Is the Humboldtian university model an engine of local development? New empirical evidence from the ETER database

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Introduction

The higher education system, in advanced countries, has reached the point of massification (i.e. enrolment rates exceeding 50% of the relevant age cohort), while the public budget has not grown correspondingly. Universities are put under pressure to use existing resources, namely staff and funding, in the most efficient way. At the same time there is an increased pressure from the research side: the expectations of society and policy makers on the contribution of research to societal problems have grown significantly, there are new entrants in scientific arena (particularly from Asia) and the competition for funding has increased sharply. This situation creates a classical issue in public policy: we have two valuable goals (serving better mass educational needs and producing good research) between which there is tension or trade-off.

Do universities benefit from having inputs (staff and funding) that can produce jointly teaching and research, or there are efficiency-enhancing specialization effects that suggest to keep these activities under separate institutions? What is the impact of the environmental context of the universities? We focus here on the complementarity between teaching and research, which is at the core of the Humboldtian model of university (Schimank & Winnes, 2000). Is the traditional Humboldtian model of university, in which teaching and research are produced jointly by the same academic staff able to foster the economic development of the area in which the university is located? What are the main contextual factors which affect the performance of the European Humboldtian universities?

Purpose of the analysis and method

The main objective of this paper is to investigate the determinants of the efficiency scores of European universities, whose production is characterized by teaching and research outputs.

In efficiency analysis, nonparametric estimators are particularly attractive because they do not rely on restrictive parametric assumptions on the process that generates the data.

We apply a nonparametric approach, DEA (Data Envelopment Analysis, Charnes et al., 1978), which allows for multi-input - multi-output analyses, followed by a bootstrap analysis to estimate bias corrected efficiency scores and to provide confidence intervals on the efficiency scores. Given that universities in Europe face heterogeneous conditions, in a second step, we applied a semiparametric bootstrap-based approach (Simar & Wilson, 2007) to assess the statistical significance of external contextual factors on their performance.

Data and variables

Our sample is composed by 753 HEIs (Higher Education Institutions) belonging to 22 different European countries.

In the following tables we present the data analysed, the inputs, the outputs and the external factors investigated in the paper.

Table1. Data.

Data Source	Description
SCIMAGO INSTITUTION RANKING	The SIR purpose is a characterization of institutions, based on three different ranges: research, innovation and web visibility. This source uses normalized indicators, in a scale from 0 to 100, to facilitate the comparison between the institutions. The SIR database provides some bibliometric indicators for each institution, like number of publications, high quality publications, normalized impact, international collaboration and specialization index.
ETER	The European Tertiary Education Register wants to build a complete register of higher education institutions. Its database gives various information, like number of students, professors, graduates, doctorates, total incomes and expenditures. This register is developed by the Directorate General for Education and Culture of the European Commission.
EUROSTAT database	The EUROSTAT database wants to be the leading provider of high quality statistics on Europe. It contains regional data at a very disaggregated level.

Table2. Selected inputs

Input	Formula
Teaching	$\frac{\#\text{ of academic staff}}{\#\text{ of students}} * 100$
Structural	$\frac{\#\text{ of administrative staff}}{\#\text{ of students} + \#\text{ of academic staff}}$
Research	$\frac{\#\text{ of graduates at ISCED 8}}{\#\text{ of undergraduates enrolled}}$

Table 3. Selected outputs.

Output	Formula
Teaching	$\frac{\#\text{ of graduates}}{\#\text{ of students enrolled}}$
Research	$\frac{\text{output (pub)} * \text{HQP(\% high quality pub)}}{100 * (\#\text{ of academic staff} + \#\text{of graduates at ISCED 8})}$
Third mission	Percentage of third party funding.

Table 4. Selected External factors.

External factor	Description
GDP	Gross domestic product at current market prices
PAT	Patent applications
HOSP	Hospital yes/no
ER	Employment rates- age group 20-64
GERD	Total intramural R&D expenditure (GERD) at NUTS 2 level
SIZE	Size
AGE	No. of years from foundation

Modelling strategy

We estimate several partial models, i.e. models of single output production (teaching model, research model, third mission model) as well as complete models (of joint production of teaching and research, including also the third mission dimension) to analyse how the evaluation of the impact of external factors affects the production of the considered universities.

A correlation analysis is carried out to analyse the degree of association of the obtained efficiency scores with the degree of internationalization of the considered universities to account for recent results that show that is the quality of the academic staff that plays an important role to facilitate and faster third stream activities as complement of teaching and research missions.

Preliminary results and next steps

Figure 1 reports some illustrative preliminary results of the two-stage analysis conducted on the dataset.

We are going to extend the analysis in the following directions:

1. Inclusion of other third mission indicators in the input-output characterization (Geuna & Rossi, 2015), to investigate how their inclusion affects the impact of the considered external factors.
2. Apply robust nonparametric approaches (Daraio & Simar, 2007) which do not rely on the separability condition assumed by the two stage approach applied in this paper, and are more robust to outliers and extremes in the dataset as well as more flexible directional distance models (Daraio & Simar, 2014; Daraio et al., 2015a,b).

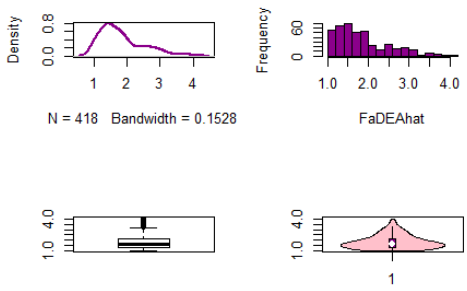

Figure1. Distribution of the European efficiency scores. Top left panel: nonparametric kernel density distribution, top right panel: histogram, bottom left panel: box plot and bottom right panel: violin plot.

Some Selected References[1]

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[1] See authors' webpage for a full list of references, which are removed due to space limitations.