Selective admission tests and students' performances. Evidence from a natural experiment in a large Italian University*

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Abstract

We use a difference-in-differences method exploiting a natural experiment occurred in a large public university located in Southern Italy to study whether the introduction of a selective admission test affects two indicators of students' performances (dropout rate, grade point average). Our analysis shows that new admission policy improves college performance, reducing the dropout rate of first year students by about 11% and increasing grade point average by 0.7 points. Estimates are robust to various sensitivity analysis. Compared to other studies, our results show that the effect of selective admission tests may differ across geographic or institutional settings. The policy conclusion is that test based on selective admission policy to tertiary education are effective where they are less used i.e. in public universities.

Key-words: Selective entry test; students' performances; natural experiment

JEL-Codes: I21; I28; C21

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1. INTRODUCTION

To the extent that growth and development of nation economies hinge on human capital accumulation, college access and students' performance are important policy issues in tertiary education in both developed (Goldin and Katz, 2008) and developing countries (Hanushek and Woessmann, 2012a, 2012b). The organization of tertiary education systems world-wide is therefore under continuous scrutiny by the policymakers in the quest for the relaxation of the specific quantity-quality trade-off inherent this segment of education. As it is well known, the Scylla and Charibdys endangering the policy action and reforms are mainly, on the one hand, selectivity of the institution in granting access (to meet excellence standards for the positioning of the nation economy on the technological frontier) and, on the other hand, the extended participation by increasingly larger fractions of the population (to foster social and occupational mobility and to accompany structural transformations of the economy). Our aim, in this paper, is empirically investigating the effects of a change of regime in access policies at local level on students' performances, measured in terms of dropout rate and grade point average in a Southern Italian public university in the first decade of 2000.

Extensive literature has highlighted the national specificity of tertiary education systems[1]; Italy is a particularly interesting case for our aim since, during the 1990s and in reply to nationwide policy changes pushing the expansion of enrollment, "Italian universities started to expand their supply, both in terms of opening of new sites by established universities in neighboring cities and by offering a broader variety of degrees" (Bratti, Checchi and De Blasio, 2008).

The evaluation of local admission policies, the object of our analysis, is particularly interesting in such a context since as argued by Bratti, Checchi and De Blasio, (2008) "Italian policy-makers did not pursue the route of stratifying the supply of tertiary education (between university and non-university or between public and private), but followed the principle of autonomy, encouraging local solutions while still retaining a regime of central approval".

There is some evidence that the wave of reforms in Italy may have hit a particularly hard rock in their maneuvering between the Scilla and Charibdys mentioned above "as the greater availability of

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[1] For a primer on "100 years of Education reforms in Europe" with specific attention to the modern historical origin and evolution of the reform process in OECD countries see Christell Garrouste (2010).

courses had a significantly positive impact only on the probability of university enrolment but not on that of obtaining a university degree" (once again in Bratti et al., 2008, Dornbusch and Giavazzi, 2000). Reducing the costs of enrolment into higher education institutions, therefore, is not necessarily a winning strategy in the "race between education and technology", when higher education careers are too long or are interrupted (drop-out).

Although documented in the assessments of recent Italian reform, the problem of interrupted careers (drop out) in higher education has become an increasing concern in the higher education system in OECD countries (see appendix 1 for further details). On average 31% of students entering tertiary education leave without at least a first tertiary degree among the 18 OECD countries for which data are available in 2008 (OECD, 2010). Even though the optimal dropout rate is not necessarily zero in general (see Manski, 1989 on schooling as experimentation and an interpretation in O'Higgins et al., 2007), a high dropout rate shows that the higher education system did not probably match the students' expectations and needs (OECD, 2009; OECD, 2010)[2].

To improve students' performances in higher education institutions a range of instruments have been considered in the literature.[3] A specific instrument, in order to select high-performing undergraduates and to improve student's performances, is to make use of selective admission tests to target a minimum quality level for the students entering the institution[4].

Straightforward theoretical arguments (Stiglitz, 1975, Fernandez and Gali, 1999) can be used to argue for the effectiveness of admission entry tests in improving students' performance.

In such a setting it should be obvious that, to the extent that the test is correlated with inner ability, motivation and other conditions for good individual performance, a more selective policy leads to better educational outcomes. However, the evidence from correlational studies from several countries is mixed (see section 3 for further details). More importantly, the only study based on a natural experiment framework we are aware of (i.e. Francesconi et al. 2011 on Italian data), does

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[2] Bradley and Lenton (2007) show " how young people are sorted into different levels (high vs low) and types (academic vs vocational) of courses in post-compulsory education on the basis of their prior attainment. The most qualified enter 'high' academic courses and are less likely to drop out, implying optimal matches between course type and student. Conversely, the least qualified are more likely to enroll in 'low' level courses but are more likely to drop out, implying sub-optimal matches".

[3] This include "removing financial obstacles (Singell, 2004), preparing high school students better (DesJardins, Ahlburg, and McCall 2002), improving the quality of the match between universities and students (Bowen, Chinos, and McPherson 2009), and improving the entrants social and academic integration (Tinto 1975)", see Bettinger et al. (2013).

[4] An effect of the selective test is a commitment device for the higher education institution to maintain reputation to provide a certain quality level in teaching and research standards. This mechanism is extensively exploited by private university, especially those operating in the anglo-saxon world.

not find any significant effect of the policy variation on educational outcomes. A causal framework is important on this issue since selection effects different from the test based admission policy (e.g. parental background, soft skills) may bias the results[5]. Our aim is to investigate whether the introduction of a selective admission test has been effective in improving student performances in a different setting, taking advantage of a unique administrative data set from a southern Italian public university. We use a difference-in-differences method exploiting a natural experiment occurred in the University of Salerno, namely the introduction of admission tests in the Faculty of Economics (more details in section 2). The first contribution of the paper, therefore is to estimate a causal effect of selective tests on educational outcomes. Secondly, the fact of conducting the experiment in a different setting may be useful to assess the external validity of the experiment conducted by Francesconi et al (2011). As it is well known, the external validity of any natural experiment is a debated and important issue, especially when it come to policy implications (Meyer, 1995). One of the threats to external validity is that "the effect of treatment may differ across geographic or institutional settings". A natural way out is the replication of the design in different context. Our results show that, indeed, more selective admission policies in a public university located in the south of the country improve students performances in terms of drop-out rates and in terms of weighted scores at the exams. This casts doubt on the fact that selective test produces the same results in terms of educational outcomes in all geographic and institutional settings.

The rest of the paper is organized as follows: section 2 provides specific institutional details on the policy experiment leading to more restrictive access policy, section 3 describes some related literature, section 4 illustrates the data used and the econometric analysis, section 5 provides robustness checks and sensitivity analysis. Section 6 concludes.

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[5] For a natural experiment approach used to evaluate reforms in education see Lang and Kropp (1986) and Chevalier, Harmon, Walker e Zhu (2004). For specific attention to higher education see Bedard (2001) and Hamalainen and Uusitalo (2006).

2. INSTITUTIONAL SETTING

Italy is an interesting case for our analysis due to the policy changes in the higher education system introduced in the 1990s and at the beginning of the 2000s (see appendix 2 for some details on the university system in Italy). As already underlined by Bratti, Checchi and De Blasio (2008), after a period of relative immobility, since the 1990s the Italian university system has been characterized by new policy interventions which contributed to increase the supply of higher education in the country both through the opening of new sites in neighboring cities and by offering a broader variety of degrees. At the same time the expansion of the tertiary education supply was followed by the concession of a certain degree of autonomy to the universities by letting them having their own statutes, allocating the central funding and creating new faculties and courses. According to the National Committee for the Evaluation of the University (CNVSU, 2001), only in the decade from 1990 to 2000, the number of universities rose from 58 to 70, the number of faculties rose from 365 to 474 and the number of 4 and 5 years degrees rose from 898 to 1321. However, the above stated expansion of the tertiary education supply, even though had positive effects on university enrolment, did not lead to an increase in probability of attaining a degree (see the empirical evidence provided by Bratti, Checchi and De Blasio, 2008).

An important step of this still ongoing process was made with the introduction of a "3+2" model implemented by the Decree n. 509/99 which reduced the length of the degree programmes and the number of exams, lowering, according to Cappellari and Lucifora (2009), "the costs of investing in tertiary education". Moreover, "the wider menu of degrees available and the possibility to prolong education further to obtain a second cycle degree, might also have increased the expected returns of human capital investment, by allowing a better match between supply and demand of higher education. All this amounts at an increase in the expected net benefit of higher education, which should translate into higher enrollment, particularly from individuals that were somehow constrained in the old system" (see again Cappellari and Lucifera, 2009). As underlined by the annual report made by the National Committee for the Evaluation of the University (CNVSU, 2009; CNVSU, 2011), although the reform has led to an increase in the number of fields and courses a student could choose, this action has been made without taking completely into account the students' needs and the educational demand required by the labour market.

This setting was characterized by the presence of no limits in the universities' access policies even after the reforms mentioned above was implemented (with the exception of private universities and fewer faculties where the number of students enrolled was limited). Furthermore non selective (but compulsory) entry tests have been formally introduced by the Ministerial Decree 270/2004 (art. 6) to preliminarily evaluate students, according to the curriculum selected. At the University of Salerno, as in many other Italian Universities, the Faculties have complied with this law by proposing a non-selective test, that is to say a test whose results would not invalidate the student's entitlement to enroll. Students are admitted regardless of the score, but specific additional educational duties are set (i.e. learning debts) to those who receive a low score, to be fulfilled during the first year of enrollment. De facto, if the test was not passed, the students had to participate in educational activities more or less challenging. Except for some of the Faculties (i.e. Medical School), this test is not a proper entry test. Its rationale seems to be providing the students with hints in relation to their capacity to usefully enter the educational process proposed by the Faculties. In the academic year 2010/2011 a local (i.e. not on a national level) selective admission test was introduced in the Faculty of Economics at University of Salerno. The instrument controlled by the faculty admission committee was the "numero programmato locale" (i.e., constrained by national legislation) and the test was selecting on the basis of tournament criterion: ranking *n* applicants (*n=1200* in the population considered) only *k* students where admitted (*k=800*) in the Managements and Economics curricula operated by the Economics Faculty based on the rank obtained in the test. Importantly, no minimum quality standard (a minimum score in the test) has been used. The test consisted in a class written examination which tested candidates on logic, gain understanding of a written text and finally mathematics. This change in the University policy will allow us to identify the casual effects of introducing such scheme implementing a natural experimental technique such as the difference-in-differences methodology.

3. SOME PREVIOUS EVIDENCE ON SELECTIVITY AND STUDENT OUTCOMES

The empirical evidence on the effects of implementing selective schemes on student performances[6] is mixed, although the large part of it is based on correlational studies[7].

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[6] See Dale & Krueger, 2002 and Hoekstra, 2009 for evidence on the relationship between selectivity and future earnings.

Higher education admission tests contribute substantially to the prediction of students' performances such as grade point average, graduation and persistence (Bridgeman, Pollack and Burton, 2004; Park and Kerr, 1990; Noble, Maxey, Ritchie and Habley, 2005). Evidence that using either admission tests scores or high-school grades alone do not predict success in university as well as models that include both has been found (Bett and Morrel, 1999; Cohn et al., 2004, Ragan, Li and Matos-Diaz, 2011, Burton and Ramist, 2001).

On the other hand, conflicting evidence on the relationship between selectivity schemes and students' performances has been found. The use of admission tests' scores is largely redundant once high school grades have been taken into account (Crouse and Trusheim, 1988; Geiser and Santelices, 2007) while Perkhounkova et al. (2006) showed that the higher the test scores the less likely it was that students would remain at the university. No statistical significant evidence of a positive relationship between entry test scores and academic achievement has also been found (Huda et al, 2001).

The only study on Italian data departing from the correlational approach, as far as we know, is based instead on a natural experiment which analyses whether using schemes such as admission test (written exams testing students' general knowledge) and conditional progression schemes (specific rules which prevent students of taking exams a subsequent year unless they have taken a certain number of previous years' exams) help in selecting high performing students in a leading private university in Northern Italy (Francesconi et al. 2011). They use a difference-in-differences approach very similar to the one used in our study. They have actually taken advantage of the interruption of the above stated schemes finding no statistical significant effect on the probability of obtaining the degree; moreover, once the admission tests have been suspended, they have found that, conditional on obtaining a degree, students increase their probability of graduating with top marks. According to the authors the results may be explained by the fact that "institutional selectivity by private universities, therefore, may never be successfully sustained in such an environment, where public institutions can offer a valuable outside option to students' enrollment decisions" and by the "expansion of the aggregate supply of university slots in Italy, which led to a considerable increase in uncertainty and competitive pressure felt by all incumbents, including the university under study.

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[7] Most of the existing literature from United States consists on checking the average median score of enrolled students in standardized tests such as SAT (Scholastic Aptitude Test) and ACT (American College Test) tests.

The changed environment seemed to have pushed this institution to a recruitment strategy based on securing market shares, placing lesser emphasis on institutional selectivity". Since external validity of any natural experiment is problematic (as recognized by Francesconi et al., 2011), we think it might be interesting to test whether the inefficacy of admission policies in selecting high performing students holds true also in a complete different geographical and institutional setting, namely a large public University located in the south of Italy.

4. DATA AND METHOD

The empirical investigation has been performed using a unique administrative dataset on post-reform students (students enrolled after the "3+2" reform and enrolled in a three year degree program) enrolled at the University of Salerno in the academic years 2009/2010 and 2010/2011. We have a sample of 8907 entrants, enrolled in the following faculties: Economics, Engineering, Art and Philosophy, Languages, Educational Science, Math, Physics and Natural Science and Political Science. All the degree courses which applied a selective entry test in both academic years (namely Heritage Studies, Heritage Studies, Communication Sciences, Communication Sciences, Education Sciences for Childhood and Adolescence, and Herbal Sciences) are excluded from the sample. The dataset contains information about individuals' characteristics (gender, age, residence), educational background and pre-enrollment characteristics (type of high school attended and high school diploma score), households' financial conditions (family declared income) and general information about the university's careers and performances (faculty of enrollment, credits acquired and marks obtained). See Appendix 3 for summary statistics and a description of the variables used.

The empirical strategy used is based on a difference-in-differences (DID) design (Angrist & Pischke, 2008). Our identification strategy relies on the fact that the introduction of the selective entry test was not implemented in all faculties in the same year. One of the groups (students enrolled in the Faculty of Economics) is exposed to a treatment (selective entry test) in the second period (academic year 2010/2011) but not in the first period (academic year 2009/2010). The second group (students enrolled in the following faculties: Engineering, Art and Philosophy, Languages, Educational Science, Math, Physics and Natural Science and Political Science) is not exposed to the treatment during either periods. We compare the difference in outcome between

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treatment and control group in the second period with respect to the first period. The difference in these differences can be interpreted as the causal effect of the reform under the assumption that the trend in the outcome variables would be the same across faculties in the absence of treatment (i.e., selection bias is constant over time). In other words we assume that the counterfactual evolution of the treatment group is equal to the factual evolution of the control group over time. "In this way any variables that remain constant over time (but are unobserved) and that are correlated with the selection decision and the outcome variable will not bias the estimated effect" (Buckley and Shang, 2003). In section 6 we assess the robustness of the trend similarity showing that if changes in economic conditions or other policy initiatives exists, they affect both the participants and the non-participants in similar ways. More formally let Y_{1ijt} be the outcome of student i, in faculty j, at the time t with the selective entry test and Y_{0ijt} be the outcome of student i, in faculty j, at the time t without the selective entry test. We assume that:

$$E[Y_{0ijt}|j,t] = \gamma_j + \lambda_t \qquad (1)$$

Equation 1 states that in the absence of an entry test change, outcomes of our interest are determined by the sum of a time-invariant faculty effect γ_j and a cohort effect λ_t that is common across faculties.

Let D_{ijt} be a dummy for students enrolled in faculties with selective entry test and assuming that $E[Y_{1ijt} - Y_{0ijt}|j,t] = \delta$ is the treatment effect, then our outcome of interest could be written as:

$$Y_{ijt} = \gamma_{ij} + \lambda_{it} + \delta D_{ijt} + \varepsilon_{ijt} \qquad (2)$$

such that $E[\varepsilon_{ijt}|j,t] = 0$. Let be $t = t_0$ and $t = t_1$ indicating the two periods, before and after the policy change, respectively, and $j = T$ and $j = C$ denoting the treatment and control group respectively.

In the treatment group we have:

$$E[Y_{ijt}|j = T, t = 1] - E[Y_{ijt}|j = T, t = 0] = (\gamma_T + \lambda_1 + \delta) - (\gamma_T + \lambda_0) = \lambda_1 - \lambda_0 + \delta \qquad (3)$$

In the control group we have:

$$E[Y_{ijt}|j = C, t = 1] - E[Y_{ijt}|j = C, t = 0] = (\gamma_C + \lambda_1) - (\gamma_C + \lambda_0) = \lambda_1 - \lambda_0 \qquad (4)$$

The population difference-in-differences estimator is therefore equal to:

$$E[Y_{ijt}|j = T, t = 1] - E[Y_{ijt}|j = T, t = 1] - E[Y_{ijt}|j = C, t = 1] - E[Y_{ijt}|j = C, t = 0] = \delta \quad (5)$$

which could be estimated using the sample analog of the population means.

We preferred estimate the difference-in-differences estimator in a regression framework which allows us to easy calculate standard errors and to control for other variables which may reduce the residual variance (lead to smaller standard errors). We use a linear probability model in order to obtain a meaningful interpretation of the interaction effect of our interest, since, as suggested by Ai and Norton (2003), a simple summary measure of the interaction effect is problematic in non linear models since the effect and the sign of interaction effect actually changes for each single observation (being dependent on the different values of the covariates). We estimate the following linear probability model:

$$Y_{ijt} = \alpha + \gamma D_{ijt} + \lambda T_{ijt} + \delta D_{ijt} * T_{ijt} + \beta X'_{ijt} + \varepsilon_{ijt} \quad (6)$$

where Y_{ijt} is the outcome for a student i in period t enrolled in faculty j, D is a dummy which is equal to 1 if the observation is from the treatment group, T is a time dummy which is equal to 1 for the observation after the introduction of the selective entry test and X' is a vector of control variables included to account for differences between the treatment and control group that cannot be attributed to faculties fixed effects or to time trend (see appendix 3 for a discussion about the motivation which has driven the choice of the covariates). The parameter δ is the treatment effect we are interested in, namely the impact of selective entry tests on educational outcomes.

5. RESULTS

Table 1 presents the difference-in-difference estimates of the treatment effects (see table 6 for the estimates with all the covariates) based on separate linear probability models for each of the outcomes above described. As showed in column 1, and considering the full sample of students, the introduction of the selective test in the faculty of Economics leads to a statistically significant reduction of the dropout rate by almost 11% without controlling for all the covariates and by almost 10% controlling for all the covariates. Column 2 presents the difference-in-difference estimates of the impact of selective entry tests on the student's grade point average, conditional on having a

GPA different from zero (in other words we have taken into account only the students who have passed at least one exam). Introducing the test is also associated with an improvement in the students' performances in term of grade point average by almost 0.6 points. It is worth to notice that in both cases (considering both the educational outcomes considered) the estimates without and with covariates are not far from each other meaning that the introduction of the selective procedure is important regardless the individual students' characteristics.

[Insert Table 1 here]

6. SENSITIVITY ANALYSIS

We perform different checks to verify the robustness of our results and to test the plausibility of the already above stated common trend assumption. Firstly, we use data form previous years to show graphically the trend similarity in the educational performances among treatment and control group (see Hasting, 2004, for a similar approach). Secondly, we carry out a placebo difference-in-difference (i.e. a falsification test) to give more credit to our estimates (see Duflo, 2001, Card and Krueger, 1994 for a similar procedure). Thirdly, we control for the potential confounding effect of reduced class size on students performances.

The idea of using a relatively long time series for outcome measures relies on the fact that "may allow the researcher to examine if the treatment and control groups tend to move in parallel" (Meyer, 1995) as we should expect in case of absence of interactions between treatment and other (omitted) influences. Figure 1 displays the trend in the outcomes variable analyzed in this paper, by treatment and control group, in the previous five academic years to the introduction of the selective test, in order to motivate the common trend assumption.

[Insert figure 1 here]

We can see in figure 1 that the trend in both the dropout rate (considering the full sample) and the grade point average (conditional on having passed at least one exam) in treatment and control

groups is similar in the previous periods, in absence of treatment, suggesting that the assumption of common trend is a reasonable one.

We perform also a placebo difference-in-difference (i.e. using a fake treatment group), namely we look for two groups whom we know should have not got benefits from the policy under evaluation. The introduction of the selective entry test was implemented in the Faculty of Economics in the academic year 2010/2011, thus we apply the same difference-in-differences methodology using data on students enrolled in the same faculties in the academic years 2008/2009 and 2009/2010, that is to say over two years when there was no change in the entry test rules. If our common trend assumption was true, we would expect to find this placebo difference not statistically significant. As we can see in table 2 the estimates of the placebo treatment effect show a not statistically significant effect of the coefficient of interest. The falsification test, therefore, again supports the assumption of common trend.

[Insert table 2 here]

Lastly, we control for the potential confounding effect of reduced class size on students performances. Indeed, we do not know whether the improvement in the students' performances we have measured is only due to the policy or is also due to the effect of large per student resources (i.e. small classes, pupil per professor ratio, facilities devoted to students' activities). In other words, our estimates may be affected by the presence of class size effects on students' performances[8]. In order to rule out this possibility, a measure of student/professor ratio has been included in the analysis, namely the proportion of students enrolled to the total number of academic staff. Moreover, in order to increase the precision of this indicator, the empirical investigation has been performed using data on students enrolled at the University of Salerno in the academic years 2005/2006, 2006/2007, 2008/2009, 2009/2010 and 2010/2011 for a total sample of 27771 entrants.

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[8] There is a vast literature on the presence of class size effects on students' performances. See among others Bandiera et al., 2010, Kokkelenberg et al., 2008 for the impact of class size on tertiary education student grades and test scores.

As we can see in table 3 below, we still find that the introduction of the selective test in the faculty of Economics leads to a statistically significant reduction of the dropout rate and improvement in the student performances in term of grade point average, leaving almost unaffected the estimated δ.

[Insert table 3 here]

7. CONCLUSIONS

Selective entry tests has been increasingly used in higher education institutions in the attempt of improving the students' performances such as the grade point average, the number of exams and credits acquired. The use of such procedure aims at selecting high-performing undergraduates and at reducing the dropout rate. Our analysis is particularly relevant for Italy, where a wave of reforms was passed and implemented in the aim of increasing access to university degrees. Up to now there has been little evidence on the casual relationship between the institutional selectivity and the students' outcomes. In this paper we documented that the introduction of selective entry test leads to an improvement of the students outcomes and especially to a reduction of the dropout rate. Differently from a similar study on Italian students from a private university, it shows that a stricter selective access policy can have a significant impact on the performance of enrolled students in a public institution. By estimating a difference-in-differences on a unique data set from a public university in southern Italy we documented that the introduction of a selective entry test leads to an improvement of the dropout rates by almost 11%. This is quite a strong effect since in Italy, on average, almost 19% of the tertiary education students[9] did not renew the registration in the 2nd year. Moreover, more diligent students seem to benefit from the selectivity as we found an improvement in students' performances such as the grade point average by almost 1 point among those students who have a grade point average different from zero.

Within the limit of external validity allowed by the approach used in our analysis it seems to us that our result is particularly interesting in a country like Italy, where, in the last two decades, important

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[9] According to the persistence indicator from academic year 2002/2003 to academic year 2008/2009 (CNVSU, 2011).

steps have been taken towards the objective of providing higher education services for the masses and increase university access. Having established that the route of more restrictive access in public higher education institutions can be effective is important in that it provides an important policy instrument to local university and governance structures (Senate, Executive Board and the Rector) to control for adverse effects of the increases in access occurred in the past decades. This policy instrument may be important in that recent regulations from the Ministry of Education, University and Research (MIUR) established that the number of students who make the transition between the first and the second year as a key parameter for the assessment of the quality of the teaching process and a criterium for the assignment of public funding. A final comment deserves the comparison of our results with the findings of a similar study performed on student from a leading private university (Francesconi et al. 2011), where no effects of selective tests were found on students' performances. Aware of the limits of external validity of the present study, our preferred reading of so different results is that it is due to different selection effects at work. The lesson we think can be learned is that selection effects induced by transport costs and tuition fees in the leading Italian university are strong enough that once the selective test is removed no worsening of student's performance shows up as empirically relevant. On the contrary the selection effects inherent the enrollment in a large public university in the South of Italy are so small that a restrictive access policy turns out to be quite effective[10]. More generally, our study provides evidence about the fact that the same policy instrument aimed at controlling the quality of higher education process can have dramatically different effects among public universities and private universities, albeit within the same national system.

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[10] A leading private University in the North of Italy attracts students from all over Italy whereas in the University of Salerno most of the students come from the region where the campus is located (around 60% from the province of Salerno and around 30% from all other provinces of Campania region) considering both the academic years 2009-2010 and 2010-2011.

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APPENDIX 1: Some descriptive statistics on drop-out in Italy and other OECD countries

In the last decade the percentage of students who dropped out after the first year in the higher education institutions in Italy has been reduced but it is still very high. Specifically (see figure 2 below) 19.1%, 21.4% and 18.2%[11] are the percentages of entrants in Italian tertiary education institutions in the academic years 2002/2003, 2005/2006 and 2008/2009, respectively, who did not enroll in the second year (CNVSU, 2007, 2011)[12]. Supported by the data which suggest that the highest percentage of students drop out at the end of the first year (CNVSU, 2011), the transition between the first and the second year has been strongly incentivized and higher education institutions started being evaluated and then financially supported also on the base of parameters such as the number of students who make the transition between the first and the second year (CNVSU, DOC. 07/2007; CNVSU, DOC. 07/2009; Ministerial Decree 31 October 2007, 544; Ministerial Decree 18 October 2007, n. 506).

[Insert figure 2 here]

Still with regard to the dropout phenomenon, a recent analysis carried out by OECD[13] shows that considering the eighteen OECD[14] countries for which data are available, almost 31% (the percentage is a bit lower, 29%, considering the nineteen EU countries) of those who enter tertiary programs leave without tertiary qualifications in 2008[15]. Specifically, the dropout rate is higher than 40% in Mexico, New Zealand, Sweden, United States, more than 35% in Israel[16], less than 25% in

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[11] A US Benchmark is needed. Reported in Bettinger et al (2013) evidence fo the US is that "After six years, 35 percent of students who started a postsecondary program in Fall 2003 had not received a degree and were no longer enrolled in any institution of higher education (Radford et al. 2010)".

[12] The number of students who did not acquire any credit or passed any exam during the first year of enrollment has also been reduced, even though is still consistent (in the academic year 2008-2009, the last one analyzed, almost 16 students did not acquire any credit or pass any exam during the first year out of 100 student enrolled).

[13] OECD, Education at a Glance, 2010.

[14] Both considering tertiary type A programs (which are largely theory-based and are designed to provide sufficient qualifications for entry to advanced research programs and professions with high skill requirements, such as medicine, dentistry or architecture. They have a minimum cumulative theoretical duration, at tertiary level, of three years' full-time equivalent, although they typically last four or more years) and tertiary type B programs (which are typically shorter than those of tertiary-type A and focus on practical, technical or occupational skills for direct entry into the labour market, although some theoretical foundations may be covered in the respective programs. They have a minimum duration of two years full-time equivalent at the tertiary level).

[15] Dropouts are defined as students who leave the specified level without graduating from a first qualification at that level. The first qualification refers to any degree, regardless of the duration of study, obtained at the end of a program that does not have a previous degree at the same level as a pre-requisite.

[16] Considering only tertiary type A programs.

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Belgium, Denmark, France, Japan, Korea and Spain and finally around 33% in the United Kingdom (see figure 3 below).

[Insert figure 3 here]

A similar analysis[17] carried out by the OECD two years before showed that, considering the nineteen OECD[18] countries for which data are available, some 31% of students of those who enter tertiary programs leave without tertiary qualifications in 2005[19]. Specifically, this proportion is more than 40% in Hungary, New Zealand, more than 50% in the United States, more than 30% in the United Kingdom and less than 25% in Belgium, Denmark, France, Germany and Japan. In this analysis also Italy appears (see figure 4) with more than 50% of students of those who enter tertiary programs leaving without tertiary qualifications in 2005[20] (a few percentage higher than United States).

[Insert figure 4 here]

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[17] OECD, Education at a Glance 2008.
[18] Both considering tertiary type A programs (which are largely theory-based and are designed to provide sufficient qualifications for entry to advanced research programs and professions with high skill requirements, such as medicine, dentistry or architecture. They have a minimum cumulative theoretical duration, at tertiary level, of three years' full-time equivalent, although they typically last four or more years) and tertiary type B programs (which are typically shorter thathose of tertiary-type A and focus on practical, technical or occupational skills for direct entry into the labour market, although some theoretical foundations may be covered in the respective programs. They have a minimum duration of two years full-time equivalent at the tertiary level).
[19] Dropouts are defined as students who leave the specified level without graduating from a first qualification at that level. The first qualification refers to any degree, regardless of the duration of study, obtained at the end of a program that does not have a previous degree at the same level as a pre-requisite.
[20] Considering only tertiary type A programs.

APPENDIX 2: A glimpse of the Italian higher education system's institutional setting

Italian universities have been historically characterized by a strong centralized system and many years have passed before the realization of both a decentralization of powers from the State to the universities and of the following attempts to set up an evaluation system. The first real steps towards a system which allows to give a certain degree of autonomy to the universities and, consequently, to evaluate their activities, have been moved in the late '80s and early '90s. The real turning point was actually made by the Law 168/1989[21]. The Ministry of University and Scientific and Technological Research was introduced (art. 1, comma1) as the main authority for governing the national research and university system. Moreover, the concept of universities' autonomy has been formally stated and the ground for the self-government has been prepared specifying that universities have teaching, scientific, organizational, financial and accounting autonomy through their own statutes and regulations (art. 6, comma 1). The higher education institutions were now allowed to autonomously allocate the funding from the central government. The higher education evaluation system, instead, has been properly introduced by the Law 537/1993[22], remodeling the funding mechanisms from the State to the universities and introducing a more performance-oriented system of resources allocation[23]. The process to move toward a more decentralized system was then completed, as Bratti, Checchi and de Blasio (2008) have pointed out, by the DPR. 25/1998 which gave the opportunity to the universities to self-finance the opening of new faculties and degrees without central approval. An additional important step of the reform process of the Italian higher education system, in order to meet the objectives of the Bologna process, was made by the introduction of a "3+2" model implemented by the Decree n. 509/99[24] which changed the length of the degree programs introducing a first Degree (L*aurea di primo livello*) which lasts three years,

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[21] Law 9 May 1989, n. 168.
[22] Law 24 December 1993, n. 537.
[23] The Internal Evaluation Unit with the task of verifying, through comparative analysis of costs and returns, the proper management of public universities, their productivity in research and teaching and the overall success of their administration, has been introduced (art. 5, comma 22). Furthermore, in order to make an evaluation of universities' activities on national level and to ensure that it was done according to the degree of universities' virtuosity, the Permanent Observatory (later the National Committee for the Evaluation of the University system with Law 370/1999) has also been introduced (art. 5, comma 23). The Permanent Observatory, in collaboration with the CRUI and the CUN, must fill out evaluation of the results regarding the efficiency and productivity of research and training, also for the subsequent allocation of resources. Among its tasks was to work firstly on building an evaluation system and secondly on developing both quantitative and qualitative indicators to assess the higher education institutions' outcomes (CNVSU, DOC, 5/97). For the first time funding from the State to the universities depends on how virtuous are their activities and their results. Through an allocation of the resources in a less discretionary way and on the base of more objective parameters, the aim is to encourage universities, moved by the opportunity to attract more funding from the Ministry, to reach very high levels of quality.
[24] Most of the Universities have actually implemented the reform in the academic years 2001/2002 and 2002/2003.

followed by a two-year Specialized Degree (*Laurea specialistica*)[25]. The goals that the new reform was supposed to reach were increase of the number of entrants, decrease of the dropout rates, and decrease of the time needed to complete the course of study and increase of the number of graduates. (CNVSU, DOC 07/2007). "The reform gives universities a great autonomy with respect to the choice of the content and structure of their degree programs, though they still have to comply with certain standard national requirements. This means that since 2001 a wider variety of courses have been offered to students. As a broader array of courses is likely to improve the match between students' interests and what is available within academic institutions, one would also expect this provision to yield lower dropout rates" (Di Pietro and Cutillo, 2007).

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[25] Specifically the first level of study lasts 3 years and allows to obtain the title of University degree (Laurea). Those who have obtained the Laurea have the access to one of the following second cycle degrees: a) to a second level degree, lasting two years, which is more specialized degree (Laurea Specialistica), b) to a first level master, which lasts one year (Master universitario di primo livello) and c) to a first level of a specialized degree, lasting 2 or 3 years (Corsi di specializzazione). Those who have obtained the Laurea specialistica can have access to one of the following third level of study a) to a Phd doctoral research programme, lasting three years (Dottorato di Ricerca), b) to a second level of Specialized degree which lasts one year (Diploma di Specializzazione) and c) to a one year second level master (Master universitario di secondo livello).

APPENDIX 3: Description of the variables

Two different indicators of students' performances have been used such as the dropout rate and the grade point average. Specifically, a broader dropout definition rather than the formal one used by the Universities administration offices has been taken into account. This means we have a characterization of the university leavers closer to the reality. A student drops out, in line with some previous research[26], both when he/she officially withdraws (in our case after the 1st year) from the university (the so called "rinunciatari") presenting a formal request to the student office[27], and when he/she does not renew the registration leaving the degree program (in our case after the 1st year) in which had been enrolled. Differently from the approach used in some previous research on student retention, students who do not renew their registration but asked to move to another university are not considered as dropout [28]. Moreover, students who do not renew their registration but are found to be enrolled in another Faculty of University of Salerno the following year[29] are not considered dropout either[30]. About the grade point average (grades weighted by the corresponding credits after the 1st year), it has been calculated in the following way:

$$Grade\ point\ average\ (GPA)_i = \frac{\sum_{j=1}^{n} grades_{ij} * credits_{ij}}{\sum_{j=1}^{n} credits_i}$$

for a student i who passed the exam $j \in \{1, \dots n\}$. Exams to which correspond only credit but without marks are excluded (i.e. computer science exam).

As mentioned in section 4 and appendix 3, several individuals control variables were included in the analysis to account for differences between treatment and control group which cannot be attributed to faculties fixed effects of time trends. Tables n. 4 and n. 5 below show, respectively, a description of the dependent and independent variables used in the empirical investigation and the summary

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[26] See among others Boero, Laureti and Nylor (2005) and Belloc, Maruotti and Petrella (2009).

[27] Under the assumption that those who officially withdraw (i.e. students who make an official resignation) leave the higher education system entering in the job market and only a few of them, and this is the case we cannot control for, enrolled again in another university. It's also true, in fact, that sometimes when a student makes an official resignation (even paying a stamp duty), it is because a) has an interest in closing the career in Salerno and then enroll in another University, perhaps in a degree program where he/she has no interest in asking for the validation of credits already obtained and b) has interest in abandoning the studies undertaken to newly enroll in another course of study (at another university), with no obligation to pay the back taxes which may be due to the old University.

[28] See Belloc, Maruotti and Petrella (2009) where students transferred to another university are considered also dropout.

[29] The students are controlled by the administration student office through a personal ID. In this way it has been possible to check whether students who did not enroll in the second year where instead

[30] This to avoid to put together forms of leaving behavior different in their characteristics. According to Tinto (Tinto, 1975), failure to separate permanent dropout from temporary and transfer behaviors has often led institutional and state planners to overestimate substantially the extent of dropout from higher education.

statistics in term of differences in means by reform and sample. More specifically, as covariate, a dummy variable indicating whether a student is male or female has been included as it may be relevant on student behavior with respect to academic career (Mastekaasa and Smeby 2008). Age was modeled as a continuous variable. Based on the high school qualification six levels of education have been considered: Scientific Lyceum, Classical Lyceum, Linguistic Lyceum, Professional school, Technical school and other institutions. Secondary school track chosen also represents a channel through which the family environment (consolidating the intergenerational correlation in the educational attainment) influences the level of education completed (Checchi et al. 2013, Carneiro and Heckman, 2005). High school final scores have been constructed as a continuous variable, ranked on a scale from 60 to 100. They act as a proxy for academic preparedness and have been shown to be an important predictor of students' outcomes (Boero, Laureti and Naylor, 2005; Di Pietro and Cutillo, 2007). It is relevant to control for the high school grades according to what has been shown by the empirical literature on whether entry test scores are informative by themselves or in addition to high school records (see the literature review in section III). In order to take into account the time (years) between the end of high school and the university enrollment, a dummy variable (1 if enrolled in the year of the diploma, 0 otherwise) has been included, supported by the evidence that the number of years between the secondary education diploma and the enrollment in the university might be correlated to the students' performances (Belloc, Maruotti and Petrella, 2009). Some more information about how student's residence and student's family income are measured has to be added. About the residence variable, the main literature usually refers to the student's residence in the city, province or region where the university is located. Given the geographical peculiarity of the province of Salerno relative to the other provinces of Campania and given the geographical position of the University of Salerno (the campus is located approximately 15 kilometers from the city of Salerno), the residence variable measures, for each student, the distance in kilometers of the student's residence from the university location[31]. The use of such variable is meant to take into account either the cost of reaching the campus or the cost of renting a room which might influence students' motivations and is supported by the evidence showing that those who live at the parental address and off campus have a higher

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[31] In order to calculate that distance Google map has been used. Specifically the distance is considered as the best and fastest way, suggested by Google map, to reach the university campus.

probability of dropping out (Smith and Naylor, 2001). About the family income variable, factors which are linked to higher education students' persistence and performances are also family related (Belloc, Maruotti and Petrella, 2009). We control for the family's socioeconomic status using a measure of the family financial capability. A good measure of family income was lacking. Thus, a measurement of the student's household economic situation (ISEE), which takes into account the household income, personal estate and number of members has been used as a proxy for income. Specifically the amount of fees the students have to pay is graded on seven bands contribution. According to the declared income, each students falls in one of the bands (i.e. students who fall in the first band, to which correspond the lowest fee to pay, are those who declare a family income up to €4.500,00; students who fall in the second band, to which correspond the second lowest fee to pay, are those who declare a family income between €4.500,01 and €7.000,00 and so on till students who fall in the seventh band, to which correspond the highest fee to pay, declaring a family income above €32.000,00). Thus, the family income is self-reported by the students while the fees they have to pay, according to this income, is set by the University. The dataset we have used in the analysis specifies the fees the students are asked to pay; knowing that, we deduced the range in which the declared family income falls. For simplicity, household income was therefore measured on three categories such as low income (income tax returns from € 0 to € 12.000,00), medium income (income tax returns from € 12.000,01 to € 32.000,00) and high income (income tax returns higher than € 32.000,01).

[Insert table 4 here]

[Insert table 5 here]

Tables and Figures

TAB.1 - Difference-in-difference estimates – Effects of introduction of selective entry test on student's performances

	(1) *dropout between the I and II year* *(full sample)*	*(2)* *GPA* *(Conditional on having a grade point average different from zero)*
Entry test (not including covariates)	-0.110*** (0.025)	0.628*** (0.178)
Entry test (including covariates)	-0.097*** (0.024)	0.564*** (0.163)
N. obs.	8907	6011

* p<0.10, ** p<0.05, *** p<0.01
Standard errors in parentheses
Notes: Other variables included in the regression are gender, age, residence, high school type and score, family income and whether the student enrolled immediately after high school. See table 6 for the difference in differences estimates with all covariates.

TAB. 2 - Difference-in-difference estimates – Placebo Regression

	(1) *dropout between the I and II year* *(full sample)*	*(2)* *GPA* *(Conditional on having a grade point average different from zero)*
Entry test (including covariates)	-0.015 (0.021)	-0.040 (0.150)
N. obs.	9663	6533

* p<0.10, ** p<0.05, *** p<0.01
Standard errors in parentheses
Notes: Other variables included in the regression are gender, age, residence, high school type and score, family income and whether the student enrolled immediately after high school.

TAB.3 - Difference-in-difference estimates – Effects of introduction of selective entry test on student's performances – Control for student/teach ratio

	(1) dropout between the I and II year	(2) GPA
Entry test (including covariates)	-0.109***	1.279**
	(0.023)	(0.559)
Year fixed effects	Yes	Yes
N. obs.	27771	27771

* p<0.10, ** p<0.05, *** p<0.01
Standard errors in parentheses
Notes: Other variables included in the regression are gender, age, residence, high school type and score, family income, whether the student enrolled immediately after high school and student/teacher ratio.

Tab. n. 4 – Definition of variables used in the empirical investigation

Variable name	Variable definition
Outcome variables	
Dropout after the 1st year	1 if dropout after the 1st year, 0 otherwise
GPA	Grade point average at the end of the 1st year
Controls	
Individual characteristics	
Males	1 if male, 0 otherwise
Age	Age in years at the beginning of the enrolment year
Age^2	Age in years at the beginning of the enrolment year squared
KM	Residence distance from the University campus
KM	Residence distance from the University campus squared
Education	
Scientlyc	1 if attended Scientific lyceum, 0 otherwise
Classlyc	1 if attended Classic lyceum, 0 otherwise
Linglyc	1 if attended Linguistic lyceum, 0 otherwise
Techninst	1 if attended Technical Inst., 0 otherwise
Profinst	1 if attended Professional Inst., 0 otherwise
Otherinst	1 attended Other Inst., 0 otherwise
Score	High school final exam score
Family income	
Lowincome	1 if declared family income from € 0 to € 12.000,00, 0 otherwise
Mediumincome	1 if declared family income from € 12.000,01 to € 32.000,00, 0 otherwise
Highincome	1 if declared family income higher than € 32.000,01, 0 otherwise
Gaptime	1 if enrolled in the year of the diploma, 0 otherwise

Tab. n. 5 – Sample means by reform and sample (Standard errors in parentheses)

Variable name	All students			Students who have a grade point average different from zero		
	Treatment	Controls	Difference	Treatment	Controls	Difference
Dropout	0.364	0.451	0.086	0.232	0.251	0.018
	(0.016)	(0.005)	(0.183)	(0.016)	(0.005)	(0.018)
GPA	17.911	16.403	-1.508	23.078	24.674	1.595
	(0.349)	(0.132)	(0.434)	(0.105)	(0.041)	(0.126)
Males	0.614	0.480	-0.133	0.592	0.450	-0.142
	(0.017)	(0.005)	(0.018)	(0.019)	(0.006)	(0.021)
Age	19.845	20.616	0.771	19.634	20.029	0.394
	(0.097)	(0.051)	(0.167)	(0.095)	(0.046)	(0.141)
KM	35.509	40.628	5.119	34.320	40.057	5.736
	(1.585)	(0.605)	(1.984)	(1.813)	(0.689)	(2.118)
Education						
Scientlyc	0.502	0.403	-0.099	0.530	0.434	-0.095
	(0.017)	(0.005)	(0.018)	(0.019)	(0.006)	(0.020)
Classlyc	0.089	0.113	0.024	0.096	0.131	0.034
	(0.010)	(0.003)	(0.011)	(0.011)	(0.004)	(0.014)
Linglyc	0.022	0.059	0.036	0.024	0.065	0.041
	(0.005)	(0.002)	(0.008)	(0.006)	((0.003)	(0.010)
Techninst	0.317	0.241	-0.076	0.296	0.208	-0.087
	(0.016)	(0.004)	(0.015)	(0.018)	(0.005)	(0.017)
Profinst	0.046	0.066	0.020	0.032	0.051	0.019
	(0.007)	(0.002)	(0.009)	(0.007)	(0.003)	(0.009)
Otherinst	0.022	0.115	0.093	0.020	0.107	0.087
	(0.005)	(0.003)	(0.011)	(0.005)	(0.004)	(0.012)
Score	79.485	78.123	-1.362	80.482	80.270	-0.212
	(0.406)	(0.131)	((0.435)	(0.450)	(0.160)	(0.495)
Family income						
Lowincome	0.410	0.476	0.066	0.413	0.460	0.046
	(0.017)	(0.005)	(0.018)	0.019)	(0.006)	(0.021)
Mediumincome	0.401	0.382	-0.019	0.397	0.398	0.0009
	(0.017)	(0.005)	(0.017)	(0.019)	(0.006)	(0.020)
Highincome	0.187	0.140	-0.047	0.189	0.141	-0.047
	(0.013)	(0.003)	(0.012)	(0.015)	(0.004)	(0.014)
Gaptime	0.865	0.025	-0.039	0.895	0.854	-0.041
	(0.012)	(0.004)	(0.013)	(0.012)	(0.004)	(0.014)

TAB. 6 - Difference-in-difference estimates – Effects of introduction of selective entry test on student's performances – All covariates -

All covariates	(1) Dropout between the I and II year	(2) GPA
Year	0.163***	-0.164**
	(0.011)	(0.078)
Treatment	-0.078***	-2.132***
	(0.016)	(0.113)
Treatment*Year	-0.097***	0.564***
	(0.024)	(0.163)
Males	0.088***	-0.582***
	(0.010)	(0.075)
Age	0.062***	0.169***
	(0.006)	(0.055)
Age^2	-0.0007***	-0.001***
	(0.0001)	(0.0008)
Km	0.0007	-0.002
	(0.00007)	(0.001)
Km^2	-0.00000003	0.000001
	(0.0000002)	(0.000002)
Classlyc	-0.054***	0.928***
	(0.016)	(0.111)
Linglyc	0.035	0.673
	(0.022)	(0.152)
Techninst	0.091***	-0.686***
	(0.012)	(0.092)
Profinst	0.149***	-0.780***
	(0.021)	(0.166)
Otherinst	0.056***	0.358***
	(0.017)	(0.129)
Score	-0.007***	0.082***
	(0.0004)	(0.003)
Mediumincome	-0.050***	-0.030
	(0.010)	(0.075)
Highincome	-0.014	-1.181*
	(0.015)	(0.106)
Gaptime	0.010	-0.192
	(0.014)	(0.109)
N. obs.	8907	6011
Prob>F	0.0000	0.0000
R-sqaured	0.1333	0.2345
Pseudo R-squared	0.1316	0.2323

* p<0.10, ** p<0.05, *** p<0.01; Standard errors in parentheses

Figure 1. Trend in educational performance. Dotted line refers to the treatment group and solid line to the control group
Treatment (1) and control (1) show the dropout rate after the 1st year for the full sample.
  Treatment (2) and control (2) show the grade point average after the 1st year conditional on having a grade point average different from zero.
Treatment group consists of the students enrolled in the faculty of Economics. Control group consists of the students enrolled in the faculties of Engineering, Art and Philosophy, Languages, Educational Science, Math, Physics and Natural Science and Political Science.
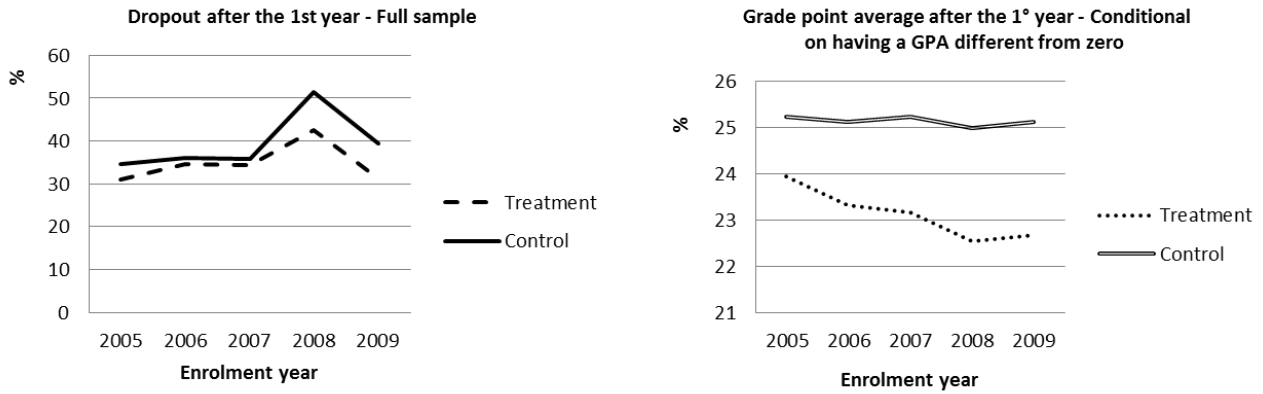

Figure 2. Students' persistence indicators from academic year 2002-03 to academic year 2008-09 *(CNVSU, 2007 e 2011).*
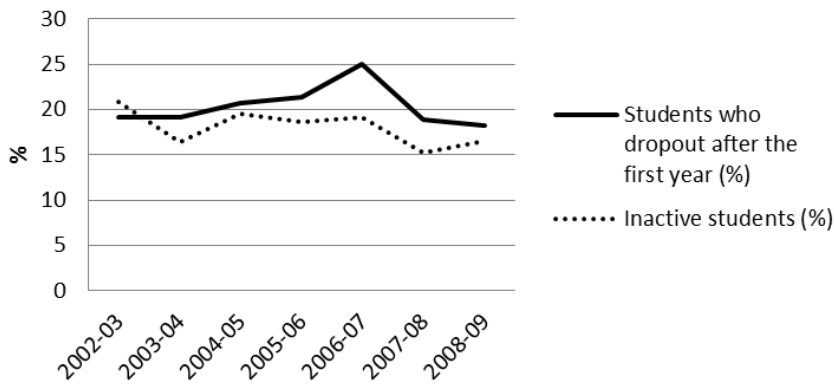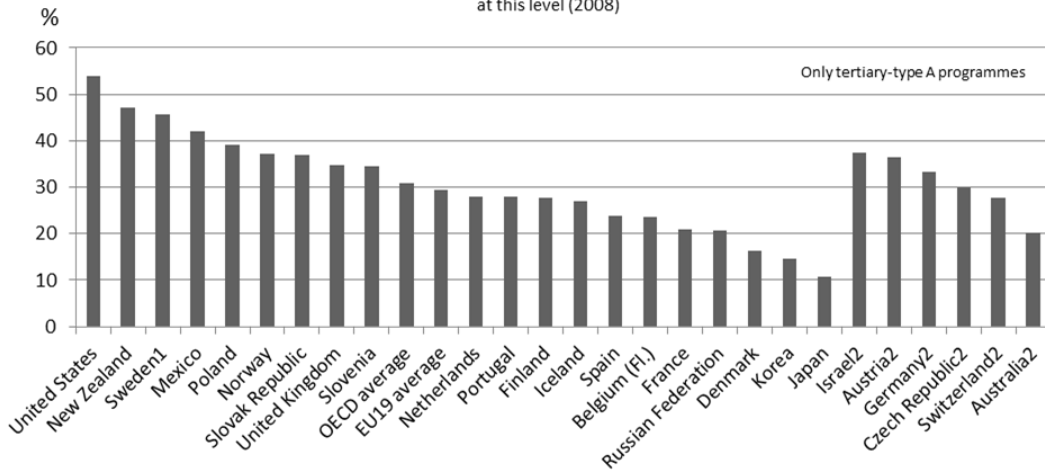
Figure 3. Proportion of students who enter tertiary education without graduating from at least a first degree
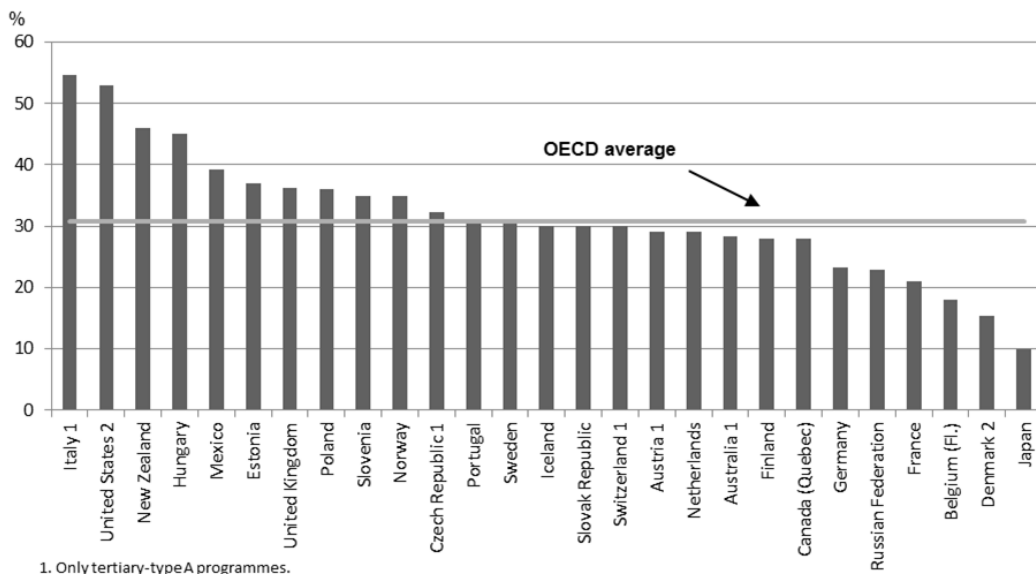at this level (2008)

%

Only tertiary-type A programmes

United States, New Zealand, Sweden1, Mexico, Poland, Norway, Slovak Republic, United Kingdom, Slovenia, OECD average, EU19 average, Netherlands, Portugal, Finland, Iceland, Spain, Belgium (Fl.), France, Russian Federation, Denmark, Korea, Japan, Israel2, Austria2, Germany2, Czech Republic2, Switzerland2, Australia2

Note: Some of the students who have not graduated may be still enrolled, or may have finished their education at a different institution than the one they started at, like in the United States.
1. Includes students entering single courses who may never intend to study all courses needed for a degree.
2. Tertiary-type A only.
Source: OECD. Table A4.1. See Annex 3 for notes (*www.oecd.org/edu/eag2010*).

Figure 4. Proportion of students who enter a tertiary programme and leave without at least a first tertiary degree (2005)

%

OECD average

Italy 1, United States 2, New Zealand, Hungary, Mexico, Estonia, United Kingdom, Poland, Slovenia, Norway, Czech Republic 1, Portugal, Sweden, Iceland, Slovak Republic, Switzerland 1, Austria 1, Netherlands, Australia 1, Finland, Canada (Quebec), Germany, Russian Federation, France, Belgium (Fl.), Denmark 2, Japan

1. Only tertiary-type A programmes.
2. Only full-time students.
Source . OECD. Table A4.1 . See Annex 3 for notes (*www.oecd.org/edu/eag2008*).