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ARE WE WASTING PUBLIC MONEY? NO! THE EFFECTS OF GRANTS ON ITALIAN UNIVERSITY STUDENTS' PERFORMANCES *

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ABSTRACT: In this paper, we estimate the effect of receiving a financial aid for a cohort of students who enrolled at Politecnico di Milano (Italy) in the year 2007/08, through a Propensity Score Matching approach. Using 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, dropout 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 several robustness checks. Exploring the heterogeneity of this effect, we demonstrate that this latter is higher for immigrants, Italians who moved from another region for studying, and students attending an Engineering course. 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.

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

Keywords: Financial aid, propensity score matching.

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1. Introduction

Despite 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 with low socioeconomic backgrounds experience a low probability to enroll to universities, and thus to complete tertiary education (Checchi *et al.*, 2013). Bratti *et al.* (2008), studying the evolution of the 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 low inter-generational mobility affects the Italian educational system as a whole, and engenders 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).

In Italy, the provision of grants to university students with poor socioeconomic background has a twofold aim: i) favor their participation to tertiary education; and ii) reduce their dependence on work, so helping them to pass exams and graduate. Originally, the Italian legislation designed a grant scheme that was partly need-based and partly merit-based. In such scheme, academic requirements were included as conditions to obtain the grant and maintain it during the academic career. However,

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

the program has been changed over time, and merit-based criteria have been softened. First, when the student enrolls as freshman, the only requirement is coming from a disadvantaged family. Second, in the subsequent years the number of formative credits (Cfu) that the student must obtain to maintain the grant is quite low. As an example of the latter proposition, to maintain the grant in the second year the threshold of Cfu at the first year is 25, out of the 60 Cfu that each student can obtain in the first year.

Moreover, past research highlighted that many students, who obtained a grant, actually dropout after few months. 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. However, rigorous evidence on this lack of positive effects 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: (i) reduce liquidity constraints, and so help students to organize their life orienteering the efforts towards studying (i.e. avoiding work activities), and (ii) give 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). Further, it must be evaluated if the financial aid programs are able to improve the

students' commitment to college, and especially their motivation to provide more effort in studying[2].

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 Italian university - *Politecnico di Milano* - through a matching technique that allows us to compare the grant beneficiaries' performances with those of similar students who did not obtain the grant. The empirical analysis does not focus on the real effectiveness of grants in stimulating participation to HE, but on their 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 backgrounds) 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 financial aid 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 result is stable across a wide set of robustness checks. This positive effect is also heterogeneous. In fact, the most part of it is concentrated among immigrants, students whose family resides in another regions ("out-of-region" students), and those attending an Engineering course. The effect of the grant is not "cumulative", i.e. it is not dependent upon the fact that students receive the grant

[2] A recent paper by Carruthers & Özek (2013) illustrates how losing aid (specifically, Georgia HOPE) exerted a negative effect on motivation and led students to work more during college, not only for liquidity constraints.

during their entire academic path. Lastly, when using a more precise control group, composed by students who are likely to share also unobservable factors (i.e., intrinsic academic motivation) with those who received a grant, the impact of financial aid seems even bigger, and particularly effective in the first years of academic career.

The remainder of the paper is organized 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. Section 8 concludes.

2. Literature review

In the US, there is a huge literature about the role of financial aids in stimulating participation to HE and fostering academic performances. 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. At the same time, they 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 investigate the effects of aids not only on enrolment, but also on academic performances. The results suggest that grants which 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 because of their similarity 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 reveals that the aid positively affects academic outputs, and does 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. The author finds that the financial aid has a positive impact on students' performances, but limited to the proficiency levels required for the annual renewal of the benefit. The paper claims that the 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.[3] As our paper considers a grant program which has components of both types, the discussion of our results has been informed of these studies. Moreover, we were also 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).

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

In Europe, the most part of previous studies is still focused on the effects of financial aids on enrolment (e.g., Nielsen *et al.*, 2010; Steiner & Wrohlic, 2012). Conversely, few works look at the effects of aids on academic outputs. Arendt (2013) discusses the impact on students' results of a Danish reform, which changed the available financial aid to Danish university students. The author shows the positive influence of increasing grants' amount on reducing dropout; further, the heterogeneity of such effect is explored between subgroups of students. Belot *et al.* (2007) explored the impact of a reform in the 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 affects students' results.[4] Glocker (2011) used a duration model to analyze 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. Leuven *et al.* (2010) reported the results from a randomized experiment conducted in a department of Economics at a Dutch university, showing that financial incentives (not aid) helped high-ability students to obtain higher academic results, while impacting negatively on less-able students.

In Italy, the literature on this topic is quite sparse. Mealli & Rampichini (2012) studied the effects of grants on the students enrolled at the University of Florence and found that these have a significant impact in reducing dropout. These results are in

[4] It is important to note 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.

line with those reported by Aristelli *et al.* (2001) on the same university. 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. Overall, the magnitude of the effects seems quite modest. Graziosi (2012) analyzed a particular case, that of the University of Trieste, 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, dropout in the first and second year, graduation on time, and graduation within four years (one year later than the legal duration of the courses). Second, we explicitly focus on various dimensions of effects' heterogeneity, related to student type (immigrants vs Italians, students whose family lives in the same city in which they are attending university vs those who come from another region) and course attended (Engineering vs Architecture and Design). Third, we explore whether unobservable factors affect the results, i.e., we analyze if students who obtained a grant perform better than similar ones who: i) did not receive a grant; and ii) share not only observable characteristics, but also (intrinsic and unobservable) motivation.

3. Background: student support in Italy

In Italy, the responsibility for student support is in charge of the national government.[5] 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 to take into account when evaluating the eligibility of students in their first year. While, the latter is necessary to maintain eligibility in the second and third year of the bachelor. The same criteria are used when 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, performance in secondary schooling is not a requirement for obtaining the grant in the first year of tertiary education. Second, the performance requirement in the second and third year is quite low: 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 the expected performance).[6] 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

[5] 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 conducted in this paper concerns the period 2007/08-2009/10.

[6] 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".

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, supported students 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 grants or loans is much higher: 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 in Italy is so low. Among them, 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 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 are attending university, and who commute daily) and “far-from-home” students (those whose family lives far from the university’s city). The latter students are considered likely 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 only intended to help covering living costs (apartment's renting, meals, educational materials, etc.). For this reason, the amount of the grant 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' living 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 (see Figure 1).

[Figure 1] around here

The university, which has been selected for our study, is a big public institution located in Milan, in the Northern Italy, named *Politecnico di Milano*. It enrolls 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" 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 the academic year 2010/11). The figure 2 illustrates the reason behind the

public discourse about the lack of effectiveness of student aid. At *Politecnico di Milano*, 453 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 maintain 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 received a (publicly funded) grant, but did not succeed. However, such interpretation could be misleading. In fact, observing simple statistics about grants' confirmation rates does not tell anything about the "causal" effect of the grant. In other words, we would instead have to answer 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/he 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 di Milano 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, a technical school, a vocational school or a foreign school type, alternatively (the names of the variables are: *Secondary_schooltype_Lyceum*, *Secondary_schooltype_Technical*, *Secondary_schooltype_Vocational*, *Secondary_schooltype_Foreign*.

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 also 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),[7] (iv) graduation in the legal duration of the course (1=yes, 0=no),[8] and (v) graduation within four years (1=yes, 0=no).

[7] The dropout status is not defined in an administrative sense, as students are not obliged to communicate their decision to dropout to university's administrative offices. Instead, a student is considered to be dropped-out if she/he did not obtain formative credits in a given year. The number of students who did not obtain formative credits in the year t and do so in the year t+1 is negligible (in our sample, around 1.5%).

[8] The phenomenon of students remaining enrolled for more than the legal duration of study is one of the major ones for the Italian HE system, even though data from AlmaLaurea Consortium show that the proportion of students who obtain graduation within the legal duration increased from 10% in 2001 to more than 40% in 2012 (www.almalaurea.it; Report on graduates 2012).

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 students' academic performances, we should rely upon an adequate methodological approach. We only had access to administrative data, and thus we were not able to resort to a randomized assignment of the grant to a sample of students. We then opted for a propensity score matching (PSM) approach, through which we build a control group for the "treated" students (those who received a grant; thus, the treatment is *obtaining a grant*). Besides the grant, there are many factors that are likely to affect students' academic performances. So, we must be sure to match students who are very similar and differ only for their treatment status. The available variables to apply the matching procedure are described in detail in the previous section. One of the main factors affecting achievement is the student's socioeconomic status (SES).[9] Unfortunately, the university does not collect direct information about the students' SES.

However, we took advantage of a specific characteristic of the system to collect students' fees at *Politecnico di Milano* to obtain an indirect proxy of students' SES. The fee that each student should pay is calculated on the basis of her/his 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 their family's income. To give an idea, in the academic year 2009/10 students classified in the level 2 paid around € 800/year, while those in the

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

level 10 paid more than € 3,500/year. The fee is composed of 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 first component of the fee, so all the students must declare their income to be assigned to a specific fee level in the scale. Indeed, the request to obtain a grant should be formulated after the payment of the fee's first part. When the focal student receives a grant in the subsequent weeks, then the fee she/he paid is reimbursed.

Such mechanism is important for our identification strategy. In fact, we see that the most part (92%) 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/he did not request it because of lack of information, or administrative burdens that prevented her/him access to the procedure for obtaining the grant. Moreover, there are students who are able to cover their living expenses without 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.[10] 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.

[10] Of course, there are 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 they do not invalidate our identification strategy.

Table 1 provides the numbers about the students we analyzed. 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".

[Table 1] around here

However, these abovementioned groups of "treated" and "untreated" students must be reduced because of missing values on some important variables. More specifically, there was missing information on the variable "Secondary_School_Type", which is a strong predictor of students' academic performance. When removing the students for whom this variable is missing, the number of observations reduces by about 15% for students who obtained a grant and 25% for non-beneficiaries (see Table 2, panel A). Despite such differences in the proportion of missing data between the two groups of students, through a battery of t-tests we show that there is not a non-random distribution of missing information, with reference to both students' characteristics and performances (panel B). The only exceptions are related to: i) the type of secondary school, as expected – as it was the variable for which we have missing values; and ii) near-home and immigrant students, as it appears that our final sample contains slightly more immigrants and less near-home students. However, the sample is fully representative of the population when looking at outputs, so we can conclude that we did not exclude particular groups of students who might bias the results. Overall, chi^2 tests about the joint representativeness of the different variables reveal that our sample is representative of the corresponding population of students.

[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 74%). Second, 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 students 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 students (31% vs 12%). 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 secondary school: this explains why among 40% of immigrant students who obtained a grant, only 31% have a foreign secondary schooling degree.

[Table 3] around here

A glance to the two output indicators 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 the untreated students (42.4/60 vs 34.3/60), and (ii) the dropout propensity is lower for students who obtained a grant (8% vs 21%). Figure 3 plots the

entire distribution of the number of formative credits acquired by the sampled students in the academic year 2007/08. 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. It is worth noting that such evidence must be interpreted as a correlation, and not as causal relationship, as we did not control for the composition of the two groups of students, which is pretty different as already discussed (we illustrate the methodology we used to this purpose in the next section).

[Figure 3] around here

[Figure 4] around here

In Table 4, we take a closer look at the cohort of students, who are analyzed in this work. In the first year there are 1,223 students (see above): 354 treated students and 869 who represent the control group. In the second year, only 1,011 of them (82.7%) are still enrolled, and the dropout rate of 17.3% is in line with the national average. Among the "survived" students, 224 received the grant in both years, 622 students did not obtain the grant neither in the first year nor in the second year, 101 students obtained the grant in the first year but not in the second year, and 64 students obtained the grant in the second year but not in the first year. An important remark is due here. It is certainly possible that other two categories of students obtained a grant in the academic year 2008/09 but are not included in the empirical analysis: (i) those who were not classified in the fee scale 2 in the academic year 2007/08, and (ii) those who moved to Politecnico di Milano after their first year in another HE institute. As we use a cohort-based approach, we deliberately exclude these two groups of students.

When considering the third year (2009/10), only 845 students of the original cohort are still enrolled at Politecnico di Milano ("survival rate": 69.1%): 166 students received the grant for three years consecutively, while 470 students never received the grant.

[Table 4] around here

6. Methodology

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

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

where y_i is the output for the i^{th} 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 (*Male*; *Born in 1989|1990*; *Near_home_student*; *Other_region_student*; *Immigrant*; *Course_Design*; *Course_Architecture*; *Course_Engineering*; *Secondary_schooltype_Lyceum*; *Secondary_schooltype_Technical*; *Secondary_schooltype_Vocational*; *Secondary_schooltype_Foreign*). The treatment ($GRANT_i$) is alternatively defined as:

- the receipt of a grant in the first academic year (2007/08), when y_i is the number of formative credits acquired in the academic year 2007/08 or the dropout rate at the first year;
- the receipt of a grant in both the first and the second year (2007/08 and 2008/09) when y_i is the dropout rate at the second year;

- the receipt of 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).

Four out of the five output variables (all but the number of formative credits obtained after the first year) are dichotomous. So, we estimated a logit regression instead of a traditional OLS.[11] 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 did not receive a grant but are similar to treated students according to a set of *a priori* characteristics). Having defined such states of nature, we apply propensity score matching (PSM) methods to match each treated student with a similar untreated one.[12] In fact, the receipt of a grant can hardly be considered as the result of a random process. First, even though the central Government sets 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,

[11] 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 logit estimation and are available upon request from the authors.

[12] 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.

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 this latter 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 our procedure to the order of students in the dataset. We performed a one-to-one matching without replacement 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 the treated ones; and (ii) an improvement in the precision of the estimates.

7. Results

Baseline results

The baseline results are reported in Table 5. They can be interpreted as the Average Treatment effect on the 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 columns 1 and 3, the coefficient of $GRANT_i$ is reported when estimating through OLS or PSM (when the first stage is run as a logistic regression), respectively. In column 2, we report the marginal effect of $GRANT_i$ calculated

through the Delta method when estimating through logistic regression. The rows of Table 5 show the impact of the treatment on the five academic output measures: (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, and (v) graduation after four years. All the estimates point to a positive effect of receiving a grant, albeit the more credible PSM approach estimates a slightly lower magnitude of the coefficients.

Before looking at the results in detail, we performed a balancing test on the variables included in the PSM (Table 6). 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. 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 7).

[Table 5] around here

[Table 6] around here

[Table 7] around here

Commenting on the PSM estimates, the receipt of a grant allows a student acquiring 10.3 formative credits more (out of 60), where the average of the overall cohort of

students is around 36/60. Moreover, the grant reduces the probability to dropout at the first year of around 17 percentage points (when compared with the mean). Receiving a grant for the first two years consecutively (2007/08 and 2008/09) reduces the probability to dropout at the second year of 19.6%. As the average dropout rate in the overall cohort of students is 22% in the first year, and 10% in the second year, the computed effects (respectively, -3.75% and -2%) must be judged as high. In the last two rows of Table 5, we consider as a treatment the receipt of the grant for three years consecutively (from 2007/08 to 2009/10). The effect is an increase in the probability to graduate on time of 19.3% (with respect to the mean), and in the probability to graduate by the end of the fourth year (2010/11) of 25.9%. In the overall cohort of students, the figures about on-time graduation rate and graduation rate within the fourth year are 25% and 53%, respectively, so the estimated effects are +4.8% and +13.7%.

Robustness checks

As robustness checks, first we used a different version of our matching procedure. More specifically, we allowed replacements in the control group, i.e. each treated student is compared with the most similar untreated one, even if this latter is matched more than once. Second, we estimated the first-stage regression (to calculate propensity scores) through a probit regression instead of a logit one.

Table 8 reports the outcomes of the robustness checks described above. The third column reports the baseline PSM estimates shown in Table 5. The results obtained using a probit regression to derive propensity scores are virtually identical to the PSM results shown in Table 5. Instead, the estimated coefficients when we allow

replacements in the control group are higher than those reported in our baseline estimations, as regards three out of five output measures. In fact, the effect of the grant is (i) an increase of 15.48 formative credits in the first year (compared to 10.3), (ii) a reduction of the probability of first-year dropout of about 21% (compared to 17%), (iii) an increase of the graduation rate within the fourth year of 30% (compared to 26%). As regards the other two output measures, the estimated coefficients when we allow replacements in the control group are lower than those reported in our baseline estimations. The average effect of the receipt of a grant is (i) a reduction of the second-year dropout rate of about 15% (compared to 19.6%), and (ii) a negligible impact on the on-time graduation rate. However, all the estimated coefficients are more imprecise than those obtained through our baseline procedure (as the lower t-statistics highlight).

[Table 8] around here

Heterogeneity

In the previous analyses, we estimated the "average" effect of the financial aid on students' academic performance, i.e. the expected benefit that an average student would obtain with a grant. However, such average 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: "(…) more research is likely to focus on (…) to what extent program effects vary across different type of students" (p. 32). More specifically, we explore whether the effect of receiving a grant is different for (i) Italian vs immigrant students, (ii) near-home students vs those from different regions, and (iii) students attending an

Engineering course vs those enrolled at the other two courses (Design or Architecture). There are a number of reasons explaining a heterogeneous effect of the grant. First, immigrants tend to enroll at university less frequently and dropout more frequently than Italian students (Cingano & Cipollone, 2007). So, the receipt of a grant is likely to have a higher impact on immigrants. Second, surveys conducted among Italian university students showed that the most important expenditures are related to residential services (Catalano & Figà Talamanca, 2002). To this extent, relatively poor students who move to another city/region to attend their courses would need more financial aid to cover their expenses. These students when not receiving the grant often need to work and this might negatively affect their academic performance. So, the receipt of a grant is likely to have a higher impact on Italian students from other regions than on "near-home" ones. Lastly, data about Italian students' grades show that, on average, Engineering students obtain lower academic performances when compared with other students attending different courses.[13] This is probably due to the fact that Engineering courses are more difficult than others. If it is the case, the impact of receiving a grant should be more beneficial for Engineering students. In fact, Engineering students must lavish higher efforts to acquire formative credits and graduate than students attending other courses. As a consequence, Engineering students would have more incentives to maintain the financial aid to avoid going work.

We performed a PSM analysis for each subgroup separately: i) Italians vs immigrants, ii) near-home vs from-other-regions students, and iii) Engineering students vs

[13] We analyzed 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.

students attending other courses. The results are reported in Table 9 (panel A, B and C respectively). In each panel, the third column reports the baseline PSM estimates shown in Table 5.

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

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 increases the number of formative credits acquired in the first year of about 12.5 points for immigrants, while the (not statistically significant) difference for Italian students is 2.6 points. Also the reduction of dropout rate at first year is much higher for immigrants (-25%) than for Italians (-5.2%): this pattern persists in the second year. Lastly, the impact on graduation within four years is similar for immigrants (+26%) and Italians (+27%). As regards the on-time graduation, even though the magnitude if the impact is about 15% for both types of students, only the impact on immigrants is statistically significant (at 5% confidence level).

Within the group of Italian students, the impact of receiving a grant might be 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 of the higher living costs that the latter group should sustain (e.g., for the accommodation). Recalling that we are comparing individuals with or without a grant within the group of relatively poor students (level 2 of the fee scale), it is likely that those who moved to another city are more helped by the financial aid than those who (can) live with their parents. Panel B shows that the grant has a lower impact on any dimension of academic performance for near-home

students than for students from other regions. The impact on three output variables (formative credits acquired in the first year, dropout rate at first year and on-time graduation) out of five is negligible. This finding raises questions about the effectiveness of grants for near-home students. Conversely, the grant helps students from other regions in improving their academic results, albeit the magnitude of these effects is sometimes lower than that for immigrant students (see Panel A). The effect of grants on graduation (both on time and within four years) of students from other regions is strongly significant and high (+28.6% and +30%, respectively). More interestingly, such effect is even higher than that exerted on immigrant students. In the Panel B1, we report additional estimates about the impact of receiving € 1,000 as a grant. The estimates are based on the coefficients for far-from-home students, as the impact on students from Lombardy is not statistically significant. Assuming the current level of the grant (€ 4,700), the estimated effect of adding € 1,000 is an increase in the number of formative credits at first year of 1,6 (around 4.5% calculated at the sample mean), a reduction of the dropout of 2.6% and 4.1% in the first year and in the second year respectively, and an increase in the probability of graduation of about 6%.

Finally, panel C reveals that receiving a grant is beneficial whatever the course attended (Engineering, Architecture and Design) even though the magnitude of the effect appears higher for Engineering students. This evidence suggests that for these students the receipt of a grant is more helpful and stimulates better performances. In particular, the high effect on the formative credits in the first year (+14/60 vs +7/60 for students attending Architecture or Design) suggests that the channel through which the grant operates is stimulating better results in the first year – which, in turn,

persists by reducing the probability to dropout in the first and second year more than for students attending Architecture or Design. Of particular relevance is the high effect in reducing first-year dropout (-22.7%). Furthermore, the effects persist and are higher than those for students attending Architecture or Design when considering dropout at second year and graduation – the estimated impact on graduation in this case is the highest one we obtained.

Overall, the baseline results point at demonstrating that students who received 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 9] around here

Partial treatment

In this section, we checked whether the (positive) effect of receiving a grant is due to a cumulative treatment (i.e., obtaining the grant for two or three years consecutively) or if such effect stems from obtaining the aid in a single academic year. In this perspective, we define two kinds of "treatment": (i) obtaining the grant in the first year and in the second year, and (ii) obtaining the grant for all the three years under scrutiny. We also define two control groups: (i) students who obtain the grant only in the second year, and (ii) students who obtain the grant only in the second year and in the third year. We do not include in the control groups the students who obtained the grant in the first year only, because losing the grant after the first year is a sign of low academic ability which prevents a meaningful comparison between treated and untreated students (i.e., students who did not confirm the grant from the first to the second year are likely to be systematically and endogenously different from those

who did). At the same time, comparing "fully-treated" students with those who received the grant only for a part of their academic career helps in understanding whether there is a cumulative effect of the grant or not.

The results are illustrated in Table 10, and point at demonstrating that students who got the grant for all three years achieve academic performances which are not statistically different from students who obtain the grant only in one or two years (with the exclusion of the first year). This result suggests that the grant operates more on the incentive side (i.e., the stimulus in performing to obtain it) than on the economic one (i.e., removing the liquidity constraints). Indeed, in the latter case obtaining the grant in a continuative way should be a prerequisite to see the academic effect at work.

[Table 10] around here

Narrower (more precise) control group

The results presented in the previous sections might be affected by some selection on unobservable factors, such as the 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 received a grant and those who did not. For instance, those students who did not apply for a grant (although having the characteristics to ask for it) could be less academically motivated than those who applied. To some extent, we take advantage of an information included in our dataset: we know which students applied 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 procedure, but who probably share the same "motivation" of the 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.[14] This "restricted" control group includes 46 "untreated" students in the first year, 84 in the second year, and 115 in the third year. Because the group of "treated" students is bigger in all the three years (354, 224 and 166, respectively) we were forced to opt for a matching procedure with replacement, i.e. 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: it should be kept in mind when reading the coefficients. Table 11 illustrates the results. As above, the second column reports the baseline results ("average" effect of the grant, ATT) shown in Table 5 for a straightforward comparison. The findings suggest that receiving a grant has a strong and very high effect in the first year: the grant helps increasing the number of formative credits of about 20 points (ATT is 10.3) and reducing the dropout 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 financial aid persists in second year (as it reduces the possibility of dropping out after the second year), and then disappears. A potential explanation is that those students who applied for the grant in the first year are those who really needed it, and the receipt of the grant is an essential condition to continue studying.

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

Then, a large part of those students who did not obtain it dropout. This is why the estimated effect is so high in the first year.

[Table 11] around here

At the end of this subsection, we must also express some caution 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 of the difference in students' abilities (between beneficiaries and students who did not receive the grant). We do not have adequate data to further explore this issue.

8. Concluding remarks

This paper assesses the effect of receiving a grant on academic performances of 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. Indeed, the students who obtain the grant show better results than those who do not 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. Available data do not allow to understand the mechanisms behind the effectiveness of such financial aid, and

especially if it helps more in removing liquidity constraints or stimulating performance. This is an obvious area of extension for future research.

The evidence presented in this work casts serious doubts on the decision of the central government about the prospective public funds devoted to this program. In fact, the central government announced a reduction of State funding for the next years: while around € 150 million and € 100 million 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 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 central 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 year and in the 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 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.

In a policymaking perspective, the most important finding concerns 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 the 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 as the best/the second best university in Italy (see the national rankings[15]) and the students who enroll to it are likely to be more motivated and skilled than the average Italian student. Moreover, as fees are higher at *Politecnico di Milano* than at other universities, and living costs in Milan are high as well, an "income effect" might play a role (i.e., the liquidity constraints are less tight for students who chose *Politecnico di Milano*). All these caveats impose considering the results specific to the reality of *Politecnico di Milano*, 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 receiving a grant makes the difference and can help disadvantaged students closing the gap. In the light of public policies aimed at reducing intergenerational persistence, it would be useful to extend the evaluation of grants' effects to other universities in Italy.

[15] 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 at the second place in the group "Politecnici".

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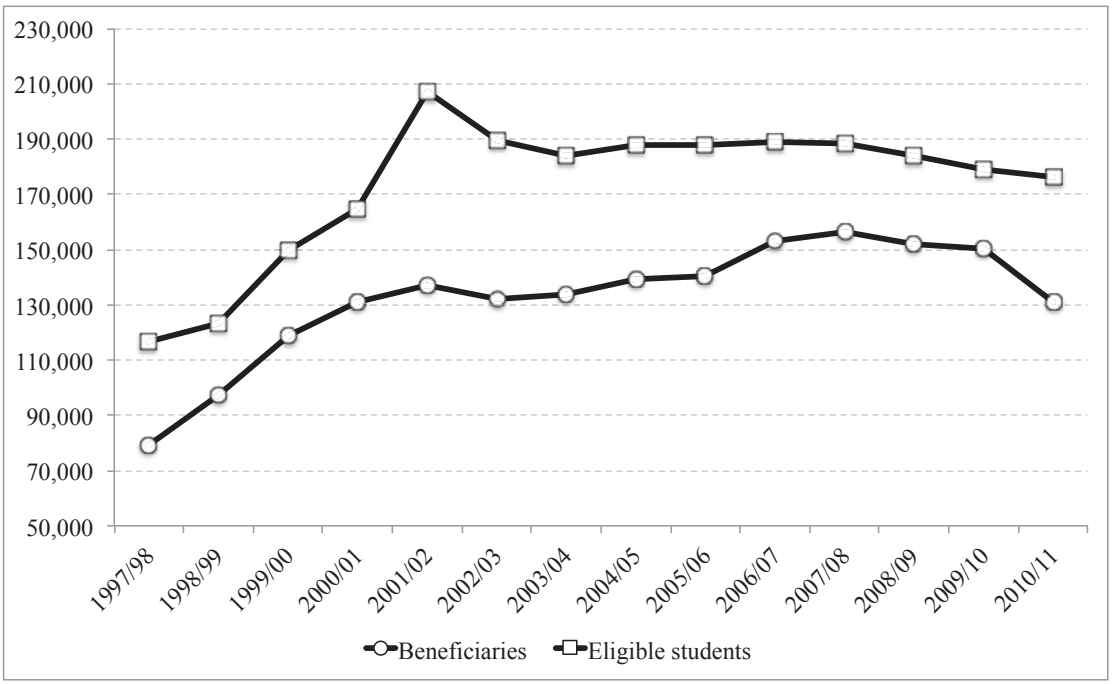
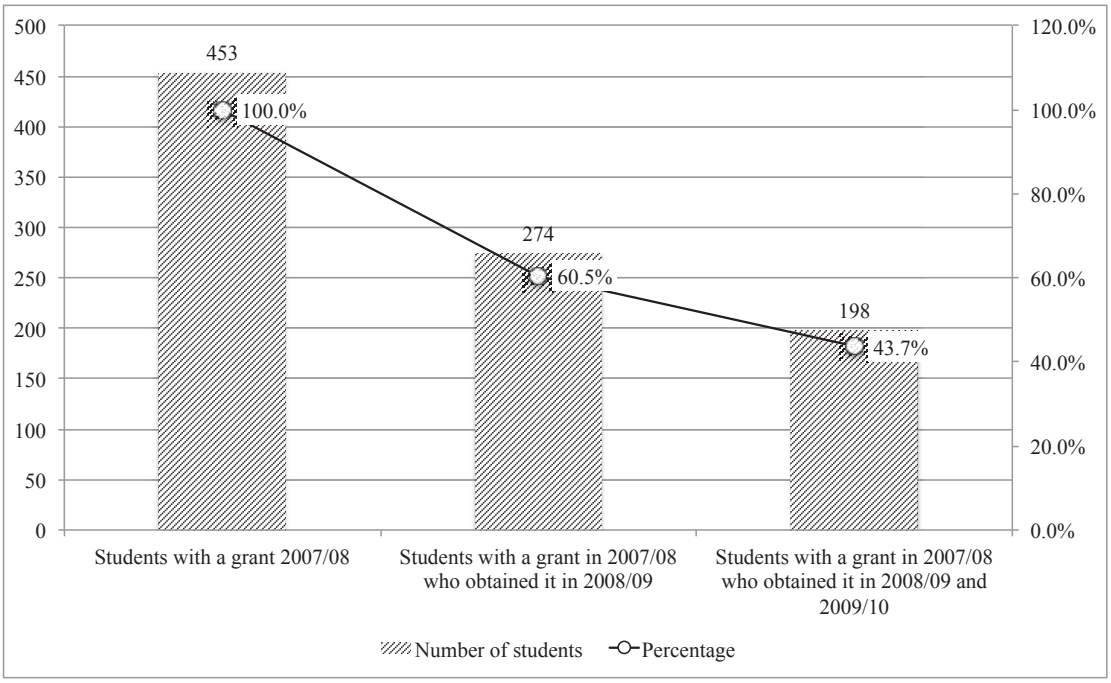
Figure 1. The number of eligible students and beneficiaries in the period 1997/98 – 2010/11



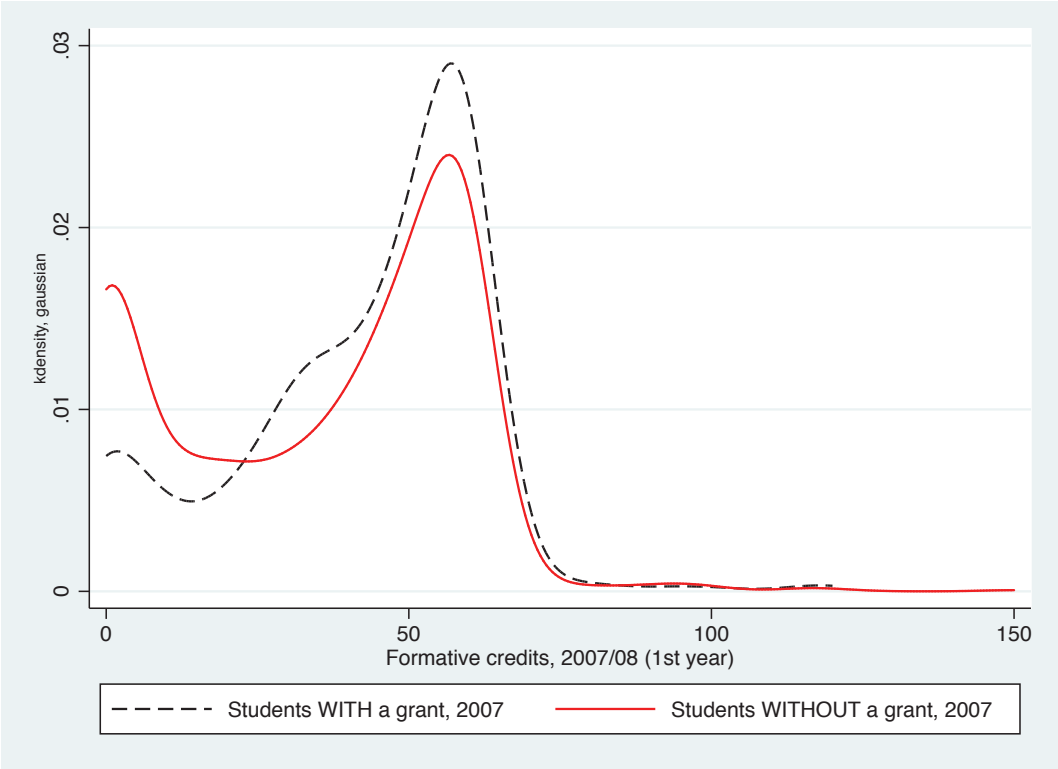
Source: Ministry of Education (www.miur.it).

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



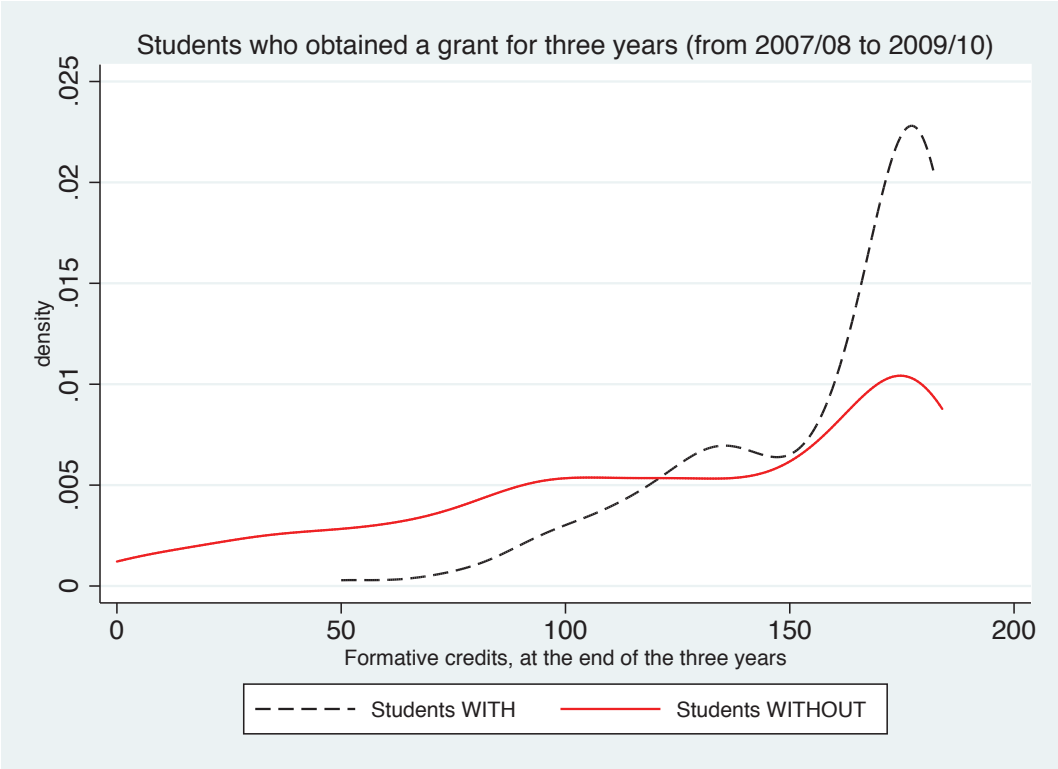
Source: authors' elaborations on administrative data provided by Politecnico di Milano.

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. 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. 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 following tables report the information about the composition of the sample actually used for the empirical analysis.

Table 2. Exclusion of 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%

Notes. "Treated" students are those labeled as "WITH grant". The treatment is defined as having received the grant for all years: (two years consecutively in 2008/09, or three years consecutively in 2009/10). The numbers are slightly different from those in table 2, as here we restrict the sample to students who are classified in the fee scale 2.

Panel B. T-tests about the representativeness of the sample

Students WITH a grant ("treated")	Average for all the students in the level 2 (n=416)	Average for the sampled students in the level 2 (n=354)	p-value
Academic outputs			
Formative credits 2007/08	42.233	42.429	0.8935
Dropout first year	8.6%	8.1%	0.8183
Dropout second year	14.2%	14.1%	0.9815
Graduation on-time	26.7%	26.6%	0.9678
Graduation	54.6%	55.6%	0.7638
Students' characteristics			
Male	59.9%	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%	24.6%	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	13.0%	15.3%	0.3685
Secondary_schooltype_Foreign	26.7%	31.4%	0.1557

Students WITHOUT a grant ("untreated")	Average for all the students in the level 2 (n=1190)	Average for the sampled students in the level 2 (n=869)	p-value
Academic outputs			
Formative credits 2007/08	35.316	34.320	0.3623
Dropout first year	19.3%	21.1%	0.3354
Dropout second year	13.8%	13.3%	0.7769
Graduation on-time	19.7%	19.6%	0.9169
Graduation	46.9%	45.0%	0.3939
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	29.2%	27.4%	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	21.2%	29.0%	0.0001***
Secondary_schooltype_Foreign	8.5%	11.6%	0.0208**

Notes. The sample 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 distributions of the variables related to all the students in the level 2 of the fee scale and to the sampled students in the level 2 of the fee scale are identical or not.

Table 3. Year 2007/08: descriptive statistics

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

Variable	Mean
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
Dropout_year1	21.1%

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

Variable	Mean
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
Dropout_year1	8.2%

Table 4. The cohort of students enrolled in the academic year 2007/08

		N	"Survival rate" (% of the initial cohort)
	First year (2007/08)		
(a)	Baseline cohort of students	1,223	initial cohort
	Students who obtained the grant in the first year	354	initial cohort
	Students who did not obtain the grant in the first year	869	initial cohort
	Second year (2008/09)		
(b)	Students (a) still enrolled	1,011	82.7%
	Students who obtained the grant both in the first and the second year	224	63.3%
	Students who obtained the grant in the first year but not in the second year	101	
	Students who obtained the grant in the second year but not in the first year	64	
	Students who obtained the grant neither in the first year nor in the second year	622	71.6%
	Third year (2009/10)		
(c)	Students (a) still enrolled	845	69.1%
	Students who obtained the grant in all three years	166	46.9%
	Students who obtained the grant only in the first year	45	
	Students who obtained the grant only in the first year and in the second year	47	
	Students who obtained the grant only in the second year	26	
	Students who obtained the grant only in the second year and in the third year	37	
	Students who obtained the grant only in the third year	37	
	Students who obtained the grant only in the first year and in the third year	17	
	Students who never obtained the grant	470	54.1%

Notes. The initial cohort comprises all 2007/08 freshmen classified in the level 2 of the fee scale, for whom the information about secondary school type is available.

Table 5. Baseline results: the impact of receiving a grant

	OLS	Logit	PSM
Formative credits 2007/08	**11.784*** **		**10.331*** **
	(8.12)		(5.88)
Dropout first year		**-0.199*** **	**-0.169*** **
		(-7.18)	(-6.20)
Dropout second year		**-0.254*** **	**-0.196*** **
		(-6.06)	(-6.09)
Graduation on-time		**0.167*** **	**0.193*** **
		(4.37)	(3.82)
Graduation		**0.348*** **	**0.259*** **
		(7.20)	(5.43)

Notes. ***, ** and * indicate $p < 0.01$, $p < 0.05$ $p < 0.10$, respectively. In columns 1 and 2, estimates are derived from OLS or logit regressions. In column 3, estimates are derived from a PSM procedure. Logit functional form was used to derive propensity scores. The sample of students was restricted to common support. T-statistics in round brackets. In column 2, we report marginal effects calculated through the Delta method.

Table 6. Balancing properties: observable factors of treated and untreated students, before and after the matching

Panel A. First year
(students who received a grant in the academic year 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 who received a grant in the academic years 2007/08 and 2008/09 vs control group)

Students' characteristics		Treated	Control	t-test
Male	unmatched	0.563	0.619	-1.52
	matched	*0.563*	*0.527*	*0.76*
Born in 1989|1990	unmatched	0.629	0.773	-4.35*
	matched	*0.629*	*0.656*	*-0.59*
Near_home_student	unmatched	0.192	0.585	-10.96*
	matched	*0.192*	*0.192*	*0.00*
Other_region_student	unmatched	0.415	0.253	4.78*
	matched	*0.415*	*0.415*	*0.00*
Immigrant	unmatched	0.393	0.163	7.62*
	matched	*0.393*	*0.393*	*0.00*
Course_Design	unmatched	0.219	0.177	1.43
	matched	*0.219*	*0.254*	*-0.89*
Course_Architecture	unmatched	0.223	0.311	-2.56*
	matched	*0.223*	*0.228*	*-0.11*
Course_Engineering	unmatched	0.558	0.512	1.21
	matched	*0.558*	*0.518*	*0.85*
Secondary_schooltype_ Lyceum	unmatched	0.563	0.625	-1.70*
	matched	*0.563*	*0.571*	*0.85*
Secondary_schooltype_ Vocational	unmatched	0.004	0.011	-0.93
	matched	*0.004*	*0.000*	*1.00*
Secondary_schooltype_ Technical	unmatched	0.138	0.255	-3.70*
	matched	*0.138*	*0.134*	*0.14*
Secondary_schooltype_ Foreign	unmatched	0.295	0.108	7.08*
	matched	*0.295*	*0.295*	*0.00*

Panel C. Third year

(students who received the grant in all academic years vs control group)

Students' characteristics		Treated	Control	t-test
Male	unmatched	0.578	0.600	-0.51
	matched	*0.578*	*0.506*	*1.32*
Born in 1989|1990	unmatched	0.639	0.800	-4.46*
	matched	*0.639*	*0.705*	*-1.28*
Near_home_student	unmatched	0.205	0.593	-9.40*
	matched	*0.205*	*0.205*	*0.00*
Other_region_student	unmatched	0.422	0.264	4.02*
	matched	*0.422*	*0.440*	*-0.33*
Immigrant	unmatched	0.373	0.143	6.97*
	matched	*0.373*	*0.355*	*0.34*
Course_Design	unmatched	0.223	0.178	1.34
	matched	*0.223*	*0.271*	*-1.02*
Course_Architecture	unmatched	0.187	0.303	-3.00*
	matched	*0.187*	*0.193*	*-0.14*
Course_Engineering	unmatched	0.590	0.519	1.64*
	matched	*0.590*	*0.536*	*0.99*
Secondary_schooltype_ Lyceum	unmatched	0.572	0.658	-2.07*
	matched	*0.572*	*0.572*	*0.00*
Secondary_schooltype_ Vocational	unmatched	dropped	dropped	-
	matched	*dropped*	*dropped*	-
Secondary_schooltype_ Technical	unmatched	0.127	0.254	-3.52*
	matched	*0.127*	*0.120*	*0.17*
Secondary_schooltype_ Foreign	unmatched	0.301	0.088	7.54*
	matched	*0.301*	*0.307*	*-0.12*

Notes. * indicates that the difference between treated and control group is statistically significant at least at 10% significance level. Values of the variables after matching are in italic. The last column reports t-tests for equality of means before and after matching for all covariates used in the matching procedure.

Table 7. 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	0.127	0.003	0.133	0.012
LR chi^2	179.43	5.78	135.44	2.03	111.120	5.630
p>chi^2	0.000	0.761	0.000	0.980	0.000	0.689

Table 8. Robustness checks on the impact of receiving a grant: alternative versions of PSM

	PSM "with replacement"	PSM with probit in the first-stage	Baseline results
Formative credits 2007/08	**15.489*** **	**10.213*** **	**10.331*** **
	(2.77)	(5.81)	(5.88)
Dropout first year	**-0.215** **	**-0.169*** **	**-0.169*** **
	(-2.36)	(-6.20)	(-6.20)
Dropout second year	**-0.147***	**-0.192*** **	**-0.196*** **
	(-1.71)	(-5.98)	(-6.09)
Graduation on-time	0.127	**0.205*** **	**0.193*** **
	(1.23)	(4.09)	(3.82)
Graduation	**0.301** **	**0.277*** **	**0.259*** **
	(2.41)	(5.79)	(5.43)

Notes. ***, ** and * indicate $p < 0.01$, $p < 0.05$ $p < 0.10$, respectively. In column 1, estimates are derived from a PSM procedure, where we allowed replacements in the control group. Logit functional form was used to derive propensity scores. In column 2, estimates are derived from a PSM procedure, where a probit functional form was used to derive propensity scores. In both cases, the sample of students was restricted to common support. In column 3, baseline PSM estimates shown in Table 5. T-statistics in round brackets.

Table 9. Heterogeneity of the impact of receiving a grant

Panel A. Italian students vs immigrants

	Italian students	Immigrants	Average effect (baseline results)
Formative credits 2007/08	2.633	**12.476*** **	**10.331*** **
	(1.39)	(4.30)	(5.88)
Dropout first year	**-0.052** **	**-0.252*** **	**-0.169*** **
	(-2.12)	(-5.01)	(-6.20)
Dropout second year	**-0.103*** **	**-0.250*** **	**-0.196*** **
	(-3.68)	(-4.05)	(-6.09)
Graduation on-time	0.147	**0.146** **	**0.193*** **
	(1.31)	(2.03)	(3.82)
Graduation	**0.270*** **	**0.258*** **	**0.259*** **
	(5.46)	(2.95)	(5.43)

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

	near_home students	students from other_region	Average effect (baseline results)
Formative credits 2007/08	3.535	**7.658*** **	**10.331*** **
	(1.16)	(3.03)	(5.88)
Dropout first year	-0.042	**-0.122*** **	**-0.169*** **
	(-1.03)	(-3.39)	(-6.20)
Dropout second year	**-0.070** *	**-0.194*** **	**-0.196*** **
	(-1.77)	(-4.46)	(-6.09)
Graduation on-time	0.147	**0.286*** **	**0.193*** **
	(1.31)	(3.54)	(3.82)
Graduation	**0.294*** **	**0.300*** **	**0.259*** **
	(3.00)	(5.20)	(5.43)

Panel B.1. The effect of receiving € 1,000 as a grant

Outputs of "far-from-home" students	Coefficient	Effect of € 1,000
Formative credits 2007/08	7.658	1.6
Dropout first year	-0.122	-2.60%
Dropout second year	-0.194	-4.13%
Graduation on-time	0.286	6.09%
Graduation	0.300	6.38%

Panel C. Engineering students vs students attending other courses

	Engineering students	Design and architecture students	Average effect (baseline results)
Formative credits 2007/08	**14.081*** **	**6.744*** **	**10.331*** **
	(6.11)	(2.79)	(5.88)
Dropout first year	**-0.227*** **	**-0.109*** **	**-0.169*** **
	(-5.67)	(-3.17)	(-6.20)
Dropout second year	**-0.208*** **	**-0.121*** **	**-0.196*** **
	(-4.88)	(-2.65)	(-6.09)
Graduation on-time	**0.224*** **	0.132	**0.193*** **
	(3.62)	(1.58)	(3.82)
Graduation	**0.316*** **	**0.176** **	**0.259*** **
	(5.01)	(2.46)	(5.43)

Notes. ***, ** and * indicate $p < 0.01$, $p < 0.05$ $p < 0.10$, respectively. In columns 1 and 2, estimates refer to subgroups of students (see Section 7). In column 3, baseline PSM estimates shown in Table 5. All the estimates are derived from a PSM procedure. Logit functional form was used to derive propensity scores. The sample of students was restricted to common support.

Table 10. Partial treatment: the effect of receiving the grant for all three years vs receiving it only in one or two years

	Partial treatment	Baseline results
Partial treatment (1): Control group - students who obtained the grant only in the second year		
Dropout second year	0.027	**-0.196*** **
	(0.45)	(-6.09)
Partial treatment (2): Control group - students who obtained the grant only in the second and/or third year		
Graduation on-time	-0.006	**0.193*** **
	(-0.04)	(3.82)
Graduation	-0.048	**0.259*** **
	(-0.41)	(5.43)

Notes. ***, ** and * indicate $p < 0.01$, $p < 0.05$ $p < 0.10$, respectively. In column 2, baseline PSM estimates shown in Table 5. All the estimates are derived from a PSM procedure. Logit functional form was used to derive propensity scores. The sample of students was restricted to common support.

Table 11. The impact of receiving a grant: accounting for intrinsic academic motivation

	Restricted control group (1)	Baseline (2)
Formative credits 2007/08	**20.251*** **	**10.331*** **
	(3.50)	(5.88)
Dropout first year	**-0.350*** **	**-0.169*** **
	(-2.85)	(-6.20)
Dropout second year	**-0.138***	**-0.196*** **
	(-1.79)	(-6.09)
Graduation on-time	-0.157	**0.193*** **
	(-1.21)	(3.82)
Graduation	0.102	**0.259*** **
	(0.85)	(5.43)

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 applied for a grant but did not receive it. In column 2, baseline PSM estimates shown in Table 5. All the estimates are derived from a PSM procedure. Logit functional form was used to derive propensity scores. The sample of students was restricted to common support.

2011

2011/1, Oppedisano, V; Turati, G.: "What are the causes of educational inequalities and of their evolution over time in Europe? Evidence from PISA"
2011/2, Dahlberg, M; Edmark, K; Lundqvist, H.: "Ethnic diversity and preferences for redistribution "
2011/3, Canova, L.; Vaglio, A.: "Why do educated mothers matter? A model of parental help"
2011/4, Delgado, F.J.; Lago-Peñas, S.; Mayor, M.: "On the determinants of local tax rates: new evidence from Spain"
2011/5, Piolatto, A.; Schuett, F.: "A model of music piracy with popularity-dependent copying costs"
2011/6, Duch, N.; García-Estévez, J.; Parellada, M.: "Universities and regional economic growth in Spanish regions"
2011/7, Duch, N.; García-Estévez, J.: "Do universities affect firms' location decisions? Evidence from Spain"
2011/8, Dahlberg, M.; Mörk, E.: "Is there an election cycle in public employment? Separating time effects from election year effects"
2011/9, Costas-Pérez, E.; Solé-Ollé, A.; Sorribas-Navarro, P.: "Corruption scandals, press reporting, and accountability. Evidence from Spanish mayors"
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