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Regular article

What drives university research performance? An analysis using the CWTS Leiden Ranking data



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ARTICLE INFO

Article history:

Received 20 May 2017

Received in revised form 13 June 2017

Accepted 21 June 2017

Available online 30 August 2017

Keywords:

University ranking

Indicators

Excellence

Internationalization

Innovation

Country differences

ABSTRACT

This paper analyzes the factors underlying university research performance as indicated by the number of highly-cited publications, international co-publications, and university–industry co-publications. The three performance indicators evaluate three possible university missions, respectively: research excellence, internationalization, and innovation. Using a regression analysis, we assess to what extent a university's research performance is influenced by structural variables including size, age, city size, location in a capital city, disciplinary orientation, and country location. Our results show that research performance differences among universities mainly stem from size, disciplinary orientation and country location. This suggests that simple global benchmarking can be misleading; rather, benchmarking is most meaningful between universities of a similar size supplemented with contextual information on a university's specific mission, orientation and national institutions.

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1. Introduction

Nowadays, we can find a ranking for almost every form of human activity. Academic activities at universities are no exception. We could, however, ask ourselves how meaningful such university rankings are and whether they are currently being used in a biased or naïve manner. Undeniably, there are large differences in performance among universities. Thus, the logic of university ranking seems appropriate: rankings reveal a university's performance compared to others. Indeed, university rankings are now proliferating. Apart from the most well-known ones such as the ARWU (“Shanghai”) ranking, the Times Higher Education (THE) ranking and Quacquarelli Symonds (QS) ranking, at least 30 other rankings exist (Shin, Toutkoushian, & Teichler, 2011).

People both criticize and applaud global university rankings. While there is disagreement on which data, methodology and interpretations are the most robust (see for example Moed, 2017), many observers believe that global university rankings are here to stay. With students and academics facing greater options and opportunities, the existence of these rankings has heightened competition the world over and governments are now paying closer attention, even utilizing rankings to determine policies. Rankings are “performative” (Dahler-Larsen, 2011) in the sense that students, university boards and governmental bodies consider them meaningful, and rankings therefore influence their opinions, decisions, and actions. In most rankings, the aim is to compare so-called world-class universities, especially research-intensive ones. In doing so,

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rankings are creating a framework in which universities are part of a global knowledge system where global norms apply about what is considered performance.

Given the increasing impact of university rankings, and their questionable implicit assumption of a single global system, it has become pivotal to develop more reflexive and useful ways to interpret the results of rankings. Global university rankings suggest there is a single 'global' academic system with homogeneous university structures and objectives. Such a viewpoint ignores strong specificities among disciplines, countries, and university missions. Hence, university rankings have been criticized for misleading their users such as international students, job-hopping scientists, and policy officers (European Journal of Education, 2014; Kehm & Stensaker, 2009; Shin et al., 2011).

The fundamental problem underlying global university rankings is well articulated by Shin and Toutkoushian (2011, p. 2), who argued that "ranking universities is a challenging task because each institution has its own particular mission, focus and can offer different academic programs. Institutions can also differ in size and have varying amounts of resources at their disposal. In addition, each country has its own history and higher education system which can impact the structure of their colleges and universities and how they compare to others. It is therefore very difficult to rank entire universities, especially across national borders, according to the single criterion of ranking indicators". In our view, what is needed is an understanding of – and reflection on – the factors underlying university research performance. We will look at age, size, city size, capital city, disciplinary orientation and country location. An empirical analysis of university performance will give us insight into the structural differences among the best research universities worldwide. Consequently, we can form more specific – and more meaningful – peer groups that are relevant for benchmarking universities. For example, if size turns out to be very predictive of a high ranking – all other things being equal – a small university may compare itself more meaningfully with fellow smaller universities rather than those of any size. Or, if medical schools systematically perform differently compared to generic universities, we could argue that such schools should consider each other as relevant peers, rather than all types of universities. Furthermore, regression analysis can assess, for an individual university, whether its performance is better or worse than the expected value we can obtain from the regression coefficients. If the residual of an observation is positive (negative), this means the university in question is doing better (worse) than could have been anticipated from its structural features.

Our empirical study aims to analyze the factors underlying university research performance. We do so by using regression analysis to explain a university's performance from underlying structural variables. As dependent variables, we use three indicators provided by the CWTS Leiden University ranking, which has detailed bibliographical information on 750 universities worldwide for the period 2010–2013. The performance indicators we analyze are as follows: number of highly-cited publications, number of international co-publications, and number of co-publications with industry. The three indicators denote the evaluation criteria of three potential and different university missions. Highly-cited publications indicate research excellence, which many universities see as their goal. In addition to excellence, a second mission that some universities embrace is to act as an absorber of global knowledge through international networks. This goal is often pursued by universities in developing countries. Finally, universities can play a key role as sources of human capital and innovation for the economy. Some universities consider it as their main mission to contribute to the local economy, especially universities in peripheral regions (Bonaccorsi, 2016). In this paper, we use the number of highly-cited publications as a criterion of excellence, the number of international co-publications as a criterion of internationalization, and the number of university-industry co-publications as a criterion of a university's contribution to innovation.

Our study follows on previous studies that attempted to unravel the drivers of universities' research performance to advance a more careful use of ranking data. A study by Li, Shankar and Tank (2011) focused on national differences by taking for each country the number of universities reported in the ARWU 2008-ranking as dependent variable. The analysis, covering 93 countries, showed that – apart from population – GDP per capita, R&D expenditures and English as a language all contributed to the number of universities in the ARWU list. The residual analysis further revealed that UK and China are over-performers and the US an under-performer. A second study by Bornmann, Mutz and Daniel (2013) applied a multi-level analysis to analyze to what extent university output and country variables (population, GDP per capita, notably) affect the probability that a paper is among the top ten percent highest cited publications. They used the Leiden Ranking data for the period 2005–2009, which at the time was available for 500 universities. Their key result was that country variables explain the larger part of performance differences between universities (about eighty percent), while differences among universities matter relatively little (about twenty percent). The study was followed up by Bornmann, Stefaner, de Moya Anegón and Mutz (2014) applying the same multi-level approach on Scopus data while distinguishing between subject areas.

2. Leiden ranking

Although specific countries have been creating university rankings for certain disciplines for almost a century, global university rankings that cover many more universities and sciences are a relatively recent phenomenon (Kehm & Stensaker, 2009; Shin et al., 2011). Among the first was the *Academic Ranking of World Universities* (initially under the label of the Shanghai Ranking), published since 2003 by Shanghai Jiao Tong University in China. This ranking was soon followed by

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