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The growth process of higher education institutions and public policies

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ABSTRACT

This paper investigates the growth over time of the size of higher education institutions (HEIs), as measured by the number of academic staff, and its association with HEI and country attributes. We analyze a sample of 837 HEIs from 18 countries derived from the European Tertiary Education Register (ETER) and from the European Micro Data dataset (EUMIDA) for the years 2008 and 2012. Our analysis shows that (1) HEIs growth is largely proportional to their size, leading to a nearly log-normal distribution of size (Gibrat's law), even if small institutions tend to grow faster; (2) the growth of the number of students and HEI's reputation level positively influences HEI growth. Consequently (3) small HEIs need a lower level of reputation and less growth of students to continue growing over time, while only highly reputed HEIs are able to maintain a large size over time. Our results are relevant to understand the extent to which cumulative effects lead to a lasting concentration of resources in the HE system and whether public policies are able to redistribute resources based on merit.

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1. Introduction

The growth of the higher education system is a subject that has received little attention from the scientific community. There are only a few studies that address this process at the system's level, by looking at the growth and number of universities over several decades (Bonaccorsi & Daraio, 2007; Riddle, 1993) and at the growth of overall student enrolment (Schofer & Meyer, 2005). This may be explained by the lack of reliable data on individual HEIs, but this subject can be explored in more detail with the development of databases such as the European Micro Data (EUMIDA) and the European Tertiary Education Register (ETER), two projects supported by the European Commission and realized in close cooperation with EUROSTAT whose aim was to establish a comparable dataset of European Higher Education Institutions in Europe (Lepori et al., 2014).

The topic is of theoretical and practical relevance. First, an extensive literature review demonstrated that the growth process of many types of organizations is driven by cumulative advantage, where the growth rate is largely independent of size, leading to a highly skewed distribution of organizational size (Gibrat's law; Mitzenmacher, 2004). Such cumulative effects are well known in the science system, where a power-law distribution has been found for paper citations, researchers' productivity and impact (e.g. Katz, 1999, 2000; van Raan, 2006a, 2008a,b, 2013). Therefore, it is important to analyze whether this effect can also be found in the growth of HEI size over time.

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Second, in most European countries, public policies increasingly allocate funding to HEIs based on performance, by increasing the share of competitive funds and by linking the level of core allocation to the number of students and to some measure of research performance (Auranen & Nieminen, 2010; Geuna & Martin, 2003; Jongbloed & Vossensteyn, 2001). Yet, cumulative effects imply that large HEIs have more opportunities – for example they acquire more students – and therefore, performance-based allocation would reinforce the existing hierarchy rather than redistributing resources based on merit. An analysis of how resources are redistributed over time and whether this leads to differential growth is clearly required.

In this paper, we analyze the growth of a sample of 837 HEIs in 18 European countries between 2008 and 2012, using total academic staff as a measure of organizational size. This is the first study of its type, according to our knowledge of the literature. We include a set of variables at the country and at the organizational level that may influence organizational growth.

First, we present descriptive statistics on the variables considered, highlighting the skewness of their distribution.

Second, we show that the distribution of HEI size, at a given point of time, is nearly log-normal, therefore providing evidence that Gibrat's law might play a role in explaining organizational growth. We also perform distributional analysis of the increase in total academic staff between 2008 and 2012, focusing on differences between countries and on the identification of fast-growing HEIs.

Third, we run multi-level regressions to predict size in 2012 as a function of size in 2008, of HEI characteristics (growth of the number of students, reputation, HEI type) and of the change in national investment in tertiary education.

In the discussion section, we provide an interpretation of these results in terms of the model of growth of HEIs, highlighting the interplay between cumulative effects and performance-based allocation and its implication for the resulting distribution of organizational size within HE systems. Lastly we point to some future extensions of our research.

2. Theoretical framework

2.1. Size distribution and growth processes

Several phenomena in the world and in society are not characterized by a normal distribution of the variable of interest *at a given point in time* – like organizational size, number of species, paper citations – but by a right-skewed distribution, where the values for a small number of observations are much larger than the median and account for a large proportion of total scores. Such distributions can frequently be fitted by a log-normal distribution, where the logarithm of the variable is distributed normally, or by a power law distribution of the form $p(x) = c \times x^{-\alpha}$, where $p(x)$ is the proportion of observations with score x (Newman, 2005). The two distributions are very similar in shape, except that a log-normal distribution has a less fat tail of extreme values, making difficult, in some situations, to decide which distribution is a better fit for empirical data.

The power law has been found in several contexts: to measure the usage frequency of words in various languages (Zipf, 1949); in the number of papers a researcher writes (Coile, 1977); in the impact of the papers measured by the number of citations (Perc, 2010; Price, 1965); in the number of visitors to sites of the World Wide Web (Adamic & Huberman, 2000), in the number of species per genus of mammals (Willis & Yule, 1922) and in income distribution of companies (Okuyama, Takayasu, & Takayasu, 1999).

The log-normal distribution has been used in: fitting molecular weight distributions (Monteiro, 2015; Shin-Ya, Yoshizawa, Hong, Lee, & Kajiuchi, 2003); fitting the coefficients of friction and wear distributions (Steele, 2008); fitting the g-index and the h-index distributions for researchers (Perc, 2010) and in fitting the file size distribution of publicly available data files on the Internet (Gros, Kaczor, & Markovic, 2012). In economics, there is extensive evidence that the size distribution of firms in many fields displays a log-normal distribution (Ijiri & Simon, 1967).

These distributions can be linked to simple generating processes, where the growth over time of individuals or organizations is in proportion to their current size, as the outcome of some form of cumulative advantage (Mitzenmacher, 2004).

A log-normal distribution can be generated from Gibrat's law, which states that the probability distribution of a firm's growth rate is independent from the firm's size (Mansfield, 1962). The growth of individual firms is dependent on their profitability as well as on other factors that are dependent on the quality of the firm's management, the availability of the inputs and the economic environment. The combined effect of these factors will lead to a probability distribution of the rates of growth for firms of a given size. If that distribution is the same for all size-classes of firms, the size distribution of firms converges to a log-normal distribution.

More precisely, Gibrat's law can be expressed as follows:

$$Size_t = (1 + \varepsilon) \times Size_{t-1} \tag{1}$$

where ε is a random variable with mean m and variance σ accounting for variation in the growth rate among HEIs. Provided the selected time difference is short and therefore ε is sufficiently small:

$$\log(Size_t) = \log((1 + \varepsilon) \times Size_{t-1}) \approx \log(Size_{t-1}) + \varepsilon \tag{2}$$

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