QUALIS: The journal ranking system undermining the impact of Brazilian science

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Abstract

A journal ranking system called QUALIS was implemented in Brazil in 2009, intended to rank graduate programs from different subject areas and promote selected national journals. Since this system uses a complicated suit of criteria (differing among subject areas) to group journals into discrete categories, it could potentially create incentives to publish in low-impact journals ranked highly by QUALIS. Here I assess the influence of the QUALIS journal ranking system on the global impact of Brazilian science. Results reveal a steeper decrease in the number of citations per document since the implementation of this QUALIS system, compared to the top Latin American countries publishing more scientific articles. All the subject areas making up the QUALIS system showed some degree of bias, with social sciences being usually more biased than natural sciences. Lastly, the decrease in the number of citations over time proved steeper in a more biased area, suggesting a faster shift towards low-impact journals ranked highly by QUALIS. Overall, the findings documented here suggest that the QUALIS system has undermined the global impact of Brazilian science, and reinforce a recent recommendation from an official committee evaluating graduate programs to eliminate QUALIS. A journal ranking system based on internationally recognized impact metrics could avoid introducing distorted incentives, and thereby boost the global impact of Brazilian science.

Keywords: CAPES, citations, impact factor, scientometrics, Scimago, Scopus.

Introduction

In 1998 the Brazilian agency responsible for establishing criteria for evaluating the performance of higher education institutions (CAPES) launched a journal ranking system called "QUALIS", which classified journals according to their distribution (local, national or international) and their quality within subject areas (A, B and C) (Andrade & Galembeck, 2009). In 2009 this system was replaced by a new QUALIS (currently in use), which uses a complicated suit of criteria (differing among subject areas) to group journals into eight discrete categories (A1, A2, B1, B2, B3, B4, B5 and C) (Andrade & Galembeck, 2009; Andriolo et al., 2010). Criteria include different impact factor metrics, the proportion of journals in each category, the relevance or prestige of journals within subject areas, the number of issues published per year, the publishers, the need to support certain Brazilian journals, among others (a full explanation of the criteria employed by each subject area is available in Portuguese at: https://sucupira.capes.gov.br/sucupira/public/consultas/coleta/veiculoPublicacaoQualis/listaConsultaGeralPeriodicos.jsf). QUALIS rankings are updated every four years, and used to evaluate the scientific production of graduate programs from higher education institutions in the following quadrennial (the last ranking was made with data from 2013-2016 and is being used to evaluate scientific production between 2017-2020). The system has a strong impact on Brazilian science, given that the distribution of funding resources and departmental fellowships are conditioned on the number of papers published in the highest QUALIS categories.

Although the QUALIS system has been subject to substantial criticism (da Silva, 2009; Rocha-e-Silva, 2009a; Andriolo et al., 2010; Ferreira, Antoneli & Briones, 2013; Fernandes & Manchini, 2019), no systematic cross-subject area assessment has been yet performed to quantify its influence on the global impact of Brazilian science. This is surprising considering the system could create incentives to publish in low-impact journals ranked highly by QUALIS, thereby resulting in a decreased global impact. A relative decrease in the number of citations per article (a measure of impact) since the implementation of the new QUALIS system, would indicate that QUALIS has actually undermined the impact of Brazilian science. However, because QUALIS criteria to rank journals differ between subject areas, some areas are expected to be more biased than others. We could thus anticipate that the relative decrease in the number of citations per article would be affected by the level of bias. Here I test these predictions.

Materials & Methods

My aim was to assess the influence of the QUALIS journal ranking system on the global impact of Brazilian science. To this end I tested three specific predictions:

1) There has been a steeper relative decrease in the overall number of citations per document since the implementation of the new QUALIS system in 2009.

Since citations are expected to decrease with time (older articles accumulate more citations than newer ones), the prediction refers to the "relative" decrease, when compared to other countries. A steeper relative decrease in the number of citations since 2009 would indicate a negative effect of QUALIS in the global impact of Brazilian articles (i.e. articles are being less cited). I chose the top five Latin American countries publishing more scientific journal articles (according to

Scimago's 2019 country rankings) to perform this comparison. The total number of citations per documents (combining all subject areas) was plotted against time, using data from Scimago's yearly country rankings between 2009 and 2019 (https://www.scimagojr.com/countryrank.php?year=2019&region=Latin%20America).

2) Since QUALIS criteria to rank journals differ between subject areas, some areas are more biased than others.

I used the proportion of journals indexed in the Scopus database in each of the QUALIS subject areas as a first proxy of bias. I chose the List of Scopus Index Journals (36,500 journals) because it contained more journals than Scimago Journal Rank (26,199 journals) or InCites Journal Citation Reports (12,300 journals). Scopus data was downloaded from this site: https://www.researchgate.net/publication/330967992_List_of_Scopus_Index_Journals_February_2019_New. To be indexed by Scopus, journals should meet all of the following minimum criteria: a) Consist of peer-reviewed content and have a publicly available description of the peer review process; b) Be published on a regular basis and have an International Standard Serial Number (ISSN) as registered with the ISSN International Centre; c) Have content that is relevant for and readable by an international audience; and d) Have a publicly available publication ethics and publication malpractice statement (see a more detailed description of Scopus's evaluation criteria here: https://www.elsevier.com/solutions/scopus/how-scopus-works/content/content-policy-and-selection).

I then employed Scopus's CiteScore as a proxy of the journal's realized global impact. Scopus's CiteScore 2017 represents the number of citations received in 2017 to documents published in 2014, 2015 and 2016, divided by the number of documents published in 2014, 2015, and 2016. Since it employs a 3-year citation window, rather than the 2-year window of the traditional Impact Factor, it approaches the QUALIS quadrennial classification. The last QUALIS ranking was made with data for 2013-2016, so I collected CiteScore 2017 for journals comprised in all QUALIS subject areas (49 subject areas, 27,619 journals, raw data is available here: https://sucupira.capes.gov.br/sucupira/public/consultas/coleta/veiculoPublicacaoQualis/listaConsultaGeralPeriodicos.jsf). I used the journal's ISSN number to match both databases (QUALIS and Scopus). I then ran a Kruskal-Wallis test to compare the overall variation in CiteScore across QUALIS categories, and used chi-squared values as a measure of the strength of this variation. I also assessed the number of cases when lower QUALIS categories had a higher median CiteScore than preceding higher QUALIS categories (example: median of B1 > median of A2). Finally, I calculated the number of journals classified as A1 having a CiteScore below the area median.

I thus calculated four bias metrics:

i) Proportion of journals indexed by Scopus: Since a higher proportion of journals indexed by Scopus implies that more journals pass Scopus's minimum eligibility criteria, subject areas with a larger proportion of indexed journals are expected to be less biased.

ii) Kruskal-Wallis chi-squared: Since higher chi-squared values indicate stronger differences in CiteScore between QUALIS categories, subject areas with higher chi-squared values are expected to be less biased.

iii) Cases where lower QUALIS > higher QUALIS: Since larger values (more such cases), indicate that more journals in lower ranking categories have a higher CiteScore that those of the preceding, higher ranking category, subject areas with larger values of this indicator are expected to be more biased.

iv) A1 journals with CiteScore below the area median: Since the A1 category is supposed to contain the area's top ranking journals, higher values (more journals) indicate more journals have been miss-classified as A1, so subject areas with higher values of this indicator are expected to be more biased.

3) The relative decrease in the number of citations per document is affected by the level of bias.

I identified the top less and more biased subject areas according to the four bias metrics described above, using the lower (5%) and upper (95%) quantiles as cutoff values for each metric. I then chose two subject areas that where ranked in each of these top groups using more than one bias metric. The number of citations per document between 2009 and 2019 received by Brazilian journal articles belonging to these two subject areas where then plotted against time, using data for the most similar subject areas from Scimago. To facilitate the comparison, I chose subject areas with a comparable number of citations per documents in 2009.

Results

While the number of scientific papers produced by Brazilian scientist has increased during the past two decades, since 2009 the number of citations per document has remained the lowest among the top five Latin American countries publishing more scientific papers (Fig. 1). From all journals comprised in the QUALIS system (including all subject areas), 21,541 (78%) where not indexed by Scopus. Across all subject areas the proportion of journals indexed by Scopus was low, ranging between 0.02 and 0.4 (Fig. 2, Table S1 in Supplemental Information). The number of indexed journals without CiteScore was low (ranging between 0 and 124), and I was able to retrieve CiteScore for a total of 5,525 journals comprised in QUALIS, but these where not evenly distributed across subject areas (final sample sizes ranged from 9 to 1801, Table S1, Fig. 2). The distribution of journal's CiteScore values across QUALIS categories showed a very large variation across subject areas (Fig. 3). Remarkably, all subject areas showed some degree of bias in at least one bias indicator (Tables 1 and S1, Figs. S1-S4). In general, subject areas belonging to the social sciences where among the top more biased, whereas those belonging to the natural sciences where among the top less biased, with a few exceptions (Table 1).

Table 1: Top less and more biased subject areas according to four bias metrics (see methods for details). Each group is composed of the lower (5% quantile) or upper (95% quantile) subject areas. Areas in bold were ranked in these quantiles using more than one bias metric. Original QUALIS subject area names are shown (as written in their respective classification sheets) but their English translation can be found in Table S1.

Bias metric	Top less biased	Top more biased
Proportion of journals indexed by Scopus	ciencias_biologicas_ii, **medicina_i**, medicina_iii	**ciencias_da_religiao_e_teologia**, direito, **letras_linguistica**
Kruskal-Wallis chi-squared	interdisciplinar, **medicina_i**, **medicina_ii**	**antropologia_arqueologia**, **artes_musica**, **ciencias_da_religiao_e_teologia**
Cases where lower QUALIS > higher QUALIS	**astronomia_fisica, medicina_ii** *	**antropologia_arqueologia**, **artes_musica**, **educacao**, **letras_linguistica**
A1 journals with CiteScore below the area median	arquitetura_urbanismo_e_design, **astronomia_fisica**, ciencias_ambientais, geociencias, materiais, medicina_veterinaria, quimica, servico_social	**educacao**, enfermagem, ensino

* In this case I used the lower 4% quantile as cutoff since the 5% quantile resulted in too many subject areas.

The two selected subject areas that where ranked in the top less and more biased groups using more than one bias metric where “Astronomy and Physics” and “Arts and Music”, respectively (Scimago’s most similar subject areas are “Physics and Astronomy” and “Arts and Humanities”). The number of citations per document received by Brazilian journal articles belonging to these two subject areas showed a progressive decease in time, as expected. However, this decrease was much steeper in “Arts and Humanities” than in “Physics and Astronomy” (Fig. 4).

Discussion

Results reveal that the QUALIS system, originally intended to rank graduate programs from different subject areas and promote selected national journals, has been unable to increase the relative impact of Brazilian science since its implementation in 2009. Moreover, all the subject areas making up the QUALIS system showed some degree of bias, with social sciences being usually more biased than natural sciences. Finally, the decrease in the number of citations over time was steeper in “Arts and Humanities” (a more biased subject area) than in “Physics and Astronomy” (a less biased subject area).

The steeper decline in the number of citations per document since 2009, compared to the top Latin American countries publishing more scientific papers, suggest that the QUALIS journal ranking system has created incentives to publish in low-impact journals ranked highly by QUALIS. For instance, changes in the QUALIS journal rankings have affected submission rates in journals like *Anais da Academia Brasileira de Ciências*: Submissions from Biological Sciences plummeted after this subject area downgraded the journal from A2 to B2 in 2013 (Kellner, 2017). As faculty and graduate students are evaluated based on the number of papers they publish in journals that are highly ranked by QUALIS, they are more likely to select journals in the A categories with lower impact factors and higher acceptance rates (Aarssen et al., 2008). Over time, this system appears to have shifted publications towards low-impact journals ranked highly by QUALIS, thus undermining the global impact of Brazilian science. In contrast, in countries where scientists are evaluated based on the impact factor of the journals where they publish, the number of citations per document accumulate more quickly (so impact shows a slower decrease over time). This effect is exemplified by Mexico and Colombia, which matched Brazil in number of citations per document in 2009 (when the current QUALIS system was implemented), but show a less abrupt fall since (Fig. 1).

Most of the journals comprised in the QUALIS system (78%) where not indexed by Scopus, and the proportion of journals indexed in Scopus was low across all subject areas (Fig. 2). These results suggest that the bulk of the journals comprised in the QUALIS system do not meet the minimum eligibility criteria of the largest source-neutral database (Scopus). This is alarming, and reveals a need to set higher journal quality standards across all subject areas.

Although some subject areas were found to be more biased than others by the QUALIS system, all showed some degree of bias in at least one bias indicator. This result is surprising, and indicates that even in hard, quantitative areas, QUALIS journal ranks do not reflect the journal's realized impact. In computer sciences (second row with first column in Fig. 3), for example, category B2 has a higher median CiteScore than categories A2 and B1, and there are journals classified as B5 and C showing a CiteScore above the A1 median. Similar patterns are observed in many other subject areas, revealing that the multiple criteria used to create QUALIS journal ranks result in a mismatch between the perceived and the realized journal's impact. Biases nevertheless appear to be more pronounced in the social sciences, suggesting a marked disregard for impact factors (Table 1, Figs. S1-S4). Remarkably, in four subject areas (anthropology and archaeology, religion and theological sciences, arts and music, and law) CiteScore values did not differ between QUALIS categories (Fig. 3, Table S1), indicating that the QUALIS rankings do not consider the journal's impact factor at all.

Two of the least and most biased subject areas ("physics and astronomy" and "arts and humanities", respectively) showed differing patterns of citations over time, with arts and humanities exhibiting a steeper decline (Fig. 4). This result indicates a faster shift towards low-impact journals ranked highly by QUALIS in arts and humanities, resulting in an overall decrease in impact. In contrast, in physics and astronomy the QUALIS journal ranking follows the journal's realized impact (CiteScore) more closely, so incentives are in place to publish in high-impact journals (also ranked highly by QUALIS). Perhaps thanks to these publications in high-impact journals, the number of citations per document accumulate more quickly (see right to left increase in Fig. 4). These findings reinforce that the QUALIS system implemented in 2009 is likely a major driver of the steeper overall decline in the number of citations per document since 2009, compared to the top Latin American countries publishing more scientific papers.

Conclusions

Overall, the findings documented here suggest that the QUALIS system has undermined the global impact of Brazilian science. Likewise, they reveal that a journal ranking system based on the realized impact of journals would avoid introducing distorted incentives, and thereby boost the global impact of Brazilian science (da Silva, 2009). It is also difficult to justify QUALIS as a mean to promote national journals in the age of open-access and pre-prints (Rocha-e-Silva, 2009b; Andriolo et al., 2010; Kellner, 2017), and less so if it is at the expense of the global impact of Brazilian science (Ferreira, Antoneli & Briones, 2013). QUALIS was once considered a temporary strategy (da Silva, 2009), and a recent report by CAPES has recommended it should not be used in the future any more, being replaced with “internationally established and broadly recognized metrics” (COMISSÃO ESPECIAL DE ACOMPANHAMENTO DO PNPG, 2020). The results presented here strongly support this recommendation.

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Author comment

The ideas presented in this article belong to the author and do not reflect the opinion of the institution where he is affiliated.

Data Deposition

All data used in this manuscript is publicly available and sources have been cited in the text.

Figures

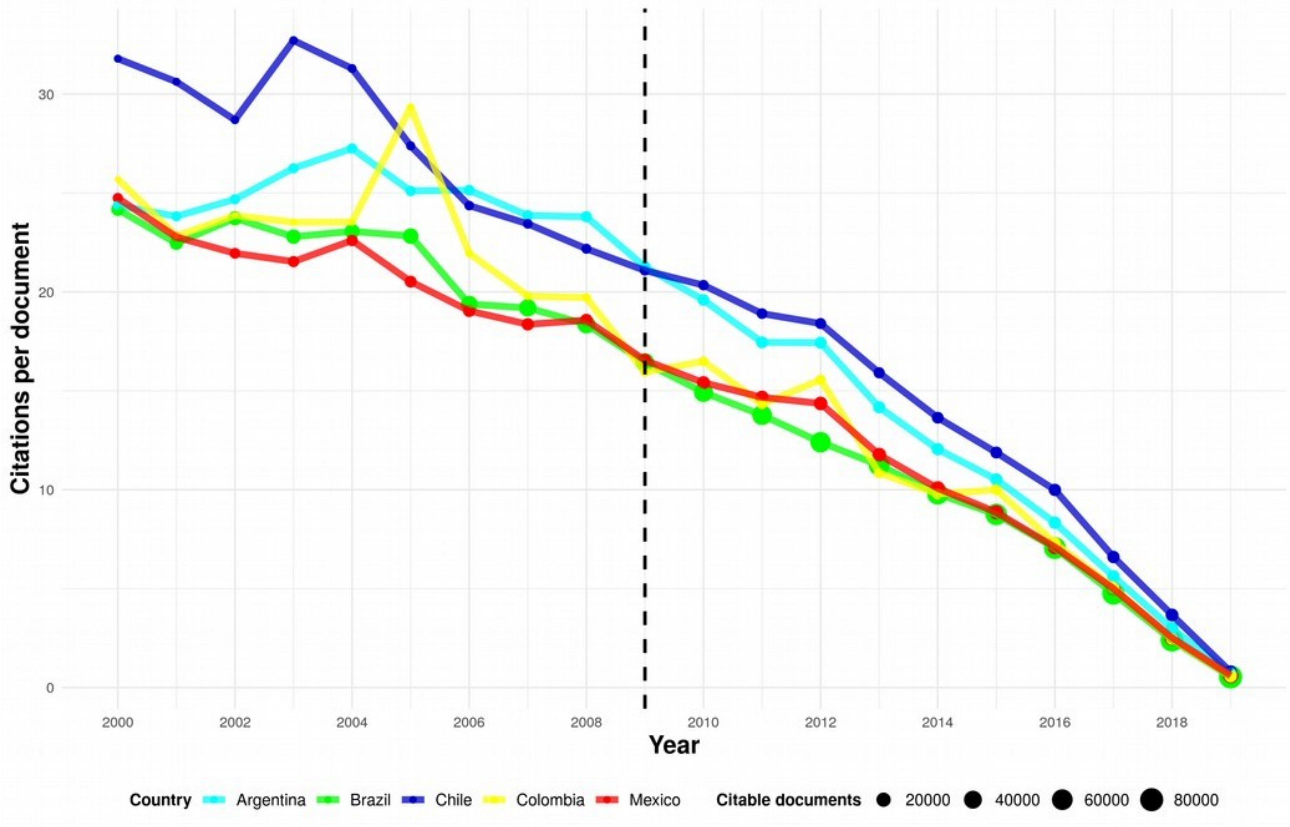
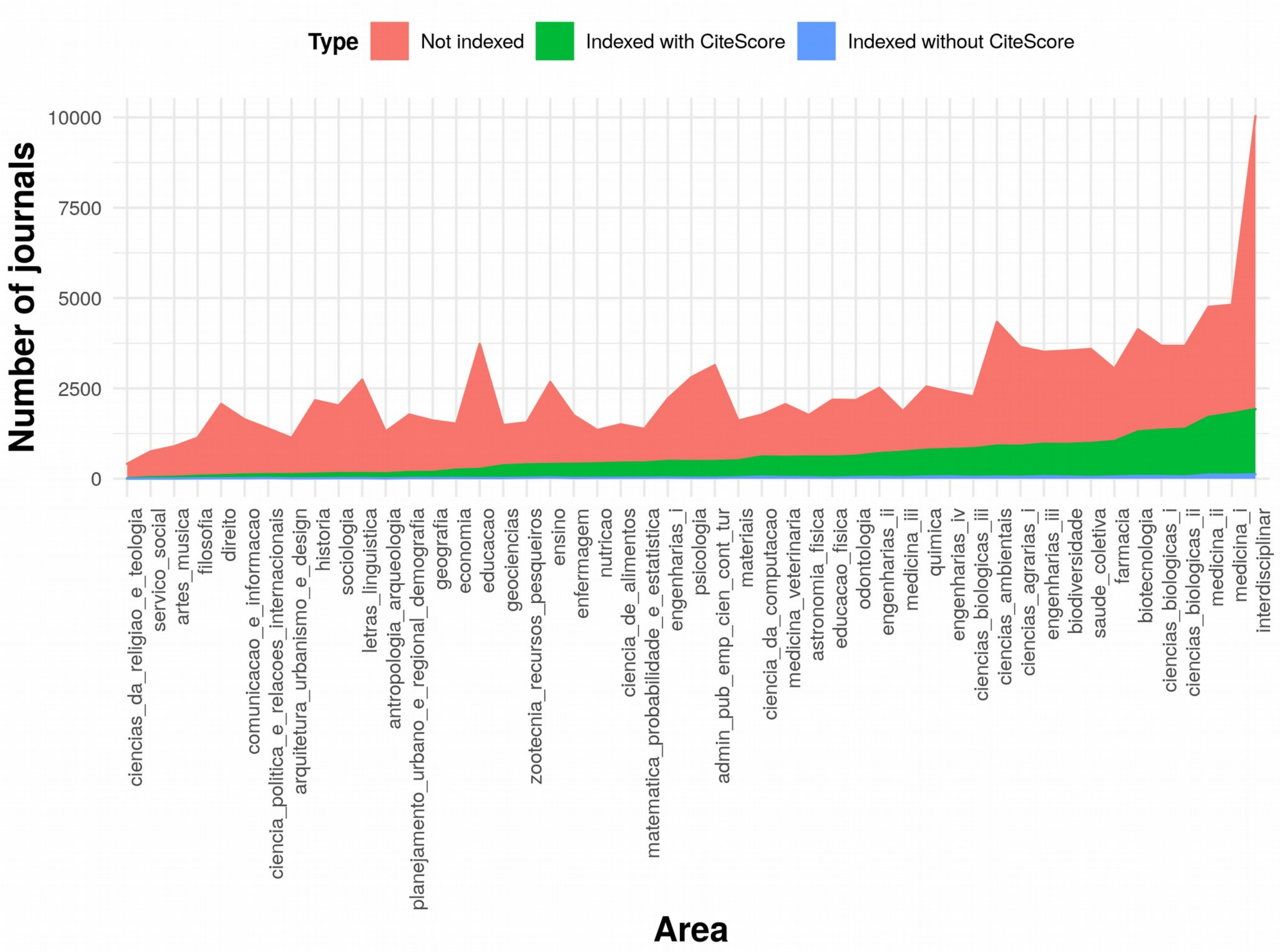


Figure 1: Number of citations per document between 2000 and 2019 in the five Latin American countries publishing more scientific journal articles (according to Scimago's 2019 country ranking). Countries are identified by colors, while dot size represent the total number of citable documents. The vertical dashed line indicates the year when the new QUALIS system was introduced in Brazil.



296 **Figure 2:** Number of journals not indexed by Scopus, indexed with available CiteScore 2017, and indexed without CiteScore 2017, across all 49 QUALIS subject areas. Original QUALIS subject area names are shown (as written in their respective classification sheets) but their English translation can be found in Table S1.

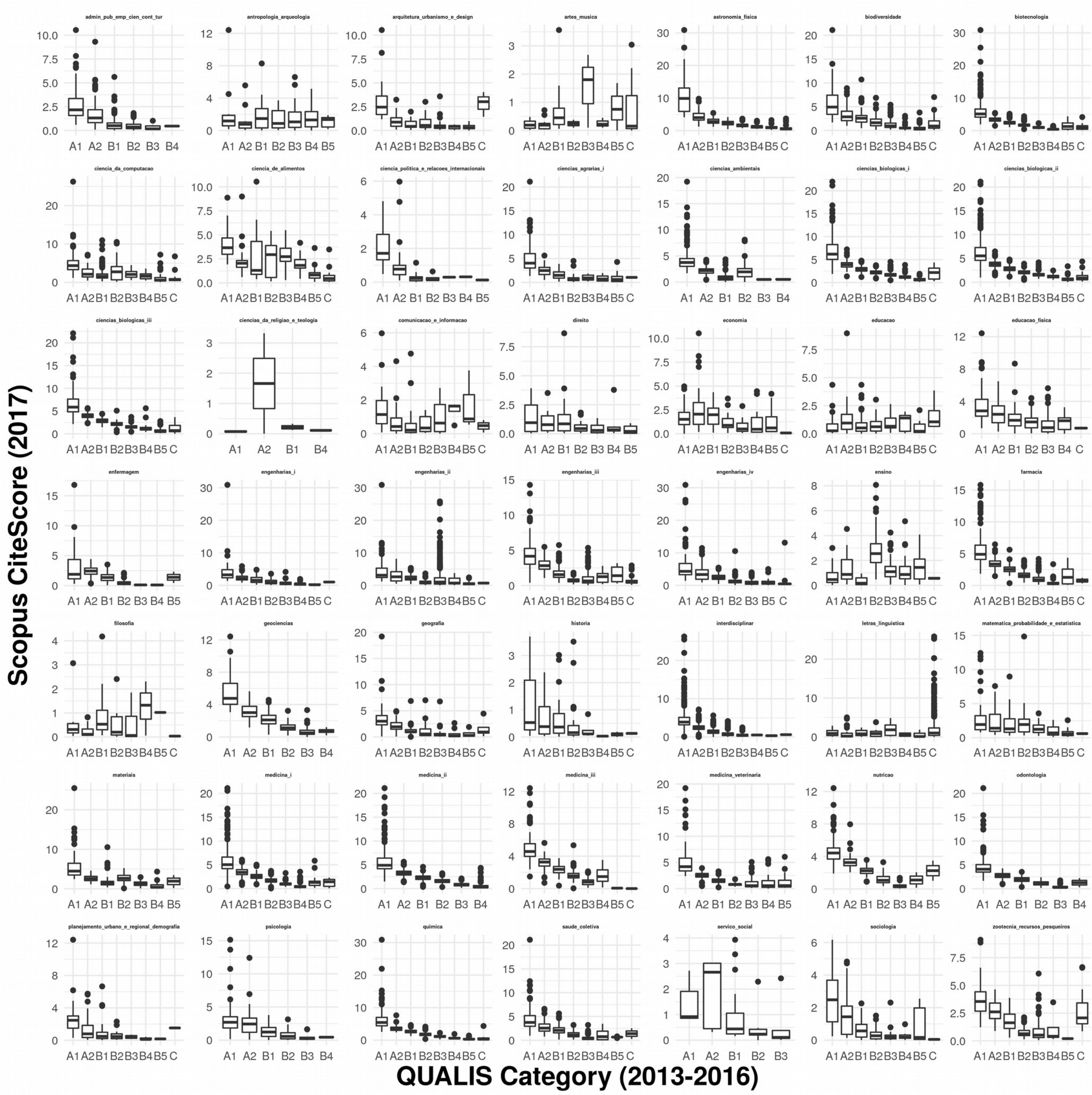


Figure 3: Scopus CiteScore variation across QUALIS categories in each subject area. Original QUALIS subject area names are shown (as written in their respective classification sheets) but their English translation can be found in Table S1.

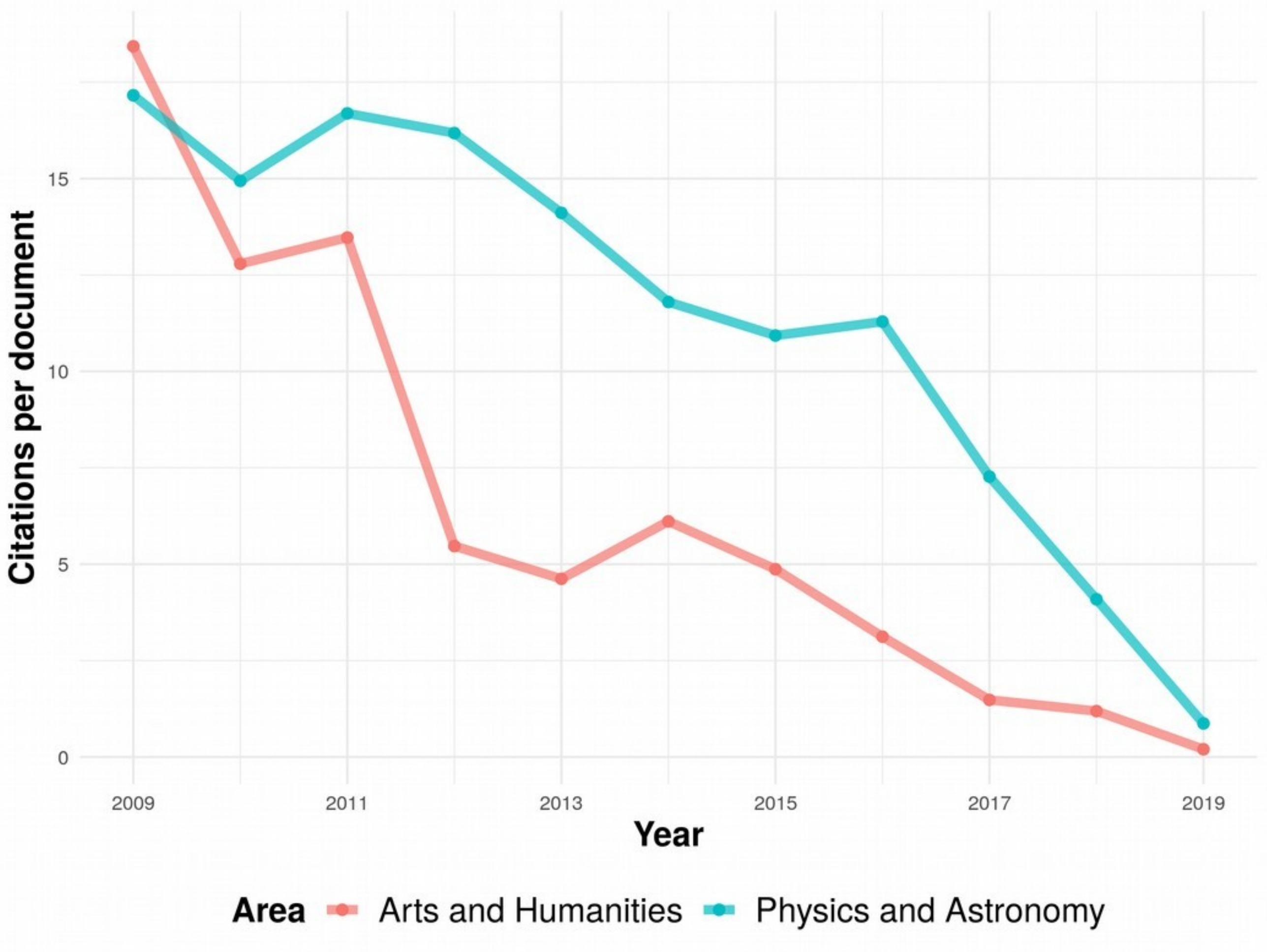


Figure 4: Number of citations per document received between 2009 and 2019 by Brazilian journal articles belonging to Scimago's subject areas "Arts and Humanities" and "Physics and Astronomy".