Irreproducibility of the results of the Shanghai academic ranking of world universities

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I discuss the difficulties that I encountered in reproducing the results of the Shanghai ranking of world universities. In the Shanghai ranking, the dependence between the score for the SCI indicator and the weighted number of considered articles obeys a power law, instead of the proportional dependence that is suggested by the official methodology of the ranking. Discrepancies from proportionality are also found in some of the scores for the N&S and Size indicators. This shows that the results of the Shanghai ranking cannot be reproduced, given raw data and the public methodology of the ranking.

Introduction

The Shanghai academic ranking of world universities\textsuperscript{1} has been published in the last few years by the Institute of Higher Education of Shanghai Jiao Tong University, and rapidly gained international recognition. I attempted to estimate the score that Romanian universities would obtain in this ranking, as none of them entered among the top 500 universities.\textsuperscript{2} An unexpected result of this study was that the results of the 2005 Shanghai ranking cannot be reproduced by following the public methodology of the ranking. I present here the inconsistencies that I found between the scores obtained by
universities in the ranking, on one side, and data processed according the public methodology, on the other side.

The SCI indicator

The methodology of the 2005 Shanghai ranking is presented on the ranking website; I will refer to it as the public methodology. According to it, one of the indicators used in the ranking is the SCI indicator, measuring the “total number of articles indexed in Science Citation Index-Expanded, Social Science Citation Index, and Arts & Humanities Citation Index in 2004. Only publications of article type are considered. When calculating the total number of articles of an institution, a special weight of two was introduced for articles indexed in Social Science Citation Index and Arts & Humanities Citation Index.” It is also said that “for each indicator, the highest scoring institution is assigned a score of 100, and other institutions are calculated as a percentage of the top score. The distribution of data for each indicator is examined for any significant distorting effect; standard statistical techniques are used to adjust the indicator if necessary.”

The scores obtained by the top 500 universities for each of the indicators, including the SCI one, are provided in an Excel file on the ranking website. I noted with $s_{ISI}$ the score for the SCI indicator, given in this file. The number of articles indexed in 2004 in Science Citation Index-expanded (SCIE), Social Science Citation Index (SSCI), and Arts & Humanities Citation Index (AHCI), and in either of all these three indexes (SCI), with authors from the top 500 universities, was extracted from the ISI database by a group from Institute Jozef Stefan, Slovenia, and made available on the internet. I noted with $n_{SCIE}$, $n_{SSCI}$, $n_{AHCI}$ and $n_{SCI}$ these numbers of articles. The queries used in the Slovenian study for searching in the Thomson ISI database are made available on its website and thus the data can be easily reproduced.

I noted with $n_{ISI}$ the total number of articles of an institution, as used in the calculation of the Shanghai score for the SCI indicator. The three indexes (SCIE, SSCI, AHCI) are not disjoint (currently, 304 journals are indexed in both SCIE and SSCI; 37 journals in both SCIE and AHCI; 53 journals in both SSCI and AHCI – data computed from the Thomson ISI journal lists available online). Hence, it is not clear from the stated methodology how $n_{ISI}$ is computed from $n_{SCIE}$, $n_{SSCI}$, $n_{AHCI}$ and/or $n_{SCI}$. I considered the alternatives $n_{ISI,1}=n_{SCI}+n_{SSCI}+n_{AHCI}$ and/or $n_{ISI,2}=n_{SCIE}+2(n_{SSCI}+n_{AHCI})$. I did not consider the possible alternative $n_{ISI,3}=n_{SCI}+n_{SSCI, AHCI}$, where $n_{SSCI, AHCI}$ is the number of articles in either SSCI or AHCI, for lack of data, but the discrepancy between the results obtained with this option and the results expected from the Shanghai official methodology would be even greater than with the other options (as $n_{ISI,3}<n_{ISI,1}$).

When plotting $n_{ISI,1}$ and $n_{ISI,2}$, computed from the data of the Slovenian group, against $s_{ISI}$, the score used in the Shanghai ranking (Figure 1), it is immediately clear