Endogenous Grading Standards and Labour Market Mismatch*

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Abstract

The systems of Higher Education are undergoing deep institutional reforms in most European countries. In this paper we analyze the experience of Italy during the 90s. In this period universities were affected by dramatic demographic changes and the introduction of new financing schemes. We show empirically that the apparent increase in competition had an effect on grading standards. Particularly, standards deteriorated mostly in those degrees that were less demanded. Most importantly, these variations in the difficulty of certain degrees affected both enrolment decisions and graduation rates, contributing to the generation of labour market mismatch.

Keywords: Grade Divergence, Labour Market Mismatch, University Financing

JEL codes: I2, J31, J64

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1. Introduction

Systems of Higher Education are undergoing deep institutional reforms in most European countries. The process has been driven so far by two main forces: first, for many European governments fiscal policy constraints became binding as tertiary enrolment rates have been constantly increasing[1]. Second, a deep feeling of inadequacy to cope with increasing international competition is perceived by most countries and by EU institutions. Indeed, with the notable exception of the UK, European universities have a dismal performance in most international rankings (e.g. according both to the Times Higher Education Supplement and to the Shanghai's Jiao Tong University ranking continental Europe would have no more than five institutions among the top 50 world universities).

The core distinctive feature of European tertiary education systems is that they are almost entirely publicly financed and, moreover, education is publicly provided. Despite some heterogeneity, in the past funds have been allocated directly to institutions (i.e. the supply-side) and funding has been based on "itemised budgets", which were revised periodically on historical basis. Nowadays most European governments, in order to cope with the challenges mentioned above and without giving up with their (quasi)-monopoly in tertiary education provision, have increasingly shifted towards demand-side funding, either through grants or through loans (Jacobs & Van der Ploeg, 2005). Moreover, as far as supply-side funds' allocation is concerned, most countries have relied increasingly on lump-sum "block grants" allocated to single institutions, which can spend them as they whish, as long as they comply with government regulation.

On the pros side of the above reforms, it stands a substantial increase in the degrees of autonomy of tertiary education institutions, which started to function as self-governed bodies in most domains. For policy makers, however, the problem is inducing an appropriated trade-off between the respect of the principle of autonomy and the overall efficiency of the organization. In other words, they must set rules in order to align self-governed institutions' objectives with the socially desirable ones. As noted by Jacobs & Van der Ploeg (2005), in this respect the two pillars of the new systems have been: (a) "input funding" dependent on students enrolled and (b) "output funding" based on the number of diplomas delivered. As noted by the same authors, as currently implemented, both pillars are likely to bias institutions' incentives towards undesirable behaviours. In particular, input funding is believed to strengthen monopolistic practices and

[1] The proportion of adult with higher education in OECD countries almost doubled in he last 25 years.

output funding to induce grade inflation. Nevertheless, so far, to the best of our knowledge, no empirical evidence has been provided to support the above conjecture.

This paper focuses on the Italian case. Italy has implemented during the early 90s a new set of rules which links university financing to a series of input and output indicators. We argue that this new system of incentives may have generated perverse outcomes both by inducing a decrease in the standards of certain degrees or universities and by biasing students' choices. In this respect, we present two central findings: first, we show that those departments that lost students have, over time, decreased their grading standards; second, we find that these variations in grading standards tend to generate labour market mismatch both by inducing an excessively number of students to enrol in easy but unpromising degrees or universities and by distorting graduation rates.

Our finding may help to rationalize a striking fact about the Italian labour market which has been previously overlooked. In Italy, both within disciplines (e.g. among all graduates in a certain discipline) and within universities (e.g. among all graduates in a certain university) graduates who obtain lower grades during their studies are less likely to be over-qualified and tend to earn higher wages. The explanation for this paradoxical finding is that obtaining a high grade closely signals the fact that this grade has been granted by a department or a university which offers poor labour market perspectives. Naturally, if one restricts the analysis only to those students that attended both the same university and the same degree, the expected positive relationship between grades and labour market performance is re-established.

One of the main contributions of the present paper relies in the data base used for the analysis. We combine administrative university-degree level data concerning enrolment with several editions of an individual level survey on University-to-Work transition (Indagine Inserimento Laureati). As far as the information contained in the latter is concerned, even if other authors have used it to measure Italian university productivity (e.g. Brunello and Cappellari, 2005), we can exploit the longitudinal dimension in order to control for fixed effect of university-degree units of observation.

The rest of the paper is organized as follows. First, we describe some relevant features of the Italian system of higher education. Second, we spell out our hypothesis concerning the shortcoming of both input and output funding and their likely outcomes in terms of institutions' grading standards. After that, in Section 4, we present our empirical analysis. We start from the description of the basic structure of the database. Subsection 4.2 continues by presenting the key finding of the paper, namely, the effect of the size of enrolment on final grades. We claim that

this result is consistent with endogeneity of grading standards. Subsections 4.3 - 4.4 spell out alternative explanations for our findings and show that these are in contrast with several regularities present in the data. Subsection 4.5 provides some evidence on the economic consequences of endogenous grading standards. Finally, the last section concludes.

2. Institutional Background

As Perotti (2002) puts it, nobody seems happy with the Italian System of higher education: graduates experience long non-employment spells after graduation and earn relatively low wages compared with their European homologous (See Table 1). Young researchers' careers depend mostly on being insiders rather than on the quality of their research (Perotti, 2002). Business firm association increasingly complains about the deteriorating skills of the graduates.

Several explanations for the above phenomena have been proposed in the literature. A special attention has been devoted to factors that may explain the *mismatch* between university degrees choices and those skills that have higher returns in the labour market. To begin with, Boeri and Pellizari (2005) argue that the lack of adequate information at the moment of undertaking enrolment decisions leads to students' biased choices. Incidentally, they also show that most bad decisions are taken by those students who declare that have chosen "an easy subject in order to graduate quickly". On a different ground, Brunello and Cappellari (2005) speculate that the excessive low geographical mobility may stem from liquidity constraints.

Besides mismatch, overall enrolment decisions are harmed by a perverse mix of weak labour demand and inefficient higher education institutions. Dornbusch, Gentilini and Giavazzi (1999) suggest that excessive enrolment may represent a sort of hidden unemployment, which makes students postpone their graduation. In turn, this may stem from the combination of three factors: lack of opportunities in the labour market, better social perception of student status with respect to unemployment and low university fees.

However, so far little has been said on how higher education system may itself contribute to educational mismatch. At the same time, the population dynamics during 90s has led to substantial imbalances between faculty sizes and the number of students. Particularly, at the end of the 80s the number of 19 years old individuals started to decline and, despite the increasing share of high school graduates who decided to go to university, it appeared clear that Italian universities were soon going to face declining enrolment rates, which actually started in 1993. When the national wide number of enrolling student shrinks, a few tertiary education institutions may face a declining number of new students, so universities have to compete for new students

in order to justify new public funding. Incidentally, this is a problem faced also by other European countries.

As recognised by Mass-Colell (2003): "[…] For the competition for students to be important it is necessary that it occurs for the right reasons. For example, it would not be acceptable that it be based on making it easy to obtain a degree. I would say that for the competition to be beneficial it has to be based on reputation effects that generate rewards in the professional markets (at least in the more economically oriented ones). A more refined version of the conjecture would then include the claim that forms of competition not based on reputation will not be efficiency enhancing". In this section we address some features of the Italian System of Higher Education (i.e. financial incentives and recruitment procedures) that make likely that in the last two decades competition occurred for the "wrong reasons", namely attracting students weakening grading standards. As we shall show below, this competition is inefficiency enhancing because it biases high school student enrolment decisions.

2.1. Financial Incentives

Before a 1993 law (n.537/1993) the Italian national ministry of education was in charge not only of fixing the total amount of funds and their shares across public universities, but also of allocating them across disciplines. Its decisions were largely made on historical bases and were sometimes affected by distinct bargaining with single institutions and faculties within institutions. After the reform was approved, each university became an autonomous entity with its own budget to be allocated across distinct disciplines. Moreover, discretion was replaced by a very complex set of rules, which in the short run left around the 90 per cent of the big bulk of public funding (what is commonly called FFO and represents the largest part of state expenditure for higher education) to be assigned on historical basis and the rest to be allocated via an Equalization Component (EC). The latter is supposed to progressively substitute the former, even if every year important matters are renegotiated within a special committee.

Given the unsystematic way in which funds were allocated before 1993, the EC overriding objective has been to reduce public funding disparities across university and across disciplines. In order to pursue this goal the EC has started to introduce the system where allocation of funds depends positively on number of student enrolled weighted by disciplines' standard unit cost.[2] On the incentives side, the EC seeks to reward the quality of teaching linking funding to the

[2] See Perotti (2002) for a description of how standard unit costs are computed.

number of exams passed by enrolled students[3]. Anecdotal evidence, however, shows that the only institutional responses by distinct institutions to such incentives have been respectively (i) an increase in funding devoted to advertisement and (ii), to some extent, a decrease in examination standards. We shall focus on the second of these unintended consequences.

2.2. Professors Recruitment

The rules for professor's recruitment have also been deeply changed in the 90s (Law n.210 issued on 1998). The old procedure selected new faculties through a yearly national wide public exam[4]. The new rules were designed to enhance university autonomy: the selecting committees are now elected on local bases, even if all national appointed faculties are entitled to vote, and they rule on qualification and not on appointment. Local universities can then refuse to hire the professors that have been judged as qualified (idoneo). In the old system, conversely, they did not have full command on an opening once they had called it. In the best scenario, the new system would have allowed more control by each university on its own recruitment process and would have ameliorated their responsiveness to major changes in demand for education. In practice, the performance of the new rules has been dismal: as showed by Perotti (2002), unworthy candidates are not screened out effectively and the average age of researcher has increased. This latter fact pinpoints that the intended improvements in the system's responsiveness did not take place.

2.3. Entry Restrictions

With a few exceptions (i.e. Medicine and Architecture), Italian Universities cannot restrict high school graduates' enrolment. While demand is completely flexible, education supply, i.e. the number of professors, adjusts very slowly to changes in both geographic and degree-specific enrolment rates. As a consequence, the number of students per professor -*class size*- across Italian universities and across faculties tends in the short term to be mainly driven by variations in the number of enrolled students.

[3] Technically, the funds depend positively on the number of *Equivalent Students*, which is in turn calculated on the basis of exams passed. See Perotti (2005) for details.
[4] See Checchi (1999) for a vivid account on one of these exams.

3. Theoretical Background

The potential endogeneity of academic requirements has deserved a great deal of attention, particularly within the American educational system. The existing literature can be organized around two lines.

The first line of studies focuses on the variations in grades overtime. This literature has coined the term *grade inflation* which refers to the perception of deterioration in the educational standards accompanied with a rising trend in university grades which has been observed in the American educational system in the last 25 years, especially within top universities (Sowell, 1994; Strauss, 1997; Stone, 1995; Moore, 1996; Mansfield, 2001). The second line provides evidence on grade divergence, this is, the existence of a divergence in the evolution of grading standards across different departments. For instance, Sabot and Wakeman-Linn (1991) presented evidence of nine colleges and universities documenting the division of colleges into high and low grading departments[5].

Several reasons for the existence of grade divergence have been proposed. A number of authors claim that professors may inflate the grades to escape negative evaluations by students, whose opinions matter for tenure and promotion decisions. Dickson (1984), analyzing more than 600 courses given by the faculty of Arts of a Canadian university, finds that departments with low student/faculty ratios gave higher grades. Dickson attributes this finding to concerns about job security on the part of professors belonging to departments with low enrolment, although this finding could also be explained by the greater attention available to students in low student/faculty ratio departments improving student performance. Staples (1998) also suggests that some departments tend to increase their grades to fill poorly attended courses that might otherwise be cancelled. Another factor that might put an upward pressure on grading policy is the subsidized taxation schemes for parents having children enrolled in university, which are based on students' performance.

In a contribution closely related to ours, Freeman (1999) finds that in a sample of 10,800 college graduates from 648 American institutions, graduates from high-grading fields of study have lower earnings than graduates from low-grading fields of study, even when controlling for factors such as student ability and experience. Freeman argued that this relationship was caused by the institutional constraints that prevented, within each university, a system of flexible money pricing for those courses which had different expected earnings. This is, "because *institutional*

[5] Economics, along with Chemistry and Math, tends to be low-grading. Art, English, Philosophy, Psychology, and Political Science tend to be high grading

constraints prevent this type of money price adjustment, I hypothyzed that instructors and departments act strategically to manage enrolment by adjusting the time and the effort cost of achieving a given grade". Freeman warns that grade divergence could have negative consequences if either employers or, as he rather suspects, students, are subject to some kind of informational distortion.

Grade divergence, its possible explanations and its consequences, have received less attention in Europe. A report on the development of exam grades at German universities recently found that the average grades vary widely not only between subjects but also between universities (Wissenschaftsrat, 2004). Still, while empirical evidence is scarce, there are several reasons to fear that grade divergence might be a concern also for European institutions.

First, certain changes in the financing mechanisms of European universities may have an effect on grading standards. In particular, the increasing introduction of an incentive system which takes explicitly into account diverse quantitative measures such as the number of enrolled students or the number of delivered diplomas may push universities to compete by lowering their standards. More precisely, making university resources dependent on the number of enrolled or graduating students may induce grade inflation if "grades serve as productivity signals to completely uninformed employers" (Warning & Welzel, 2005) or, more generally, if titles possess in the labour market some intrinsic value independently of the institution which issued them. The legal value that is associated to titles in many European countries may, in this respect, allow some universities or departments to depreciate their grading standards without suffering the corresponding negative reputation effects. As pointed out by Andreu Mas-Colell[6], Europe "has not yet developed muscular reputation effects" and "is still on the whole, dominated by a generic culture of credentialization where what is important is to have a credential to exercise, or to open the way to exercise, a profession and it is much less significant who the issuer of this credential is."

Second, during the 90s the number of individuals in the age of 19 incorporating into higher education decreased in most European countries. A potential reduction in the demand for higher education could exacerbate the need for universities to compete for new students.

In both respects, the Italian university system during the 90s constitutes a very likely candidate for grade divergence. First, at the beginning of the 90s a new system of incentives was introduced such that financing started to be dependent both on the number of enrolled students

[6] "The European Space of Higher Education: Incentive and Governance Issues", Rivista di Politica Economica, November 2003, page 15.

and on the number of exams taken. Still, in Italy university titles possess an intrinsic value independently of the institution which has granted them. Access to most public positions, for instance, requires a university title. Second, beginning in the early 90s demographic changes have caused the number of newly enrolled students to steadily decrease.

In the following section we will use the Italian experience to test whether the increasing importance of financing incentives, the demography-driven decrease in the demand for higher education and the relative low importance of institutional reputation effects may have induced a decrease in the grading standards of some Italian institutions.

4. Empirical Analysis

4.1. Data

The data used concern Italian university graduates and the academic institutions where they studied. In particular, data about graduates' labour market performance are provided by three distinct (but almost identical) surveys named *Indagine Inserimento Professionale Laureati* (Survey on University-to-Work Transition) run in 1998, 2001, and 2004 on individuals that graduated in 1995, 1998, and 2001 respectively[7].

The target samples consist of 25,716 individuals in 1998, 36,373 individuals in 2001, and 38,470 individuals in 2004. They represent respectively the 25%, 28.1%, and 24.7% of the total population of university graduates in Italian universities. The response rates have been of 64.7%, 53.3%, and 67.6% for a total of 17,326, 20,846 and 26,006 respondents[8]. In all three years the sample is stratified according to sex, university and obtained degree and in the analysis below all estimations are performed using stratification weights. For methodological reasons in our analysis we have only considered those individuals graduating from public universities (around 95% of the sample). As well, graduates from physical education studies have been excluded.

The information provided by these surveys can be grouped in three subsets: (i) individual characteristics that were predetermined with respect to college choices and outcomes, (ii) university curricula and (iii) labour market outcomes. Descriptive statistics and the definition of key variables are provided in Table 4.

[7] The publicly available micro-data do not include information on the university from which the interviewed individual graduated. Therefore, we carried out the analysis at the ADELE ISTAT laboratory in Rome.

[8] Differences may stem from different interviewing technologies used in the surveys: in 1998 ISTAT mailed paper-based questionnaires, while in 2001 and 2004 questions were asked following the so-called C.A.T.I. (Computer Assisted Telephone Interview) technique.

The first set of variables includes information related to the individual's socio-demographic background –i.e. sex, nationality, parent's education and employment when respondent was around 14 years old, siblings, province of residence before college enrolment, and military service obligations- and high school curricula - high school grade, type of school attended -. The second set of variables refers to the type of degree and university attended, the educational outcomes -i.e., average grade obtained and the number of extra years spent in the completion of the degree- and also includes a number of controls such as students' occupation during studies, changes in the degree followed, attainment of a previous degree and university location in a different city or region. Third, the survey collects information about a number of occupational outcomes considered three years after graduation - employment, wage, mismatch measures -.

Data concerning college characteristics is provided yearly by ISTAT in the bulletin *Lo Stato dell'Università*. We collected information at the department level relative to the total number of students enrolled, the number of first-year students, the total number of students that graduated and the number of student that graduated within the official length of the program. Information about the number of tenured and contract professors at the department level was only available for years 1996 and 1999. Also, information relative to the amounts of funding from the Ministry of Education received yearly by each university is also available at the university level[9].

Finally, in order to control for changes in the economic conditions we have also considered information on per capita GDP, total population and unemployment at the provincial level, and the number of individuals aged nineteen at the regional level (ISTAT).

4.2. The Determinants of Academic Performance

The grades obtained by a university graduate might reflect his academic performance as well as the grading standards of the institution that issued these grades. We will analyze the determinants of grades exploiting the empirical evidence provided by several cohorts of graduates. In particular the following equation is estimated:

$$G_{iudct} = \alpha + \beta * \mathbf{X}_i * + \delta * D_{ud} + \lambda * Y_t + \varepsilon_{iudct} \qquad (1)$$

The dependent variable G_{iudct} refers to the average grade obtained by individual *i*, who enrolled in year c and graduated in year *t* from department *d* and university u. $\mathbf{X}_i$ is a set of individual controls who includes the province of origin, gender, military service obligations, parental occupation and education, number of siblings, citizenship, , whether she originated from

[9] In the Italian tertiary education system those funds are dubbed Fondi di Finanziamento Ordinario (Ordinary Financial Funds) and represent about 70 percent of total financial resources of public colleges.

another town or province other than the one where the university attended was located, self-reported high school marks and the type of high school attended. The last variable combined with the type of attended high school allows us to control for students' pre-university academic quality.

The availability of information at three distinct points of time allows to include in the regression a set of department and university dummies (D_{ud}). This specification makes possible to control for the existence of time-invariant unobserved heterogeneity across departments which would, otherwise, be a serious threat to the consistency of the estimates. Systematic variations across time in unobserved characteristics are captured by three temporal dummies (Y_t).

An important problem for the consistency of our estimates is the presence of endogenous sample selection. In fact, we observe only those individuals that have graduated, but not those who dropped out. This fact generates two problems. First, the factors that affect the grades obtained by those students that do not manage to graduate could differ from the factors affecting the grades obtained by graduates. A key assumption will be, therefore, that the grades obtained by graduates reflect, conditional on observables, the grades obtained by those students that dropped out. Second, a more subtle problem is related to the fact that the very same unobservable characteristics – i.e. talent – that affect grades do also affect selection into the sample, this is, graduation. This makes the usual selection-based-on-observables assumption likely to fail. Still, the nature of the problem allows us to make some predictions about the direction of the bias. A decrease in grading standards will increase the sample size by adding into the sample individuals which are, conditional on observables, relatively worse in unobservables. This suggests that the effect of decreases in grading standards would tend to be underestimated or, in other words, that the estimated coefficients will tend to be a lower bound of the true value.

Column 1 of Table A of the appendix shows the relationship between the grades obtained by an individual and his personal characteristics, conditional on the department and university attended. The estimation results are largely consistent with those ones of Boero et al. (2001), who studied the determinants of the grades obtained by those students that graduated in 1995.

Both family background and pre-university curricula play a significant role in determining the university grade. We find that the educational level and the occupation of individual's mother, when he was at the age 14, exert especially strong influence on academic performance. (Note that on the contrary – as columns 2 and 3 suggest – father's education and occupation has a rather strong effect on individual's labour market performance.) Generally, those who stayed at home while attending university perform significantly better. We confirm the previous findings

suggesting that girls on average get significantly higher grades, *ceteris paribus*. Similarly we find that foreign students perform significantly better. Again in line with the results of Boero et al. we find that the high school grade appears to be a good predictor of university grade and attending classic and scientific lyceums provides an additional positive signal. We find that economic characteristic of the individual's province of origin have some effect on academic performance. In this way higher unemployment tends to be associated with lower grades and also with longer period taken by students to graduate (column 4).

As a side product of this regression it is interesting to observe that grades tend to vary greatly across universities, even after controlling for individuals' personal characteristics. Figure 1 depicts for each university the grade component which cannot be explained by individuals' personal characteristics. Since universities are ordered from left to right by their official university code, the apparent positive slope suggests that, as one moves from the North to the South of Italy (bigger codes' values correspond to southern locations), grading standards tend to become more generous. Note that, since the province of origin has been included among the individual characteristics, the estimation of these dummies relies strongly on the assumption that those students that decide to attend a university in their own province are not different in unobservables from those ones that move to a university located in another province.

The existence of great variations in grading across universities was also observed by Boero et al. (2001). The authors, however, do not attempt to explain the origin of this phenomenon. As they put it, "*whether this indicates use of differential standards across the different institutions or genuine institutional differences in value-added cannot be identified from the data."* On the contrary, in this paper we intend to contribute to the explanation of this result by trying to disentangle precisely the two driving forces mentioned by Boero et al.

The theoretical discussion in section 3 suggests that grading standards can be affected by decreases in the demand for a certain department or university. We test whether variations in the number of students that enrol at a certain department may generate variations in grading standards. Consequently, we include in the estimation of equation (1) the logarithm of the number of students that had enrolled to the first year together with an individual (log STUDENTS_1YEAR$_{udct}$):

$$GRADE_{iudct} = \alpha + \beta * \mathbf{X}_i * + \gamma * \log STUDENTS\_1YEAR_{udct} + \delta * D_{ud} + \lambda * Y_t + \varepsilon_{iudct} \qquad (2)$$

The grades obtained by a certain student do not depend only on his individual characteristics and on the institution and faculty chosen, but they are also negatively affected by the number of students that enrolled with him (Table 5, column 1). This is, we observe that, across time, when

the number of individuals that enrols within a certain department and university decreases individuals tend to obtain higher grades.

4.3. Explanations of Grade Divergence

In the previous section we documented the existence of a negative relationship between the number of students that enrol in a certain department and the grades obtained by these students, conditional on a large set of personal characteristics and controlling for time invariant department characteristics. Broadly speaking, two different set of explanations can be proposed for the existence of such correlation.

First, the existence of grade divergence is consistent with the use of grading standards as a competitive element in order to attract students by professors, departments or the university as a whole. This hypothesis presumes than when fewer students decide to enrol in a certain department grades increase because grading standards have been lowered. In this case variations in grades driven by variation in enrolment do not reflect variations in actual quality of graduates.

Second, variations in average grades may be simply reflecting variations in graduates' quality. In this sense, the observed divergence in grades could be explained either by 1) the existence of some systematic differences in the unobservable quality of students which would be correlated with group size and 2) the existence of some learning advantages for smaller groups.

Unobserved Heterogeneity in Individual Characteristics

Naturally, variations in enrolment are not random events. There exists the possibility that a decrease in the number of newly enrolled students involves variations in the average unobservable quality of these students. Note that although in our analysis we control for a wide range of students' observable characteristics, however, there might be still some source of systematic self-selection remaining correlated with the number of individuals that decide to enrol. For instance, students that are more flexible in terms of university or discipline choice might be also different in terms, for instance, of motivation.

Diminishing Returns to Scale in Learning or Congestion Effects

The existence of a relationship between the number of students that enrol and the grades they obtain could also be explained by to the existence of diminishing returns to scale in learning activities. This is, individual in smaller groups would obtain higher grades not because grading standards have decreased but because they tend to learn more. This is, students or professors could be subject to some "technological" constraints or some cognitive bias such that learning

decreases in larger classes. It might be also that universities have some capacity constrains that make the period of study longer. For instance, during enrolment peaks universities might experience the shortage in equipment, laboratories, etc. In addition, given the fact that most of the exams in universities are oral, professors might simply experience strong time constrains and thus create long waiting lists for exams.

4.4. Testable Implications

The hypothesis of endogenous grading standards differs in a substantial way from other explanations of the relation between grades and enrolment. Namely, this hypothesis – contrary to both individual unobserved heterogeneity and congestion hypotheses – suggests that variations in grades are pure variations in grading standards and do not reflect any variations in graduates' quality.

In order to disentangle whether the observed variations in grades are due to changes in grading standards or simply reflect a better quality we will perform a number of tests.

4.4.1. Changes in Total Enrolment vs. Changes in Class Size

If the increase in grades that seems to be associated to reductions in enrolment was due to the existence of diseconomies of scale in learning, one would expect that variations in grades were related to changes in the professor per student ratio, and not to changes in the total number of enrolled students.

We estimated a model where the number of enrolled students as well as the professor-student ratio were included among the regressors (see columns 4-5, Table 5). The professor-student ratio seems to have quite a strong effect on students' grades. This is, the grade obtained by a graduate in a given university depends significantly on the number of professors relative to the total number of individuals that did originally enrol within the student's cohort. Academic requirements seem to rise with larger class sizes. Note also that the class-size effect becomes especially large for those departments that experience a decline in the number of students (columns 6-7, Table 5).

The presence of both a class-size effect on grading along with a pure size effect suggests that self-selection can not uniquely explain the observed variations in grades. This is, the mechanism which generates a relationship between class size and grades must be related not only to changes in the unobservable characteristics of the demand for education but also must be related to the

supply side. Moreover, the asymmetric nature of the effect – grades are affected by decreases in class size but not by increases – seems more consistent with the existence of some endogeneity in grading standards rather than with the existence of relevant diseconomies of scale in learning.

4.4.2. Demand-driven vs. Supply-driven changes in Enrolment

As mentioned above, in Italy entry is open in most departments, except Architecture, Medicine and Veterinary. We test whether variations in enrolment in these departments generate any effect in grading standards. If smaller groups tend to learn more, one would expect learning diseconomies of scale to exist independently of the reason which has caused the variation in class size. As shown in column 8 of Table 5, changes in the number of students that have been admitted to these departments do not affect grades: the negative enrolment effect observed across all departments is exactly compensated by the positive enrolment effect specific to the departments with constraint admission. This result is inconsistent with the existence of significant diseconomies of scale in learning, at least within these specific departments.

4.4.3. University Grades and External Exams

We have observed that when departments lose students, grades tend to increase. If this increase in grades was not related to a variation in grading standards, but merely reflected better individual quality or better learning, one would expect that these students would also tend to perform better in external examinations. In order to test this hypothesis we use the information provided by state qualification exams.

In Italy for performing many professional activities graduates have to pass a so-called “abilitation” (or qualification) exam in addition to possession of a university degree. The qualification exams are prepared by the Ministry of Education and take place several times a year. In our sample around 50 percent of graduates passed successfully these exams. However, the asymmetry in qualification requirements results in big differences in the participation pattern and in the percentage of those who passed the exam across disciplines: in Economics, Literature and Law it is less than 20 percent, whereas in Medicine and Engineering it is almost 90 percent.

Our results suggest that while a lower number of class-mates is correlated with higher university grades, enrolment has no effect on the probability of passing the external qualification exam (see column 1, Table 6). This is, if the increase in grades that is associated to decreases in enrolment was reflecting increases in quality, the evidence suggests that this quality is orthogonal to the knowledge which is examined in external qualification exams.

4.4.4. University Grades and Labour Market Outcomes

The relationship between grades and labour market outcomes has deserved attention in the literature. In Switzerland a number of studies find that graduates with better grades tend to obtain also better labour market outcomes (Schweri, 2004). Boero et al. (2001) observe that while in England there exists a positive relationship between the average grade obtained by a graduate and the wage he makes later on in the labour market, in Italy they find no significant relationship.

Table 7 presents the estimation results from the regression of university grade on graduates' earnings after graduation. Column 1 suggests that within the same class those students that got higher grades in fact earn more in the labour market[10].

However, if we consider only the endogenous component of grade this result changes radically. In column 2 we perform IV estimation where on the first stage we estimate the effect of enrolment on grades and on the second stage we see if the component of grade explained by enrolment is correlated with wage. We find that this component is negatively – although no significantly so – correlated with wage. The same is true if we use class size instead of overall size of enrolment as an instrument for endogenous grading standards.

Table 8 presents similar results with other measures of labour market performance. These results suggest that attributing the variation in grades to congestion effects is not sufficient. On the contrary, the observed results are consistent with endogeneity of grading standards.

The extent to which universities and departments in Italy adjust their grading standards is so strong that it generates some striking results. For instance, within each discipline (i.e. Economics, Law...), those Italian graduates that have obtained lower grades in university tend on average to obtain in the labour market a higher salary and are less likely to be over-qualified (Column 4 Table 7). A similar paradox arises within each university (Column 5 Table 7). Among all individuals that graduated from a particular university (i.e. Pisa, Parma...), those who obtained worse grades will tend to obtain better labour market outcomes. It is important to remark that this negatively relationship between grades and labour market outcomes seems to have increased significantly in recent years.

[10] This result differs from the one obtained by Boero et al. due because of the more detail information available in our analysis. Boero et al. exploit the publicly available version of the 1998 ISTAT Indagine. This dataset does not provide information about the precise university where the individual graduated, but only the region.

4.5. Do Grading Standards Matter?

The previous section provided evidence consistent with the existence of some endogeneity in the set up of grading standards by higher education institutions. Naturally, whether these variations in grading standards matter will depend on how they affect students' enrolment decisions and their graduation rates. Otherwise, if the labour market was able to differentiate between the different grading standards used by different departments, these variations in grading standards would, in principle, have no real effect.

However, if high-school graduates do take into account difficulty and probability to graduate in their enrolment decisions endogenous grading might generate mismatch in the labour market. By substantially lowering the standards the departments that generally are losing students – and thus are providing a degree that is undervalued in the labour market – can still attract some students who are to a certain degree myopic (as they can not perfectly predict the negative effect of variations in grading standards on variations in the evaluation of the corresponding degree in the labour market). Thus, as a result these students later would experience difficulties in finding a job corresponding to their speciality.

4.5.1. Graduation rates, duration of studies and grades

Table 9 presents the correlations between graduation rates, duration of studies and grades. One can see that grades are only one of the possible indicators of difficulty. In fact, columns 1 and 3 show that duration of studies is negatively correlated with grades and, in its turn, duration of studies is negatively correlated with the graduation rate. This might mean that the problems of high drop out rate and high effective duration studies in Italy are related to the effects of perverse competition between universities.

Note that in columns 2 and 3 the estimations are performed at the *department level of analysis*. In order to control for individual characteristics at the department level of analysis we developed the following two-step estimation procedure.

On the first step we run regression on individual level taking as a dependent variable $GRADE_{udt}$ or $EXTRA\_YEARS_{udt}$ and as independent variables, first, university department dummies – different for each graduates' cohort – and, second, a large set of individual predetermined characteristics, which, most importantly, includes the province of origin (see Appendix for the effect of individual characteristics). This procedure allows us to estimate average values for academic performance indicators at the department level conditional on observed individual characteristics. Specifically, we interpret the estimated coefficient of a

department dummy variable in the above two regressions as the department average grade and duration of studies, respectively, conditional on individual characteristics (more precisely, this coefficient represents the difference of the department average from the omitted benchmark value).

On the second step we estimate equations of columns 2 and 3 of Table 9 in differences using department average grades (in place of $GRADE_{udt}$) and department average duration of studies (in place of $EXTRA\_YEARS_{udt}$) estimated on the first step. Estimation in differences assures that we compare institutional effects on those students that come from the same province of origin and that have graduated from the same university department but at different points of time. We expect that the differences in unobserved characteristics across these groups of students are less sharp than those across students that come from different places and have graduated from different Italian universities. The assumptions on the absence of these latter differences are, however, required in a typical cross section analysis.

4.5.2. Enrolment decisions and grading standards

Next, we would like to see whether academic standards affect enrolment decisions. If students over-value the probability to graduate in their enrolment decision, this can contribute to the generation of the mismatch in the labour market. Again, we analyse students' enrolment decisions on the *department level of analysis*. Therefore, we used the two-step procedure described in the previous subsection for the estimation of department average wage returns $WAGE_{udt}$ and the department-level percentage of graduates having reported a knowledge match between their university degree and current job ($KNOWLEDGE\_MATCH_{udt}$) conditional on individual characteristics.

Before proceeding with the analysis of enrolment decisions notice that our evidence on the enrolment effect on grades presented in section 4.2 is not affected by the aggregation procedure presented above. In column 2 of Table 10 we replicate this evidence at the department level. Moreover, we show that enrolment also negatively affects the graduation rate (column 3).

Now we would like to see on which basis potential students build their enrolment decisions. We acknowledge that consistency of our estimation is conditioned by the presence of simultaneity *and endogeneity of different university inputs and outputs*. Students' enrolment decisions are likely to be affected by students' expectations about labour market conditions and the probability/cost of graduating. We deal with the above endogeneities by exploiting the temporal structure of decision-making and by ruling out the existence of perfect foresight. This

is, we will assume that at each point of time individuals make their decisions based only on the available information at that moment and are unable to predict future shocks.

Table 11 suggests that the high-school graduates of the year 1995 cohort were taking into account for their enrolment decisions both the average wage of graduates' from the previous cohort and the observed graduation rate (columns 1 and 4). The observed grade for the previous cohort also has a positive – although not significant effect – on enrolment. We can also notice that for this particular year variation in the regional number of 19 years old people was not significantly mattering for enrolment.

4.5.3. Skill mismatch

We exploit the fact that simultaneous consideration of dynamics of different university inputs and outputs might improve the efficiency of our estimation. Specifically, we check whether this affects the results presented in Table 8, where we show a negative, not significant, effect of endogenous components of grades on knowledge match in the labour market $KNOWLEDGE\_MATCH_{udt}$.

We first perform a 2-stage least square estimation of equation (3)

$$og(KNOWLEDGE\_MATCH_{it}) = \alpha + \beta * \overbrace{\log(GRADE_{it})}^{\text{Predicted value}} + \varepsilon, \qquad (3)$$

where at the first stage we calculate the predicted value of average grade resulting from equation (4):

$$\log(GRADE_{it}) = \alpha + \beta * \log(STUDENTS\_1YEAR_{it}) + \varepsilon_{it}. \qquad (4)$$

This procedure allows us to consider specifically the effect of the endogenous component of grades on skill mismatch. Columns 1 and 2 of Table 12 describe the results of this estimation performed in differences for 2001 graduates. It suggests that $\hat{\beta}$ coefficients from both equation (3) and equation (4) are negative but not significant. By now, this result is confirming the effect observed in Table 8 for the individual-level analysis.

Next, we continue the analysis using the technique of seemingly unrelated regression (SUR) for the simultaneous estimation of equation (3) together with equation (5):

$$\begin{aligned}\log(STUDENTS\_1YEAR_{it}) &= \alpha + \beta * \log(KNOWLEDGE\_MATCH_{i,t-1}) \\ &+ \gamma * \log(GRADE_{i,t-1}) + \lambda * Z_{it} + \varepsilon_{it}\end{aligned} \qquad (5)$$

where *t* – stands for the cohort of students graduated in time *t*, and *Z* for the regional population of 19 years old people.

Equation (5) suggests that students' enrolment decisions may be affected by the expected observed "academic difficulty" and by the expectation to find job corresponding to the field of study associated to different institutions. As before, we assume that these expectations are based on information provided by the previous (3 years earlier) cohort of students. We also control for the possible effect of the demographic wave.

The results of the simultaneous estimation of equations (3) and (5) are presented in columns 2 and 4 of Table 12. Most importantly, we observe that the endogenous component of grades now has a significant negative effect on the skill match in the labour market.

5. Conclusions

This article analyzed how the incentive structure present in some European university systems may contribute to the overall skills mismatch at the labour market. European countries are increasingly relating university funding to the number of students enrolled and to the number of diplomas delivered. At the same time, generally there are no quantity entry restrictions on students' admission to universities and the tuition fees are very low and not varying much across universities.

In this paper we argued that such a system of state-provided tertiary education is likely to generate a divergence in grading standards across universities and departments such that the difficulty of obtaining a university title will tend to be negatively related to the market value of this title. This might happen because the departments that are negatively affected by variations in the demand in the labour market are mostly disposed towards reducing their standards in order to compete for students. Thus, if university financing mechanisms do not take into account labour market outcomes and, moreover, public university titles possess some intrinsic value, the decrease in grading standards will tend to induce a persistent mismatch between graduates skills and labour market demand. In the paper we tested the above hypothesis using a rich dataset on Italian tertiary education system. The empirical evidence showed that grading standards at Italian departments are significantly driven by students' enrolment. Particularly, in line with our hypothesis, we found that those departments that experience a decrease in the number of new students tend subsequently to significantly reduce the academic requirements for obtaining a degree.

The latter finding is consistent with the presence of other effects that do not necessarily involve the variation in standards. We proposed several tests in order to disentangle these alternative effects and all of the estimation results were in line with the hypothesis of endogenous grading standards.

Finally, we demonstrated that grades affect enrolment decisions and graduation rates, and the endogenous component of grades is also likely to produce a negative effect on graduates' labour market outcomes. Specifically, our results show that the increase in the university grade occurring due to the drop in grading standards is associated with the increase in the probability of being overqualified, i.e. in the probability not to find a job that would utilize graduate' knowledge obtained in university.

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Table 1. Graduates' unemployment and relative earnings in a sample of OCDE countries (2003)

	Unemployment		Graduates' Relative Earnings[3]
Country	Graduates[1]	Overall[2]	
Australia	2,1	4,7	144
Belgium	5,2	9,6	146
Denmark	6,9	4,4	151
Finland	2,6	6,2	190
France	6,4	9,3	169
Germany	2,3	8	163
Ireland	3	4,1	157
Italy	**13,6**	**10,4**	**127**
Netherlands	2,6	2,5	141
Norway	3,1	4,3	131
Spain	8,9	10,8	157
Sweden	2,4	5,2	131
Switzerland	5,2	5,3	164
United Kingdom	2	3,5	174
United States	2,6	4,4	181
Mean	4,6	6,2	155,1

Source: OCDE, Education at a Glance 2005.

(1) Percentage of the population with tertiary education, not in education and unemployed in the total population. Year 2003.

(2) Percentage of the population, not in education and unemployed in the total population. Year 2003.

(3) Relative earnings of the population with income from employment, aged 25 to 64, who have attained tertiary-type A or advanced research programmes. Upper secondary and post-secondary non-tertiary education = 100. Data refer to various years between 1997 and 2000.

Table 2. Enrolment Rate, Graduating Rate and Class Size in a sample of OCDE countries

Country	Enrolment Rate[1]	Graduation Rate[2]	Class Size[3]
Australia	68	49,0	16,1
Austria	35	19,0	13,7
Belgium	34		19,2
Denmark	53	42,2	
Finland	73	48,7	12,3
France	39	26,7	18,6
Germany	36	19,5	12,2
Ireland	41	36,8	15,2
Italy	**54**	**26,7**	**22,3**
Netherlands	52		13,4
Norway	68	39,8	11,9
Spain	46	32,1	13,3
Sweden	80	35,4	9,0
Switzerland	38	21,6	18,7
United Kingdom	48	38,2	18,2
United States	63	32,9	15,2
Mean	51,8	33,5	15,3

(1) Entry rates into tertiary type A education, year 2003, source OCDE.

(2) Percentage of tertiary graduates to the population at the typical age of graduation, all tertiary type-A programs, year 2003, source OCDE.

(3) Ratio of students to teaching staff in tertiary type-A education, calculations based on full-time equivalents, year 2003, source OCDE.

Table 3. Legal and effective duration of university programs in Italy

	Mean legal duration	Median effective duration	Mean effective duration
Sciences	4.01	6.0	6.94
Chemistry and Pharmacy	4.66	6.0	6.95
Geo-biology	4.17	7.0	7.63
Medical school	5.77	7.0	8.28
Engineering	4.99	7.0	7.73
Architecture	4.99	8.0	8.79
Agrarian sciences	4.83	7.0	8.21
Economics and statistics	4.04	6.0	6.74
Political sciences	4.02	6.0	7.23
Law	4.02	6.0	7.04
Arts	4.02	7.0	7.61
Literature	4.02	7.0	7.38
Teaching	4.01	7.0	8.55
Psychology	4.92	6.0	6.71
Total	4.39	7.0	7.41

Table 4. Descriptive statistics and abbreviation of key variables

Name of the variable	Description of the variable	Cohort of graduates		
		1995	*1998*	*2001*
Predetermined individual characteristics				
Female	Female	0.530 (0.004)	0.554 (0.004)	0.565 (0.005)
High School grade	High School grade	48.363 (0.062)	48.911 (0.054)	49.047 (0.065)
College-related individual characteristics				
GRADE	University grade	102.908 (0.064)	102.601 (0.057)	102.766 (0.068)
EXTRA_YEARS (**)	Number of extra years taken to graduate after the end of the official program duration	2.304 (0.012)	2.364 (0.010)	2.178 (0.013)
Labour market outcomes				
JOB_SEARCH_TIME	Months spent to find a first job	13.184 (0.113)	14.160 (0.105)	11.519 (0.126)
EMPLOYMENT	Proportion of employed in 3 years after graduation	0.716 (0.004)	0.736 (0.003)	0.739 (0.004)
KNOWLEDGE MATCH	Proportion of those who claim that knowledge obtained in university is necessary for their job	0.738 (0.005)	0.818 (0.003)	0.683 (0.006)
WAGE	Wage in 3 years after graduation	958.69 (4.883)	1137.28 (4.151)	1201.92 (6.017)
Number of observations at the individual level		*17279*	*20818*	*25507*
Department characteristics (*)				
STUDENTS	Total number of regular students (enrolled within official program duration)	n/d	2858.42 (3023.67)	2428.75 (2460.16)
STUDENTS_1YEAR	Average number of students enrolled to the first year together with the graduates of current period	916.08 (992.54)	993.67 (1107.98)	913.84 (1071.29)
GRADUATES	Total number of graduates	n/d	337.83 (407.28)	383.981 (420.02)
GRADUATION_RATE	Ratio of the number of students graduated within the official program duration to the number of students enrolled to the first year together with these graduates	0.043 (0.047)	0.052 (0.091)	0.122 (0.153)
TENURED_PROF	Number of tenured professors	n/d	135.80 (138.96)	133.68 (135.32)
CONTRACT_PROF	Number of professors with short-term contracts	n/d	24.89 (63.95)	40.19 (77.79)
PROFESSORS-STUDENTS	Ratio of the total number of professors to the number of regular students	n/d	0.084 (0.084)	0.090 (0.074)
Number of observations at the department level		*283*	*336*	*360*

Notes: n/d – no data for this year.

All means - except from those marked with (*) - are corrected for the sample composition weights. Linearized standard erros in parenthesis.

(**) The values of this variable lie in the range from 1 to 4: value 4 is assigned if a student has taken 4 or more extra years to graduate. Thus the actual average number of extra years is different from the one indicated in the table and varies around 2.8.

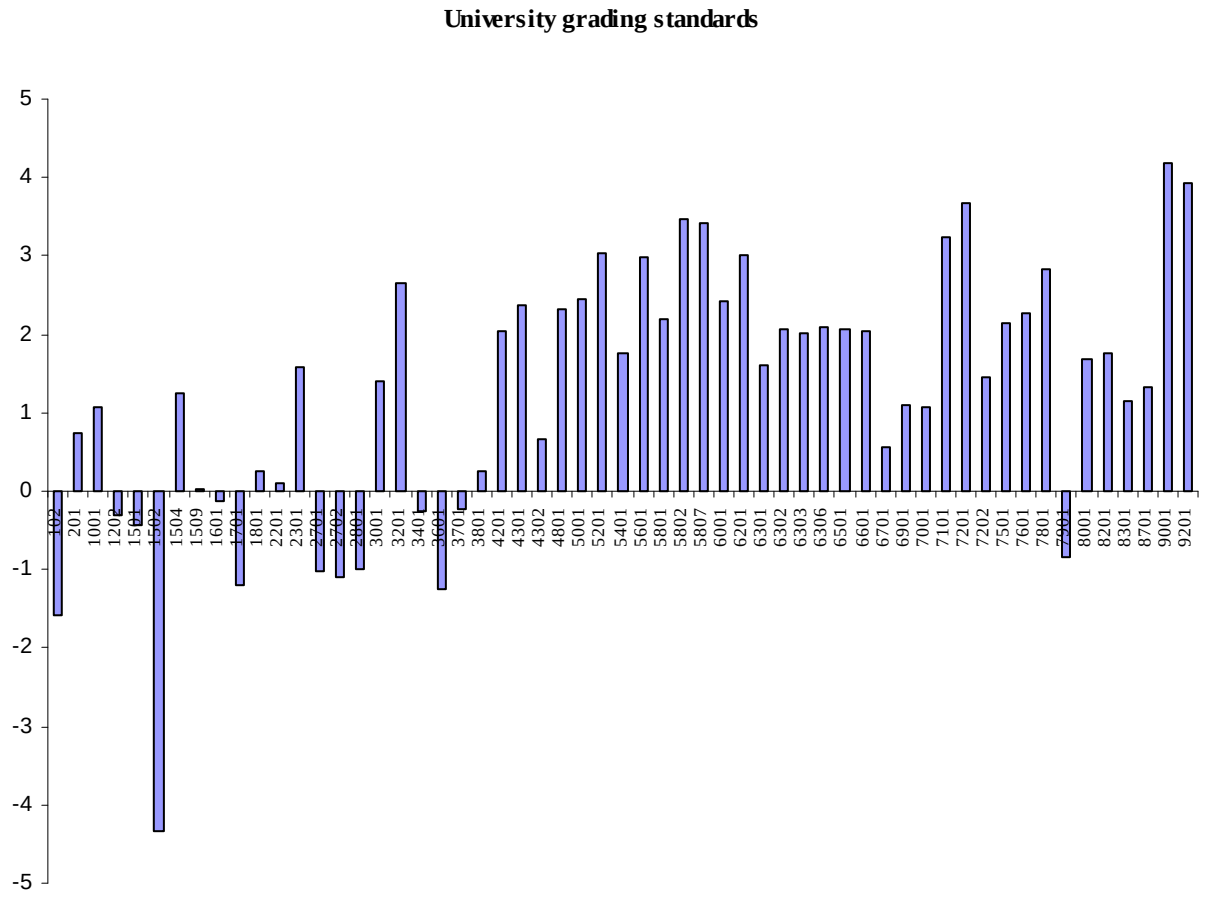

Figure 1. The effects of university fixed effects on grades conditional on individual characteristics and department choice, OLS estimates from pooled cross-section for 1995, 1998 and 2001 (university code on the ordinate; 101 is a benchmark)

Table 5. Endogeneity of university grading standards, OLS estimates

	GRADE							
	(1) 1995-2001	(2) 1995-1998	(3) 1998-2001	(4) 1998-2001	(5) 1998-2001	(6) 1998-2001	(7) 1998-2001	(8) 1998-2001
Log STUDENTS_1YEAR	-0.759***	-0.471*	-0.825***	-0.721***	-0.721***	-0.743***	-0.832***	-0.947***
	(0.155)	(0.244)	(0.186)	(0.190)	(0.190)	(0.195)	(0.198)	(0.205)
Constrained admission* Log STUDENTS_1YEAR								0.974**
								(0.394)
Shrinking department* Log STUDENTS_1YEAR						-0.011	0.185	
						(0.086)	(0.116)	
PROFESSORS-STUDENTS				3.467***			-1.497	
				(1.307)			(1.929)	
Shrinking department* PROFESSORS-STUDENTS							5.244***	
							(1.832)	
TENURED_PROF-STUDENTS					3.738**			
					(1.640)			
CONTRACT_PROF-STUDENTS					3.235*			
					(1.930)			
Shrinking department						0.271	-1.689*	
						(0.616)	(0.938)	
Constrained admission								-7.840***
								(2.318)
Dummies for EXTRA_YEARS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual characteristics (*)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Characteristics of the province of origin 2 years before graduation (**)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Department*University dummies (in total 394 dummy variables)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province of origin	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	31960	15737	28331	28227	28227	27427	27345	28325
R-squared	0.44	0.44	0.44	0.44	0.44	0.45	0.45	0.44

Significance level: * p<0.10, **p<0.05, ***p<0.01. Robust standard errors in parentheses.
(*) The variables corresponding to individual characteristics (section 1 and 2) that appear in Table A are included among the regressors.
(**) The population variable is substituted with the (log) number 19 years old people observed for the province of attended university at the year of first enrolment.
"Shrinking department" is a dummy variable indicating that an individual was enrolled in the department, which had been experiencing a drop in the overall number of new students (change in STUDENTS_1YEAR is less than zero).
"Constrained admission" is a dummy variable indicating that an individual was enrolled in the department, which has a numerus *clausus* constraint on enrolment.

Table 6. Enrolment effect as a predictor of success in external qualification exams, Probit and IV estimates

	Probability to pass qualification exam		
	(1)	(2)	(3) IV OLS with STUDENTS_1YEAR
	1995-2001	1995-2001	1995-2001
Log STUDENTS_ 1YEAR	0.064		
	(0.054)		
GRADE		0.017***	-0.014
		(0.002)	(0.018)
Individual characteristics (*)	Yes	Yes	Yes
Characteristics of the province of origin 2 years before graduation	Yes	Yes	Yes
Department * University dummies (394)	Yes	Yes	Yes
Province of origin	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	31210	58133	31975
Pseudo R-squared	0.40	0.40	0.44

Significance level: * p<0.10, **p<0.05, ***p<0.01. Robust standard errors in parentheses.
(*) The variables corresponding to individual characteristics (section 1 and 2) that appear in Table A are included among the regressors.

Table 7. University grade as a predictor of (log) wage, OLS and IV estimates

	Log WAGE						
	(1)	(2) IV with STUDENTS_ 1YEAR	(3) IV with PROFESSORS-STUDENTS	(4) Department dummies	(5) University dummies	(6) Only individual characteristics	(7) Without controls (**)
	1995-2001	1998-2001	1998-2001	1998-2001	1998-2001	1998-2001	1998-2001
GRADE	0.004***	-0.013	-0.008	-0.002*	-0.002**	-0.001	-0.003***
	(0.001)	(0.014)	(0.013)	(0.001)	(0.001)	(0.001)	(0.001)
Log STUDENTS_ 1YEAR			Yes				
Dummies for EXTRA_YEARS		Yes	Yes				
Individual characteristics (*)	Yes	Yes	Yes			Yes	
Characteristics of the province of origin 2 years before graduation	Yes	Yes	Yes			Yes	
Department * University dummies (394)	Yes	Yes	Yes				
Department dummies (12)				Yes			
University dummies (67)					Yes		
Province of origin	Yes	Yes	Yes				
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	35795	18745	16475	25688	25688	25649	25812
R-squared	0.24	0.21	0.21	0.16	0.14	0.13	0.02

Significance level: * p<0.10, **p<0.05, ***p<0.01. Robust standard errors in parentheses.
(*) The variables corresponding to individual characteristics (section 1 and 2) that appear in Table A are included among the regressors.
(**) Dummies for age clusters are retained among the regressors.

Table 8. University grade as a predictor of other indicators of labour market performance, OLS and IV estimates

	KNOWLEDGE MATCH			EMPLOYMENT		
	(1)	(2)	(3)	(4)	(5)	(6)
		IV with STUDENTS_ 1YEAR	IV with PROFESSORS-STUDENTS		IV with STUDENTS_ 1YEAR	IV with PROFESSORS-STUDENTS
	1998-2001	1998-2001	1998-2001	1998-2001	1998-2001	1998-2001
GRADE	0.004***	-0.013	-0.008	0.000	-0.021	-0.021
	(0.001)	(0.014)	(0.013)	(0.001)	(0.015)	(0.021)
Log STUDENTS_1YEAR			Yes			Yes
Dummies for EXTRA_YEARS		Yes	Yes		Yes	Yes
Individual characteristics (*)	Yes	Yes	Yes	Yes	Yes	Yes
Characteristics of the province of origin 2 years before graduation	Yes	Yes	Yes	Yes	Yes	Yes
Department*University dummies (394)	Yes	Yes	Yes	Yes	Yes	Yes
Province of origin	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	21234	18745	16475	22443	22443	22377
R-squared	0.11	0.21	0.21	0.14	0.06	0.05

Significance level: * p<0.10, **p<0.05, ***p<0.01. Robust standard errors in parentheses.
(*) The variables corresponding to individual characteristics (section 1 and 2) that appear in Table A are included among the regressors.

Table 9. The relationship between grading standards, the duration of studies and graduation rates, OLS estimates

	Individual level	Department level	
	(1)	(2)	(3)
	EXTRA_YEARS	GRADUATION RATE	GRADUATION RATE
	1995-2001	1998-2001, in differences	1998-2001, in differences
GRADE	-0.052***	-0.006**	
	(0.001)	(0.003)	
EXTRA_YEARS			-0.082***
			(0.010)
Individual characteristics (*)	Yes		
Characteristics of the province of origin 2 years before graduation	Yes		
Department*University dummies (394)	Yes		
Province of origin	Yes		
Year dummies	Yes	Yes	Yes
Observations	58609	516	516
R-squared	0.24	0.21	0.30

Significance level: * p<0.10, **p<0.05, ***p<0.01. Robust standard errors in parentheses.
Note: (*) The variables corresponding to individual characteristics (section 1 and 2) that appear in Table A are included among the regressors.
In the analysis at the department level GRADE and EXTRA_YEARS represent departments' fixed effects obtained from the individual-level analysis after controlling for individual characteristics. In equations 2 and 3 the analytical weights are used, corresponding to the overall number of regular students in the department.

Table 10. Endogenous grading and difficulty standards, OLS estimates in differences at the department level

	Department level			
	(1)	(2)	(3)	(4)
	GRADE		GRADUATION RATE	
	1998-2001, in differences		1998-2001, in differences	
Log STUDENTS_1YEAR (*)	-0.401**	-0.811*	-0.024***	0.001
	(0.177)	(0.465)	(0.010)	(0.015)
Log PROFESSOR-STUDENTS_1YEAR		0.649*		0.041**
		(0.337)		(0.017)
Year dummies	Yes	Yes	Yes	Yes
Observations	574	296	516	328
R-squared	0.01	0.02	0.17	0.02

Significance level: * p<0.10, **p<0.05, ***p<0.01. Robust standard errors in parentheses.
Note: (*) In equations (1-2) the number of students enrolled to the first-year course is taken 8 years before the observation of the average grade. The is that on average the official duration of degree programs is 5 years and the average number of extra years taken by students to graduate is about 2.8. In equations (3-4) where we estimate the ratio of students graduating on-time, the number of students enrolled to the first-year course is taken 5 years before observation of the ratio.
In equations (1-2) the analytical weights are used, to the overall number of regular students in the department.

Table 11. Enrolment decisions, OLS estimates in differences at the department level

	Department level				
	(1)	(2)	(3)	(4)	(5)
	Log STUDENTS_1YEAR (*)				
	1998-2001, in differences				
L1: Log WAGE	0.213*				
	(0.122)				
L1: KNOWLEDGE MATCH		-0.053			
		(0.158)			
L1: GRADE			0.017		
			(0.015)		
L1: GRADUATION RATE				2.497***	
				(0.634)	
Log Regional population of 19 years old in the year of enrolment					0.439
					(0.450)
Observations	299	299	300	186	331
R-squared	0.01	0.00	0.004	0.08	0.003

Significance level: * p<0.10, **p<0.05, ***p<0.01. Robust standard errors in parentheses.
Note: (*) The number of students enrolled to the first-year course is taken 5 years before the observation of the graduation data. The regressors are taken with one lag, because the enrolment decisions are assumed to be based on the observation of the performance of the previous cohort of graduates.

Table 12. 2-SLS and SUR estimates of Knowledge match in the labour market, in differences for 1998-2001

	Department level			
	(1)	(2)	(3)	(4)
	2-SLS		SURE	
	First Stage: GRADE	KNOWLEDGE MATCH	Log STUDENTS_1YEAR	KNOWLEDGE MATCH
GRADE (endogenous component) (*)		-0.072		-0.049*
		(0.076)		(0.029)
Log STUDENTS_1YEAR (**)	-0.386			
	(0.241)			
L1: GRADE			0.033**	
			(0.015)	
L1: KNOWLEDGE MATCH			-0.076	
			(0.172)	
Log Regional population of 19 years old in the year of enrolment			0.777	
			(0.933)	
Observations	295	295	288	288
R-squared	0.009	-	0.018	0.005

Significance level: * p<0.10, **p<0.05, ***p<0.01. Robust standard errors in parentheses.
Note: (*) The predicted value from the estimation of equation (2).
(**) The number of students enrolled to the first-year course is taken 8 years before the observation of the graduation data.
The analytical weights are used, corresponding to the overall number of regular students in the department.
Breusch-Pagan test of independence for SUR model: chi2(3) = 0.188, Pr = 0.6642.

Appendix

Table A. Impact of individual characteristics on university grade, wage, knowledge match and extra years in university, OLS estimations for 1995-2001

	(1)		(2)		(3)		(4)	
	University grade		**(Log) Wage**		**Knowledge match between university degree and job duties**		**Extra Years in University**	
1. Pre-determined individual characteristics								
Female	0.802***	(0.095)	-0.134***	(0.008)	-0.025***	(0.008)	-0.094***	(0.026)
Age clusters (52 groups)	Yes		Yes		Yes		Yes	
When an individual was 14 years old his father was:								
- working	0.008	(0.268)	0.064**	(0.032)	-0.032	(0.022)	-0.195***	(0.062)
- looking for a job	0.001	(0.525)	0.024	(0.059)	-0.041	(0.062)	-0.397***	(0.127)
- a pensioner	0.177	(0.351)	0.034	(0.039)	-0.065**	(0.031)	-0.222***	(0.078)
- other	Benchmark		Benchmark		Benchmark		Benchmark	
When an individual was 14 years old his mother was:								
- working	0.158**	(0.073)	-0.001	(0.006)	-0.003	(0.006)	-0.045****	(0.015)
- looking for a job	0.394	(0.407)	-0.195***	(0.066)	-0.019	(0.058)	0.128	(0.108)
- a pensioner	0.496**	(0.236)	-0.016	(0.018)	-0.015	(0.025)	-0.143***	(0.053)
- other	Benchmark		Benchmark		Benchmark		Benchmark	
When an individual was 14 years old his father's highest educational title was:								
- elementary license or none	Benchmark		Benchmark		Benchmark		Benchmark	
- secondary education license	-0.010	(0.093)	0.019***	(0.008)	0.023***	(0.009)	-0.096***	(0.020)
- higher education diploma	-0.037	(0.108)	0.028***	(0.009)	0.031***	(0.010)	-0.086***	(0.025)
- university degree	0.054	(0.127)	0.032**	(0.012)	0.048***	(0.011)	-0.164***	(0.027)
- no answer	0.120	(0.390)	0.018	(0.049)	0.004	(0.046)	-0.066	(0.100)
When an individual was 14 years old his mother's highest educational title was:								
- elementary license or none	Benchmark		Benchmark		Benchmark		Benchmark	
- secondary education license	0.013	(0.089)	0.014*	(0.008)	0.006	(0.008)	-0.150***	(0.020)
- higher education diploma	-0.056	(0.103)	0.022**	(0.009)	0.015	(0.009)	-0.234***	(0.023)
- university degree	0.269**	(0.134)	0.013	(0.014)	0.025*	(0.013)	-0.450***	(0.031)
- no answer	-0.091	(0.434)	0.026	(0.055)	-0.013	(0.044)	-0.093	(0.105)
Father's sector of work								
- agriculture	-0.797**	(0.384)	-0.074***	(0.033)	0.050	(0.036)	0.035	(0.089)
- industry	-0.352	(0.364)	-0.75***	(0.031)	0.052	(0.034)	-0.043	(0.089)
- services	-0.307	(0.358)	-0.094***	(0.031)	0.043	(0.034)	0.007	(0.087)
- no answer	Benchmark		Benchmark		Benchmark		Benchmark	
Number of siblings	-0.030	(0.037)	0.001	(0.003)	-0.004	(0.003)	0.066***	(0.008)
Nationality:								
- Italian	Benchmark		Benchmark		Benchmark		Benchmark	
- European Union	1.996**	(0.811)	0.025	(0.081)	0.108	(0.069)	-0.173	(0.179)

- Extra-communitarian	2.783***	(0.795)	0.112	(0.074)	0.078	(0.060)	-0.262*	(0.147)
Type of high school:								
- scientific lyceum	Benchmark		Benchmark		Benchmark		Benchmark	
- classic lyceum	0.332***	(0.086)	-0.027***	(0.010)	0.015*	(0.009)	0.067***	(0.021)
- technical industrial institute	-1.158***	(0.155)	0.023***	(0.009)	-0.024*	(0.013)	0.123***	(0.027)
- technical institute for geometers	-1.815***	(0.194)	-0.025**	(0.014)	-0.007	(0.014)	0.151***	(0.040)
- technical commercial institute	-1.747***	(0.177)	-0.004	(0.010)	-0.032**	(0.013)	0.174***	(0.022)
- other type of technical institute	-1.865***	(0.165)	0.019	(0.013)	-0.015	(0.017)	0.227***	(0.036)
- teachers school or institute	-1.475***	(0.141)	0.040***	(0.013)	0.021	(0.013)	0.472***	(0.039)
- language lyceum	-1.387***	(0.147)	-0.002	(0.016)	-0.047***	(0.016)	0.199***	(0.031)
- professional institute	-2.600***	(0.192)	-0.018	(0.022)	-0.023	(0.017)	0.244***	(0.044)
- art lyceum or institute	-2.196***	(0.272)	-0.053*	(0.029)	-0.036*	(0.020)	0.466***	(0.055)
High school grade (*)	0.349***	(0.007)	0.003***	(0.000)	0.002***	(0.001)	-0.044***	(0.001)
Military service obligations:								
- exempt	-0.235*	(0.135)	0.023***	(0.008)	0.035***	(0.008)	0.091***	(0.039)
- before university	-0.327*	(0.186)	0.128***	(0.015)	0.029**	(0.015)	-0.056	(0.044)
- other	Benchmark		Benchmark		Benchmark		Benchmark	
2. College-related individual characteristics								
Moved from other course	-0.244***	(0.100)	0.043***	(0.007)	-0.013	(0.010)	0.012	(0.026)
Second degree	0.608	(0.452)	0.052	(0.092)	0.078	(0.090)	-0.384***	(0.109)
Studied in the region of birth	0.301**	(0.122)	-0.035***	(0.010)	-0.032***	(0.009)	-0.002	(0.026)
Studied in the town of birth	0.727***	(0.082)	0.023**	(0.008)	-0.017**	(0.008)	-0.075***	(0.019)
Moved from own town to study	-0.014	(0.089)	-0.007	(0.008)	-0.007	(0.007)	0.007	(0.008)
3. Province of birth characteristics, 2 years before graduation								
GDP	0.008	(0.008)	-0.001	(0.001)	0.003***	(0.001)	-0.003*	(0.002)
Unemployment	-0.037*	(0.021)	0.011***	(0.002)	0.005***	(0.002)	0.015***	(0.006)

Notes: (*) – With the exception of this table, in all regressions in the paper the high school grade was interacted with the type of high school which the individual has graduated from.
Significance level: * p<0.10, **p<0.05, ***p<0.01. Robust standard errors in parentheses.