Rise of the Rest: The Growing Impact of Non-Elite Journals

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Abstract

In this paper, we examine the evolution of the impact of non-elite journals. We attempt to answer two questions. First, what fraction of the top-cited articles are published in non-elite journals and how has this changed over time. Second, what fraction of the total citations are to non-elite journals and how has this changed over time.

To answer these questions, we studied citations to articles published in 1995-2013. We computed the 10 most-cited journals and the 1000 most-cited articles each year for all the 261 subject categories included in Scholar Metrics. We considered the 10 most-cited journals in a category as the elite journals for the category and all other journals in the category as non-elite.

There are two main conclusions from our study. First, the fraction of highly-cited articles published in non-elite journals increased steadily over 1995-2013. While the elite journals still publish a substantial fraction of high-impact articles, many more authors of well-regarded papers in a diverse array of research fields are choosing other venues.

Our analysis indicates that the number of top-1000 papers published in non-elite journals for the representative subject category went from 149 in 1995 to 245 in 2013, a growth of 64%. Looking at broad research areas, 4 out of 9 broad areas saw at least one-third of the top-cited articles published in non-elite journals in 2013. All broad areas of research saw a growth in the fraction of top-cited articles published in non-elite journals over 1995-2013. For 6 out of 9 broad areas, the fraction of top-cited papers published in non-elite journals for the representative subject category grew by 45% or more.

Second, now that finding and reading relevant articles in non-elite journals is about as easy as finding and reading articles in elite journals, researchers are increasingly building on and citing work published everywhere. Considering citations to all articles, the percentage of citations to articles in non-elite journals went from 27% of all citations in 1995 to 47% in 2013. Six out of nine broad areas had at least 50% of total citations going to articles published in non-elite journals in 2013.

1 Introduction

Several factors have driven the sustained impact of elite journals. First, these journals have traditionally been available in many more academic libraries worldwide. The costs of physical distri-
bution and storage required due to print publication meant only selected journals would be widely available. Articles published in these journals had a much higher likelihood of being read, built upon and cited.

Second, success metrics in scholarly communication had largely been computed at the journal-level. Those of us who have been on the academic job market well know that our resumes were likely to be summarized as “X articles in the top journals”. As a result, researchers usually target elite journals for their best work.

Third, literature research approaches had primarily been either browsing journal issues or scanning reverse chronological search results (most-recent-first). These approaches present researchers with a large number of articles to scan and require substantial effort to track down relevant articles. As a result, researchers had been more likely to limit the scope of their literature search to elite journals.

There have been several dramatic changes in scholarly communication over the last two decades that have the potential to significantly influence these factors. First, scholarly journals have largely moved from physical distribution of print issues to online availability of individual articles. A large number of journals have also digitized older articles and made them available online. Many publishers and aggregators provide large collections as a part of Big Deal licenses. As a result, it is easier for many more libraries to provide access to publications beyond a core collection of elite journals.

Second, success metrics for researchers have expanded to include article-level metrics. These include per-article citation counts as well as aggregate metrics such as the h-index [6]. Furthermore, these metrics are widely available to all users without a subscription – which makes it easier for both researchers and those considering their resumes to view these metrics. This allows researchers to highlight the success of their impactful articles no matter where they are published.

Third, search services now cover all available journals, instead of a selected subset. Furthermore, they index the entire text of articles instead of just abstracts and keywords. The common ranking approach has moved from reverse chronological to relevance ranking (most-relevant-first). Finding and reading relevant articles in non-elite journals is now about as easy as finding and reading articles in elite journals.

To understand the influence of these changes on the impact of non-elite journals, we studied citations to articles published in 1995-2013. We attempted to answer two questions. First, what fraction of the top-cited articles are published in non-elite journals and how has this changed over time. This covers the impact of the most visible papers, which are often the ones that make key contributions. Second, what fraction of the total citations to all articles are to non-elite journals and how has this changed over time. This covers the impact of all papers.

We computed the 10 most-cited journals and the 1000 most-cited articles each year for all the 261 subject categories included in Scholar Metrics [10]. We considered the 10 most-cited journals in a category as the elite journals for the category and all other journals in the category as non-elite.

There are two main conclusions from our study. First, the fraction of highly-cited articles
published in non-elite journals increased steadily over 1995-2013. While the elite journals still publish a substantial fraction of high-impact articles, many more authors of well-regarded papers in a diverse array of research fields are choosing other venues.

Our analysis indicates that the number of top-1000 papers published in non-elite journals for the representative subject category went from 149 in 1995 to 245 in 2013, a growth of 64%. Looking at broad research areas, 4 out of 9 broad areas saw at least one-third of the top-cited articles published in non-elite journals in 2013. All broad areas of research saw a growth in the fraction of top-cited articles published in non-elite journals over 1995-2013. For 6 out of 9 broad areas, the fraction of top-cited papers published in non-elite journals for the representative subject category grew by 45% or more.

Second, now that finding and reading relevant articles in non-elite journals is about as easy as finding and reading articles in elite journals, researchers are increasingly building on and citing work published everywhere. Considering citations to all articles, the percentage of citations to articles in non-elite journals went from 27% of all citations in 1995 to 47% in 2013. Six out of nine broad areas had at least 50% of total citations going to articles published in non-elite journals in 2013.

2 Methods

For this study, we included all journals and conferences that were assigned to one or more subject category in the 2014 release of Scholar Metrics. The Scholar Metrics inclusion criteria for publication venues were [4]: (1) publish 100 or more articles over 2009-2013, (2) at least one article must receive at least one citation over 2009-2013, (3) follow Google Scholar indexing guidelines. Scholar Metrics limits categorization into subject categories to English publications. Accordingly, this study covers all the English language journals and conferences included in Scholar Metrics. Scholar Metrics also includes selected preprint repositories. Preprint repositories are not included in this study.

We used the subject categories from the 2014 release of Scholar Metrics. We created a group of articles for each subject-category-year combination, such as Immunology for the year 2000. Each category-year group included all articles published in the given year in all publications in the given category.

For each publication, we included all articles with a publication date within 1995-2013, both inclusive. Note that each journal or conference can be associated with more than one subject category. Such publications are included in the computation for each category they are a part of.

We identified the 10 most-cited journals for each category-year group. For this, we used the ordering mechanism used in Scholar Metrics [4]: journals are sorted by their $h_5$-index with ties being broken by their $h_5$-median. These journals were considered as the elite journals for the 1

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1The $h_5$-index of a publication is the largest number $h$ such that at least $h$ articles published in the last five complete calendar years in that publication were cited at least $h$ times each. The $h_5$-core of a publication is a set of top cited $h$ articles from the publication that were published in the last five complete calendar years. These are the articles that the $h_5$-index is based on. The $h_5$-median of a publication is the median of the citation counts in its
group. All other journals in the group were considered non-elite. Note that the list of elite journals was recomputed each year which allowed the analysis to capture changes in the focus of subject categories as well as newly successful journals.

Next, we computed the list of the 1000 most-cited articles in each category-year group. These were considered the top-cited articles in the category-year group. We determined how many of these top-cited articles were published in non-elite journals.

Given the large number of subject categories under study (261), we grouped subject categories into broad research areas. We used the broad areas from Scholar Metrics for this, with one change — we separated Engineering and Computer Science. The citation patterns in these two areas are significantly different and this separation allowed us to explore the differences. We also added All articles as the union of all broad areas.

For each year, we sorted the subject categories in each broad area by the number of top-cited articles published in non-elite journals. We then picked the median subject category in each broad area as the representative for the area — roughly half the subject categories in the area would have more top-cited articles published in non-elite journals than the representative and roughly half would have fewer such articles. Note that we recomputed the representative category for each year to ensure that we picked the middle point in the list of subject categories at all times.

We picked the median subject category as the representative instead of computing an average across all categories to limit distortions due to outliers. In addition to selecting a representative category, we also computed the 25th and the 75th percentile categories for each broad area in each year. These are the categories whose number of non-elite top-cited articles was larger than or equal to that for 25% and 75% of all the categories in the area, respectively. The results for these categories help us get an idea of how the number of top-cited articles in non-elite journals varied across the entire set of subject categories in an area.

Finally, we computed the number of citations to all articles in a category-year group as well as the number of citations to all articles in the group that were published in non-elite journals.

3 Results

Figure 1 presents the trend in publication of top-cited papers. It shows that the fraction of top-cited papers published in non-elite journals has grown steadily over 1995-2013. The graphs for the representative subject category as well as those for the 25th and 75th percentile categories are similar. This indicates that the trend of growth in fraction of top-cited papers published in non-elite journals holds across a wide range of subject categories.

Figure 2 presents the trend in publication of top-cited papers for individual broad areas. It shows that all areas saw growth in the fraction of top-cited papers published in non-elite journals; 6 out of 9 broad areas seeing a substantial increase.

Table 1 presents the number of 2013 top-cited papers published in non-elite journals for the h5-core. The h5-median is a measure of the distribution of citations to the articles in the h5-core.
The line marked *median* presents the data for the representative subject category in each year. Lines marked 25% and 75% represent results for the 25th and 75th percentile categories, respectively.

Figure 1: Fraction of top-cited papers published in non-elite journals over 1995-2013.

It shows that the number of top-1000 papers published in non-elite journals for the overall representative subject category went from 149 in 1995 to 245 in 2013, a growth of 64%. Four out of nine broad areas saw at least one-third of the top-cited articles published in non-elite journals in 2013. All broad areas of research saw a growth in the fraction of top-cited articles published in non-elite journals over 1995-2013. For 6 out of 9 broad areas, the fraction of top-cited papers published in non-elite journals for the representative subject category grew by 45% or more.

$$\frac{\text{num\_non\_elite\_in\_2013} - \text{num\_non\_elite\_in\_1995}}{\text{num\_non\_elite\_in\_1995}} \times 100$$

It shows that this is computed by dividing the sum of citations to all articles in non-elite journals by the sum of citations to articles in all journals. The fraction of non-elite citations went from 27% in 1995 to 47% in 2013. The graph shows growth over the entire period, the growth rate being lower in the first third of the period under study (1995-2000) and higher over the rest of the period (2001-2013).

Figure 3 presents the fraction of citations to non-elite journals over 1995-2013. Note that this is computed by dividing the sum of citations to all articles in non-elite journals by the sum of citations to articles in all journals. The fraction of non-elite citations went from 27% in 1995 to 47% in 2013. The graph shows growth over the entire period, the growth rate being lower in the first third of the period under study (1995-2000) and higher over the rest of the period (2001-2013).

Figure 4 presents the evolution of the fraction of non-elite citations for all broad areas. It shows that all broad areas saw a significant increase in the fraction of non-elite citations over 1995-2013.
Figure 2: Per-area changes in the fraction of top-cited papers published in non-elite journals over 1995-2013.
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| Broad area                        | Top-cited non-elite in 2013 | Change since 1995 |
|----------------------------------|-------------------------------|-------------------|
| Physics & Mathematics            | 289                          | 204%              |
| Health & Medical Sciences        | 192                          | 98%               |
| Chemical & Material Sciences     | 108                          | 80%               |
| Computer Science                 | 345                          | 72%               |
| Engineering                      | 174                          | 63%               |
| Business, Economics & Management | 333                          | 45%               |
| Social Sciences                  | 349                          | 18%               |
| Life Sciences & Earth Sciences   | 177                          | 18%               |
| Humanities, Literature & Arts    | 414                          | 6%                |
| All articles                     | 245                          | 64%               |

The numbers for each broad area are from the representative subject category for the area.

Table 1: Change in the number of top-1000 papers published in non-elite journals over 1995-2013.

Table 2 presents the per-area growth in numerical form, for ease of comparison. It shows that six out of nine broad areas had at least 50% of total citations going to articles published in non-elite journals in 2013. Furthermore, 8 out of 9 broad areas saw an increase of 40% or more in the fraction of citations to non-elite journals over 1995-2013.

4 Related Work

The idea that a small core set of journals covers most of the key papers in a discipline has long been prevalent in the study of scholarly communication. For example, see [1, 2, 3] or do a query for “core journals” in article titles on Google Scholar [5].

Larivi`ere et al [7] examined the concentration of citations at the article level over 1900-2007 and concluded that while distributions of citations remained highly skewed, the fraction of citations to highly cited articles has been decreasing. Looking at broad research areas, they found that for Natural Sciences & Engineering and Medicine, the decrease in concentration started around 1990.

Lozano et al [9] studied the relationship between impact factor and article citations. They examined three broad categories, Natural Sciences & Medicine, Physics and Social Sciences, over 1902-2009 and found that the correlation between impact factor of the journal and the citations its articles receive has been weakening since around 1990. In another part of their study, they computed the fraction of 10% most-cited articles that appear in the 10% highest impact-factor journals. For this, they focused on Natural Sciences & Medicine. They found that a decreasing fraction of most-cited articles is being published in the most-cited journals.

In a follow-up study [8], they took a closer look at 13 journals, seven traditionally top-ranked journals and six upcoming journals. They found that since around 1990, the fraction of most-cited papers published in the traditionally top-ranked journals has been dropping and the fraction of
Figure 3: Fraction of citations to non-elite journals over 1995-2013.

Figure 4: Fraction of citations to non-elite journals for broad areas of research.

**bio:** Life Sciences & Earth Sciences; **bus:** Business, Economics & Management; **cs:** Computer Science; **chm:** Chemical & Material Sciences; **eng:** Engineering; **hum:** Humanities, Literature & Arts; **med:** Health & Medical Sciences; **phy:** Physics & Mathematics; **soc:** Social Sciences
Table 2: Change in the fraction of citations to non-elite journals over 1995-2013.

| Broad area                              | Non-elite citations in 2013 | Change since 1995 |
|-----------------------------------------|-----------------------------|-------------------|
| Computer Science                        | 50%                         | 133%              |
| Life Sciences & Earth Sciences          | 43%                         | 95%               |
| Health & Medical Sciences               | 51%                         | 83%               |
| Physics & Mathematics                   | 30%                         | 67%               |
| Engineering                             | 50%                         | 52%               |
| Business, Economics & Management        | 53%                         | 51%               |
| Chemical & Material Sciences            | 41%                         | 46%               |
| Humanities, Literature & Arts           | 53%                         | 42%               |
| Social Sciences                         | 56%                         | 22%               |
| All articles                            | 47%                         | 74%               |

such papers published in the upcoming journals has been increasing.

The goal of our study is similar to those of Larivière et al [8, 9]. We have examined the impact of non-elite journals for a large number of specific research fields. Structuring such a study to consider individual research fields separately is necessary since: (1) usually only the journals in a specific field are the possible venues for the highly-cited articles in the field, (2) there are large differences in the citation frequency in different fields and grouping a large number of research fields usually results in the fields with higher citation frequency dominating the results. That said, our results are complementary to theirs and point in the same direction.

5 Conclusions

There are two main conclusions from our study. First, the fraction of highly-cited articles published in non-elite journals increased steadily over 1995-2013. While the elite journals still publish a substantial fraction of high-impact articles, many more authors of well-regarded papers in a diverse array of research fields are choosing other venues.

Our analysis indicates that the number of top-1000 papers published in non-elite journals for the representative subject category went from 149 in 1995 to 245 in 2013, a growth of 64%. Looking at broad research areas, 4 out of 9 broad areas saw at least one-third of the top-cited articles published in non-elite journals in 2013. All broad areas of research saw a growth in the fraction of top-cited articles published in non-elite journals over 1995-2013. For 6 out of 9 broad areas, the fraction of top-cited papers published in non-elite journals for the representative subject category grew by 45% or more.

Second, the fraction of citations to articles published in non-elite journals has grown substantially over most research areas. The percentage of citations to articles in non-elite journals went from 27% of all citations in 1995 to 47% in 2013. Six out of nine categories had at least 50% of
total citations going to articles published in non-elite journals in 2013.

Now that finding and reading relevant articles in non-elite journals is about as easy as finding and reading articles in elite journals, researchers are increasingly building on and citing work published everywhere.

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