studies to analyze the possible correlation between uncited rate and percentile correspond to subject categories of very different sizes in terms of the number of journals, and from the four different branches of knowledge. These disciplines are: Medicine (A), with 202 journals from the Health Sciences; Plant Science (B), with 398 journals from the Life Sciences; Physics and Astronomy (C), with 41 journals from the Physical Sciences; and Economics and Econometrics (D), with 579 journals from the Social Sciences & Humanities.

[Figure 8 about here]

To analyze the correlation in the case of conference proceedings, the subject category Electrical and Electronic Engineering (E) was selected. This is an example of a discipline in which this means of scientific communication is widespread (39 proceedings). Finally, the discipline History (F) was selected to analyse the correlation in the book series typology. This is also an example of a discipline where this means of scientific communication is widespread (103 book series).

In the six case studies, a strong negative correlation was observed between the uncited rate and the percentile. The higher the percentile of the serial title, the lower the uncited rate. The correlation coefficient is close to 0.95 in the case of journals, 0.97 in the case of conference proceedings, and falls to 0.90 in the case of book series. In general, a greater dispersion in the points cloud (worse fit) is observed among the serial titles in the highest percentile (Q1).

Diagrams A, B and D show points of journals located in the first positions of the ranking by average impact (around 99th percentile) with uncited rates above 30%. This is due to

one or more punctual successes (papers abnormally highly cited) that considerably increase the average impact of that journal. Conversely, there are some journals in these disciplines in which most papers receive no citation (uncited rate of 100%) two years after publication. These cases correspond to the journals located in the first percentiles. Note that the correlation is practically linear, although the fit is somewhat improved with second degree polynomials, and in some cases with a third degree polynomial (see diagram D).

In the case of book series (Diagram F), the slope of the curve is less pronounced than in the case of journals and conference proceedings. The points cloud moves to the top of the quadrant. This means that in all cases except one, the book series in History show uncited rates above 50% two years after publication. However, as previously stated, in the area in which the use of books is most widespread (Humanities), the maturation time of citations is much longer and two years may be too short a time to measure the real impact in the medium and long term.

The scatter plot between uncited rate and percentile in the case of OA journals is shown in Appendix B (see Figure B.1). Note that there are no OA conference proceedings in Electrical and Electronic Engineering, and only two OA book series in History. For the journals, in these case studies no significant differences are observed in relation to the total group of journals. The only appreciable difference is that it improves the fit of the regression curve within the group of journals with the greatest impact (Q1).

A bubble diagram for the source size (total documents) in the same six disciplines used as case studies is shown in Figure 9. The size of the bubble is proportional to the number of published documents in the serial title, and the coordinates are the uncited rate and percentile. The size of the serial title does not appear to be influencing either the uncited rate or the percentile. Journals of similar size are distributed uniformly across the entire points cloud. There are specific cases of serial titles that are much larger than the average, but these cases appear in some disciplines at the top of the curve and in others at the bottom, and no trend can be concluded from the data in this regard.

[Figure 9 about here]

A scatter plot between the uncited rate and the CiteScore is shown in Figure 10. The same six disciplines are used as case studies. A strong non-linear relationship is observed. The

higher the average impact of the serial title, the lower the uncited rate. This has already been observed previously (see Figures 8 and 9). However, it can now be seen that this relationship is convex. This means that at the beginning of the curve (small CiteScore values), an increase in the number of citations (and therefore in the average impact) causes greater reductions in the uncited rate compared to the end of the curve (high CiteScore values). Furthermore, it is possible to observe the important differences that exist in the range of variation of the average impact in the serial titles (CiteScore). Most of the points present an average impact of less than 5 points in the case of journals, less than 2 points in the case of conference proceedings, and less than 0.5 points in the case of book series.

[Figure 10 about here]

Finally, the same scatter plot between uncited rate and CiteScore for the OA journals in the four disciplines used as case studies for journals is shown in Appendix B (see Figure B.2). Remember that there are no OA conference proceedings in Electrical and Electronic Engineering, and only two OA book series in History. However, no significant differences are observed (in relation to the shape of the regression curve) in these case studies with respect to the total group. The only appreciable difference is that it improves the fit of the curve within the group of journals with the greatest impact (at least in the case of Medicine and Plant Science).

## **Discussion and Conclusions**

The phenomenon of uncitedness is relevant in research policy. In the past, authors have focused on estimation of the frequency and the characterization of uncited documents. However, uncitedness needs to be better understood and characterized before it can be used in an assessment of productivity. With this in mind, we conducted a large-scale analysis of uncitedness focusing on the influence of field, document typology, access modality, and source visibility.

There is a high degree of variability in uncitedness for the case of journals, but in half of the 316 disciplines considered in the present study the average uncited rate is higher than 47% at two years after publication. The disciplines with the highest uncited rates correspond to Humanities, while the lowest uncitedness is observed in Life Sciences (especially in Chemistry and Materials) and Health Sciences. As for access modality, the

uncited rates in the group of OA journals are generally higher than those in the group of paywalled ones, at least when it is not distinguished by journal visibility. Specifically, in 65% of disciplines the uncited rate is higher within the OA journals, while in 29% of cases uncitedness is higher in the paywalled ones.

However, if disaggregated by journal visibility, the results are somewhat different. In general, the uncited rate decreases as journal average impact increases. Moreover, when comparing journals of similar impact, the differences that were observed previously for the aggregated data are reduced.

With respect to the correlation between uncitedness and the so-called “OA citation advantage”, some considerations can be made. We do not find any strong correlation between OA and uncitedness. This is important because it provides new evidence in the debate about OA citation advantage. Within the group of most cited journals (Q1 and top 10%), OA journals generally have somewhat lower uncited rates. This could be due to the OA citation advantage effect. Papers published in the most widely distributed journals receive more citations when they are published openly. This OA citation advantage effect would also reduce the uncited rate in this group of top journals. This is because a part of the papers that would not receive any citation within a paywalled journal could now receive some citations when they are distributed in OA.

Something similar is observed within the journals with lowest visibility. In the last quartile (Q4), uncitedness is again somewhat lower in the case of the OA journals. This group corresponds to those journals for which many institutions do not have a subscription, and therefore OA facilitates visibility and impact. Unfortunately, institutions that cannot maintain full subscriptions to publishers first drop the subscription to this group of least read and cited journals.

However, in the intermediate quartiles (Q2 and Q3) no differences are observed between access modalities in relation to the uncited rate. Within the group of journals in intermediate positions in the rankings by impact factor, there is no observed OA citation advantage, at least in relation to a possible reduction of the uncited rate. This seems to indicate that access modality is not a determining factor for reading a paper, at least in the group of journals with a medium perceived quality.

In the case of conference proceedings, in half of the cases uncitedness is greater than 60%, much higher than that obtained for journals. For book series, OA books generally have a higher uncited rate than paywalled ones. Therefore, the OA does not guarantee better visibility and impact in disciplines where book series are widespread. Furthermore, the uncited rates for book series are much higher than for journals and conference proceedings. However, in the area in which the use of books is most widespread as a means of communication for research results (Humanities), the maturation time of citations is much longer, and therefore the citation window of two years after publication may be too short a period to measure the real impact in the medium and long term.

Finally, after removing the field effect, a strong negative correlation is observed between the uncited rate and the average impact. The higher the percentile of the serial title, the lower the uncited rate. This correlation coefficient is close to 0.95 in the case of journals, 0.97 in the case of conference proceedings, and falls to 0.90 in the case of book series. In general, a greater dispersion in the points cloud, and therefore a worse fit, is observed among the serial titles in the highest percentiles (Q1). Moreover, there are no differences according to access modality or size of the serial title.

With respect to the quality of the database, Scopus is among the largest citation databases, with a wide global and regional coverage of scientific journals, conference proceedings, and books. A rigorous content selection has allowed Scopus to be used as a bibliometric data source for large-scale analyses in research assessments, research landscape studies, science policy evaluations, and university rankings (Baas et al., 2020).

In relation to possible biases in the dataset, the use of either Elsevier's Scopus and Thomson Reuters' Web of Science (WoS) for research evaluation may introduce biases that favor Natural Sciences and Engineering as well as Biomedical Research to the detriment of Social Sciences and Arts and Humanities (Mongeon and Paul-Hus, 2016). These considerations imply that our results should be used with caution.

Regarding possible applications, the uncited rate of a serial title (journals, conference proceedings and book series) can be used as a better measure of the frequency of low-impact documents within that title than an impact ranking that measures the average impact of all published documents in that title. This is especially relevant in the case of interdisciplinary journals (Hernández and Dorta-González, 2020).

## References

- Baas, J., Schotten, M., Plume, A., Côté, G., & Karimi, R. (2020). Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies. *Quantitative Science Studies*, 1(1), 377–386.
- Burrell, Q. L. (2013). A stochastic approach to the relation between the impact factor and the uncitedness factor. *Journal of Informetrics*, 7(3), 676–682.
- Dorta-González, P., González-Betancor, S. M., & Dorta-González, M.I. (2017). Reconsidering the gold open access citation advantage postulate in a multidisciplinary context: an analysis of the subject categories in the Web of Science database 2009-2014. *Scientometrics*, 112(2), 877–901.
- Dorta-González, P., & Santana-Jiménez, Y. (2018). Prevalence and citation advantage of gold open access in the subject areas of the Scopus database. *Research Evaluation*, 27(1), 1–15.
- Egghe, L. (2013). The functional relation between the impact factor and the uncitedness factor revisited. *Journal of Informetrics*, 7(1), 183–189.
- Egghe, L., Guns, R., & Rousseau, R. (2011). Thoughts on uncitedness: Nobel laureates and fields medalists as case studies. *Journal of the American Society for Information Science and Technology*, 62(8), 1637–1644.
- González-Betancor, S. M., & Dorta-González, P. (2019). Publication modalities ‘article in press’ and ‘open access’ in relation to journal average citation. *Scientometrics*, 120(3), 1209–1223.
- Heneberg, P. (2013). Supposedly uncited articles of Nobel laureates and Fields medalists can be prevalently attributed to the errors of omission and commission. *Journal of the American Society for Information Science and Technology*, 64(3), 448–454.
- Hernández, J. M., & Dorta-González, P. (2020). Interdisciplinarity metric based on the co-citation network. *Mathematics*, 8(4), 544.
- Ho, Y. S., & Hartley, J. (2017). Sleeping beauties in psychology. *Scientometrics*, 110(1), 301–305.
- Hsu, J. W., & Huang, D. W. (2012). A scaling between impact factor and uncitedness. *Physica A: Statistical Mechanics and its Applications*, 391(5), 2129–2134.
- Hu, Z., & Wu, Y. (2014). Regularity in the time-dependent distribution of the percentage of never-cited papers: An empirical pilot study based on the six journals. *Journal of Informetrics*, 8(1), 136–146.
- Kamat, P. V. (2018). Most cited versus uncited papers. What do they tell us? *ACS Energy Letters*, 3(9), 2134–2135.
- Liang, L., Zhong, Z., & Rousseau, R. (2015). Uncited papers, uncited authors and uncited topics: A case study in library and information science. *Journal of Informetrics*, 9(1), 50–58.

- Lou, W., & He, J. (2015). Does author affiliation reputation affect uncitedness? *Proceedings of the Association for Information Science and Technology*, 52(1), 1–4.
- Mavrogenis, A. F., Quaile, A., Pećina, M., & Scarlat, M. M. (2018). Citations, non-citations and visibility of International Orthopaedics in 2017. *International Orthopaedics*, 42(11), 2499–2505.
- Mongeon, P., & Paul-Hus, A. (2016). The journal coverage of Web of Science and Scopus: a comparative analysis. *Scientometrics*, 106(1), 213–228.
- Nicolaisen, J., & Frandsen, T. F. (2019). Zero Impact: a large-scale study of uncitedness. *Scientometrics*, 119 (2), 1227–1254.
- Rosenkrantz, A. B., Chung, R., & Duszak, R. (2019). Uncited research articles in popular United States general radiology journals. *Academic Radiology*, 26(2), 282–285
- Thelwall, M. (2016). Are there too many uncited articles? Zero inflated variants of the discretised lognormal and hooked power law distributions. *Journal of Informetrics*, 10(2), 622–633.
- Van Leeuwen, T. N., & Moed, H. F. (2005). Characteristics of journal impact factors: The effects of uncitedness and citation distribution on the understanding of journal impact factors. *Scientometrics*, 63(2), 357–371.
- Van Noorden, R. (2017). The science that's never been cited. *Nature*, 552, 162–164.
- Van Raan, A. F. (2015). Dormitory of physical and engineering sciences: Sleeping beauties may be sleeping innovations. *PLoS ONE*, 10(10), e0139786.
- Wallace, M.L., Larivière, V., & Gingras, Y. (2009). Modeling a century of citation distributions. *Journal of Informetrics*, 3(4), 296–303.
- Yamashita, Y., & Yoshinaga, D. (2014). Influence of researchers' international mobilities on publication: A comparison of highly cited and uncited papers. *Scientometrics*, 101(2), 1475–1489.



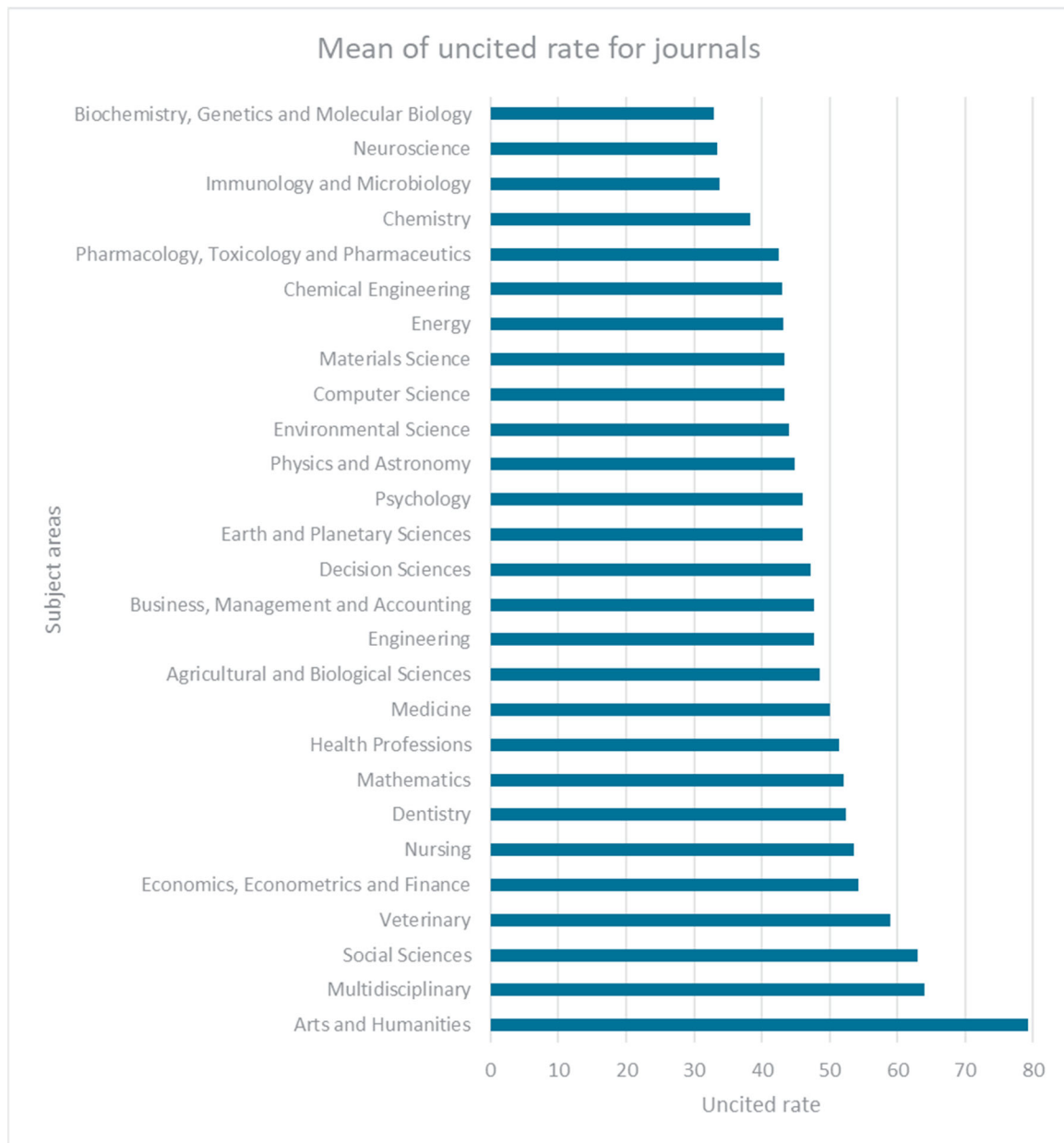


Figure 1: Mean of uncited rate for journals by subject area

Table 1: Central tendency and variability measures for the average uncited rate by access modality

	<i>OA Journals</i>	<i>Paywalled Journals</i>	<i>All Journals</i>
Median	51	46	47
Mean	51.32	48.57	48.96
Standard Deviation	13.69	12.22	11.87
Minimum	18	23	23
Maximum	93	89	89
Range of variation	75	66	66
Asymmetry coefficient	0.544	0.840	0.835
Kurtosis	0.593	0.879	1.049

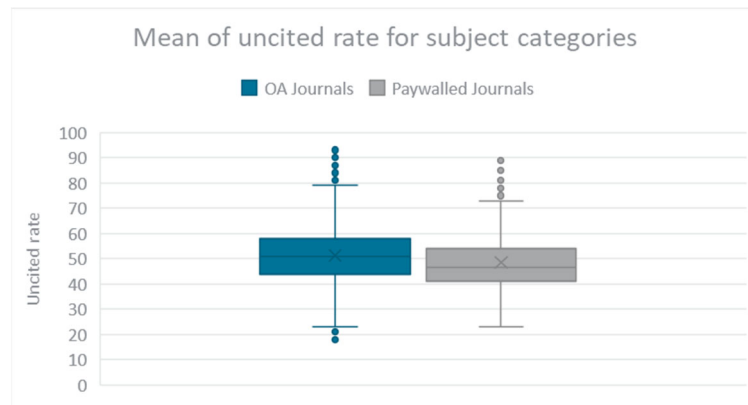


Figure 2: Distribution of mean uncited rate for subject categories by access modality

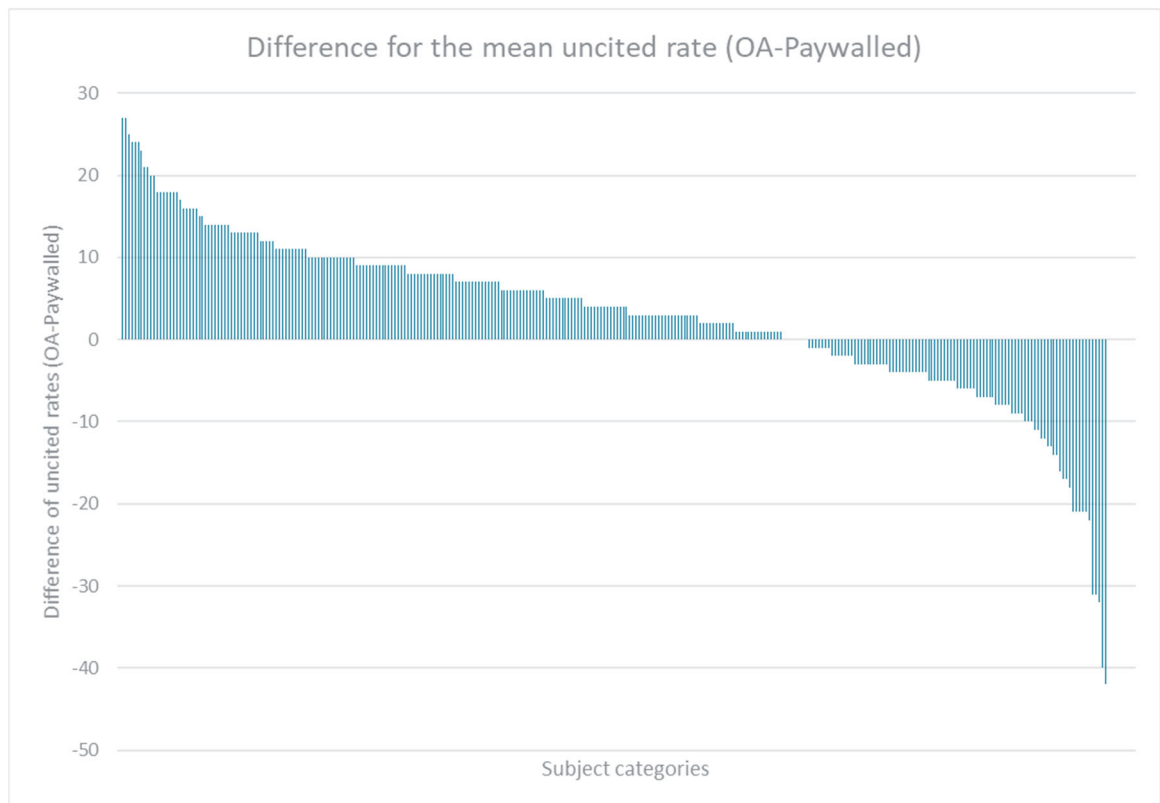


Figure 3: Difference in the mean uncited rate (OA - Paywalled) in journals by subject category

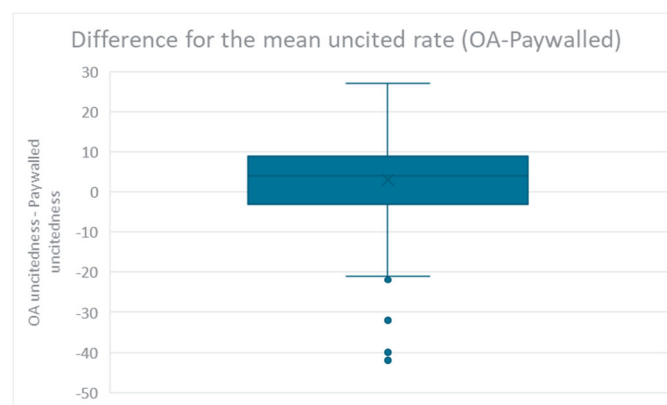


Figure 4: Distribution for the difference of mean uncited rates for journals by subject category

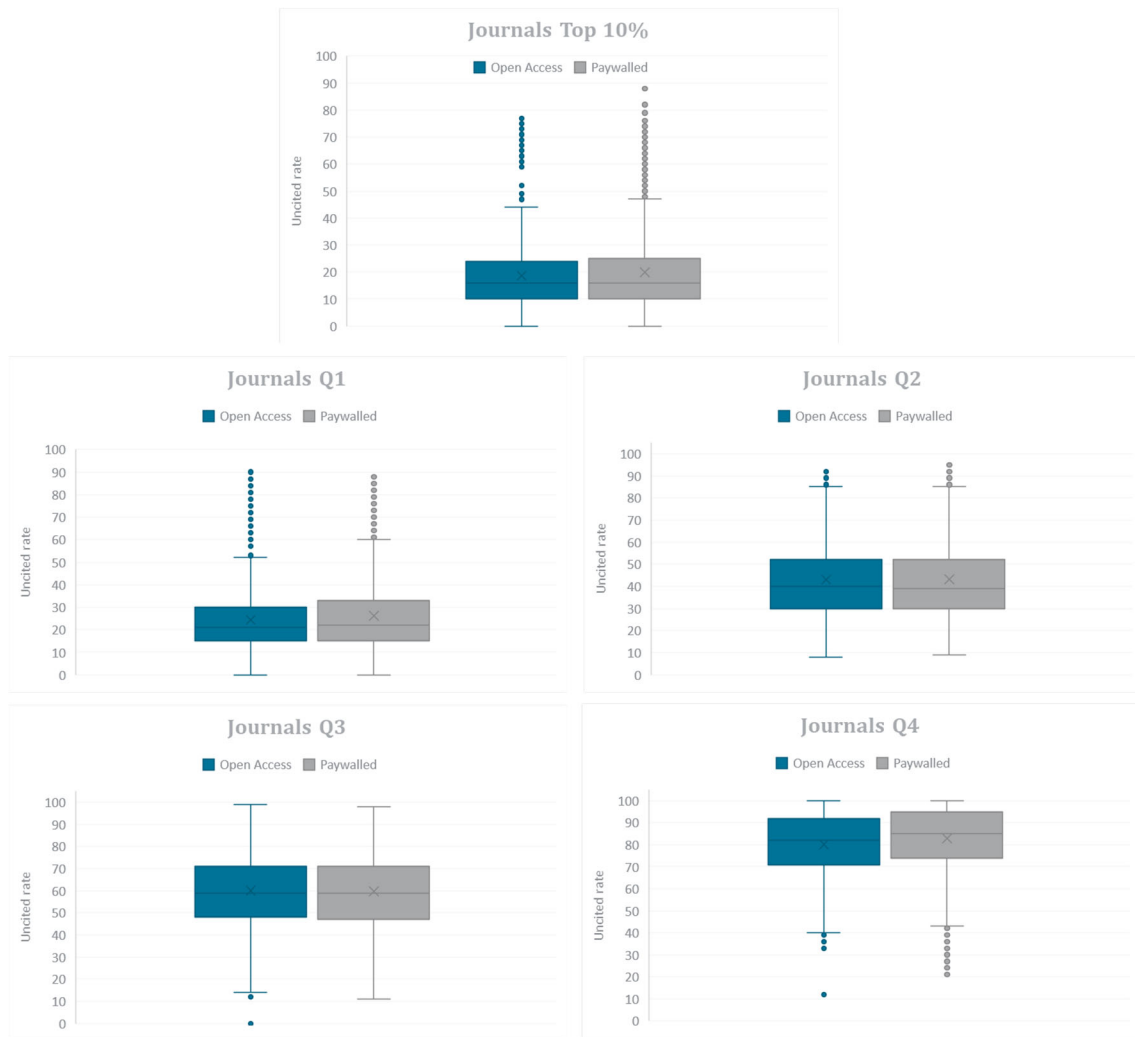


Figure 5: Box diagram for the distribution of the uncited rate for journals by access modality and average impact ranking (CiteScore)

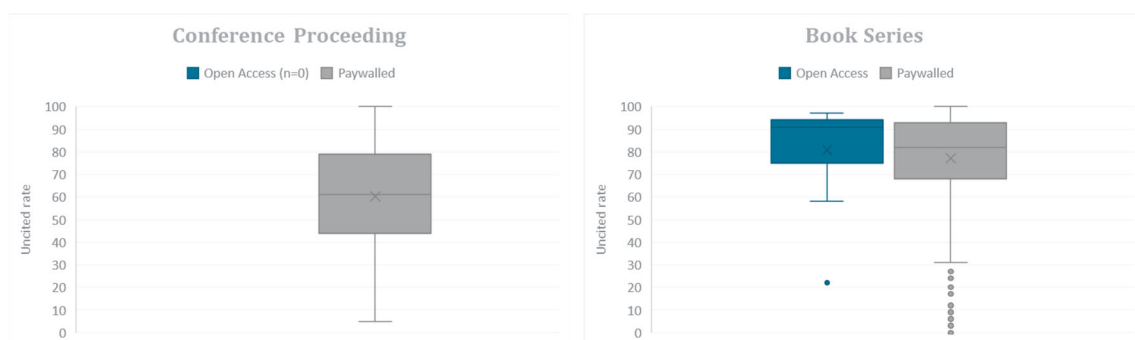


Figure 6: Box diagram for the distribution of the uncited rate for conference proceedings and book series by access modality

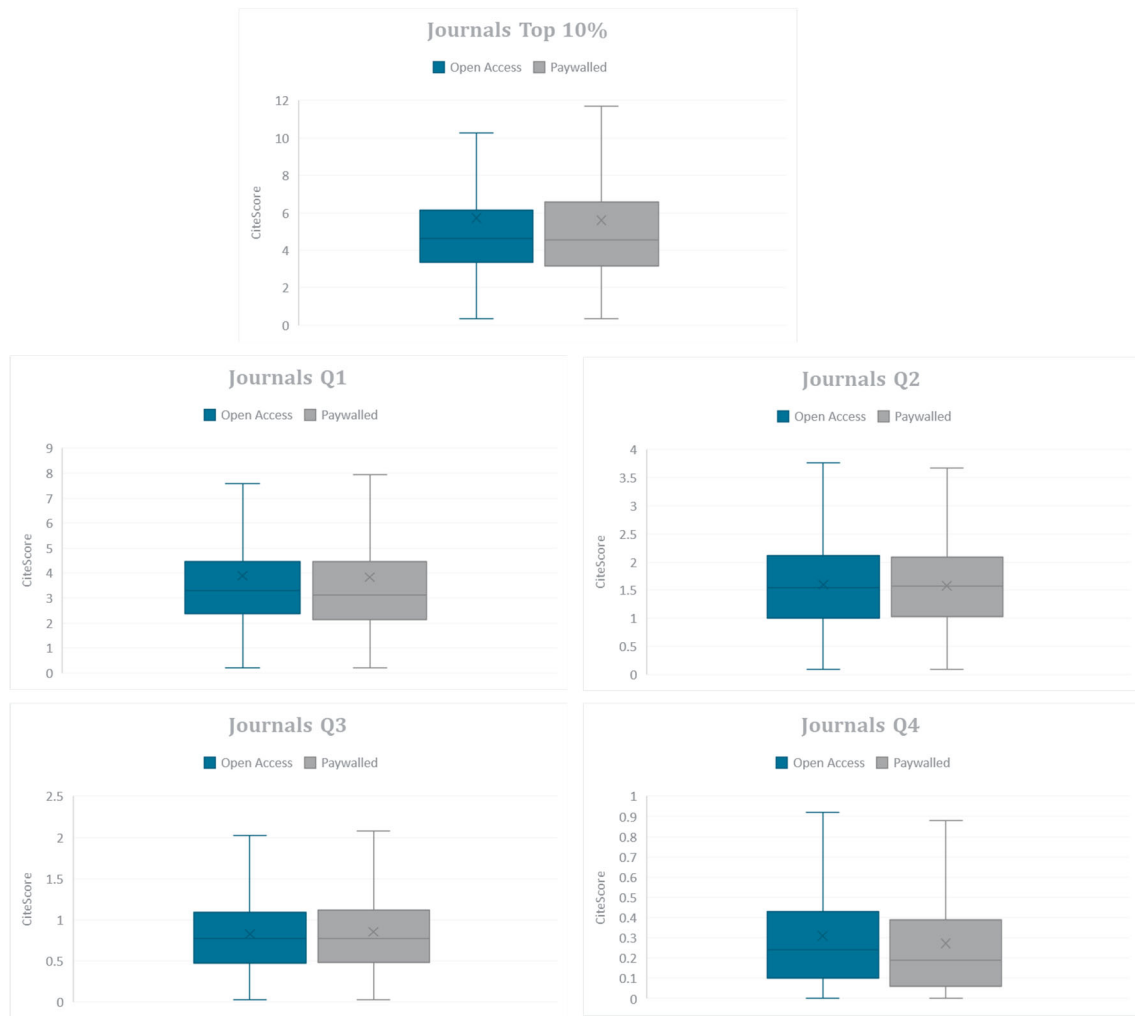


Figure 7: Box diagram for the distribution of CiteScore for journals by access modality and average impact ranking (outliers are not shown to allow better visualization of the vast majority of cases)

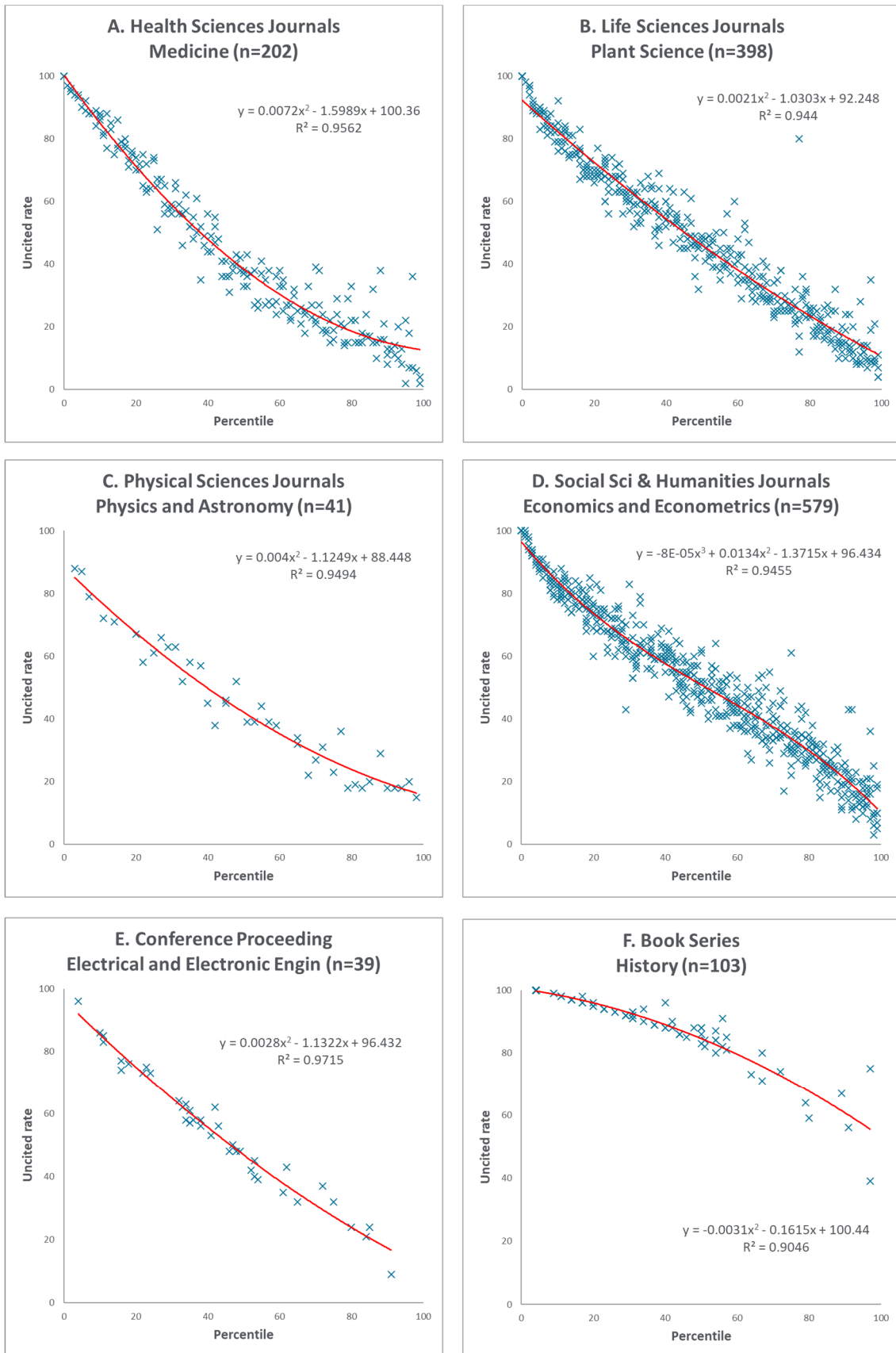


Figure 8: Scatter plot between the uncited rate and percentile in six subject categories

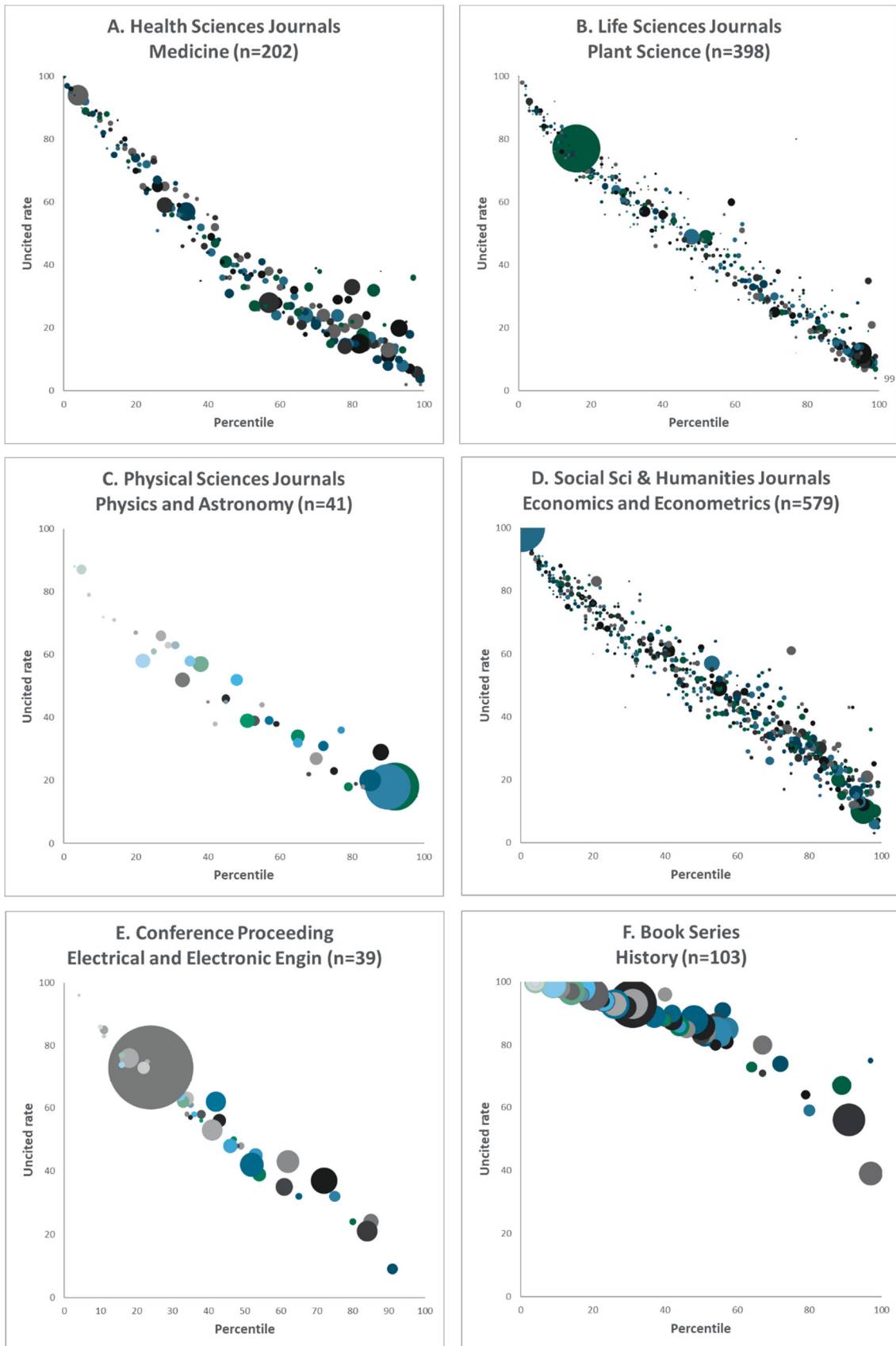


Figure 9: Bubble diagram for the source size (total documents) in six subject categories. The size of the bubble is proportional to the number of published documents in the serial title, and the coordinates are the uncited rate and percentile

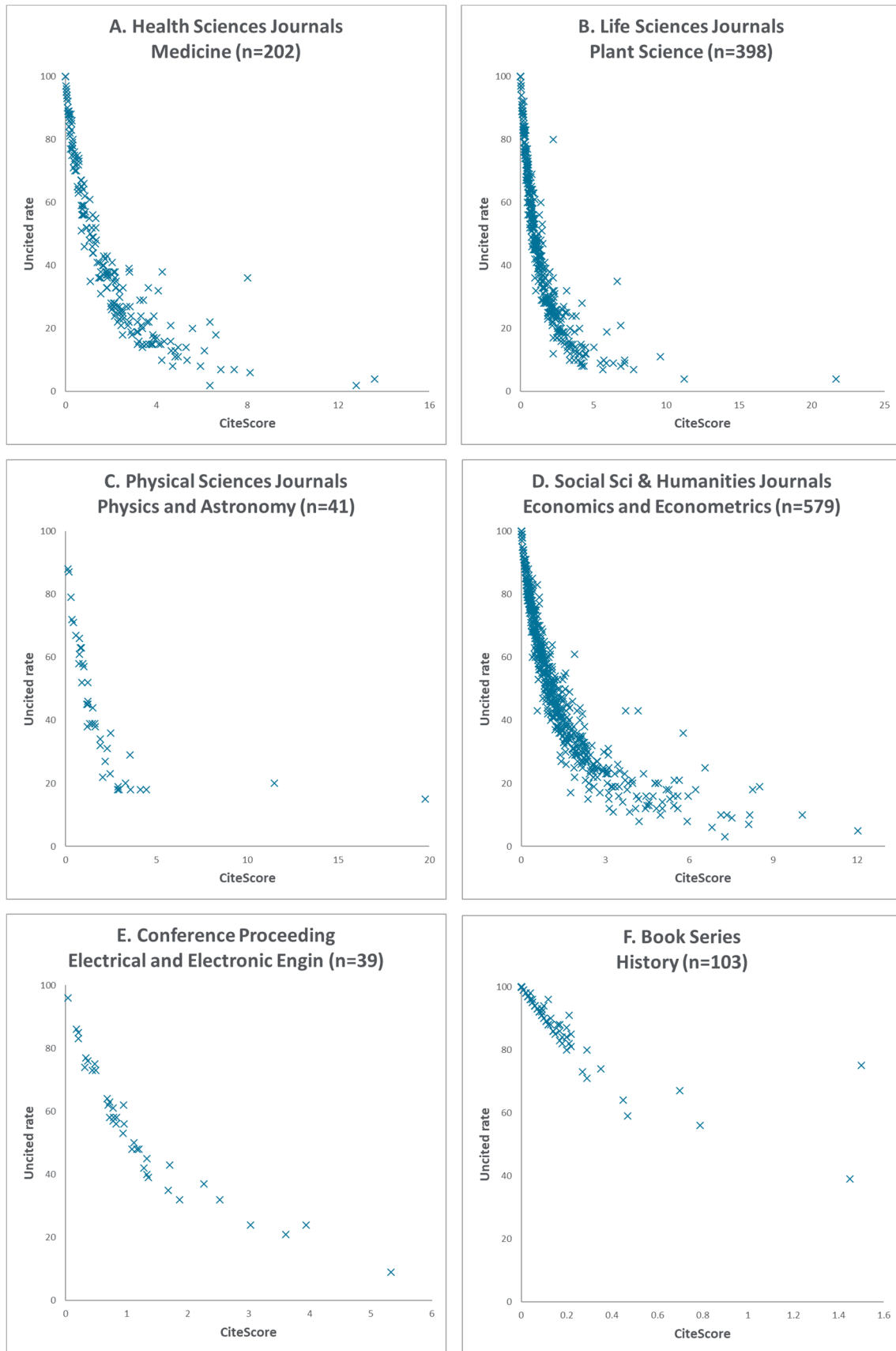


Figure 10: Scatter plot between uncited rate and CiteScore in six subject categories



**Appendix A: Mean uncited rate for OA and paywalled journals by subject area and category**

Scopus Subject Area	Scopus Subject Category	Mean of Uncited Rate for Journals						Difference OA-Paywalled
		Total Group	N	OA Group	N	Paywalled Group	N	
Agricultural and Biological Sciences	General Agricultural and Biological Sciences	56	177	55	79	57	98	-2
	Agricultural and Biological Sciences (miscellaneous)	51	60	52	22	50	38	2
	Agronomy and Crop Science	51	317	55	105	48	212	7
	Animal Science and Zoology	52	380	57	133	50	247	7
	Aquatic Science	43	197	48	48	42	149	6
	Ecology, Evolution, Behavior and Systematics	45	577	48	143	44	434	4
	Food Science	46	266	48	77	46	189	2
	Forestry	52	132	53	50	52	82	1
	Horticulture	52	74	59	26	49	48	10
	Insect Science	51	138	55	36	50	102	5
	Plant Science	48	398	53	128	46	270	7
	Soil Science	45	114	55	39	40	75	15
Arts and Humanities	General Arts and Humanities	84	123	87	34	83	89	4
	Arts and Humanities (miscellaneous)	52	256	77	20	50	236	27
	History	81	1018	87	154	80	864	7
	Language and Linguistics	74	656	84	161	71	495	13
	Archaeology	73	473	78	90	72	383	6
	Classics	87	90	93	13	86	77	7
	Conservation	78	63	75	19	80	44	-5
	History and Philosophy of Science	68	127	78	18	66	109	12
	Literature and Literary Theory	89	702	90	101	89	601	1
	Museology	80	42	82	9	80	33	2
	Music	83	120	91	14	82	106	9
	Philosophy	77	511	86	96	75	415	11
	Religious studies	85	398	88	45	85	353	3
	Visual Arts and Performing Arts	87	417	92	46	87	371	5
Biochemistry, Genetics and Molecular Biology	General Biochemistry, Genetics and Molecular Biology	44	183	44	79	44	104	0
	Biochemistry, Genetics and Molecular Biology (miscellaneous)	39	20	28	10	50	10	-22
	Ageing	29	29	25	7	30	22	-5
	Biochemistry	32	392	36	100	30	292	6
	Biophysics	38	122	47	25	36	97	11
	Biotechnology	40	246	42	75	39	171	3
	Cancer Research	31	187	26	43	32	144	-6
	Cell Biology	28	263	26	62	29	201	-3
	Clinical Biochemistry	35	112	31	25	35	87	-4
	Developmental Biology	28	76	26	19	28	57	-2
	Endocrinology	33	117	45	28	29	89	16
	Genetics	32	315	30	87	33	228	-3
	Molecular Biology	29	371	29	102	29	269	0
	Molecular Medicine	30	159	28	42	31	117	-3
	Physiology	32	164	35	28	31	136	4
	Structural Biology	33	46	27	10	35	36	-8
Business, Management and Accounting	General Business, Management and Accounting	52	169	58	24	51	145	7
	Business, Management and Accounting (miscellaneous)	48	71	52	6	48	65	4
	Accounting	46	131	62	12	45	119	17

	Business and International Management	51	323	57	39	50	284	7
	Management Information Systems	44	76	53	5	43	71	10
	Management of Technology and Innovation	45	187	57	18	44	169	13
	Marketing	43	147	59	16	41	131	18
	Organizational Behavior and Human Resource Management	47	180	58	23	46	157	12
	Strategy and Management	48	383	53	46	47	337	6
	Tourism, Leisure and Hospitality Management	43	99	64	14	40	85	24
	Industrial relations	54	49	59	8	54	41	5
Chemical Engineering	General Chemical Engineering	44	257	47	50	44	207	3
	Bioengineering	35	131	39	26	33	105	6
	Catalysis	24	48	32	6	23	42	9
	Chemical Health and Safety	28	21	32	6	26	15	6
	Filtration and Separation	31	10	36	4	28	6	8
	Fluid Flow and Transfer Processes	45	123	45	29	44	94	1
Chemistry	General Chemistry	43	332	51	63	41	269	10
	Chemistry (miscellaneous)	37	23	34	6	39	17	-5
	Analytical Chemistry	34	100	45	17	31	83	14
	Electrochemistry	34	30	44	5	32	25	12
	Inorganic Chemistry	37	64	45	7	36	57	9
	Organic Chemistry	34	159	44	21	33	138	11
Computer Science	Spectroscopy	35	62	45	8	33	54	12
	General Computer Science	50	180	52	54	49	126	3
	Computer Science (miscellaneous)	51	45	46	14	53	31	-7
	Artificial Intelligence	40	171	48	29	39	142	9
	Computational Theory and Mathematics	45	110	53	16	44	94	9
	Computer Graphics and Computer-Aided Design	43	65	44	10	43	55	1
	Computer Networks and Communications	46	246	48	51	45	195	3
	Computer Science Applications	43	528	46	103	42	425	4
	Computer Vision and Pattern Recognition	42	70	51	11	40	59	11
	Hardware and Architecture	42	132	45	17	42	115	3
	Human-Computer Interaction	40	86	55	14	37	72	18
	Information Systems	44	253	52	44	42	209	10
	Signal Processing	40	87	51	22	37	65	14
	Software	41	311	54	30	39	281	15
Decision Sciences	General Decision Sciences	38	28	46	3	37	25	9
	Decision Sciences (miscellaneous)	46	6		0	46	6	-46
	Information Systems and Management	47	88	56	12	46	76	10
	Management Science and Operations Research	45	145	53	18	44	127	9
	Statistics, Probability and Uncertainty	52	120	54	19	51	101	3
Dentistry	General Dentistry	53	110	58	44	50	66	8
	Dentistry (miscellaneous)	52	15	60	8	42	7	18
	Oral Surgery	53	46	70	12	47	34	23
	Orthodontics	60	18	58	6	61	12	-3
	Periodontics	42	21	63	5	36	16	27
Earth and Planetary Sciences	General Earth and Planetary Sciences	53	170	49	60	55	110	-6
	Earth and Planetary Sciences (miscellaneous)	46	84	47	22	46	62	1
	Atmospheric Science	38	106	40	34	37	72	3
	Computers in Earth Sciences	41	30	46	10	38	20	8
	Earth-Surface Processes	51	127	53	33	51	94	2

	Economic Geology	47	30	57	7	44	23	13
	Geochemistry and Petrology	38	111	41	19	38	92	3
	Geology	48	205	54	57	46	148	8
	Geophysics	44	98	50	23	42	75	8
	Geotechnical Engineering and Engineering Geology	48	154	48	30	47	124	1
	Oceanography	45	111	47	27	44	84	3
	Paleontology	49	88	52	26	47	62	5
	Space and Planetary Science	39	79	38	11	40	68	-2
	Stratigraphy	46	34	49	14	44	20	5
Economics, Econometrics and Finance	General Economics, Econometrics and Finance	63	196	66	52	62	144	4
	Economics, Econometrics and Finance (miscellaneous)	56	96	60	23	55	73	5
	Economics and Econometrics	52	579	61	62	51	517	10
	Finance	52	244	62	29	51	215	11
Energy	General Energy	48	61	43	11	48	50	-5
	Energy (miscellaneous)	43	19	50	6	39	13	11
	Energy Engineering and Power Technology	44	163	40	28	44	135	-4
	Fuel Technology	41	81	36	15	43	66	-7
	Nuclear Energy and Engineering	53	57	51	9	54	48	-3
	Renewable Energy, Sustainability and the Environment	38	148	37	34	38	114	-1
Engineering	General Engineering	55	252	53	65	56	187	-3
	Engineering (miscellaneous)	52	51	47	12	53	39	-6
	Aerospace Engineering	48	107	54	19	47	88	7
	Automotive Engineering	52	76	59	22	49	54	10
	Biomedical Engineering	38	196	35	46	39	150	-4
	Civil and Structural Engineering	45	260	50	57	45	203	5
	Computational Mechanics	47	56	54	15	45	41	9
	Control and Systems Engineering	42	212	52	34	40	178	12
	Electrical and Electronic Engineering	47	569	52	84	46	485	6
	Industrial and Manufacturing Engineering	47	769	50	125	46	644	4
	Mechanics of Materials	44	327	51	48	43	279	8
	Ocean Engineering	51	80	47	16	52	64	-5
	Safety, Risk, Reliability and Quality	50	139	54	18	50	121	4
	Media Technology	61	46	65	5	60	41	5
	Building and Construction	47	144	58	25	45	119	13
	Architecture	73	104	74	27	73	77	1
Environmental Science	General Environmental Science	48	180	56	41	46	139	10
	Environmental Science (miscellaneous)	45	68	48	19	44	49	4
	Ecological Modelling	36	29	33	9	37	20	-4
	Ecology	47	325	52	100	45	225	7
	Environmental Chemistry	30	95	52	8	28	87	24
	Environmental Engineering	42	114	47	24	41	90	6
	Global and Planetary Change	35	67	37	18	34	49	3
	Health, Toxicology and Mutagenesis	37	113	35	30	38	83	-3
	Management, Monitoring, Policy and Law	45	273	46	59	45	214	1
	Nature and Landscape Conservation	48	136	46	46	49	90	-3
	Pollution	42	105	47	16	41	89	6
	Waste Management and Disposal	44	87	48	21	43	66	5

	Water Science and Technology	48	192	43	43	49	149	-6
Health Professions	Health Professions (miscellaneous)	56	16	65	2	55	14	10
	Chiropractics	54	5		0	54	5	-54
	Complementary and Manual Therapy	64	13	50	1	66	12	-16
	Health Information Management	44	24	39	8	47	16	-8
	Medical Laboratory Technology	53	27	51	5	54	22	-3
	Occupational Therapy	54	15	58	2	54	13	4
	Optometry	54	8	43	1	55	7	-12
	Pharmacy	65	23	57	6	68	17	-11
	Physical Therapy, Sports Therapy and Rehabilitation	51	176	53	49	51	127	2
	Podiatry	64	6	31	1	71	5	-40
	Radiological and Ultrasound Technology	43	46	44	13	43	33	1
	Speech and Hearing	49	53	55	6	49	47	6
	General Immunology and Microbiology	34	41	35	14	33	27	2
Immunology and Microbiology	Immunology and Microbiology (miscellaneous)	43	5	18	2	60	3	-42
	Applied Microbiology and Biotechnology	38	98	35	22	39	76	-4
	Immunology	31	197	32	52	31	145	1
	Microbiology	32	138	34	40	31	98	3
	Parasitology	37	61	34	29	39	32	-5
	Virology	36	65	26	19	40	46	-14
Materials Science	General Materials Science	43	388	47	65	42	323	5
	Materials Science (miscellaneous)	52	69	46	24	55	45	-9
	Biomaterials	30	80	33	17	29	63	4
	Ceramics and Composites	42	94	42	17	42	77	0
	Electronic, Optical and Magnetic Materials	42	204	44	38	41	166	3
	Materials Chemistry	44	248	50	23	43	225	7
	Metals and Alloys	52	134	49	23	53	111	-4
	Polymers and Plastics	42	126	48	12	42	114	6
	Surfaces, Coatings and Films	43	105	43	18	43	87	0
Mathematics	General Mathematics	61	319	68	64	59	255	9
	Mathematics (miscellaneous)	59	38	71	8	55	30	16
	Algebra and Number Theory	59	86	61	15	59	71	2
	Analysis	55	131	62	28	53	103	9
	Applied Mathematics	50	439	58	70	48	369	10
	Computational Mathematics	47	128	49	21	47	107	2
	Control and Optimization	47	83	49	18	46	65	3
	Discrete Mathematics and Combinatorics	58	62	65	15	55	47	10
	Geometry and Topology	57	75	59	17	56	58	3
	Logic	57	26	79	3	54	23	25
	Mathematical Physics	50	54	61	8	48	46	13
	Modelling and Simulation	44	241	46	43	43	198	3
	Numerical Analysis	49	49	66	7	46	42	20
	Statistics and Probability	53	200	55	34	52	166	3
	Theoretical Computer Science	44	108	55	15	42	93	13
Medicine	General Medicine	69	548	65	187	71	361	-6
	Medicine (miscellaneous)	45	202	43	52	45	150	-2
	Anatomy	48	36	61	6	45	30	16
	Anesthesiology and Pain Medicine	58	115	56	31	59	84	-3
	Biochemistry, medical	39	49	36	18	41	31	-5
	Cardiology and Cardiovascular Medicine	53	319	58	76	51	243	7

	Critical Care and Intensive Care Medicine	58	80	57	21	59	59	-2
	Complementary and alternative medicine	57	83	41	19	62	64	-21
	Dermatology	55	128	56	41	55	87	1
	Embryology	40	14		0	40	14	-40
	Emergency Medicine	63	77	57	18	66	59	-9
	Endocrinology, Diabetes and Metabolism	42	205	45	69	41	136	4
	Epidemiology	36	90	31	33	39	57	-8
	Family Practice	67	36	57	19	78	17	-21
	Gastroenterology	51	131	46	38	53	93	-7
	Genetics (clinical)	33	90	30	24	34	66	-4
	Geriatrics and Gerontology	43	92	51	16	41	76	10
	Health Informatics	43	60	37	21	46	39	-9
	Health Policy	52	222	46	52	54	170	-8
	Hematology	45	119	44	28	45	91	-1
	Hepatology	47	56	46	15	47	41	-1
	Histology	43	58	37	16	44	42	-7
	Immunology and Allergy	37	186	39	49	36	137	3
	Internal Medicine	50	119	47	28	51	91	-4
	Infectious Diseases	44	271	41	105	46	166	-5
	Microbiology (medical)	41	109	38	40	42	69	-4
	Nephrology	47	56	52	20	44	36	8
	Clinical Neurology	45	332	47	80	45	252	2
	Obstetrics and Gynecology	54	165	55	39	54	126	1
	Oncology	41	317	36	90	43	227	-7
	Ophthalmology	53	110	53	29	53	81	0
	Orthopedics and Sports Medicine	50	244	50	67	50	177	0
	Otorhinolaryngology	55	99	51	18	55	81	-4
	Pathology and Forensic Medicine	48	182	47	28	49	154	-2
	Pediatrics, Perinatology, and Child Health	56	273	63	54	54	219	9
	Pharmacology (medical)	47	230	37	50	50	180	-13
	Physiology (medical)	39	94	44	17	38	77	6
	Psychiatry and Mental health	56	37	60	6	55	31	5
	Public Health, Environmental and Occupational Health	51	124	62	21	49	103	13
	Pulmonary and Respiratory Medicine	47	131	41	44	51	87	-10
	Radiology Nuclear Medicine and imaging	47	267	46	75	48	192	-2
	Rehabilitation	54	109	55	19	54	90	1
	Reproductive Medicine	47	63	47	18	48	45	-1
	Rheumatology	41	53	44	18	40	35	4
	Surgery	56	389	61	94	54	295	7
	Transplantation	44	36	58	9	40	27	18
	Urology	53	99	55	33	53	66	2
Multidisciplinary	Multidisciplinary	64	89	52	29	69	60	-17
Neuroscience	General Neuroscience	35	109	40	31	33	78	7
	Neuroscience (miscellaneous)	33	24	35	12	30	12	5
	Behavioral Neuroscience	32	68	32	17	32	51	0
	Biological Psychiatry	35	40	36	12	35	28	1
	Cellular and Molecular Neuroscience	23	85	21	29	25	56	-4
	Cognitive Neuroscience	32	91	28	23	34	68	-6
	Developmental Neuroscience	32	34	23	9	35	25	-12
	Endocrine and Autonomic Systems	32	24	44	6	28	18	16
	Neurology	40	146	42	38	39	108	3
	Sensory Systems	35	39	35	8	35	31	0
Nursing	General Nursing	59	109	59	21	60	88	-1
	Nursing (miscellaneous)	58	18	78	1	57	17	21
	Advanced and Specialised Nursing	68	53	52	3	69	50	-17
	Assessment and Diagnosis	69	6		0	69	6	-69

	Care Planning	60	6		0	60	6	-60
	Community and Home Care	61	33	61	8	60	25	1
	Critical Care	62	18	69	1	61	17	8
	Emergency	67	23	58	3	68	20	-10
	Fundamentals and skills	67	13	38	1	70	12	-32
	Gerontology	51	33	61	3	50	30	11
	Issues, ethics and legal aspects	56	36	38	4	59	32	-21
	Leadership and Management	62	28	45	2	63	26	-18
	LPN and LVN	62	16		0	62	16	-62
	Maternity and Midwifery	65	23	37	2	68	21	-31
	Medical–Surgical	72	23	59	1	72	22	-13
	Nutrition and Dietetics	43	113	42	22	43	91	-1
	Oncology (nursing)	47	15		0	47	15	-47
	Pediatrics	59	21	51	2	60	19	-9
	Pharmacology (nursing)	81	6		0	81	6	-81
Pharmacology, Toxicology and Pharmaceutics	Psychiatric Mental Health	36	145	44	17	35	128	9
	Research and Theory	54	9		0	54	9	-54
	General Pharmacology, Toxicology and Pharmaceutics	51	59	44	29	58	30	-14
	Pharmacology, Toxicology and Pharmaceutics (miscellaneous)	70	17	46	4	77	13	-31
	Drug Discovery	38	139	39	30	37	109	2
	Pharmaceutical Science	49	152	47	39	50	113	-3
Physics and Astronomy	Pharmacology	41	293	44	60	41	233	3
	Toxicology	34	110	42	22	31	88	11
	General Physics and Astronomy	48	206	54	43	46	163	8
	Physics and Astronomy (miscellaneous)	43	41	49	12	41	29	8
	Acoustics and Ultrasonics	47	39	38	7	48	32	-10
	Astronomy and Astrophysics	46	72	57	11	44	61	13
	Condensed Matter Physics	43	375	50	32	42	343	8
	Instrumentation	45	113	37	25	48	88	-11
	Nuclear and High Energy Physics	50	67	44	13	51	54	-7
	Atomic and Molecular Physics, and Optics	42	162	39	27	43	135	-4
	Radiation	49	48	45	10	50	38	-5
	Statistical and Nonlinear Physics	48	42	28	3	49	39	-21
Psychology	Surfaces and Interfaces	41	50	47	4	40	46	7
	General Psychology	49	192	63	45	45	147	18
	Psychology (miscellaneous)	47	36	59	3	45	33	14
	Applied Psychology	43	215	52	21	42	194	10
	Clinical Psychology	52	262	64	30	51	232	13
	Developmental and Educational Psychology	44	283	63	20	43	263	20
	Experimental and Cognitive Psychology	39	133	52	8	38	125	14
	Neuropsychology and Physiological Psychology	41	58	48	8	40	50	8
	Social Psychology	47	254	55	30	46	224	9
Social Sciences	General Social Sciences	65	213	77	53	61	160	16
	Social Sciences (miscellaneous)	55	235	73	35	52	200	21
	Archaeology	73	473	78	90	72	383	6
	Development	55	210	63	32	53	178	10
	Education	55	1021	62	186	53	835	9
	Geography, Planning and Development	55	608	62	120	54	488	8
	Health (social science)	51	244	54	48	51	196	3
	Human Factors and Ergonomics	43	34	60	2	42	32	18
	Law	65	574	75	79	64	495	11
	Library and Information Sciences	63	204	69	47	61	157	8

	Linguistics and Language	73	703	84	168	70	535	14
	Safety Research	51	67	45	18	53	49	-8
	Sociology and Political Science	61	1065	73	166	59	899	14
	Transportation	42	89	56	19	38	70	18
	Anthropology	67	328	76	66	65	262	11
	Communication	61	307	73	48	59	259	14
	Cultural Studies	78	829	81	137	78	692	3
	Demography	60	93	67	22	57	71	10
	Gender Studies	60	123	72	15	58	108	14
	Life-span and Life-course Studies	43	46	65	5	41	41	24
	Political Science and International Relations	63	458	71	64	62	394	9
	Urban Studies	60	154	66	43	58	111	8
Veterinary	General Veterinary	61	166	64	71	60	95	4
	Veterinary (miscellaneous)	50	9	53	4	47	5	6
	Equine	49	7	48	1	49	6	-1
	Food Animals	51	29	58	4	49	25	9
	Small Animals	62	17	42	1	63	16	-21

**Appendix B:** Scatter plot for OA journals in four subject categories (there are no OA conference proceedings in Electrical and Electronic Engineering, and only two OA book series in History)

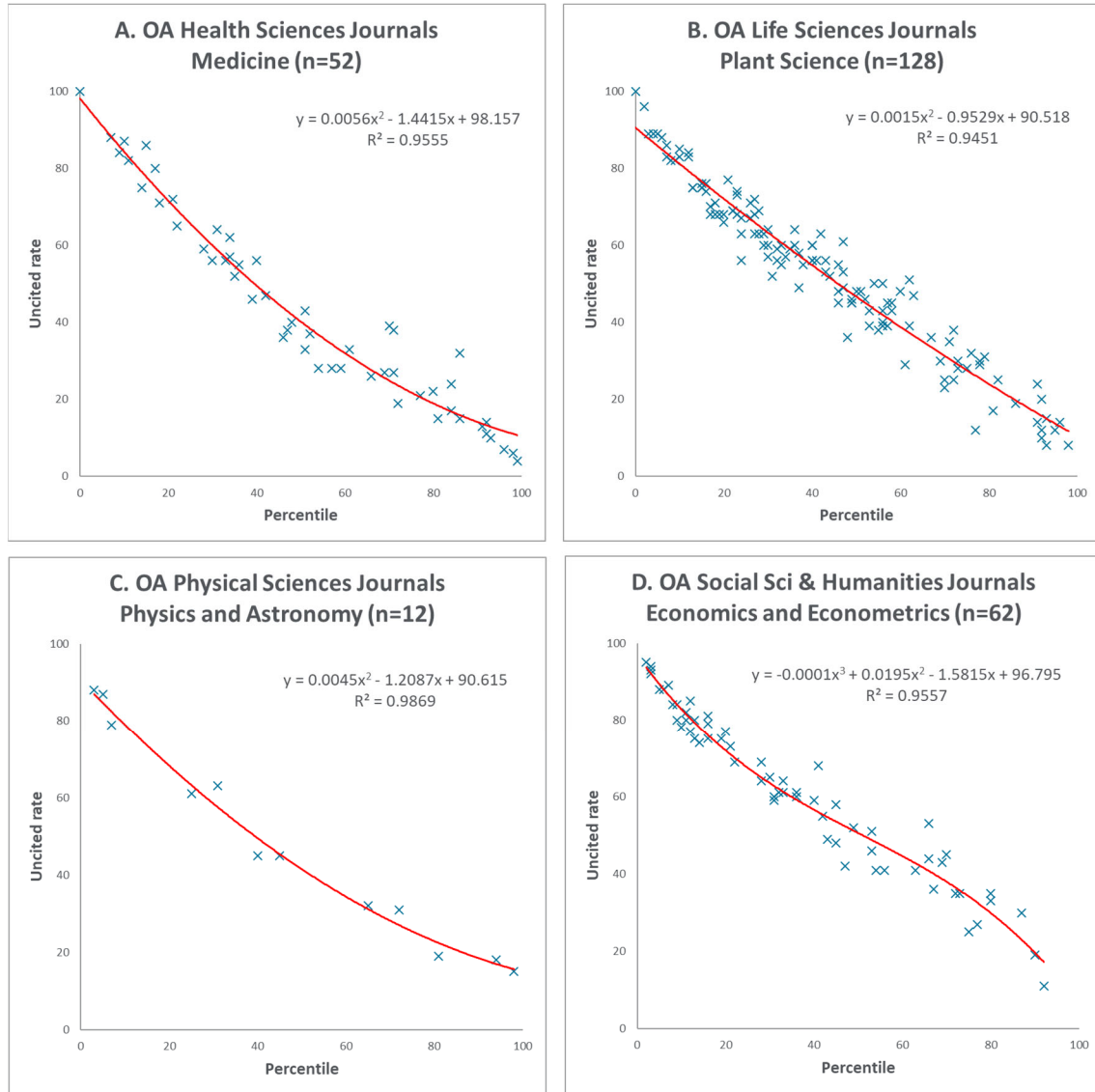


Figure B.1: Scatter plot between uncited rate and percentile for OA journals in four subject categories



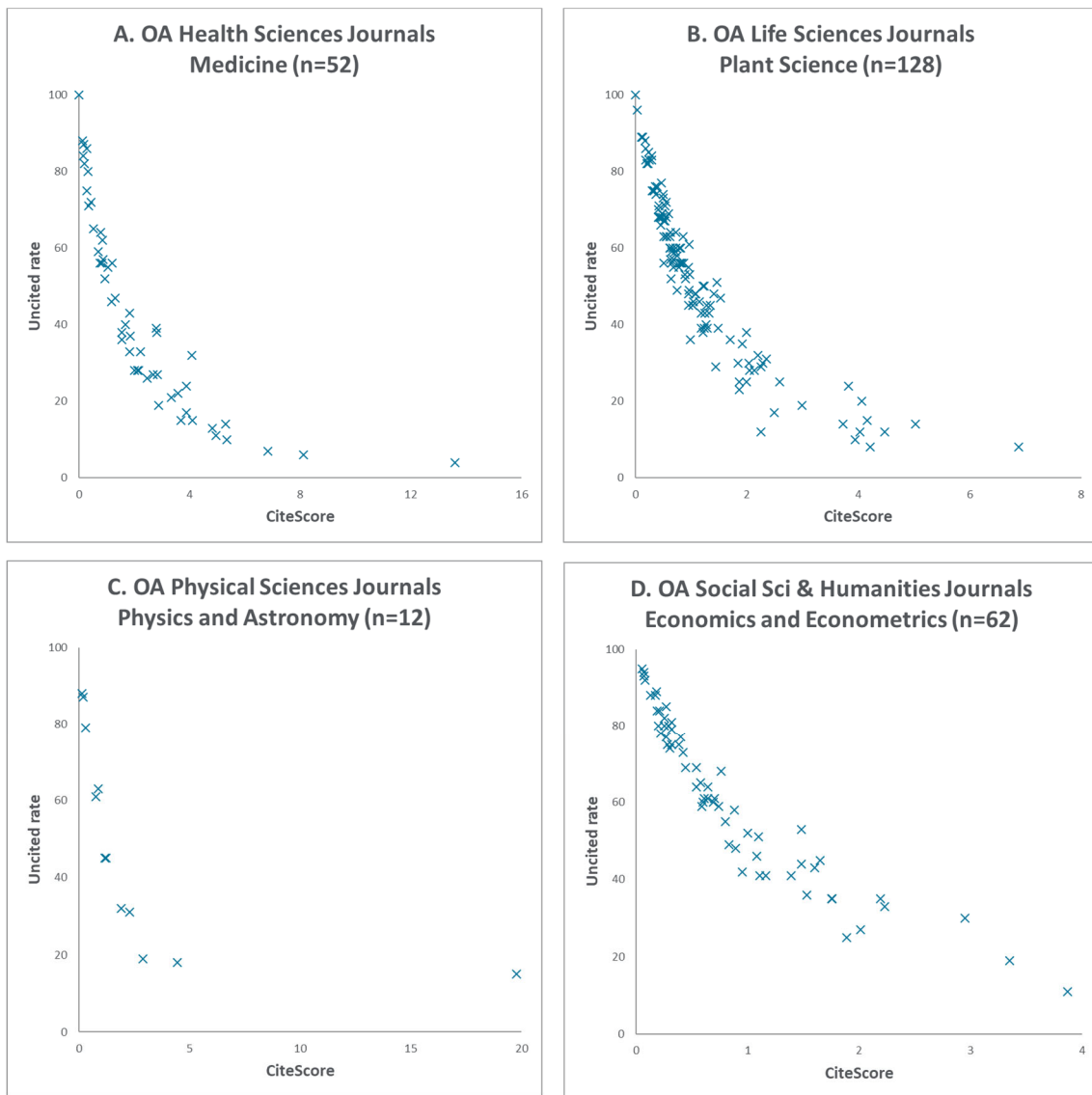


Figure B.2: Scatter plot between uncited rate and CiteScore for OA journals in four subject categories