Are we wasting public money? No!
The effects of grants on Italian university students' performances

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ABSTRACT

In Italy, first-year students from a disadvantaged socioeconomic background can receive a grant on the basis of their family's income alone, without demonstrating any academic potential. In the subsequent years, they can continue receiving this grant even if obtaining relatively modest academic results. Such design has been widely criticized, as it lacks positive incentives to foster students' academic performances; data show that many students who received the financial aid actually drop out after the first year, thus the student support system has been accused to waste public money.

In this paper, we estimate the effect of receiving a grant for a cohort of students who enrolled at Politecnico di Milano (Italy) in the year 2007/08, through a Propensity Score Matching approach. Collecting administrative data about these students for four years, we were able to evaluate the impact of the financial aid on several dimensions of academic performance: formative credits obtained after one year, drop-out probability in the first and second year, graduation in the legal duration of the course, and graduation after four years. Overall, we find a positive and statistically significant effect of the grant; this finding is stable across a number of robustness checks. Exploring the heterogeneity of this effect, we demonstrate that this is driven by a particularly high impact on immigrants, Italians who moved to another region for studying, and those attending the most difficult course (i.e. Engineering). The impact of the grant is cumulative, that is to say it appears only if students receive it during their entire academic path. We also find evidence that unobservable factors (such as students' own intrinsic academic motivation) account for an important part of the estimated impact of the financial aid.

KEYWORDS
Financial aid, Propensity Score Matching

JEL Codes.
H52, I22, I23, I28, C21

1. Introduction

While higher education (HE) provision and participation has been expanded during 1990s and 2000s in Italy, the inequality of educational opportunities is still a major problem for the country. In particular, students from lower socioeconomic backgrounds experience low probability to enrol to universities, and even less to complete tertiary education (Checchi *et al.*, 2013). Bratti *et al.* (2008), studying the evolution of HE sector in recent years, conclude that "(…) the rapid expansion of HE supply in the 1990s may have only produced a limited increase in equality of opportunities in terms of completion of tertiary education, and partly explain why tertiary educational attainment in Italy is still strongly related to parents' education" (p. 79)[1]. The problem of scarce intergenerational mobility affects the Italian educational system as a whole, and generates negative consequences: "Italian public university system (…) does not attract the expected educational investment of poor families. Indeed, the Italian system does not offer a real opportunity for children of lower income families to emerge and to keep the returns of their educational investment" (Checchi *et al.*, 1999; p. 353).

Italy undertakes the way of providing grants to university students from poor socioeconomic background, with a twofold aim: favouring their participation to tertiary education, and reducing their dependence to work during study, so helping them to pass exams and obtain graduation. Originally, the Italian legislation designed a grant scheme that was partly need- and partly merit-based, in that academic requirements were included as conditions to obtain the grant and maintain it during

[1] Similar concerns have been expressed in other countries; for instance, Posselt *et al.* (2012) demonstrated that, in the USA, the gap in the probability to enrol to selective colleges between Latinos/Blacks and White/Asian students is stable, despite the expansion of access to postsecondary education.

the academic career. However, the program has been changed over time, and merit-based criteria were softened: when the student enrols as freshman, the only requirement is coming from a disadvantaged family, and also in the subsequent years the number of formative credits (Cfu) that must obtained to maintain the grant is quite low. For instance, for confirming the grant in the second year it is just 25, out of the 60 that each student can obtain in the first year; in terms of exams, the student can pass just 2 or 3 exams, while in the first year they are usually 6-8. Also, some research highlighted that many students, who obtained a grant, actually dropout. Some observers, looking at the program design, and the statistics about low graduation rates among grants' beneficiaries, accused the financial aid system to be ineffective and a waste of public money. Rigorous evidence on this lack of positive effects, however, is still scarce.

From a theoretical point of view, there are many reasons for which need-based grants can influence students' academic results. As discussed by Hatt *et al.* (2005, p. 385), "(…) the money itself might be useful and, secondly, the money might strengthen the student's commitment to study". In other words, financial aid can operate through two channels: (i) by reducing liquidity constraints, and so helping students to organise their life orienteering the efforts towards studying (i.e. avoiding work activities), and (ii) by giving explicit incentives towards better results, this way stimulating intrinsic motivation towards studying (this latter effect is related to the presence of merit-based components of the grant program). In this direction, recent empirical research shows that the incentive structure of the scholarships often matters more than the additional income (Barrow & Rouse, 2012).

This paper empirically assesses the impact of receiving a grant for a cohort of students who enrolled as freshmen at one important big and public university, *Politecnico di Milano*, through a matching technique that allows comparing the grant beneficiaries' performances with those of similar students who did not obtain the grant. The research is useful because it can shed light on the real effectiveness of financial aid; the empirical analysis does not focus on stimulating participation to HE, but on the ability to help students improving their academic performances – such characteristic of the study is of strategic relevance: indeed, previous studies demonstrated that the expansion of HE opportunities (i.e. more students attending university, even from disadvantaged background) does not immediately translate into better results [graduation rates] for poorer students (Bratti *et al.*, 2008).

Our findings suggest that obtaining a grant positively affects academic performances. Students who receive a grant obtain more formative credits, have less probability to dropout in the first and second year, and are more likely to graduate on time or within four years, when compared with similar counterparts who did not receive the grant. This results is stable across a wide set of robustness checks. This positive effect is also heterogeneous, thus: the most part of it is concentrated among immigrants, students whose family reside in another regions ("out-of-region" students), and those attending Engineering. The effect of grant is "cumulative", that is to say dependent upon the students receiving it during their entire academic path. Lastly, when using a more precise control group, composed by students who are likely to share also unobservable factors (intrinsic academic motivation) with those who received a grant, the impact of financial aid seems even bigger, and effective in the first years of academic career.

The remainder of the paper is organised as follows. In the sections 2 and 3, we provide a literature review and background for the Italian system of student support. Sections 4, 5 and 6 are devoted to data, identification strategy and methodology, respectively. Section 7 contains the results of our empirical analysis, and section 8 concludes.

2. Literature review

In the US, there is a huge literature about the role of financial aid in stimulating participation to Higher Education and fostering academic performances. A structured review of this literature is well beyond the scope of this paper. Fortunately, a recent contribution by Dynarski & Scott-Clayton (2013) summarized the main evidence coming from the research in this field. The authors illustrate how the growing availability of grants and loans, in the US, had a significant impact on increasing college enrolments, and at the same time suggest to focus the attention on programs' design and characteristics: "No longer is it necessary to ask the question, 'Does aid work?' – for the research definitely shows that it can. But the evidence also suggests that some programs work better than others, and (…) the stakes have never been higher for understanding what aid programs work best and why" (p. 32). Fewer studies exist, which investigate the effects of aid not only on enrolment, but also on academic performances; the results, in these cases, suggest grants that provide explicit incentives to students' performances (the so-called merit-based grants) are more effective than purely need-based programs.

Nonetheless, two recent studies about US aid programs are worthy of specific notice in that they share similarities with the approach presented in this paper. Castleman &

Long (2012) evaluated the impact of the Florida Student Access Grant, a need-based program, on several dimensions of students' performances, among which the accumulation of formative credits and graduation. The empirical analysis, conducted through a regression-discontinuity design, reveals that aid positively affects academic outputs, and did not contribute only to raising participation. Scott-Clayton (2012) examined the PROMISE program in West Virginia, which consists of free tuition for students who obtain good academic performances, also using a regression-discontinuity methodology. The author finds that financial aid has a positive impact on students' performances, but limited to the proficiency levels required for annual renewal of the benefit. The paper claims that positive effects on academic results must be attributed to the incentives contained in the aid mechanism. The two papers are interesting as they are inserted in the wider discussion about the relative effects of different aid programs, based on their need- or merit-based nature[2]; as our paper considers a grant program which has components of both types, the discussion of results has been informed by these studies. Moreover, we also were stimulated by the recent proposal of Brookings Institution (2012) to "(…) moving away from the dichotomy between need-based and merit-based aid and instead designing programs that integrate targeting of students with financial need with appropriate expectations and support for college success" (p. 2).

In Europe, the most part of previous contributes is still focused on the effects of financial aid on enrolment, with few examples of studies considering the impact on students' academic results. Steiner & Wrohlic (2012) analysed the effects of changing

[2] The debate about the importance of merit- or need-based orientation of financial aid is gaining more and more attention by the wide public in the US; see, for instance, the viewpoints hosted by the Wall Street Journal (2012) in favour and against a renewed focus on need-based grants.

the amount of need-based aid to university enrolment in Germany, and found a small but positive (and statistically significant) effect, suggesting that there is some elasticity of demand for higher education dependent on the available financial aid. In a similar perspective, Nielsen *et al.* (2010) demonstrated that a reform, which changed available financial aid to Danish university students, did not affect the demand for college, and conclude that liquidity constraints is not a major determinant of the decision to enrol to an higher education institution in Denmark. Few European papers look at the effects of aid on academic outputs. Belot *et al.* (2007) explored the impact of a reform in Dutch higher education system, which reduced the duration of (mostly merit-based) grants of one year. The authors considered several dimensions of academic performances, such as passing the first-year exam, drop out and grade points; through a difference-in-difference strategy they demonstrate that the reform positively affect students' results. It is important to note, however, that this empirical analysis does not answer the question 'does the aid matter?' directly, but only explores if different treatments (different duration of grant programs) have different impacts on students' results. Glocker (2011) used a duration model to analyse if financial aid helps German university students to shorten graduation time and reduce dropout. The results show that students who benefited from aid actually experienced lower dropout, but did not graduate faster.

The literature on this topic, in Italy, is quite sparse. Mealli & Rampichini (2002) studied the effects of grants on the students enrolled at the University of Florence, by means of a regression discontinuity design, and found that these have a significant impact in reducing drop-out. These results are in line with those reported by Aristelli *et al.* (2001) on the same university: the authors used a different approach (probit

regressions and survival analysis) but came at similar conclusions about the (positive, and statistically significant) effect on reducing dropout. Mele & Sciclone (2004) used matching techniques to evaluate the effectiveness of grants in eleven Italian universities, for two cohorts of students (those enrolled in 1998/99 and 1999/2000). The authors report a heterogeneous effect of the grant: it is effective for some typologies of students but not for others, and in some universities but not in others. However, a general finding is that obtaining a grant matters more for students who attend university outside the region in which they reside (in this paper, we named these students as "from other regions"). Overall, the magnitude of the effects seems quite modest. Graziosi (2012) analysed a particular case, that of Trieste University, which accompanied the traditional need-based grants with a more innovative merit-based grant program (funded by a local foundation). Using matching techniques, the author demonstrates that need-based grants reduce dropout, while merit-based ones help students in graduating on time.

The present paper is innovative in the context of Italian academic literature for three reasons. First, we assess the effects of grants on a wider array of academic results: formative credits acquired in the first year, drop out in the first and second year, graduation on time, and graduation within four years (one year later the legal duration of the courses). Second, we explicitly focus on various dimensions of effects' heterogeneity: by student type (immigrants vs Italians, near-home students vs those who come from another region) and by course attended (Engineering vs Architecture and Design). Third, we explore whether unobservable factors affect the results, by analysing if students obtaining a grant perform better than similar ones who share not

only observable characteristics, but also similar (intrinsic and unobservable) motivation.

3. Background: student support in Italy

The responsibility for student support, in Italy, is in charge of the national government[3]. A national regulation defines the criteria for grants eligibility, which are two: (i) economic conditions of the student's family and (ii) academic performance. The former is the only parameter for evaluating the eligibility of students in their first year, while the latter is considered to maintain eligibility in the second and third year of the bachelor. The same approach is used for determining master students' eligibility, but in this paper we focus exclusively on bachelor students.

Overall, the grants can be considered much more as need-based than merit-based, because of two reasons. First, academic performance is not a requirement for obtaining the grant in the first year. Second, the requirement in the second and third years is quite low: more specifically, the students should obtain 25 formative credits (Cfu) at the end of the first year, and 80 at the end of the second. Given that the expected number of credits acquired by each student is 60 Cfu every year, the threshold is around 41% and 66% of the expected performance (for the first and second year, respectively). Nonetheless, data provided by the Ministry of Education report that, on average, Italian students acquired around 30 Cfu every year (50% of

[3] The description provided in this section concerns the student support system, which is operating until 2012/13. Some recent legislative reforms are slightly changing the scenario, but without affecting the overall functioning of the system. However, the empirical analysis realised in this paper concerns the period 2007/08-2009/10.

the expected performance)[4], so students who want to maintain the grant can just perform in line with the national average. As we will show later, this is different for the university under scrutiny in this study, as the average performance of its students is higher than the national average.

In Italy, the number of students who obtain a grant is quite low; in the academic year 2010/11, for instance, they were around 130,000 out of a total of 1,700,000 (about 7.5%). In many European countries, the proportion of students assisted with some need-based or merit-based grant or loan is much higher; for instance, it is about 70% in the Netherlands and Sweden, 60% in England, 30% in France, 25% in Germany (Department for Business Innovation & Skills, 2010). There are many reasons that explain why the proportion of assisted students is so low in Italy, among with the main are: the financial threshold for determining need-based eligibility is set at a very low level, and the public funds available for this policy are low and reducing over time.

Prospective students who want to apply for a grant can send an application to a Regional agency or to their chosen university, which manage the different administrative activities related to the student support system: the collection of applications, the selection of eligible students, and the money flows to the students. Eligible students are then classified in three categories: "near-home" students (those whose family lives in the same city in which they are attending university), "commuting" students (those whose family lives in cities located near that in which they attend university, and who commute daily) and "far-from-home" students (those whose family live far from the university's city; those students are considered likely

[4] Data come from the Report "Higher Education in Italy 2009-10", published by the Ministry of Education; see table 2.2.5 "Cfu annually acquired by the students in Italy, 2009".

to be moved from their parents' house and living alone in the university's city). In the academic year 2010/11, near-home beneficiaries represented around 20% of the total, while the proportion of commuting and far-from-home beneficiaries was 30% and 50%, respectively. All beneficiaries are exonerated from paying universities' fees, so the amount of the grant is intended to help covering living costs (apartment's renting, meals, educational materials, etc.). For this reason, the grant's amount is differentiated across the three types of beneficiaries; in the academic year 2010/11, it was around € 1,700/year for near-home ones, € 2,600/year for commuting ones, and € 4,700/year for "far-from-home" beneficiaries. Such amounts seem low not only when compared with those available in other countries, but also when compared with students' leaving costs: Italian studies based on surveys report that living costs are 40/50% higher than the amount of grants (Catalano & Figà Talamanca, 2002).

A major problem affecting the student support system is that a part of the students, who are eligible for a grant, actually do not receive it because of the lack of funding. On average, in the last years, around 25% of eligible students were not beneficiaries (figure 1).

[Figure 1] around here

The university, which is selected for our study, is a big public institution located in Milan, in the Northern Italy, named *Politecnico di Milano*. It enrols around 38,000 students (year 2010/11), and is an Engineering-focused institution that also offers courses in Design and Architecture. The problem of "eligible-but-not-beneficiaries-students" did not exist in the period 2006-2011 (so, before and after the period of our analysis), as all the eligible students actually received the grant.

4. Data

We collected data about all the first-year students who entered at *Politecnico di Milano* in the academic year 2007/08, and we followed this cohort for four years (until 2010/11). The figure 2 illustrates the reason behind the public discourse about the lack of effectiveness of student aid. At the *Politecnico di Milano*, 416 freshmen received the grant in 2007/08, on the basis of (only) their socio-economic background. When moving to the second year, a merit-based criteria is considered to "confirm" the grant: around 40% of those who obtained the grant in the first year did not meet these requirements and lose the grant. When looking at the third year, only 43.7% of the initial recipients met the merit-based requirements to mantain the grant.

[Figure 2] around here

Such low retention rates (which are even pretty high compared with many other Italian universities) stimulated questions about the effectiveness of grants. Many observers consider this phenomenon as a waste of public money, as a high proportion of students receive a (publicly funded) grant, but did not succeed. However, such interpretation is misleading. In fact, observing simple statistics about grants' confirmation rates did not tell anything about the "causal" effect of the grant. In other words we would instead answer to the following question: "which average performance would have the granted students shown if they had not been granted"? Our empirical analysis explores exactly this issue.

In so doing, we need to build a suitable and reliable control group of non-granted students (comparable with granted ones). This control group should be based on students' observable characteristics responsible for their academic performance. In our dataset, such observable characteristics are: a dummy that equals unity if the focal

student is a male (*Male*); a dummy that equals unity if the focal student is a "regular" student, i.e. if she was born in 1989 or 1990 (*Born in 1989|1990*); three mutually exclusive dummies that take value 1 if the focal student was born in the Lombardy Region – where *Politecnico* operates - (*Near_home_student*), in an Italian region different from Lombardy (*Other_region_student*), or in a foreign country (*Immigrant*), alternatively; three mutually exclusive dummies that equal unity if the focal student attends the faculty of Design (*Course_Design*), Architecture (*Course_Architecture*), or Engineering (*Course_Engineering*), alternatively; four mutually exclusive dummies whether the secondary school attended by the focal student was:

- a Lyceum (*Secondary_schooltype_Lyceum*),
- a technical school (*Secondary_schooltype_Technical*),
- a vocational school (*Secondary_schooltype_Vocational*),
- or a foreign school type (Secondary_schooltype_Foreign), alternatively.

It can be noted that we do not have direct information about students' socioeconomic background, which is likely to have an impact to their performances. However, we were able to obtain such information indirectly, and this feature constitutes our central hypothesis for identifying the effect of receiving a grant (see next section).

As output variables, we define five students' academic performance measures: (i) the number of formative credits obtained after the first year, (ii) the dropout status at the first year (1=yes, 0=no), (iii) the dropout status at the second year (1=yes, 0=no), (iv) graduation in the legal duration of the course (1=yes, 0=no), and (v) graduation within four years (1=yes, 0=no).

5. Identification strategy and descriptive statistics

As the main aim of this paper is to assess the causal effect of receiving a grant on the academic performances, we should rely upon an adequate methodological approach. We only had access to administrative data, and were not able to organise a randomised assignment of the grant to a sample of students (which is almost impossible in Europe, differently from US). We then opted to a propensity score matching (PSM) approach[5], for creating a control group for the "treated" students (those who received a grant; thus, the treatment is *obtaining a grant*). There are many factors that are likely to affect academic performances others than the grant, so we should be certain to match students who are very similar and differ just on having received the grant; the available variables for conducting the matching were described in detail in the previous section. Therefore, one of the main factors affecting achievement is the student's socioeconomic status (SES)[6]; unfortunately, the university does not collect direct information about the students' SES.

We took advantage of a specific characteristic of the system to collect students' fees at the studied university to obtain an indirect proxy for students' SES. The fee that each student should pay is calculated on the basis of her family's income: the university defines nine levels, which correspond to a growing amount of the fee. Students who refute to declare their family's income are classified in the level 10 (the highest one). Students coming from a disadvantaged background have a strong incentive to declare: to give an idea, in 2009/10 students classified in the level 2 paid

[5] As Politecnico di Milano does not collect precise information about the income level of each student's family, we cannot implement a Regression Discontinuity (RD) design, that could be useful to check the robustness of the results obtained through the Propensity Score Matching (PSM) approach.

[6] For instance, an evidence about this point that is closely related to the focus of this paper comes from a recent paper by Powdthavee & Vignoles (2009), who found that there is a gap in the probability of dropping out at university between students from low and high socioeconomic background.

around 800€/year, while those in the level 10 paid more than 3,500€/year. The payment of the fee is organised in two parts: the first must be paid by all students and is around 400€, while the second is dependent upon the income declared. It is important to note that also students who receive a grant must pay the fee, indeed, the request for obtaining a grant should be formulated after the payment of the fee's first part. If the student receives a grant in the subsequent weeks, then the fee she paid is reimbursed. Such mechanism is important for our identification strategy: indeed, we are able to see that the most part of students who received a grant are actually classified in the level 2 of the fee scale. The other students in the level 2, who did not receive the grant, are then our control group (hereafter, "baseline control group"). There are many reasons for which a student who is in the level 2 did not receive the grant. A first reason is that she did not request it: these are cases of lack of information, or administrative burdens that prevented the students to have an easy access to the procedure for obtaining the grant. Moreover, there are students who are able to cover their living expenses without asking a grant (for instance, by living at parents or relatives' home) and prefer this solution. However, there are also students who applied for a grant, but did not receive it: it is often the case of students who made errors in the administrative procedure[7]. We consider this latter group as our preferable control group (hereafter, "narrower control group"), as they share the motivation to apply for a grant, that is an unobservable factor in common with the treated students.

[7] There are, of course, students whose family's income level is higher than the required threshold; however, these students are not classified in the level 2 of the fee scale, so do not disturb our empirical analysis.

The table 1 provides the numbers about the students we analysed. As it can be seen in the Panel A, in the academic year 2007/08, 1,606 students were classified in the level 2 of the fee scale: our empirical analysis focuses on them. Within this group, there are 416 "treated" students, who received a grant, and 1,190 students who did not (our baseline control group). Among these 1,190 students, 46 requested a grant but did not receive it, and they represent our "narrower control group". When following this cohort of students to the second year (2008/09), there are 861 students classified in the level 2 of the fee scale: 213 are those "treated" while the 648 remaining students compose the baseline control group (among them, 84 are included in the narrower control group). Lastly, in the third year (2009/10), the "treated" students are 159, and the "untreated" are 609 students (of which, 115 in the narrower control group). The number of students of this cohort decreases over time because some students leave the university (dropping out or moving to other universities).

[Table 1] around here

Therefore, these are the groups of "treated" and "untreated" students only in theory; indeed, because of missing values on some important variables, we were forced to reduce the sample of students. More specifically, there were missing variables on the variable "Secondary_School_Type", which is a strong predictor of average academic performance. When dropping the students for whom this indicator is missing, the number of observations reduces of about 25% for non-beneficiaries students, and 15% for those who obtained a grant (see table 2, panel A). We performed a battery of t-tests to verify if the subsamples are representative of their original population, and the answer is positive with reference to both students' characteristics and performances (panel B). The only exceptions are related to the type of secondary school, as

expected – as it was the variable for which we have missing values – and near-home and immigrant students, as it appears that our final sample contains more immigrants and less near-home students. However, the sample is fully representative when looking at outputs, so we can conclude that the sample itself did not exclude particular groups of students who can alter or bias the results. Overall, chi2 tests about the joint representativeness of the different variables reveal that our sample is representative of the corresponding student population.

[Table 2] around here

After this check, we restricted our analysis to the sample of students for whom there is no missing information on the relevant variables: in the first year (2007/08), the sample comprises 1,223 students (354 who received a grant, and 869 "untreated" ones). Descriptive statistics are reported in table 3. Some differences between the two groups are noteworthy. First, the proportion of students who were born in 1989 or 1990 is slightly lower for the groups of beneficiaries (63% vs 73%). The proportion of immigrant students is very high among "treated" students (40% vs 18% of untreated ones), and also the proportion of students coming from another Italian region. The reason for this disparity is that the average income in regions other than Lombardy is lower, so a higher proportion of them obtains the grant, all else equal. The representativeness of the three courses (design, architecture and engineering) is similar between students with and without the grant. When looking at the secondary school type, the proportion of students who attended a Lyceum is similar in the two groups (around 55%), while the number of students with a foreign degree is higher among treated (31% vs 11%). It must be underlined that not all the immigrant students obtained a degree in a foreign country, as some of them lived in Italy when

attending a secondary school (this is why among 40% of students who obtained a grant are immigrant, only 31% have a foreign secondary schooling degree).

[Table 3] around here

A glance to two indicators of outputs reveals that: (i) the average number of formative credits (Cfu) acquired by treated students in the first year (2007/08) is higher than that obtained by untreated students (42.4/60 vs 34.4/60) – and the standard deviation is lower - , and (ii) the drop out propensity is also lower (8% vs 21%). More generally, when considering other outputs, it looks that the group of students who received a grant outperformed their "untreated" counterpart. The figure 3 plots the entire distribution of the number of formative credits acquired by the analysed students in 2007/08, and figure 4 illustrates the (cumulated) number of Cfu acquired at the end of the third year (2009/10). In both cases, it appears that the distribution of treated students dominates that of untreated ones. Therefore, such evidence must be interpreted as correlational, not causal, as we did not control for the composition of the two groups of students, which is pretty different as already discussed. In the next section, we illustrate the methodology we pursued to this purpose.

[Figures 3 and 4] around here

6. Methodology

As baseline method, we run the following simple OLS regression:

$$y_i = \alpha_1 \overline{X}_i + \alpha_2 Treatment_i + \varepsilon_i \qquad (1)$$

where y_i is the output for the ith student (one of the five performance measures presented in Section 4, namely (i) the number of formative credits obtained after the first year, (ii) dropout at the first year, (iii) dropout at the second year, (iv) graduation

in the legal duration of the course, or (v) graduation after four years, alternatively); X_i is the vector of students' characteristics described in Section 4 (gender, secondary school type, course attended, citizenship, region [Lombardy or other], birth year [1989|90 or not]). The treatment is alternatively defined as:

- Having received a grant in the first year (2007/08), when y_i is the number of formative credits acquired in the a.y. 2007/08 or the drop-out rate at the first year;
- Having received a grant in the first and second year (2007/08 and 2008/09) when y_i is the drop-out rate at the second year;
- Having received a grant in the first, second and third year (from 2007/08 to 2009/10) when y_i is graduation (either in the legal duration of the course or after four years).

For four out of the five output variables (all but the number of formative credits obtained after the first year) are dichotomous, we estimated a probit regression instead of a traditional OLS[8]. The results obtained through these simple regressions are likely to be biased, as the grants are not randomly assigned. To properly evaluate the average impact exerted by the receipt of a grant on students' performance, we define two "states of nature": 1) the "treated" students (who received a grant); 2) the "untreated" students (who do not receive a grant but are similar to treated students according to a set of *a priori* characteristics).

[8] As a robustness test, we also resorted to a linear probability model, i.e. a binary choice model estimated through OLS. The results are fully in line with those found through probit estimation and are available upon request from the authors.

Having defined such states of nature, we apply propensity score matching (PSM) methods to match each treated student with a similar untreated one[9]. In fact, the receipt of a grant can hardly be considered as the result of a random process. First, even though the central Government set a financial threshold for determining need-based eligibility, only a portion of potentially eligible students at the first year choose to apply for a grant (there is a self-selection process on the demand side; see Section 5). Second, the amount of the grant is different according to the status of the student (around € 1,700/year for near-home ones, € 2,600/year for commuting ones, and € 4,700/year for "far-from-home" beneficiaries, as explained in Section 3). These differences in financial aid might engender different incentives in applying for the grant according to the status of the focal eligible student. Third, only a portion of eligible students actually receives the grant because of the lack of funding. However the latter type self-selection process on the supply side does not exist in our sample of students, as all eligible students (who applied for a grant) actually received it (see Section 3).

We built a matched sample of untreated students that were comparable to the sample of treated ones according to the characteristics described in previous sections. As a first step, following the suggestions of Dehejia & Wahba (2002), we randomized our dataset to control for the sensitivity of the reliability of our procedure to the order of students in the dataset. We performed a one-to-one matching without replacement

[9] There are several examples of the use of PSM to assess educational interventions. Morgan *et al.* (2010) evaluated the effects of special educational services in a sample of US schools; Dearden *et al.* (2005) studied a program of subsidies to reduce dropout in the English secondary schools; Long & Kurlaender (2009) assessed whether attending community colleges help graduation (compared to traditional 4-years institutions); Heinrich *et al.* (2010) explored if supplemental educational services under No Child Left Behind positively affect students' results. However, the use of PSM is not frequent in assessing the effectiveness of grants for university students, and this represents another novelty of this paper.

where the propensity scores were obtained through a logit model. We opted for a matching procedure without replacement due to two reasons: (i) the sufficient number of untreated students acting as potential matches of treated ones; and (ii) an improvement in the precision of the estimates.

7. Results

Baseline results

The baseline results are reported in the table 4; they can be interpreted as the Average Treatment on Treated (ATT), which is the "average" effect of receiving a grant for the "average" student in the sample of students who can potentially obtain financial aid. In the first two columns, the coefficient of GRANT is reported when estimating a simple OLS or probit; the third column reports the coefficient estimate via PSM (when the first stage is run as a logistic regression). Each row contains the coefficient estimated for the impact of GRANT on the five academic outputs: (i) formative credits 2007/08 (first year), (ii) drop-out in the first year, (iii) drop-out in the second year, (iv) graduation on-time (2009/10), (v) graduation (within 2010/11). All the estimates point at a positive effect of receiving a grant, albeit the more credible PSM approach estimates slightly lower magnitudes of the coefficients.

Before looking at the results in detail, we performed a balancing test on the variables included in the PSM (table 5). First of all, we reported t-tests to verify the "balance" of all covariates included in the PSM estimation between treated and untreated students, i.e. equality of means before and after matching. Even though we have no balance for some covariates before matching, there is a perfect balance (p-values $\geq$ 0.1) for all the covariates after matching, for all of the output variables employed.

Moreover, we tested the reliability of the PSM procedure through the comparison between pseudo R^2 before and after matching, and LR tests on the joint insignificance of covariates before and after matching. As regards the former, pseudo R^2 after matching are always lower than pseudo R^2 before matching. As regards the latter, the covariates included in logit models before matching explain the focal output; while the same covariates after matching are jointly null (table 6).

[Tables 4, 5 and 6] around here

Commenting on the PSM estimates, receiving a grant allows acquiring 10.3 formative credits more (out of 60, and where the average of the overall cohort of students is around 36/60). The grant, moreover, reduces the probability to drop out of around 17 percentage points; receiving a grant for two years consecutively (2007/08 and 2008/09) reduces of 7.5% the probability to drop out in the second year. As the average drop-out rate in the overall cohort of students (n=6869) is 22% in the first year, and 10% in the second year, the computed effects must be judged as high. We then consider as a treatment to receive the grant for three years consecutively (from 2007/08 to 2009/10): the effect is to increase the probability to graduate on time of 21%, and the probability to graduate by the end of the fourth year (2010/11) of 35%. The figures about on-time graduation rate and graduation rate within the fourth year are, in the overall cohort of students, 25% and 53%, so the effect is again pretty high.

Robustness checks

We performed three different robustness checks for our results obtained through PSM. First, we used a different version of matching procedure: we allowed replacements in the control group, that is each treated student is compared with a

sample of untreated counterparts that, anytime, can include the whole subsample of students who do not received the grant. Second, we estimated the first-stage regression (to calculate propensity scores) through a probit regression instead of a logit one. Both approaches are accepted in the literature, even though the latter is usually preferred. Third, we restricted the sample of (treated and untreated) students to those who were classified level 2 in the fee scale in 2007/08 and 2009/10; the idea is that there can be some students whose socioeconomic background changed during time, so they are not the best control group nor "treated" students in the narrower meaning. For instance, a student who were classified in the level 2 in the year 2007/08, and received a grant, can be classified in the level 3 in the year 2009/10, and still receive a grant. Her socioeconomic background is then changed (albeit slightly) and such change could potentially introduce a bias in the results. We limited the empirical analysis to the effects of receiving a grant on dropping-out at the second year and graduation. The sample of students is reduced to 590 (181 "treated" and 409 who did not receive the grant) in the analysis for second-year dropout phenomenon, and 515 (380 untreated and 135 treated) in the analyses about graduation.

Table 7 reports the outcomes of the robustness checks described above; the Panel A contains the results with alternative PSM specifications, Panel B reports the results when the methodology is identical to that used for baseline analyses, but restricting the sample of students to those who were classified in level 2 of fee scale in 2007/08 and 2009/10.

The results obtained using a probit regression to derive propensity scores are virtually identical to those derived through a logit first-stage regression. Instead, the estimated coefficients when the matching allow replacements in the control group are higher

than those reported in our baseline estimations: the effect of the grant is (i) increasing 15.48 formative credits in 2007/08 (compare at 10.3), (ii) reducing the probability of first-year drop-out of about 21% (compare at 17%), (iii) reducing second-year drop-out of 15% (vs 7.5%), (iv) increasing on-time graduation probability of 29% (instead of 21%). The computed positive effect on graduation within the fourth year is in line with baseline findings (around 35%). However, all the coefficient estimates are more imprecise than those obtained through the more conservative "no replacements in the control group" approach (as the lower t-statistics attached to coefficients highlight). When considering only students who did not change at all their socioeconomic background over time, the PSM estimates are in line with baseline results, even though the computed effect on reducing drop-out in second year is slightly higher (-8% instead of -7.5%) as well as the effect on graduation within the fourth year (+38.5% instead of +35.5%).

[Table 7] around here

Heterogeneity

In the previous analyses, we estimated the "average" effect of the financial aid on academic performance; in other words, what is the expected benefit that an average student would obtain by obtaining a grant. Therefore, such a student does not exist. In a policy perspective, it is instead useful to explore the potential heterogeneity of the grants' impact on different subpopulations of students. Using the Dynarski & Scott-Clayton's words, it is possible to claim that "(…) more research is likely to focus on (…) to what extent program effects vary across different type of students" (p. 32). Given the diverse population of students attending *Politecnico di Milano*, we would

explore how the effect of receiving a grant is different for (i) Italian vs immigrant students, (ii) near-home students and those from different regions, and (iii) students attending Engineering vs those enrolled at the two different courses (Design or Architecture). There are a number of reasons for expecting the grant's effect to be different. Immigrants tend to enrol at university less frequently and dropout more frequently (Cingano & Cipollone, 2007); receiving a grant is likely to have higher impact on them, who otherwise have less probability to attend university all else equal. The same reasoning applies for Italian students from other regions when compared to their near-home counterparts. Indeed, surveys conducted among Italian university students showed that the most important expenditures are related to residential services (Catalano & Figà Talamanca, 2002); so that (relatively poor) students who move to another city/region to attend their courses would need more financial aid to cover their expenses. Those students of this kind who do not receive the grant probably need to work and this can negatively affect their academic performance. Lastly, some data about Italian students' grades show that, on average, Engineering students obtain lower academic performances when compared with others students attending different courses[10]; this is probably due to that Engineering courses are more difficult than others. If it is the case, the impact of receiving a grant can be more beneficial for Engineering students, as it can incentive higher efforts (and then higher performances) to maintain the possibility to apply for financial aid. As to explore such issues, we perform a PSM analysis for each subgroup separately: Italians vs immigrants, near-home vs from-other-regions students, engineering vs other

[10] We analysed the data reported by AlmaLaurea consortium, which collects detailed information about the characteristics of Italian graduate students. In 2011, on average, Italian students obtained a final grade of 102.9/100, and the proportion of students who graduates within the legal duration of the course is 38.9%; the same figures, for Engineering students, are 101.3/100 and 31.5%, respectively.

courses students; the results are reported in the table 8 (panel A, B and C respectively). The third column, in each panel, reports the baseline estimates (based on ATT) that serve as a benchmark to compare heterogeneity.

The results show some interesting patterns, which demonstrate how the estimated "average" effects actually mask wide heterogeneity in the treatment's impact.

When considering Italian students and immigrants, it is clear that the impact of a grant is bigger for the latter than for the former. More specifically, financial aid improves the number of formative credits acquired in the first year of about 12.5 points for immigrants, while the difference for Italian students is 2.6 points and not statistically significant. The grant also acts by reducing the probability of dropping-out, even though this effect is much higher for immigrants (-25%) than for Italians (-5.2%); this pattern persists in the second year only for immigrants, when aid reduces probability of dropout of about 12%. Lastly, the impact on graduation within four years is again higher for immigrants (+37.7%) than for Italians (+23.4%).

It could be the case that, within the group of Italian students, the impact of receiving a grant is different across near-home students (those whose family lives in Lombardy) and students from other regions (who need to move to a different city to attend the courses). Such difference could arise because the higher costs that the latter group should sustain (i.e. for accommodation). Recalling that we are comparing individuals with or without a grant within the group of relatively poor students, it is likely that those who moved to another city are more helped by the financial aid than those who must spend less because can live with their parents. Indeed, this is the case. Panel B shows that the grant has no impact on any dimension of academic performance for near-home students; and this finding raises questions about the effectiveness of grants

for this category of students. Conversely, the grant helps students from other regions in improving their academic results, albeit the magnitude of these effects is lower than for immigrant students (compare with panel A). An exception is the impact on dropout in second year (no statistically significant). The effect on graduation (both on time and within four years) is instead strongly significant and high (+26.8% and +39.3%, respectively).

Finally, panel C reveals that receiving a grant is beneficial generically for students attending all faculties (Engineering, Architecture and Design) even though the magnitude of effect appears higher for students in Engineering. This evidence suggests that for these students, who are facing more difficult courses, obtaining a grant is more helpful and stimulates better performances. The especially high effect on the formative credits in the first year (+14/60 vs +6/60) suggests that the channel through which the grant operates is stimulating better results in the first year – which, in turn, persist by reducing the probability to dropout in the first and second year. Of particular relevance is the high effect in reducing first-year dropout (-22.7%).

Overall, the results point at demonstrating that students who receive a grant, on average, perform better than similar students who did not obtain it. However, such positive effect of grants is concentrated among particular subgroups of students: immigrants, Italian students from other regions, and students attending Engineering.

[Table 8] around here

Partial treatment

In this section, we explore whether the effect of receiving a grant is cumulative, i.e. it is positively related to the duration of the aid, or if it is just concentrated in the first year. One highly debated issue, in the Italian higher education sector, is that the most

part of students who dropout do it in the first-year; in this perspective, a potential policy option is to assign grants only in the first year to allow students overcoming this critical step. To investigate this option, we analyse if "partial treatment", that is receiving the grant only in the first year, allows the students to obtain better academic results one or two years later. In so doing, we empirically employ two different analyses: (i) first, we compare students who received the grant only in the first year (2007/08) and not in the second and third (2008/09 and 2009/10) with similar counterparts who did not receive the grant in all the period considered, and (ii) second, we compare these "partially-treated" students with those who, instead, received the "full treatment" (i.e. obtained the grant in all the two/three years). The results are reported in the table 9, panel A and panel B, respectively. As above, in both panels the last column reports baseline results.

A clear picture emerges: the grant definitely has a cumulative effect. Students who obtain the grant only in the first-year do not experience better performances in the subsequent years, but their results even worsen relative to similar students who did not obtain the grant before. It is important to recall here that students who do not obtain the grant in the second year are those who did not obtain adequate academic performance in the first year, and our result confirm that these individuals continue obtaining bad performances in the further years. More specifically, the first-year-grant students are 16% more likely to dropout in second year, and -6%/-9% less likely to graduate on time or within four years, respectively. When compared with the "fully treated" students, those who receive the grant only in the first year perform dramatically worse; indeed, the former are -23.8% less likely to dropout in the second

year than the latter, and +28%/+51% more likely to graduate on time and within four years, respectively.

This result should be considered as crucial in the policy interpretation, as it demonstrates that grant matters only if received every year. As those students who obtain the grant every year are those who gain adequate academic results, the finding can be interpreted as the merit-based component of the grant is acting towards positive incentives for the first-year recipients. In other words, if the first-year beneficiaries of the grant do perform well (higher than the merit-based threshold to confirm the aid for the second year), then obtaining the grant in the subsequent years reinforce their positive academic results. In this perspective, the effect of the grant is more to "select" students in the first-year (when the students' academic performance is not known) and less to remove students' liquidity constraints.

[Table 9] around here

Narrower (more precise) control group

The results presented in the previous sections can be affected by some selection on unobservable factors, for instance intrinsic academic motivation of the students. Indeed, we were able to match students with similar observable characteristics (family's background, course attended, citizenship, gender, etc.), but we cannot rule the possibility that their "motivation" is systematically different between students who receive a grant or not. For instance, it could be the case that those students who did not apply for a grant (although having the characteristics to ask for it) are less academically motivated than those who did. We take advantage of that we know which students apply for a grant but did not receive it, albeit being classified in the

level 2 of the fee scale, so having the characteristics to become grants' recipients. This is a small number of students who probably made errors in completing the administrative process, but they probably share the same "motivation" with students who instead received the grant. In this section, we replicate our PSM estimations by considering only this small group of students as control group[11]; we consider it as more meaningful to determine the "net" effect of the grant (if considering the previous estimates as "raw" ones, in that they cannot control for unobservable factors). The "restricted" control group includes 46 "untreated" students in the first year, 84 in the second year, and 115 in the third. Because the group of "treated" students is bigger in all the three years (351, 187 and 138 respectively) we were forced to opt for a matching procedure that allows for replacements, that is each observation in the control group can be matched with more than one observation in the treated sample. According to Dehejia & Wahba (2002) this procedure reduces the precision of the estimates, and also tends to overestimate the magnitude of treatment's effects: it should be kept in mind when reading the coefficients.

The table 10 illustrates the results; as above, the second column reports the baseline results ("average" effect of the grant, ATT) for a straightforward comparison. The findings are that receiving a grant has a strong and very high effect in the first year: it helps raising the number of formative credits of about 20 points (ATT is 10.3) and in reducing the probability to drop-out after the first year of about -35% (ATT is -17%). In other words, when considering the role of unobservable factors in defining the "true" control group, the effect is twice that estimated with the wider control group that was built only on the basis of observable factors. Moreover, the impact of the

[11] As the control group is composed by a small number of students, we cannot explore further heterogeneity through this approach.

financial aid disappears after the first year. A potential explanation is that those students who apply for the grant in the first year are those who really need it, and receiving it is an essential condition to continue studying. Then, those students, who did not obtain it, drop out; this is why the estimated effect is so high in the first year.

[Table 10] around here

At the end of this subsection, we must also express some cautions about these results. While this narrower control group is probably better suited to control for (unobserved) academic motivation of students, it may be affected by self-selection in terms of (unobserved) students' capabilities. Indeed, we argue that these students made errors in compiling the administrative paperwork to apply for a grant. If such propensity to make errors is randomly distributed across students (this is our hypothesis), the results are robust. If it is not the case, the results are partially biased because the difference in students' abilities (between beneficiaries and not). We do not have adequate data to further explore this issue.

Concluding remarks

This paper assesses the effect of receiving a grant on academic performances for students attending a big, public Italian university. While the grant program has a strong need-based orientation, the merit requirements associated to it seem to stimulate higher performances among recipients. The students who obtain the grant, indeed, show better results on several dimensions: they acquire more formative credits, have less probability to dropout, and graduate faster. Overall, the picture that emerges is of an effective grant program.

Such evidence casts serious doubts about the prospective public funds devoted to this program. The central government announced a reduction of State funding for the next years: while around 150 millions and 100 millions € were available in 2011 and 2012, respectively, the money allocated to this policy is less than 50 millions €/year for 2013 and 2014. If the regional governments will not decide to fund the program with their own resources – which is quite implausible, given their declining budgets – the number of grants that will be available in the next years will be substantially lower than today.

In the meanwhile, the government is proposing a reform of the grant program that increases the number of formative credits to be acquired as a requirement to confirm the grant in the second and third year. The results of this paper suggest that such initiative can be meaningful. As the merit-based component of the grant seems to (positively) stimulate students' performances, a gradual increase in merit requirements can act as a further incentive towards further gains in terms of absolute academic results. Arguably, empirical studies and practical experiences should inform policy makers about which level of merit requirement is desirable, to avoid setting unreachable targets. The finding that the effect of grant is cumulative should suggest actions to allow the students maintaining aid during their entire academic career.

In a policymaking perspective, the most important finding concerns, perhaps, the heterogeneity of the grant effect. Indeed, when designing the program, it should be kept in mind that it affects very differently the various subpopulations of students. More specifically, the positive incidence of grants on academic performance is concentrated around immigrants and out-of-the-region students; then, the issue will be

understanding the lack of effectiveness for other types of students, and eventually amending the program itself.

A limitation of this paper is that the results cannot be straightforwardly generalized to all Italian universities. *Politecnico di Milano* is classified between the one/two best universities in Italy (see the national rankings[12]) and the students who enrol to it are likely to be more motivated and skilled than the average Italian student. Moreover, as fees are higher at *Politecnico* than at other universities, and living costs in Milan are high as well, there can also be an "income effect" playing a role (i.e. the liquidity constraints are less tight for students who chose *Politecnico*). All these caveats impose considering the results specific to the reality of *Politecnico*, and extendable only to similar institutions (e.g. *Politecnico di Torino*, etc.). Nonetheless, the findings must be interpreted as important for this university, as they demonstrate that, within *Politecnico*, receiving a grant makes the difference and can help disadvantaged students closing the gap. In the light of public policies aiming at reducing intergenerational persistence, it would be useful to extend the evaluation of grants' effects to other universities in Italy.

[12] In 2012: the ranking provided by the most influential Italian economic newspaper (*IlSole24Ore*) rated Politecnico di Milano as the best university in Italy; the ranking compiled by *Censis-La Repubblica* classifies it as the second place in the group "Politecnici".

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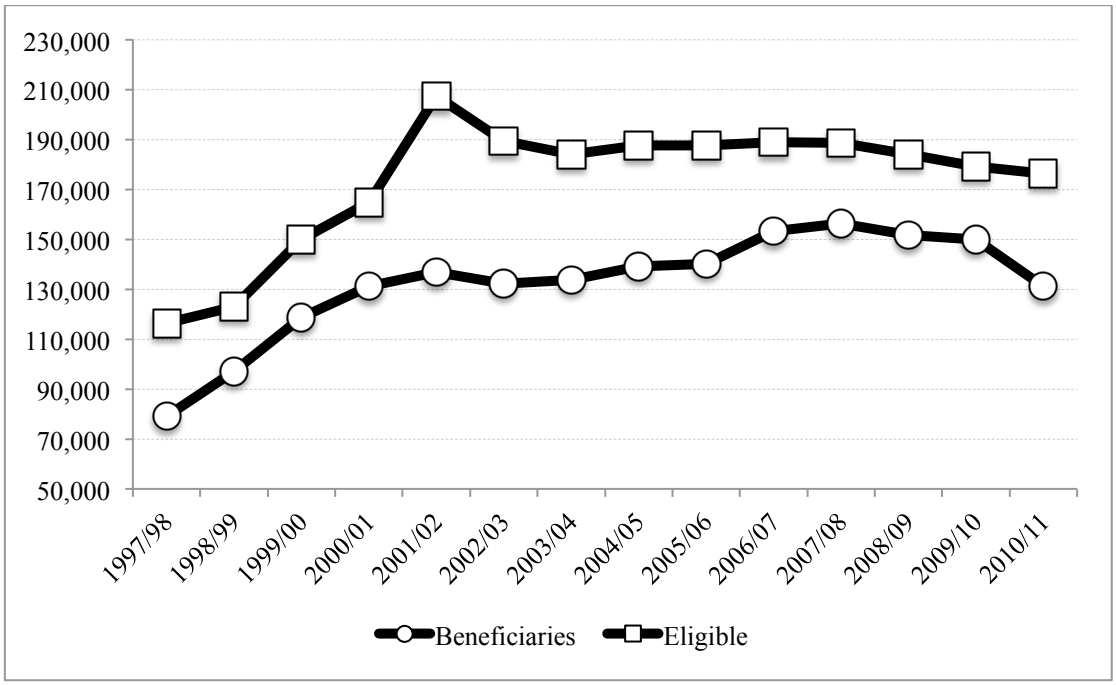
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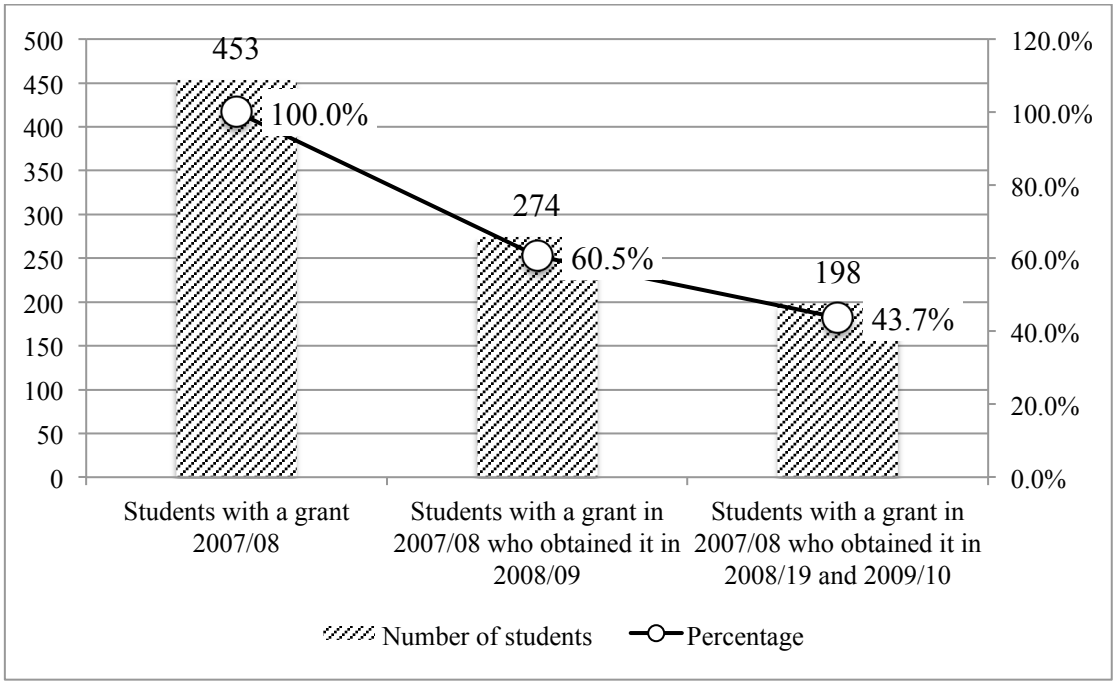
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Figure 1. The number of eligible students and beneficiaries, 1997/98 – 2010/11



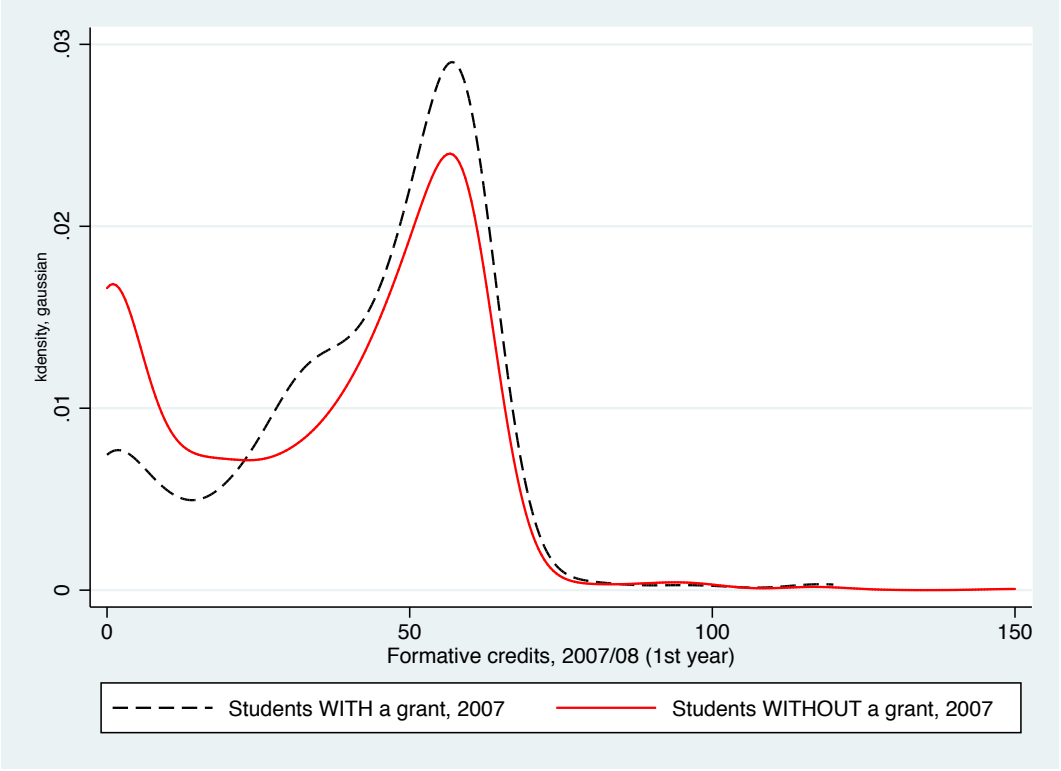
Source: authors' elaborations on Ministry of Education data, www.miur.it.

Figure 2. The number of first-year students who obtained a grant in 2007/08 and maintain it for the subsequent two years, Politecnico di Milano



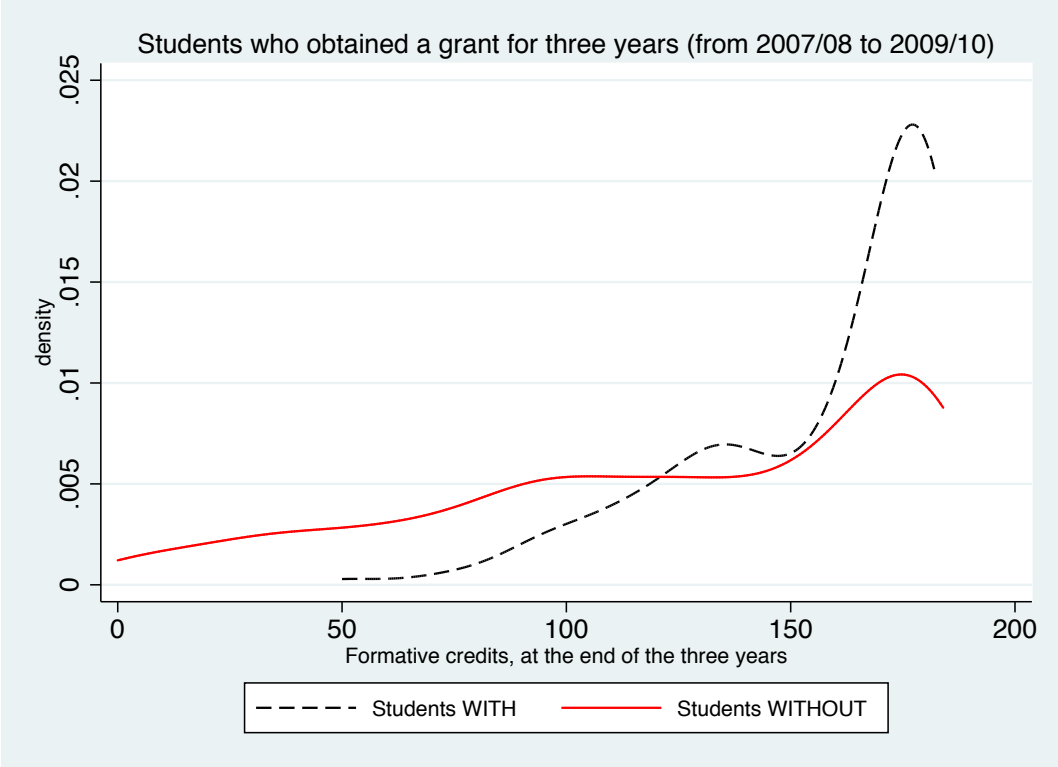
Source: authors' elaborations on administrative data provided by Politecnico di Milano.

Figure 3. The number of formative credits (Cfu) acquired by students at the end of the first year (2007/08) – kernel density distribution



Notes: Density is based on a kernel (Gaussian) estimate. The expected (regular) number of formative credits acquired each year is =60. The students included in these estimations are only those who are classified in the level 2 of the fee scale, and for whom the information about secondary school type is available.

Figure 4. The number of formative credits (Cfu) acquired by students at the end of the third year (2009/10) – kernel density distribution



Notes: Density is based on a kernel (Gaussian) estimate. The expected (regular) number of formative credits acquired each year is =60. The students included in these estimations are only those who are classified in the level 2 of the fee scale (reference year: 2007/08), and for whom the information about secondary school type is available. The treatment is defined as having received the grant for all three years (from 2007/08 to 2009/10).

Table 1. Identification strategy: the number of students in each level of the fee scale

Panel A. Year 2007/08; Students who received the grant in their first year

Fee scale (year 2007)	Students WITHOUT a grant	Students WITH a grant	Total
2	1,190	416	1,606
3	390	19	409
4	586	9	595
5	734	3	737
6	950	0	950
7	699	0	699
8	236	0	236
9	115	0	115
10	939	4	943
Total	5,839	451	6,290

Panel B. Year 2008/09: students who received the grant in the first AND second year

Fee scale (year 2008)	Students WITHOUT a grant	Students WITH a grant	Total
2	648	213	861
3	266	32	298
4	435	10	445
5	629	0	629
6	923	0	923
7	727	0	727
8	239	0	239
9	98	0	98
10	975	17	992
Total	4,940	272	5,212

Panel C. Year 2009/10: students who received the grant in the first AND second AND third year

Fee scale (year 2009)	Students WITHOUT a grant	Students WITH a grant	Total
2	609	159	768
3	237	23	260
4	414	16	430
5	580	0	580
6	882	0	882
7	724	0	724
8	225	0	225
9	115	0	115
10	934	0	934
Total	4,720	198	4,918

Notes:
These numbers include all the students (i.e. also those for which there are some relevant missing information such as the secondary-school degree type), with the exception of those for which there is missing information about the level in the fee scale (n=579). The tables below report the information about the composition of the sample actually used for the empirical analysis.

Table 2. Excluding students for whom information about secondary-school type is missing

Panel A. Number of lost observations

Population	2007/08	2008/09	2009/10
Students WITH grant (all)	416	213	159
Students WITH grant (AND information about secondary school type)	354	187	138
Difference (%)	-14.9%	-12.2%	-13.2%
Students WITHOUT grant (all)	1190	648	609
Students WITHOUT grant (AND information about secondary school type)	869	477	463
Difference (%)	-27.0%	-26.4%	-24.0%

Note: "treated" students are those labelled as "WITH grant". The treatment is defined as having received the grant for all years: (two year consecutively in 2008/09, or three years in 2009/10).

Panel B. T-tests about sample's representativeness

Students WITH a grant ("treated")	Average for all the students in the level 2 (n=416)	Average for subsample (n=354)	p-value
Academic outputs			
Formative credits 2007/08	42.233	42.429	0.8935***
Drop-out first year	8.6%	8.1%	0.8183***
Drop-out second year	14.1%	14.1%	0.9815***
Graduation on-time	26.7%	26.5%	0.9678***
Graduation	54.5%	55.6%	0.7638***
Students' characteristics			
Male	59.8%	58.2%	0.6405***
Born in 1989|1990	64.9%	63.0%	0.5831***
Near_home_student	25.2%	20.3%	0.1053
Other_region_student	40.4%	39.3%	0.7522***
Immigrant	34.4%	40.4%	0.0859*
Course_Design	19.5%	19.5%	0.9943***
Course_Architecture	24.5%	24.5%	0.9854***
Course_Engineering	56.0%	55.9%	0.9828***
Secondary_schooltype_Lyceum	44.7%	52.5%	0.0303*
Secondary_schooltype_Vocational	0.7%	0.8%	0.8438***
Secondary_schooltype_Technical	12.9%	15.2%	0.3685***
Secondary_schooltype_Foreign	26.7%	31.3%	0.1557***

Students WITHOUT a grant ("treated")	Average for all the students in the level 2 (n=1190)	Average for subsample (n=869)	p-value
Academic outputs			
Formative credits 2007/08	35.31	34.43	0.3623***
Drop-out first year	19.3%	21.1%	0.3354***
Drop-out second year	13.8%	13.3%	0.7769***
Graduation on-time	19.7%	19.6%	0.9196***
Graduation	46.9%	45.0%	0.7638***
Students' characteristics			
Male	67.6%	65.1%	0.2337***
Born in 1989|1990	73.9%	73.7%	0.8779***
Near_home_student	64.0%	58.9%	0.0187*
Other_region_student	22.8%	23.0%	0.8975***
Immigrant	13.2%	18.1%	0.0029
Course_Design	16.1%	17.1%	0.5437***
Course_Architecture	29.1%	27.3%	0.3775***
Course_Engineering	54.7%	55.5%	0.7321***
Secondary_schooltype_Lyceum	42.0%	57.5%	0.0000
Secondary_schooltype_Vocational	1.3%	1.8%	0.3799***
Secondary_schooltype_Technical	21.1%	28.9%	0.0001
Secondary_schooltype_Foreign	8.5%	11.6%	0.0208*

Note: The subsample (used in the empirical analysis) includes students in level 2 WITH information about school type. ***, ** and * indicate $p < 0.01$, $p < 0.05$ $p < 0.10$, respectively. P-value refers to the t-statistic which tests whether the two distributions (sample versus subsample) are identical or not. The subsample is representative of the sample if p-value > 0.01.

Table 3. Descriptive statistics, year 2007/08

Panel A. Students WITHOUT a grant ("untreated"; n=869)

Variable	Mean	Std. Dev.
Male	65.1%	
Born in 1989|1990	73.6%	
Near_home_student	58.9%	
Other_region_student	23.0%	
Immigrant	18.1%	
Faculty_Design	17.1%	
Course_Architecture	27.4%	
Course_Engineering	55.5%	
Secondary_schooltype_Lyceum	57.5%	
Secondary_schooltype_Vocational	1.8%	
Secondary_schooltype_Technical	29.0%	
Secondary_schooltype_Foreign	11.6%	
Formative credits 20072008	34.3	24.7
Dropout_year1	21.1%	

Panel B. Students WITH a grant ("treated": n=354)

Variable	Mean	Std. Dev.
Male	58.2%	
Born in 1989|1990	63.0%	
Near_home_student	20.3%	
Other_region_student	39.3%	
Immigrant	40.4%	
Faculty_Design	19.5%	
Course_Architecture	24.6%	
Course_Engineering	55.9%	
Secondary_schooltype_Lyceum	52.5%	
Secondary_schooltype_Vocational	0.8%	
Secondary_schooltype_Technical	15.3%	
Secondary_schooltype_Foreign	31.4%	
Formative credits 20072008	42.4	20.0
Dropout_year1	8.2%	

Table 4. Baseline results: the impact of receiving a grant

	OLS (1)	Probit (2)	PSM (3)
Formative credits 2007/08	**11.784*** **		**10.331*** **
	(8.12)		(5.88)
Drop-out first year		**-0.198*** **	**-0.169*** **
		(-7.18)	(-6.20)
Drop-out second year		**-0.078*** **	**-0.074*** **
		(-2.62)	(-2.53)
Graduation on-time		**0.165*** **	**0.210*** **
		(4.19)	(3.87)
Graduation		**0.373*** **	**0.355*** **
		(7.84)	(6.56)

Notes: ***, ** and * indicate $p < 0.01$, $p < 0.05$ $p < 0.10$, respectively.
In columns 1 and 2, estimates are derived from OLS or probit regressions. In column 3, estimates are derived from a Propensity Score Matching. Logit functional form was used to derive propensity scores. The sample of students was restricted to common support that, however, includes all treated and untreated students.

Table 5. Balancing properties: observable factors of treated and untreated students, before and after the matching

Panel A. First year students
(those who received a grant in 2007/08 vs control group)

Students' characteristics		Treated	Control	t-test
Male	unmatched	0.582	0.651	-2.28*
	matched	*0.582*	*0.588*	*-0.15*
Born in 1989|1990	unmatched	0.630	0.736	-3.73*
	matched	*0.630*	*0.655*	*-0.71*
Near_home_student	unmatched	0.203	0.589	-13.07*
	matched	*0.203*	*0.203*	*0.00*
Other_region_student	unmatched	0.393	0.230	5.83*
	matched	*0.393*	*0.393*	*0.00*
Immigrant	unmatched	0.404	0.181	8.46*
	matched	*0.404*	*0.404*	*0.00*
Course_Design	unmatched	0.195	0.171	0.97
	matched	*0.195*	*0.209*	*-0.47*
Course_Architecture	unmatched	0.246	0.274	-1.01
	matched	*0.246*	*0.271*	*-0.77*
Course_Engineering	unmatched	0.559	0.555	0.15
	matched	*0.559*	*0.520*	*1.05*
Secondary_schooltype_ Lyceum	unmatched	0.525	0.575	-1.60
	matched	*0.525*	*0.562*	*-0.98*
Secondary_schooltype_ Vocational	unmatched	0.008	0.018	-1.27
	matched	*0.008*	*0.003*	*1.00*
Secondary_schooltype_ Technical	unmatched	0.153	0.290	-5.08*
	matched	*0.153*	*0.153*	*0.00*
Secondary_schooltype_ Foreign	unmatched	0.314	0.116	8.5*
	matched	*0.314*	*0.282*	*0.90*

Panel B. Second year students
(those who received a grant in 2007/08 AND 2008/09 vs control group)

Students' characteristics		Treated	Control	t-test
Male	unmatched	0.583	0.628	-1.08
	matched	*0.583*	*0.540*	*0.83*
Born in 1989|1990	unmatched	0.567	0.703	-3.36*
	matched	*0.567*	*0.540*	*0.52*
Near_home_student	unmatched	0.166	0.491	-8.05*
	matched	*0.166*	*0.171*	*-0.14*
Other_region_student	unmatched	0.385	0.237	3.85*
	matched	*0.385*	*0.385*	*0.00*
Immigrant	unmatched	0.449	0.271	4.46*
	matched	*0.449*	*0.444*	*0.10*
Course_Design	unmatched	0.209	0.171	1.13
	matched	*0.209*	*0.246*	*-0.86*
Course_Architecture	unmatched	0.235	0.325	-2.26*
	matched	*0.235*	*0.230*	*0.12*
Course_Engineering	unmatched	0.556	0.504	1.20
	matched	*0.556*	*0.524*	*0.62*
Secondary_schooltype_ Lyceum	unmatched	0.513	0.553	-0.93
	matched	*0.513*	*0.481*	*0.62*
Secondary_schooltype_ Vocational	unmatched	dropped	dropped	-
	matched	*dropped*	*dropped*	-
Secondary_schooltype_ Technical	unmatched	0.144	0.261	-3.23*
	matched	*0.144*	*0.155*	*-0.29*
Secondary_schooltype_ Foreign	unmatched	0.342	0.186	4.35*
	matched	*0.342*	*0.364*	*-0.43*

Panel C. Third year students (those who received the grant in 2007/08 AND 2008/09 and 2009/10 vs control group)

Students' characteristics		Treated	Control	t-test
Male	unmatched	0.565	0.602	-0.76
	matched	*0.565*	*0.529*	*0.60*
Born in 1989|1990	unmatched	0.572	0.685	-2.45*
	matched	*0.572*	*0.580*	*-0.12*
Near_home_student	unmatched	0.152	0.451	-6.54*
	matched	*0.152*	*0.152*	*0.00*
Other_region_student	unmatched	0.406	0.254	3.48*
	matched	*0.406*	*0.420*	*-0.24*
Immigrant	unmatched	0.442	0.295	3.23*
	matched	*0.442*	*0.428*	*0.24*
Course_Design	unmatched	0.232	0.195	0.95
	matched	*0.232*	*0.210*	*0.43*
Course_Architecture	unmatched	0.210	0.337	-2.84*
	matched	*0.210*	*0.225*	*-0.29*
Course_Engineering	unmatched	0.558	0.468	1.85
	matched	*0.558*	*0.565*	*-0.12*
Secondary_schooltype_ Lyceum	unmatched	0.522	0.565	-0.89
	matched	*0.522*	*0.493*	*0.48*
Secondary_schooltype_ Vocational	unmatched	dropped	dropped	-
	matched	*dropped*	*dropped*	-
Secondary_schooltype_ Technical	unmatched	0.123	0.249	-3.16*
	matched	*0.123*	*0.138*	*-0.36*
Secondary_schooltype_ Foreign	unmatched	0.355	0.186	4.22*
	matched	*0.355*	*0.370*	*-0.25*

Notes: * indicates that the difference between treated and control group is statistically significant. Values for the differences after matching are in italic. The last column reports reference t-statistic.

Table 6. Balancing properties: tests about the explanatory power of observable characteristics of students, before and after the matching

	First-year students		Second-year students		Third-year students	
	unmatched	matched	unmatched	matched	unmatched	matched
Pseudo R^2	0.122	0.006	0.098	0.006	0.100	0.005
LR chi^2	179.430	5.780	76.400	2.910	64.570	1.840
p>chi^2	0.000	0.761	0.000	0.940	0.000	0.985

Notes:

R^2 expresses the proportion to which the covariates (students' observable characteristics) explain the academic output. After matching, the explanatory power is always zero, meaning that the matching procedure eliminates the influence of these factors in systematically determining differences in output.

LR chi^2 tests whether the covariates jointly contribute to explain the output in the first-stage regression; p>chi^2 reports the reference probability. After matching, the test rejects such hypothesis.

Table 7. Robustness checks on the impact of receiving a grant

Panel A. Alternative versions of PSM

	PSM using "with replacement" matching (1)	PSM with probit in first-stage (2)
Formative credits 2007/08	**15.488*** **	**10.123*** **
	(2.77)	(5.81)
Drop-out first year	**-0.215*** **	**-0.169*** **
	(-2.36)	(-6.20)
Drop-out second year	**-0.155***	**-0.069*** **
	(-1.91)	(-2.38)
Graduation on-time	**0.289*** **	**0.210*** **
	(2.86)	(3.87)
Graduation	**0.347*** **	**0.369*** **
	(2.76)	(6.84)

Notes: ***, ** and * indicate $p < 0.01$, $p < 0.05$ $p < 0.10$, respectively.
In column 1, estimates are derived from a Propensity Score Matching, where the matching allows replacements in the units of control group used as comparisons for "treated" students. Logit functional form was used to derive propensity scores. In column 2, estimates are derived from a Propensity Score Matching, where a probit functional form was used to derive propensity scores. In both cases, the sample of students was restricted to common support that, however, includes all treated and untreated students.

Panel B. Restricting the sample of students to those who were classified in the level 2 of the fee scale in 2007/08 and 2009/10

	Probit (1)	PSM (2)
Drop-out second year	**-0.079*** **	**-0.082*** **
	(-2.59)	(-2.69)
Graduation on-time	**0.173*** **	**0.200*** **
	(4.14)	(3.63)
Graduation	**0.393*** **	**0.385*** **
	(8.43)	(7.05)

Notes: ***, ** and * indicate $p < 0.01$, $p < 0.05$ $p < 0.10$, respectively.
In column 1, estimates are derived through probit regressions. In column 2, estimates are derived from a Propensity Score Matching. Logit functional form was used to derive propensity scores. The sample of students was restricted to common support that, however, includes all treated and untreated students.

Table 8. Heterogeneity of the impact of receiving a grant

Panel A. Italian vs immigrant students

	Italian students (1)	Immigrants (2)	Average effect (baseline results) (3)
Formative credits 2007/08	2.633	**12.476*** **	**10.331*** **
	(1.39)	(4.30)	(5.88)
Drop-out first year	**-0.052** **	**-0.252*** **	**-0.169*** **
	(-2.12)	(-5.01)	(-6.20)
Drop-out second year	-0.019	**-0.119***	**-0.074*** **
	(-1.01)	(-2.08)	(-2.53)
Graduation on-time	0.091	0.131	**0.210*** **
	(1.13)	(1.83)	(3.87)
Graduation	**0.234*** **	**0.377*** **	**0.355*** **
	(4.20)	(4.50)	(6.56)

Panel B. (Among Italians) near-home vs from other regions students

	near_home students (1)	other_region students (2)	Average effect (baseline results) (3)
Formative credits 2007/08	3.535	**7.658*** **	**10.331*** **
	(1.16)	(3.03)	(5.88)
Drop-out first year	-0.040	**-0.122*** **	**-0.169*** **
	(-1.03)	(-3.39)	(-6.20)
Drop-out second year	-0.065	-0.042	**-0.074*** **
	(-1.44)	(-1.36)	(-2.53)
Graduation on-time	0.095	**0.268*** **	**0.210*** **
	(0.67)	(2.92)	(3.87)
Graduation	0.238	**0.393*** **	**0.355*** **
	(1.92)	(5.72)	(6.56)

Panel C. Engineering vs other courses students

	Engineering students (1)	Design and architecture students (2)	Average effect (baseline results) (3)
Formative credits 2007/08	**14.081*** **	**6.744*** **	**10.331*** **
	(6.11)	(2.79)	(5.88)
Drop-out first year	**-0.227*** **	**-0.109*** **	**-0.169*** **
	(-5.67)	(-3.17)	(-6.20)
Drop-out second year	**-0.125*** **	-0.012	**-0.074*** **
	(-2.92)	(-0.31)	(-2.53)
Graduation on-time	**0.260*** **	0.082	**0.210*** **
	(3.70)	(0.93)	(3.87)
Graduation	**0.364*** **	**0.295*** **	**0.355*** **
	(4.99)	(3.63)	(6.56)

Notes: ***, ** and * indicate $p < 0.01$, $p < 0.05$ $p < 0.10$, respectively.
In columns 1 and 2, estimates refer to subgroups of students, as specified. In column 3, the baseline estimates are those presented in the previous table xxx, which reports the "average" effect of receiving a grant. All the estimates are derived from a Propensity Score Matching. Logit functional form was used to derive propensity scores. The sample of students was restricted to common support that, however, includes all treated and untreated students.

Table 9. Partial treatment: the effect of receiving the grant ONLY in the first year

Panel A. Treatment: receiving the grant only in the first year; control group: similar students who did not receive the grant in the period considered (2007-2009)

	Partial treatment (1)	Baseline results (2)
Formative credits 2007/08	-	**10.331*** **
	-	(5.88)
Drop-out first year	-	**-0.169*** **
	-	(-6.20)
Drop-out second year	**0.169*** **	**-0.074*** **
	(2.96)	(-2.53)
Graduation on-time	**-0.063***	**0.210*** **
	(-1.68)	(3.87)
Graduation	**-0.098***	**0.355*** **
	(-1.69)	(6.56)

Panel B. Treatment: receiving the grant in all the years (2007/08 and 2008/09; or 2007/08 and 2008/09 and 2009/10); control group: similar students who received the grant only in the first year

	Partial treatment (1)	Baseline results (2)
Formative credits 2007/08	-	**10.331*** **
	-	(5.88)
Drop-out first year	-	**-0.169*** **
	-	(-6.20)
Drop-out second year	**-0.238*** **	**-0.074*** **
	(-5.23)	(-2.53)
Graduation on-time	**0.281*** **	**0.210*** **
	(6.02)	(3.87)
Graduation	**0.527*** **	**0.355*** **
	(11.48)	(6.56)

Notes: ***, ** and * indicate $p < 0.01$, $p < 0.05$ $p < 0.10$, respectively.
In column 2, the baseline estimates are those presented in the previous table xxx, which reports the "average" effect of receiving a grant calculated by considering all students (classified in the level 2 of the fee scale) who did not receive a grant. All the estimates are derived from a Propensity Score Matching. Logit functional form was used to derive propensity scores. A replacement procedure has been used for matching. The sample of students was restricted to common support that, however, includes all treated and untreated students.

Table 10. The impact of receiving a grant: accounting for intrinsic academic motivation, narrower control group

	Restricted control group (1)	Baseline (2)
Formative credits 2007/08	**20.251*** **	**10.331*** **
	(3.50)	(5.88)
Drop-out first year	**-0.350*** **	**-0.169*** **
	(-2.85)	(-6.20)
Drop-out second year	0.000	**-0.074*** **
	(0.000)	(-2.53)
Graduation on-time	0.021	**0.210*** **
	(0.17)	(3.87)
Graduation	0.188	**0.355*** **
	(1.59)	(6.56)

Notes: ***, ** and * indicate $p < 0.01$, $p < 0.05$ $p < 0.10$, respectively.
In column 1, estimates refer to a reduced control group, composed by students who did apply for a grant but did not receive it. In column 2, the baseline estimates are those presented in the previous table xxx, which reports the "average" effect of receiving a grant calculated by considering all students (classified in the level 2 of the fee scale) who did not receive a grant. All the estimates are derived from a Propensity Score Matching. Logit functional form was used to derive propensity scores. A replacement procedure has been used for matching. The sample of students was restricted to common support that, however, includes all treated and untreated students.