Assessing quality in Higher Education: some caveats

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2014

ASSESSING QUALITY IN HIGHER EDUCATION: SOME CAVEATS

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Abstract

The technology of cognitive and non-cognitive skills formation is characterized by the cumulative nature of learning processes and by the presence of significant complementarities and irreversibilities in the acquisition of such skills [Cunha and Heckman, 2007]. From this it follows that, in order to evaluate the quality of individual phases of skills formation, it is necessary to take account of the quality of the human capital entering the training process. It is evident that this aspect is more important, the more advanced the level of education. This paper evaluates the effects of the quality of Italian matriculants at 24 engineering faculties measured with the results of the CISIA standardized test on the regularity of university studies. The preliminary results confirm that failing to take account of the incoming quality of students may give rise to significant distortions in the evaluation of the academic productivity of universities.

1. Introduction

There are several reasons for the growing interest in the performance of education systems, in particular at tertiary level. First, the wide gaps in learning outcomes recorded by international surveys, such as PISA or PIAAC, are also apparent among countries similar by level of socioeconomic development and expenditure on education. Second, the rising cost of education has a weight on fragile public finances which is judged unsustainable in the long term. Third, especially in developing countries, the sharp rise in the educational attainment of the population has not been followed by an equivalent increase in its average quality in terms of learning achievements (Hanushek, 2012). Finally, there is robust empirical evidence that the relationship between human capital and growth is explained better by learning outcomes than by the educational attainment of the population (Hanushek and Woesmann, 2008; 2012)

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It is therefore understandable that, especially in underperforming countries like Italy, education experts and policy makers agree on the need to scrutinize the performance of the education institutions more closely and to implement reforms to enhance their efficiency and effectiveness.

A large body of literature straddling economics and psychology shows that the technology of cognitive and non-cognitive skills formation is characterized by the cumulative nature of learning processes and by the presence of significant complementarities and irreversibilities in the acquisition of such skills along the educational production chain [Cunha and Heckman 2007]. In particular, the accumulation of cognitive and non-cognitive skills is characterized, especially in the first years of life, by the presence of feedback between the former and the latter, and by the fact that the further along the education production chain, the more difficult it becomes difficult to remedy learning deficits.

It is evident that this aspect is more important, the more advanced the level of education. Figure 1 illustrate the idea: the potential for learning at every stage of the chain is conditioned by the width and height of the segments of the pyramid. In particular, tertiary education is the level most conditioned by previous learning. Equally ample and consolidated is the empirical evidence on the crucial role performed by contextual factors in learning processes (family of origin, social and educational environment); factors which condition the outcomes of the latter beyond the effects of the quality of educational institutions and teachers.

It is likely that as the level of education increases, so does the weight of previous learning – with a concomitant decrease in the weight of contextual factors in conditioning the outcomes of education. This is due to the fact that, with increased age, cognitive and non-cognitive skills tend to stabilize and consolidate, having absorbed all the effects of subjective and contextual factors.

From this it follows that, in order to evaluate the quality of the individual phases of the educational process in terms of effectiveness and efficiency, account should be taken of the quality of the human capital entering the education system and measurement should be made of the *value added*.

There is a large body of literature, mainly of English-speaking origin, testifying to the importance given to the measurement of value added in countries where the assessment

of education processes and its use in the allocation of resources is most advanced [Todd & Wolpin 2003, Lochwood et al. 2009, Zhang, 2009; Rothestein, 2009 and 2010]. With regard to tertiary education in particular, Kreutzer and Wood [2007] have applied a methodology to rank American undergraduate business schools in terms of added value,[1] then comparing the results with the very different classification of the same institutions drawn up by the magazine *Business Week*. Zhang [2009] has carried out a similar exercise in order to measure the quality, in terms of added value, of public colleges at state level, obtaining differentials, in comparison with Alabama, ranging from -10% to +40%. In this case, too, the ranking differs substantially from the one customarily used by families and based on the results achieved in college entry tests by matriculants and on the ranking of the high schools attended by the latter [Barron's, 1988]. The author concludes that, to a large extent, the latter ranking does not reflect the intrinsic quality of colleges, but rather that of their students.

Measurement of the performance of schools using the added value criterion is largely restricted to the English-speaking countries. In the USA, various school districts in Tennessee have adopted the EVAAS (Education Value-Added Assessment System), and other states are experimenting with it. The Department of Education of the United Kingdom has for some years adopted a method based on calculation of CVA (Contextual Value-Added) to evaluate the performance of schools taking account of the numerous socio-economic and demographic factors that affect learning by pupils.

In Italy no such work has been conducted, and contributions by empirical analysis are virtually non-existent, with the exception of a recent study by Cipollone, Montaro and Sestito [2010] on upper-secondary schools. Also to be mentioned, given its importance for this area of analysis, is the study by Aini, Baici and Casalone [2010].

Notwithstanding the difficulties of such measurement and its limitations in evaluating the performance of individual teachers, the results of these studies show that, overall, the evaluation of educational institutions also at tertiary level – especially when it is believed that these should promote social mobility and geographical mobility is low – should take due account of the role played by contextual factors and by the quality of the students entering the educational system.

[1] The authors verify educational outcomes in terms of the initial salaries of the graduates from the business schools surveyed.

The assumption of this exploratory study is that students constitute both the fundamental input to tertiary educational processes and their output. Consequently, referring in abstract to the 'quality of universities' without considering the quality of their students is methodologically inappropriate [Zhang, 2009], especially in the presence of high variability in the quality of secondary schools and the limited mobility of students. National and international surveys on the quality of primary-level learning (PISA, INVALSI] not only confirm the important role played by the socio-economic context but also depict a highly diversified pattern in Italy – both geographically and by type of school [Montanaro 2008]. This heterogeneity has distant origins also related to delays in educational processes, and especially in primary schooling [Bertola and Sestito 2011], which inevitably weighs on the performance of the secondary and tertiary education system and extends beyond differences of a socio-economic nature between geographical area and families of origin.

The analysis that follows is based on joint use of the results from the CISIA test, as indicative of the real quality of incoming students, and of AlmaLaurea data as regards the other variables. The standardized CISIA test[2] verifies the extent to which matriculants in engineering possess the basic skills (logic, mathematics and sciences). It has the merit of absorbing the effects and interactions between subjective traits and contextual factors, yielding a measure of cognitive and non-cognitive skills at an age when they should be consolidated and stabilized. In view of the relatively low mobility among regions of matriculating students as revealed by the data, the average CISIA score, available only at aggregate level, can be *interpreted as a proxy for the real*

[2] The test consists of five sections of questions designed to verify the candidate's basic knowledge and to assess his/her aptitude for engineering studies. The five sections of questions in the booklet are as follows: logic, reading comprehension, mathematics 1, physics and chemistry, mathematics 2. The first section of questions concerns logic and consists of: (a) sequences of numbers and/or figures arranged in an order that must be identified; (b) propositions followed by five statements of which only one follows logically from the premises of the proposition. The second section of questions (reading comprehension) consists of passages taken from texts of various genres. Each of the passages is followed by a series of multiple-choice questions, the answers to which must be deduced from the content of the passage. The third and fifth sections of questions concern mathematics. Between them is the fourth set of questions, which deal with physics and chemistry. The mathematics 1 section contains questions intended to test whether the candidate possesses the mathematical knowledge deemed essential by the faculty. The mathematics 2 section verifies the candidate's skills: that is, whether or not s/he can apply the notions that s/he has learned. The fourth section of questions, on physics and chemistry, serves to assess the candidate's knowledge and skills, but the questions are mixed: some require the possession of basic knowledge, while others also require applicative skills. [Synthesis drawn from the CISIA consortium website].

average quality of the human capital possessed by the matriculants at a given engineering faculty.

The following analysis considers 24 engineering faculties of the 22 public universities belonging to the Almalaurea and CISIA consortia: *Bari Politecnico, Basilicata, Bologna, Cagliari, Calabria, Cassino, Catania, Cesena e Forlì, Ferrara, Firenze, Modena, Napoli Seconda Università, Perugia, Reggio Calabria, Reggio Emilia, Roma Tre, Salento, Salerno, Sannio, Siena, Torino Politecnico, Trento, Trieste, Udine*.

Section 2 briefly addresses issues concerning the measurement of students' incoming quality and their outgoing performance. Section 3 is devoted to the estimates and discussion of the main results. Section 4 draws the main conclusions and implications.

Bearing in mind the limited aims of this exploratory exercise – which has no ambition to furnish a model for the evaluation of universities – as well as the space available, it will not be possible to give systematic treatment of the advantages and shortcomings of systems which use added value to assess the quality of tertiary education. This is also because such treatment would have to consider what are the objective functions of the tertiary education system in relation to which it makes sense to identify productivity measures.

2. Measuring students' incoming quality and their outgoing performance

The first question that arises when setting out to measure the productivity of tertiary education is how to select the indicators best suited to assessing the quality of students at matriculation and their performance on graduation. What indicators have more significance, together with less distortion due to the presence of non-observable factors?

2.1. Measuring incoming quality

The aim in this case is to select a standardized and reliable measure which absorbs all the information relative to the learning potential of matriculants. The first candidate for this function is the high-school diploma grade, which should furnish a scale of values. However, the PISA and INVALSI educational attainment surveys raise doubts as to the reliability of this metric because of marked regional differences in its use. These doubts are confirmed by Figure 2, which shows, by region, the average scores on the CISIA standardized test (scale on the left) and the corresponding average high-school diploma

grade (scale on the right) in the corresponding year. This is a situation well known to researchers, who find that schools in certain regions systematically over/underrate their students in comparison with the results of standardized tests.

Incoming quality – with the limitations of the various indicators borne in mind – was measured in three ways: the high-school diploma grade *corrected* (see section 4) on the basis of the average CISIA score; the high-school diploma grade and the CISIA score taken separately; the high-school diploma grade corrected on the basis of a procedure which relativizes it to the distribution of grades by school and the graduate's region of provenance.[3] The decision to correct the high-school diploma grade on the basis of the average CISIA score was taken on the assumption that it reflects a relative scale of matriculants' skills and knowledge valid at local level but which is not usable on a national scale. Thus calculated was a corrected or normalized indicator of the *actual quantity of human capital* possessed by graduates at matriculation obtained by multiplying the high-school diploma grade by the average score on the CISIA test obtained by matriculants at a given faculty. This is evidently an approximation based on the idea that students taking the test at a given faculty have homogeneous educational backgrounds.

In the presence of high geographical mobility, the differences in quality among incoming students may be due to endogenous processes of self-selection: the students with most potential connected with better individual abilities, the quality of the upper-secondary school attended, or a more favourable socioeconomic background, may be induced to enrol at universities/faculties offering better opportunities for learning and for employment. In this case, in order to avoid distortions in the estimates [Hanushek 1979; Heckman et al. 1999], and in particular underestimations of the value added of the most valid universities/faculties, analysis should take account of the nature of the self-selection processes. In view of this risk, a number of preliminary checks were

[3] This is a measure developed by the AlmaLaurea researchers. The high-school diploma grade is purged of the 'area of residence' and 'type of diploma' effects. The variable identifies the quartile of high-school diploma votes, relativized with respect to the distribution of the grades by school and region, to which the graduate belongs. The advantage of this normalization, compared with the normalization performed using the CISIA data, is that it does not use a correction factor constant for all diploma-holders. On the other hand, it presupposes uniformity among distortionary factors at regional level which does not seem confirmed by the intraregional distribution of CISIA scores (figure 4). Moreover, the correction based on the CISIA data nakes it possible to draw more immediate inferences concerning the weight of incoming quality.

made. Their results did not support the conclusion that student mobility is characterized by self-selection processes. In fact, comparison between the observable characteristics of mobile and non-mobile students did not reveal statistically significant differences.[4]

2.2. Measures of outgoing performance

Outgoing performance can be measured in terms of both the quality of the *university career* of students and graduates (dispersion rate, proportion of students earning a certain number of university credits, duration of studies, regularity of academic career, average examination grade, degree grade, effective learning verified by standardized tests[5], etc.) and *labour-market entry by graduates*.[6] The choice of which measure to use presupposes that clear agreement has been reached as to what the educational system should offer to individuals and society. Except for tests on learning attainment, the indicators of outgoing performance all suffer from the presence of non-observable factors that may distort the significance of the measure selected. In fact, the average examination grade, the degree grade, or the regularity of academic career may reflect differences among the assessment methods used by universities.

If the objective of tertiary education is solely that of furnishing human capital immediately usable by the production system, the labour-market entry of graduates variously measured (for instance, by the employment conditions of the graduate X years from graduation, the duration of job-searches, pay at X years from graduation, the type of contract, the job relevance of the degree, the graduate's degree of job satisfaction) would constitute a non-distorted measure of performance, provided that account has been taken of the uneven geographical distribution of employment opportunities – that is, of local labour-market conditions[7] and the mobility of graduates.

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[4] The test of differences among the means led to 99% rejection of the hypothesis that there were differences in socioeconomic background, high-school diploma grade, normalized high-school diploma grade (see note 5) or the type of school attended.

[5] See in this regard the OECD's *AHELO* (Assessment of Higher Education Learning Outcomes) project.

[6] Ideally, verification should be made of occupational outcomes throughout the working life, especially if the presence of a trade-off between short- and long-period employability is apparent as a function, for example, of the degree of specificity of the skills acquired from different educational programmes [Hanushek, Woessmann and Zhang 2011].

[7] This conclusion is correct only if the characteristics of the jobs offered to graduates match – with reference to international standards – their qualifications. If there is a widespread mismatch between graduates and their job ranks, difficulties of labour-market entry may be symptomatic not only of deficiencies in the education system but also of the technological and organizational backwardness of the

Given the general importance of the regularity of academic career and its specific importance for the Italian university system [Brunello and Winter-Ebmer 2003; Bound Lovenheim and Turner 2010], this latter measure of outgoing performance has been selected here. It should be pointed out, however, that the regularity of academic career should be measured by following the careers of matriculants. But, bearing in mind the scant availability and reliability of data on such careers, and especially, the complexity of university drop-out behaviour, it has been preferred to perform the estimates on graduates.[8] On the other hand, specific studies [Baldissera, Galeazzi and Petrucci 2010] show that analysis by cohorts yields results comparable with those that obtained on the basis of graduates. The faculties surveyed, with their relative regularity rates calculated by bachelor degree, are listed in Table 1.

Besides those already mentioned, another limitation of the exploratory exercises derives from the fact that the CISIA test scores are available only as average values for the faculty/university. They do not describe – nor are they intended to – relations of causality, but rather simply ones of statistical association.

4. The effect of incoming quality on outgoing performance

It is likely that the university performance of students and, in particular, the time taken by them to graduate, depend – cognitive capacity remaining equal – on the quality of the academic institutions and, especially, on the quality of teachers and course programmes, on the resources used directly and indirectly to support learning (counselling and tutoring, study grants, accommodation, etc.), on the rigidity of the selection criteria applied, and on employment opportunities, whose extent can be approximated with the graduate unemployment rate or with pay levels in the local labour market – both of which are factors that influence the opportunity-cost of the time devoted to study [Light and Strayer 2000; Zhang 2003; Cappellari and Lucifora 2009].

On the basis of these hypotheses, the aim of the estimates reported here was to determine the factors which explain the regularity of academic career, and especially the

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production system due to institutional factors. Although this is a question of major importance, it cannot be addressed here.

[8] The importance of the CISIA score as a factor determining the regularity of academic career is testified by the fact that it explains 49% of the variability in the graduates/matriculants ratio among universities [1% significance level].

weight exerted by the quality of incoming students. On the basis of the findings of a large body of literature on the topic, and of preliminary analyses, besides the student's quality on matriculation, the other variables considered were the following: the educational qualifications of the parents; jobs undertaken by the graduate during his/her time at university and its influence (worker-student and student-worker); the time taken to complete the degree thesis; the motives inducing the graduate to attend university (cultural or professional); intentions regarding postgraduate studies; the assessments made by graduates on the quality of their relationship with academic staff; the average students/lecturer ratio during the first-degree course;[9] the average regional unemployment rate for the 15-24 age group in both the region of residence and the region of the university faculty attended; and a fixed effect for the 24 universities. Two control variables were introduced to control for self-selection due to mobility: the first of them concerned regional mobility if the student was enrolled at university in a region different from that of residence; the second was relative to provincial mobility.

The problem of the variability of selection standards was particularly complex. To capture its effect, it was assumed that such variability affects all aspects of university performance (regularity of academic career, examination grades, and degree grade), and that it impacts especially on the degree grade. On this basis, an OLS model was used to estimate the determinants of the degree grade, including, with the purpose of capturing the 'selection standards' variable,[10] the fixed university effects. The coefficients thus obtained, associated with variables significant to at least 10% level – excluding those relative to the fixed effects – were used to obtain an 'undistorted' measure of the grade expected (Table 3). The difference between the actual degree grade and the one thus calculated was then used as a proxy for the effects of rigour in selection criteria on an individual student's career (laxness effect).

As said, the measures of the incoming quality of graduates at the time of matriculation should have absorbed large part of the effects connected with family background and non-cognitive skills. It is therefore likely that the variables characterizing the latter

[9] This is an indicator that varies according to the year of matriculation. It was chosen on the idea that, taking account of the current system of funding allocation, the overall absorption of resources is correlated with the endowment of academic staff.

[10] If selection standards are homogeneous, the fixed effects should not be significant. However, this was not the case of the majority of universities. The estimates are reported in Table 3.

(parents' educational qualifications and social class; students' motivations) have a limited explanatory capacity. As we shall see, the exploratory analyses and the estimates performed appear to confirm this assumption.

On the basis of these conjectures and preliminary calculations, estimation was made of a probit model in which the dependent variable was the likelihood that the graduate had been regular in his/her academic career or, alternatively, had graduated with a delay of one or two years.[11] The sample consisted of 5182 first-degree graduates enrolled in the 2005/6, 2006/7 and 2007/8 academic years and who completed their degree courses in the 2009/10 academic year. The CISIA score was calculated as the average of the 2005/6, 2006/7 and 2007/8 academic years – these being the only years for which data were available.

The independent variable in the first three models estimated was only the quality of human capital at matriculation measured in the three ways described (high-school diploma grade + average CISIA test score, average CISIA score multiplied by the high-school diploma grade, normalized high-school diploma grade). Further explanatory variables were then added, taking into account that the average CISIA score does not allow the introduction of the fixed university effects. Table 4 sets out the results.

The variables significant to at least 10% exhibit the expected sign, except for the unemployment rate in the region of the university attended. All the measures of the quality of human capital on entry are significant to at least 1% level in all estimates. In particular, the score on the CISIA test, which is considered more accurately to reflect the learning potential of matriculants, has marked effects on the regularity of academic career. It should be pointed out that the estimates made on the basis of the two different ways to correct the high-school diploma grade yielded entirely similar indications. In model (7), one point more than the average score on the CISIA test determined an increase in the probability of graduating on time equal to 2.1% for a diploma-holder with the minimum grade (66) and to 3.2% for a diploma-holder with the grade of 100 [1% significant level]. Hence, in this latter case, an increase in the score of one standard deviation determines a 12.8% increase in the probability.

[11] This choice was determined by the availability of data on the CISIA test. It obviously has drawbacks in that it excludes from the calculation the (small) proportion of students who graduated with more than two years of delay. In support of our analysis, this proportion does not significantly vary among universities.

Among the variables imputable to teaching quality, the results confirm – within a general pattern of this indicator's high variability among universities – the positive contribution of the student/lecturer ratio to the regularity of academic career [1% significance level]. Also positive and highly significant is the contribution of the perceived quality of relations between lecturers and students [1% significance level]. There may be various explanations for this result. Firstly, it may depend on the fact that culturally motivated graduates are also those who most appreciate good relations with academic staff. Secondly, the cause may be the fact that more capable teachers are better able to motivate their students. The finding that the coefficient is still significant when also controlling for motivation seems to confirm the latter hypothesis.

Also borne out is the hypothesis that the presence of heterogeneity in selection criteria (laxness effect) contributes to explaining the variability of outgoing performance [1% significance]: in particular, as expected, more generous criteria are associated with a higher probability of graduating on time.

Whilst the prevalence of cultural motivations in the choice of academic programme, compared with both cultural and professional motivations, exerts a positive effect on regularity [5% significance], the prevalence of vocational motivations exerts a negative effect [5% significance]. As expected, the effect of the 'intention-to-continue-studies' variable is both positive and significant [1%], and associated with this variable is a 24% increase in the probability of graduating on time.

As might be expected, a job has a negative impact on the regularity of academic career [5% significance], especially in the case of worker-students (-20%), whereas in the case of student-workers the decrease in the probability of graduating on time is rather small (-4.8%). Also of interest is the effect on the unemployment rate. Firstly, the estimates show that both the unemployment rates considered are significant, with a decidedly greater impact of the region of university attendance. Hence, the labour-market conditions in the area where the university is situated seem to have greater influence on the behaviours of students than the area of residence. Secondly, whilst the relation with the unemployment rate in the region of residence is, as expected, negative, the relation with the unemployment rate in the region of the university attended is positive and non-linear: it is positive for unemployment rates lower than around 28% and negative above that value. There are two main explanations for this odd result. The

first concerns the fact that, as the unemployment rate decreases, so job opportunities while attending university increase – an explanation borne out by the fact that the incidence of work while studying is greater in the universities of the Centre-North: a greater propensity to work evidently has a negative effect on the regularity of academic career. The second explanation concerns the idea that, in local labour markets with higher unemployment, where job-search processes are longer and more complex, the value of the 'graduated on time' signal increases. Overall, the expected negative effect due to the lower opportunity cost of time is therefore off-set by these two positive effects for values of the unemployment rate less than 28%.

Confirming the above-discussed conjectures, mobility is not an explanatory variable for differences in outgoing performance.

The fixed university effects are almost all significant at 1% level. Taking account of the limited time horizon considered, they can be considered approximate measures of the added value of universities – that is, their net contribution to the regularity of academic career by their graduates. On the basis of this measure obtained from model (9) but also substantially confirmed by model (6), verification was made of whether and to what extent the ranking of universities changed in comparison with the one based on the raw data – that is, the actual rates of regularity. This comparison evidenced substantial differences between the two rankings: the absolute mean variation of positions was 7.5, with a maximum of 21 positions of difference.[12]

3. Conclusions and implications

This econometric exercises show that the quality of learning at upper-secondary school has a significant impact on the regularity of academic career by matriculants at engineering faculties. Teaching quality and selection standards remaining equal, if the average score achieved on the CISIA entry test by a student with average characteristics increases by one standard deviation, then his/her probability of graduating on time increases by 12%. The most immediate implication of this result is that, once the outgoing performance of graduates has been purged of the effects of the quality of the incoming students and of the other significant factors, the ranking of universities in

[12] The new ranking was robust to various specifications.

terms of their students' regularity of academic career changes radically in comparison with the regularity in the absence of such adjustment.

The classification thus obtained has indubitably been distorted by heterogeneity among the assessment standards of faculties not captured by the empirical models used. Yet this shortcoming does not affect the overall validity of the lesson to be learned from the exercise: namely, that not taking account of the quality of incoming students may distort the evaluation of the university system and, consequently, the allocation of funds on the basis of meritocratic criteria.

The essential issue often evaded when the quality of educational systems is discussed is that students are both the fundamental inputs and outputs of educational processes [Light and Strayer, 2003]. Hence, referring in abstract to the 'quality of universities', without considering the quality of the latter in the presence of scant student mobility, is methodologically inappropriate. These considerations also apply, albeit to a lesser extent, to the output and assessment of university research, the quality of which depends at least partially on the quality of the feedbacks between teaching and research.

Measures of the outgoing performance of students and graduates are of great interest to families, universities, and firms, but they should be given less importance by policy-makers intending to use them to allocate funds. Just as a firm is interested in strategies to increase its added value more than sales by employee, so policy-makers should be interested in allocating public resources according to the capacities of universities to enhance their inputs, rather than on the basis of results concerning their outputs (dispersion rate, regularity of academic career, labour-market entry, etc.). It is no coincidence that an educational system's performance is most commonly measured on the basis of value added in countries where the culture of assessment is more consolidated.

These conclusions acquire greater value with the transition from tertiary education systems characterized by strong homogeneity among matriculants to systems with broader entry – like those towards which the OECD countries and Europe have been moving in the past twenty to thirty years, and which are inevitably characterized by greater heterogeneity. This prospect has been confirmed by the Europe 2020 document, which sets a 40% target for the proportion of graduates in the 30-34 age group.

In the presence of significant differences among starting conditions, there is a risk that the superficial use of assessments based on outgoing performance indicators, and thus conditioned by the scant availability of information and its cost, will, on the one hand, reward universities which, though not particularly virtuous, enjoy more favourable conditions and, on the other, remove valuable resources – in a chronically under-funded system – from universities which, though situated in more disadvantaged areas, operate virtuously.

Meritocratic criteria in the allocation of public funds among schools and universities which do not take account of these considerations, in the absence of effective means to support the right to study (especially in the form of grants and an adequate university building programme) would exacerbate the polarization of the educational systems. They would penalize the least mobile students, regardless of their talent, and especially those from the more disadvantaged social groups, and schools/universities in more backward areas independently of the merits/deficiencies of their personnel. In this regard, it should be borne in mind that mobility is due not only to economic factors but also to social and cultural barriers on which the introduction of economic incentives would have little effect. Empirical evidence on the concreteness of these risks, in a high-mobility country like the USA, has been provided by Bound, Lovenheim and Turner [2010] in an article which shows how the longer time taken to graduate by disadvantaged social groups is due in large part to cutbacks in the resources made available to the public educational institutions in the USA.

The problem is made even more urgent, in some countries like Italy, by the fact that, for numerous universities, the lower quality of incoming students is associated with fewer opportunities to acquire funding through both external sources and increased university fees. Thus, in practice, the distribution of resources is already disproportionately tipped against those universities regardless of their productivity.

These considerations would be less important in countries characterized by high rates of graduation, and if both increased access to tertiary-level studies and the promotion of social mobility were not given priority over the pursuit of excellence and the enhancement of talents. This latter strategy would not entail relinquishing a socially inclusive university system.

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FIGURE 1. The pyramid of the education production chain

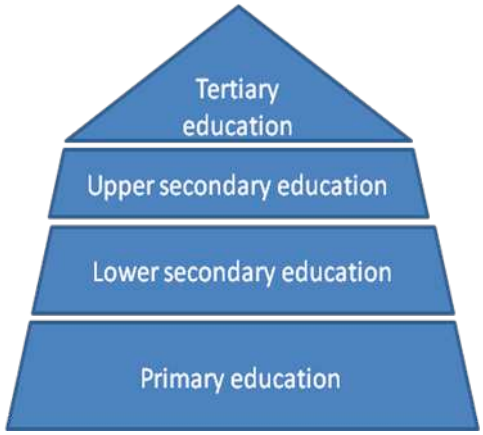

FIGURE 2. CISIA scores (PT) and high-school diploma grades (VDIP) by region

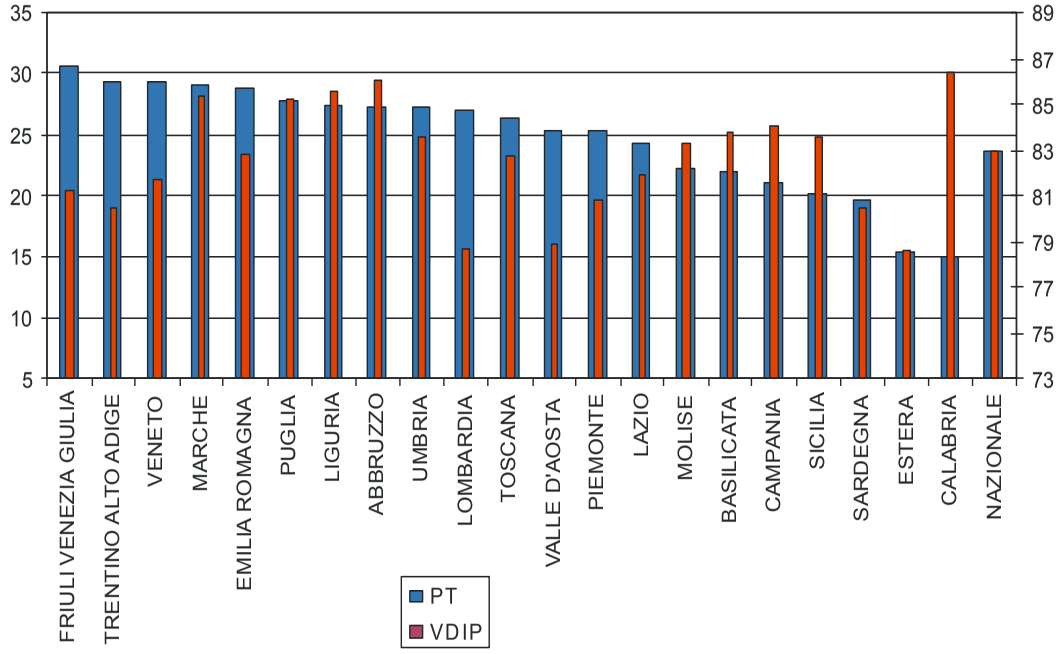

TABLE 1. *Shares of students graduating on time, average CISIA scores and high-school diploma grades by faculty*

University	% students on time	Average CISIA score	Average high-school diploma grade
Bari Politecnico	39.0%	27.3	92.5
Basilicata	20.0%	18.3	86.4
Bologna	56.9%	26.9	88.6
Cagliari	34.4%	19.2	91.3
Calabria	38.3%	15.3	94.0
Cassino	59.5%	16.8	89.6
Catania	27.1%	19.9	91.3
Cesena e Forlì	52.4%	26.8	91.1
Ferrara	45.6%	27.1	89.2
Firenze	29.8%	26.8	89.1
Modena	66.9%	28.6	87.7
Napoli Seconda Università	33.7%	17.3	92.1
Perugia	41.6%	25.2	91.9
Reggio Calabria	13.3%	17.3	95.4
Reggio Emilia	52.5%	24.7	84.1
Roma Tre	35.6%	21.7	88.4
Salento	24.5%	21.9	94.2
Salerno	39.8%	19.1	93.1
Sannio	45.9%	17.2	93.3
Siena	56.1%	23.7	89.7
Torino Politecnico	59.2%	26.1	90.2
Trento	47.3%	26.0	86.8
Trieste	57.9%	28.5	88.5
Udine	49.1%	28.9	86.8

TABLE 2. *Descriptive statistics*

Variable	Observation	Mean/frequency	Standard dev.	Min	Max
Students on time	5182	0.476457	0.4994936	0	1
Mother's educational qualification: no reply	5182	0.0144732	0.1194423	0	1
Mother's educational qualification: none	5182	0.0061752	0.0783471	0	1
Mother's educational qualification: elementary certificate	5182	0.0453493	0.2080891	0	1
Mother's educational qualification: lower-secondary certificate	5182	0.2271324	0.4190193	0	1
Mother's educational qualification: upper-secondary diploma	5182	0.4884215	0.4999142	0	1
Mother's educational qualification: degree	5182	0.2184485	0.4132332	0	1
Average CISIA test score	5182	2.443915	4.031922	15.31	28.99
Time taken to complete thesis (months)	4738	3.379485	1.743754	1	24
High-school diploma grade	5182	90.29718	1.063003	60	100
Regional mobility	5182	0.2005017	0.4004144	0	1
Mobility among provinces	5182	0.4500193	0.4975437	0	1
Father's educational qualification: no reply	5182	0.0148591	0.1210007	0	1
Father's educational qualification: none	5182	0.0050174	0.0706623	0	1
Father's educational qualification: elementary certificate	5182	0.0447704	0.2068193	0	1
Father's educational qualification: lower-secondary certificate	5182	0.2473948	0.4315398	0	1
Father's educational qualification: upper-secondary diploma	5182	0.4540718	0.4979342	0	1
Father's educational qualification: degree	5182	0.2338865	0.4233417	0	1
Satisfaction relationship with academic staff	5182	3.977229	0.5977686	1	5
Unemployment rate 15-24 years region of study	5197	21.02	10.11752	7.3	40.3
Unemployment rate 15-24 years region of residence	5158	22.09	10.23336	7.3	40.3
Students/lecturer ratio	5182	27.94724	4.014305	15	37
Graduates/matriculants ratio	5182	47.58456	9.653872	18.2	81
Sex	5182	1.249518	0.4327756	1	2
Classical high school diploma	5181	.0521135	.2222773	0	1
Scientific high school diploma	5181	.6352056	.4814189	0	1
Technical institute diploma	5182	0.2886916	0.453198	0	1
Other diploma	5182	0.0102277	0.1006234	0	1
Average examination grade	5182	25.38593	1.931394	18	30
Worker-student	5165	0.0118103	0.1080418	0	1
Student-worker	5165	0.5512101	0.4974188	0	1
Importance of cultural motivation	5164	1.712239	0.4527632	1	2
Importance of vocational motivation	5159	1.730762	0.443607	1	2

TAB. 3. *Degree grade estimation model*

	Coef.	Std. Err.	P>t
Average examination grade	3.736514	.0156624	0.000
Mother's educational qualification	0.018463	.0332103	0.578
Father's educational qualification	0.025314	.0327756	0.44

Normalized high-school diploma grade	0.098857	.0340454	0.004
Cultural motivation	0.112996	.0583714	0.000
Vocational motivation	0.107508	.059226	0.07
Worker-student	-0.72192	.2448252	0.003
Student-worker	-0.08925	.0530902	0.000
Intention to continue studies	0.507028	.1239201	0.000
Constant	3.493664	.4922992	0.000
Fixed university effects	yes		

Number of observation	5091
F(33, 5057)	2471.32
Prob > F	0.0000
R-squared	0.9416
Adj R-squared	0.9412

TABLE 4. *Results of the estimates (marginal effects = dF/dx)*

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
High-school diploma grade	0.010433***				
Average CISIA score	0.02047***				
Diploma grade x average Cisia score/100		.002807***		.004561382***	
Normalized high-school diploma grade			.1014339***		.119552***
Mother's educational qualification					
Father's educational qualification					
Time taken to complete thesis					
Mobility among regions					
Mobility among provinces					
Sex (default =woiman)					
Diploma (default: high school): technical institute					
Other diploma					
Laxness effect					
Worker-student					
Student-worker					
Students/lecturer ratio					
Cultural motivation					
Vocational motivation					
Intention to continue studies					
Satisfaction relationship with academic staff					
Unemployment rate region of study					
Unemployment rate region of study^2					
Unemployment rate region of residence					
Fixed university effects	no	no	no	yes	yes
Number of observations	5182	5182	5131	5136	5086
Wald chi2	327	288	138	533	445
Prob> chi2	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R^2	0.0456	0.0402	0.0194	0.0836	0.0701

Variable	Model 6	Model 7	Model 8	Model 9
High-school diploma grade				
Average CISIA score				
Diploma grade x average Cisia score/100		0.00323254***	0.00323037***	0.00318043***
Normalized high-school diploma grade	.0825219***			
Mother's educational qualification	.0260529**	.025341**	.027856**	.0271092**
Father's educational qualification	.0004234	-.0014892	-.0012655	-.0037058

Time taken to complete thesis	-.0339655***	-.0345911***	-.0335619***	-.0344663***
Mobility among regions	.0232654	.027305	.0290692	.03222587
Mobility among provinces	-.12046	-.0140839	-.016818	-.016242
Sex (default =woiman)	-.018982	-.0318765	-.0315165	-.0295291
Diploma (default: high school): technical institute	-.1251850***	-.1115153***	-.1077563***	-.1055233***
Other diploma	.-1970871**	-.1935436**	-.1891509**	-.1854622**
Laxness effect	.0391198***	.0368793***	.0358162***	.0367818***
Worker-student	-.2024576**	-.1883649**	-.1947163**	-.2048117**
Student-worker	-.0472653**	-.0417852*	-.0450216**	-.0478308**
Students/lecturer ratio	-.1646115***	-.1661474***	-.1679859***	
Cultural motivation	.0365749*	.0359484*	.0504265**	.049493**
Vocational motivation	-.045779**	-.0436516**	-.0400909*	-.0429317**
Intention to continue studies	-.2444911***	-.2450889***	-.2447923***	-.2445061***
Satisfaction relationship with academic staff	.0709349***	.0713582***		
Unemployment rate region of study	.0810372***	.8089471***	.810715***	.8063813***
Unemployment rate region of study^2	-0.149106***	-.0148601***	-.0148853***	-.0146425***
Unemployment rate region of residence	-.0055868***	-.0063887***	-.0061919***	-.0062262***
Fixed university effects	yes	yes	yes	yes
Number of observations	4621	4621	4621	4621
Wald chi2	2311	2293	2292	2092
Prob> chi2	0.0000	0.0000	0.0000	0.0000
Pseudo R^2	0.3694	0.3732	0.3702	0.3629

***= sig. 1%; **= sig. 5%; *= sig. 10%, Robust standard errors