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Universities as nail factories? An evaluation of the Italian public funding of higher education

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Abstract

We use data on graduates from public Italian universities and show that socio-economic factors, external to the control of the university management, can play a crucial role in determining the performance of students in terms of study completion time. We argue that the recent reform of the Italian public funding policy, which rewards universities for the number of students who complete their studies on time, can have perverse effects on the quality of undergraduate education.

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1. INTRODUCTION

In recent years, the Italian university system has experienced substantial reform. One of the main objectives is the reduction in the average completion time of graduate studies, which should ease the entry into the labor market of young graduates. Such a reduction should level off the differences with most of the other European countries, in which the average age at graduation has constantly been lower than the Italian level. In 1999, the Ministerial Decree n. 509, has changed the system of graduation programs: the old four-year and five-year cycles have been split into a first cycle of studies (bachelor degree or the three-year degree – *Laurea di I livello*), and a second cycle (master degree or two-year degree – *Laurea Magistrale*). In addition, the reform has established a new mechanism for the allocation of public funds to the education system. In this paper, we focus on this new public funding policy, which now depends on the results achieved in terms of an alleged efficiency of teaching activities[1]. A lower completion time is considered as a proxy for efficiency and teaching quality, and is one of the criteria adopted for allocating public funds to universities. The idea lies on the assumption that the universities with faster graduation rates are optimizing the use of public resources, while still providing the same level of knowledge and skills to their students. However, the policy does not take into account the potential moral-hazard behavior on the part of the university management, and the incentives to increase the number of graduates (quantity) irrespective of the skills and knowledge required to pass the exams (quality). This behavior may be exacerbated by the fact that, in Italy, public universities are not subject to a direct system of responsibility. Namely, no control is undertaken to assess the knowledge of students and, thus, no penalties can be charged. Besides, bad reputation for loose and effortless preparation usually takes a long time to develop, and in some case might be seen as appealing to some prospective students. The new system of performance indicators is vaguely reminiscent of the old urban legend of the nail factory in the Soviet Union, which goes something like this: "when Moscow set quotas by quantity, the incentive for the nail factory was to produce the largest possible quantity of tiny and faulty nails".

The choice to base part of the public funding on performance indicators could also unfairly affect those universities located in difficult territorial contexts. We argue that the performance of graduates, in terms of completion time, can be attributed to a combination of two main sets of variables: 1) the overall management of the university; 2) the socio-economic characteristics of the territory in which the university operates (such as local government policies, cultural activities, unemployment rate and degree of economic development). Many studies have tried to estimate the efficiency of the post-reform Italian university system (for example, Ferrari and Laureti, 2005, and Agasisti and Dal Bianco, 2009), but little attention has been paid to all those factors which are external to the control of the university management. The reason is that it is extremely difficult to assess in which part the performance of students can be ascribed to internal or external variables. The aim of this paper is to contribute to the literature by trying to determine the effects of socio-economic and institutional factors on the "productivity" of Italian universities. We conclude that a performance-based funding policy, such as the one implemented in Italy, can have perverse

1 In Italy, a public assessment of the higher education system was first introduced by the Law n. 537/1993, which replaced the previous allocation of public funds with an ordinary financial fund (*fondo di finanziamento ordinario* - FFO). The funds received by public universities is based on a complex range of parameters established by the Ministry of Education. It consists of both a base quote and a reassessment quote, which should consider meritocratic indicators, as for example research performance and teaching productivity. The latter is loosely parameterized to indicators based on the performance of students, in particular to the number of students who complete their courses in due time. An increasingly large part of the FFO is used to award "prizes" to universities. For example, in 2016, prizes amounted to about 20% of the FFO (see also the Law n. 98/2013).

effects as it may reward or penalize universities not for the quality of their management, but for the place where they are located. This is particularly true for the Italian territory, which is characterized by a strong dualism between the advanced North and the more backward South. Such a dualism is also reflected in the different number of university graduates between the two areas, and this may give the incentive for southern universities to engage in a race to the bottom. An unfair funding system could also widen the gap between universities, increasing the inequality between more and less developed areas.

The paper is as follows. Section 2 describes the dataset and variables employed. Section 3 applies a fractional logit model and a Data Envelopment Analysis (DEA) to the dataset and shows the main results. Section 4 draws some conclusions.

2. DATASET AND VARIABLES

We use data on the completion time of graduates in all Italian public universities with at least 1000 students enrolled (unless otherwise specified, all data are taken from the Ministry of Education, University and Research - MIUR)[2]. The dataset consists of two distinct periods, associated with two academic years: 1) academic year 1998/1999, so to focus on the old bachelor degree system (4- or 5-year degree – *Laurea*); 2) academic year 2011/2012, so to focus on the new degree system (3-year bachelor degree – *Laurea di I livello*). Each university is associated with an Italian territorial province, and for those universities with no well-defined territorial nature, we have used the arithmetic mean of the provinces in which they operate. To assess the relationship between external factors and completion time of studies, we use a student-side model. The dependent variable represents the rate of students who either complete their studies within the prescribed period of time or in two additional years (for the 4- and 5- year cycles), or one additional year (for the 3-year cycles). The estimate is based on the function

$$C\_TIME = f(UNIV, STUD, ENV),$$

where *UNIV*, *STUD* and *ENV* are three vectors of variables that include: the inputs of the education production process; the characteristics of students; the socio-economic context in which the university is located. Note that the first vector of variables is directly affected by the university management, whereas the other two groups refer to external factors. Table 1 describes the variables used throughout the analysis. The first group includes: the ratio between students and professors (*TEACH*); a structural supply index that considers the total number of available seats in teaching halls, libraries and laboratories per student (*STR*). The second group of variables includes: a student quality index (*QUAL*), measured by the ratio of students enrolled with a score equal or higher than 9/10 in secondary (high) school; the gender (percentage of women enrolled, *WOMEN*); the age characteristics (percentage of students enrolled younger than 20 years old, *YOUNG*). The variables related to the external socio-economic context are: the GDP per capita of the territorial province (*GDP*); the share of people having a bachelor degree (or higher) in the territory (*GRAD*); a variable related to cultural activities (*CULT*), proxied by the percentage of people that usually read newspapers. To take account of the lag between enrollment and graduation in the post-reform dataset, we consider the number of graduates in the year 2012, and the values of explanatory variables in

2 The number of public Italian universities is 49 in period 1, and 53 in period 2. We do not consider private universities and public universities with particular features, such as universities for foreigners.

the academic year 2009/2010. In the dataset related to pre-reform period, these values refer to the academic year 1998/1999, due to limited availability of data.

Table 1
Description of variables

Variables	Description	Level	Source
C_TIME2012	Rate of students that completed their studies in 2002 in 1 additional year	University	University Education Survey - MIUR
C_TIME1999	Rate of students that completed their studies in 1999 in 2 additional years	University	University Education Survey - MIUR
TEACH	Number of students per member of faculty staff	University	MIUR / Cineca
STR	Number of seats available in teaching rooms, libraries and laboratories per student	University	MIUR / Cineca
QUAL	Rate of enrolments with a score higher than 9/10 in secondary (high) school	University	University Education Survey - MIUR
WOMEN	Rate of female students enrolled	University	University Education Survey - MIUR
YOUNG	Rate of young enrolled (< 20 years old)	University	University Education Survey - MIUR
GDP	GDP per capita	Province	Istituto Tagliacarne - Unioncamere
CULT	Rate of people that read newspapers	Region	Multipurpose survey on households - ISTAT
GRAD	Rate of people with university degree qualification	Province	Population and housing census - ISTAT
ENR	Total number of enrolments	University	University Education Survey - MIUR

3. METHODS AND RESULTS

We follow two different approaches (parametric and non-parametric) to test the robustness of our results. We firstly apply a fractional logit model[3] to evaluate the relationship between the completion time and three groups of variables that can affect the performance of students. We use the following equation

$$C\_TIME_{it} = \alpha + \beta UNIV_{it} + \gamma STUD_{it} + \delta ENV_{it} + \varepsilon_{it}\,. \quad (1)$$

In the second model, we first calculate the efficiency scores of Italian universities using an input-oriented DEA methodology[4], which considers as inputs the variables directly affected by the university management (*TEACH* and *STR*), and as output the completion time of studies. The efficiency scores are then regressed in a second stage using a fractional logit regression, which considers as explanatory variables those included in the second and third vector (*STUD* and *ENV*). The equation is

3 See Papke and Wooldridge (1996). Due to limited availability of data, it is not possible to apply a probit model (we leave the possibility of a more general investigation to future research).
4 See Charnes, Cooper and Rhodes (1978).

$$EFF.SCORE_{it} = \alpha + \gamma STUD_{it} + \delta ENV_{it} + \varepsilon_{it}. \quad (2)$$

This approach is useful to highlight the relationship between the speed of completion and external factors also in terms of university managerial efficiency. Table 2 reports the results for both to the pre-reform period (period 1), and the post-reform period (period 2). In period 1, as expected, we find a significant negative relationship between the completion time and both the number of students per professor (*TEACH*) and the size (number of students) of the university (*ENR*). However, in period 2, this result does not hold, thus showing that the link between completion time and university inputs may be weak under different assumptions. Besides, the coefficient of the quality level of enrolled (*QUAL*) changes in sign from period 1 to period 2. This implies that, before the reform, high-scoring students were negatively associated with the speed of study completion. All socio-economic variables are highly significant for the two models, both before and after the reform. In particular, there is a strong positive relationship between *GDP* and *C_TIME*, probably because a higher chance of finding a job, which is usually associated with higher GDP levels, can encourage students to complete their studies on time. On the other hand, the negative relationship between the dependent variable and the cultural factors (*CULT*) shows that the completion time is not necessarily affected by cultural activities (an explanation can be that students with high general knowledge may be more meticulous and wish to obtain higher graduation scores at the expense of the completion time). A negative coefficient also appears for *GRAD*, probably showing that an increase in competition for qualified jobs may discourage students to complete their studies on time.

In order to assess the impact of external variables on the completion time, we also estimate the predicted values of model 1 by assuming a hypothetical "relocation" of a university to a different territorial context (province). In Table 3, we report the results of a relocation from the South to the North of Italy: the inputs *TEACH* and *STR* are kept fixed, while the values associated to *STUD* and *ENV* are re-assigned from northern to southern universities[5]. In both period 1 and period 2, we obtain that a southern university, operating in a northern territorial context, would achieve a much higher result in terms of completion time (Table 3 also shows that the opposite exercise, in which a northern university is relocated to the South, would reduce the completion time). We can conclude that the difference in performance between Northern and Southern universities is not so wide when we exclude the impact of socio-economic external factors.

We have conducted several robustness tests, using wider or narrower speed indicators of the completion time of studies, and adding alternative specifications of the socio-economic variables[6]. The significance of the estimates does not change, thus confirming our findings.

5 We consider the arithmetic means of the universities located in the provinces of the South (macro-area including the regions Campania, Puglia, Basilicata, Calabria, Sicilia, Sardegna), and of the North (macro-area including the regions Piemonte, Lombardia, Trentino Alto Adige, Veneto, Friuli Venezia Giulia, Liguria, Emilia Romagna).

6 Specifically, we have: *a*) replaced the GDP indicator with the employment rate of the province (to provide an alternative measure of the degree of development of the territory); *b*) used the stock of cultural capital as an additional measure of cultural activities, proxied by the number of archaeological sites, monuments and museums in the region (data from The Risk Map of Italian Cultural Heritage – www.uni.net/aec/riskmap/english.htm); *c*) replaced (only for period 2) the variable *QUAL* by the average score of students in the Programme for International Student Assessment (PISA) survey (results are available upon request).

Table 2
Estimation results[a]

Regressors	Period 1 - dep. var. *C_TIME1999*				Period 2 - dep. var. *C_TIME2012*			
	MODEL 1		MODEL 2		MODEL 1		MODEL 2	
	Coeff.	z	Coeff.	z	Coeff.	Z	Coeff.	Z
TEACH	-0.0096	-2.87***			-0.0073	-1.08		
STR	-0.211	-0.09			1.483	1.46		
QUAL	-2.621	-1.97**	-5.773	-2.67***	2.288	2.24**	1.919	0.53
WOMEN	-0.755	-1.05	-2.256	-2.39**	0.501	1.71*	0.886	0.72
YOUNG	-0.555	-0.56	-3.633	-2.03**	-0.694	-1.48	-2.662	-2.04**
GDP	0.00005	3.07***	0.00004	2.37**	0.0001	10.66***	0.0001	3.80***
CULT	-0.025	-1.75*	-0.111	-4.53***	-0.025	-3.09***	-0.083	-4.62***
GRAD	-5.789	-1.65*	-7.433	-1.03	-10.04	-3.83***	-12.63	-1.93*
ENR	-0.00004	-2.55**	-0.00002	-0.93	0.000004	0.03	-0.00001	-0.54
_cons	1.773	1.25	8.353	4.19***	-0.416	-0.81	3.681	2.34**
Log pseudolikelihood	-21.41		-21.67		-23.50		-23.23	
N. of observations	49		53		49		53	

[a] Z statistics computed with robust SEs. *Significant at 10%; **significant at 5%; ***significant at 1%.

Table 3
Simulated results of Model 1 (observed values in brackets)

Period 1

	North *Univ*	South *Univ*
North *Stud, Env*	45.03% (47.39%)	41.74%
South *Stud, Env*	33.15%	30.46% (31.42%)

Period 2

	North *Univ*	South *Univ*
North *Stud, Env*	59.26% (61.54%)	57.13%
South *Stud, Env*	40.38%	38.23% (37.67%)

4. CONCLUSIONS

This paper aims to provide new insight into the risk associated with the recent reform of the Italian university funding system that rewards the performance of public universities without taking into account the external environment in which each university operates. Using both a fractional logit and a DEA model, we analyze data on the completion time of studies of all Italian graduates in two different periods, academic year 1998/1999 and 2011/2012. We show that the variables associated to the socio-economic environment critically affect the university performance, especially in the post-reform period. This means that Italian universities might be rewarded or penalized not for the quality and efficiency of the internal management, but mainly for the territory in which they are located. We also argue that such a mechanism could lead to an unfair distribution of resources between the developed North and the less-developed South, thus widening the current economic gap. We also stress that, since the use of context-dependent performance indicators is usually more suited to be controlled by the political process, the new public funding system could create substantial incentives for moral-hazard behaviors, leading universities to increase the quantity of graduates at the expense of quality. The new rewarding mechanism could paradoxically result in a dangerous and unexpected source of inefficiency. Our findings do not want to justify the low performance of Southern universities, but rather to identify the "right" policy interventions, which should be based more on all those external socio-cultural factors that are likely to affect the performance of universities.

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