



Dipartimento di scienze economiche,
aziendali, matematiche e statistiche
“Bruno de Finetti”

Research Paper Series, N. 1/2016

The impact of scholarships on students’ performance: a study on five Italian universities

Eline Sneyers

Top Institute for Evidence-Based Education Research, Maastricht University (the Netherlands), eline.sneyers@maastrichtuniversity.nl;

Tommaso Agasisti

Politecnico di Milano School of Management (Italy), tommaso.agasisti@polimi.it

Kristof De Witte

Leuven Economics of Education Research, Faculty of Business and Economics, KU Leuven (Belgium), Kristof.dewitte@kuleuven.be

Top Institute for Evidence-Based Education Research, Maastricht University (the Netherlands), k.dewitte@maastrichtuniversity.nl

Grazia Graziosi

Department of Economics, Business, Mathematics and Statistics, University of Trieste (Italy), ggraziosi@units.it



UNIVERSITÀ
DEGLI STUDI DI TRIESTE

Research Paper Series

Dipartimento di Scienze Economiche, Aziendali, Matematiche e Statistiche “Bruno de Finetti”

Piazzale Europa 1

34127, Trieste

Tel.: +390405587927

Fax: +390405587033

<http://www.deams.units.it>

EUT Edizioni Università di Trieste

Via E.Weiss, 21 - 34128 Trieste

Tel. +390405586183

<http://eut.units.it>

eut@units.it

ISBN: 978-88-8303-740-5



9 788883 037405 >

The impact of scholarships on students' performance: a study on five Italian universities

Eline Sneyers

Top Institute for Evidence-Based Education Research, Maastricht University (the Netherlands), eline.sneyers@maastrichtuniversity.nl;

Tommaso Agasisti

Politecnico di Milano School of Management (Italy), tommaso.agasisti@polimi.it

Kristof De Witte

Leuven Economics of Education Research, Faculty of Business and Economics, KU Leuven (Belgium), Kristof.dewitte@kuleuven.be

Top Institute for Evidence-Based Education Research, Maastricht University (the Netherlands), k.dewitte@maastrichtuniversity.nl

Grazia Graziosi

Department of Economics, Business, Mathematics and Statistics, University of Trieste (Italy), ggraziosi@units.it

ABSTRACT¹

This paper estimates the effect of receiving a need-based grant on the performance of university students in Italy. We perform both cross-sectional (between-universities) and within-universities propensity score matching analyses in order to evaluate the effect of grants on several students' performance indicators as first year credits, dropout, and study efficiency. The findings suggest that financial aid positively affects students' performances and completion in a substantial and statistically robust way. The positive impact is heterogeneous across universities, while few differences are detected for subgroups of students within them. Reinforcing the financial aid policy can simultaneously help disadvantaged students and foster the overall academic performance of Italian universities.

KEYWORDS: Financial aid; Propensity score matching; Italian Higher Education students.

¹ **Corresponding author:** Tommaso Agasisti, Politecnico di Milano School of Management (Italy), tommaso.agasisti@polimi.it.

1. Introduction

The European Union's Education and Training 2020 strategy aims at achieving 40% of young people successfully complete tertiary education, or equivalent, by 2020. In the last decade, tertiary education attainment levels have grown significantly across much of Europe (see Figure 1). As groups traditionally excluded now participate in tertiary education, students' population is becoming increasingly heterogeneous (OECD, 2014). However, there are persisting inequalities in European higher education systems concerning both the access and the completion of tertiary studies. In particular, students from poor socio-economic backgrounds, as measured by their parents' occupational status, have low chances to access higher education in most European countries (EQUNET, 2010).

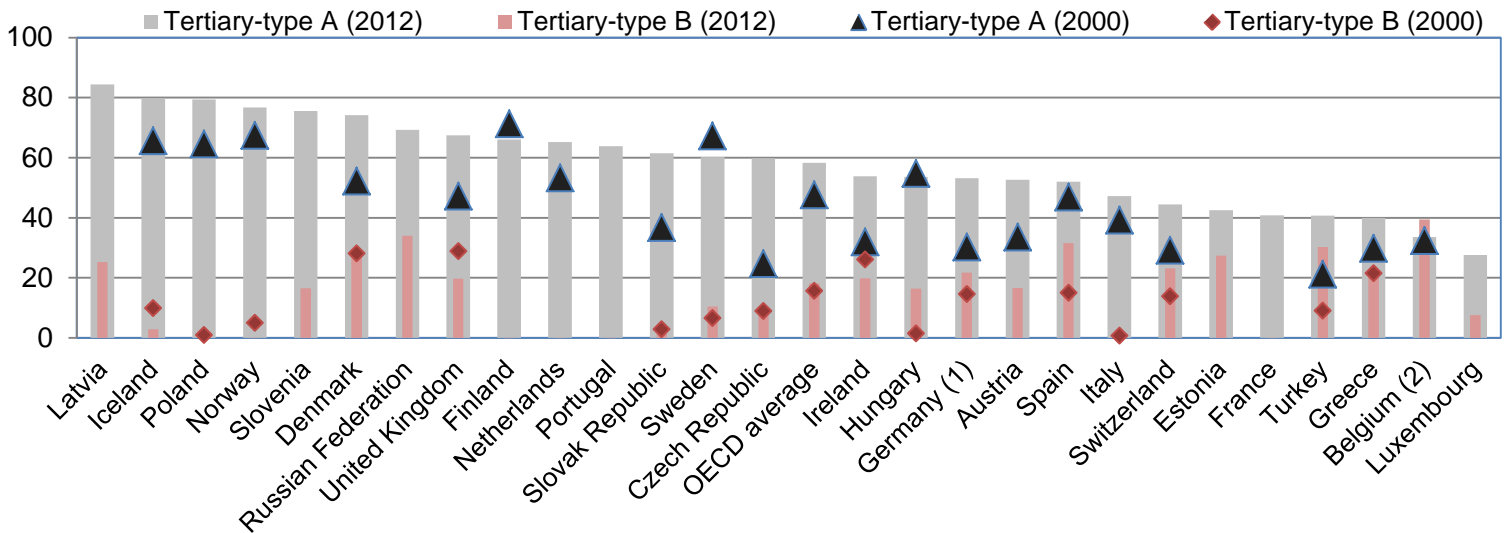


Figure 1: Entry rates into tertiary-type A and B education (2000, 2012). Source: OECD. Table C3.2a. (www.oecd.org/edu/eag.htm).

(1) Break in time series between 2008 and 2009 due to a partial reallocation of vocational programs into ISCED 2 and ISCED 5B.

(2) Year of reference 2001 instead of 2000.

The recent analysis of data from the Survey of Adult Skills (PIAAC – OECD, 2013), presented by Van Damme (2014), stresses the relationship between skills and social inequality, on the one hand, and economic performance on the other. Countries with a higher degree of inclusiveness in their skills distribution do better in terms of economic output (per capita GDP) and social equality (Gini coefficient) than countries with a similar average level of skills but with larger differences in skills proficiency across the population. Moreover, parents' educational background still strongly affects the likelihood of obtaining a tertiary degree: among the age group 25-34 year-old, only 23% of those with low-educated parents attain a tertiary qualification (OECD, 2014).

Governments address the issues of access in tertiary education and equality of opportunity by providing several forms of public support and subsidies to students and their families. Particularly low-income students are able to cover part of the cost of education and related expenses. This support is supplied in many forms, including income-based and merit-based subsidies (i.e., scholarships or grants), loans, tax allowances for students or their

parents or other household transfers. The right balance among these different kinds of subsidies may help to reduce financial disparities among students. Moreover, in a context of austerity with decreasing higher education funds and difficulties in financing the essential resources to ensure high quality educational levels, there is a need to evaluate the impact of need-based supports by examining their effects on students' tertiary education performance.

Italy makes an interesting case to study the effects of similar need-based grants. In the Italian higher education system, the government mainly provides public scholarships to targeted groups, according to both merit and family income of students. The objective of these public funding is to decrease economic barriers for deserving poor students and to reduce socio-economic inequalities, as explicitly stated in the Italian Constitution. Despite the efforts, the social inequalities are noticeable when the rates of completion of tertiary education is concerned (Checchi *et al.*, 2013; Bratti *et al.* 2008).

This paper aims to evaluate the effect of income-based public scholarships for students. We take advantage of a unique, micro data set collected by the researchers with the support of five universities' administrative offices². All universities are located in the North of Italy.

We perform both cross-sectional (between-universities) and within-universities analyses in order to evaluate the effect of grants on several students' performance indicators: (i) the number of formative credits obtained during the first year, (ii) first-year dropout, (iii) graduation in the legal duration of the bachelor course (where the legal duration of bachelor courses is three years), and (iv) graduation within four years. Furthermore, we are also interested in the heterogeneity of impact of the received scholarships for different subpopulations of students: (i) Italian vs. immigrant students, (ii) near-home students vs. students from different regions, and (iii) students from different departments. The aim is to model scholarship effects on students' performance indicators using a causal inference approach. In particular, we apply a Propensity Score Matching (PSM) technique as a method to reduce the bias in the estimation of treatment effects with observational data sets. Thanks to the PSM we construct a well-balanced and comparable control group for the students receiving a need-based grant. We will rigorously show that we avoid selection effects and endogeneity arising from unobserved heterogeneity.

In the perspective of the existent literature (see §2), the paper is innovative for several reasons. First, it provides empirical evidence about the effectiveness of the financial aid in the higher education system. Previous work mostly focused on single universities or on short term effects, e.g., enrollment and dropout by the end of first year, neglecting the long-term effects, such as graduation. This questions its external validity as universities differ significantly in their nature, scope and mission. Second, this paper contains a discussion about heterogeneous effects of financial aid, and analyzes how targeted support to subpopulations of students can become more and more a crucial theme for aid's effectiveness. In a policy perspective, it is useful to explore the potential heterogeneity of the grants' impact on different subpopulations of students since the 'average student', *de facto*, does not exist. Finally, the paper examines the effectiveness of the grant with respect to the degree course. As degree courses among departments differ in terms of selection process of students, program regulations and efforts required in passing the exams, the

² We are grateful to the responsible of the Administrative Offices, to the general directors and Vice-Rectors (not mentioned to preserve confidentiality about the identities of universities involved in the study), who helped us in the collection of data.

impact of financial aid also highlights both the ability and the inherent motivations of students.

Cross-sectional results suggest that the effect of an income-based scholarship is positive and significant for all four students' performance indicators with negligible differences across the five universities. In other words, compared to similar students in the control group, students receiving the grant have more credits acquired in the first year, less first year dropout and more graduation in-time and graduation with one year of delay. With respect to the heterogeneity of grant effect, we observe different significance levels depending on the investigated subpopulations. The latter finding points toward the efficient use of scholarships for particular groups of students, which could be one of the key issues for policy-makers to address public funding efficiently – for instance, by exploring a better targeting of the aid towards the most needy student population. Therefore, such heterogeneity is more evident within universities than across them. It suggests that managing tailored interventions should be the responsibility of each higher education institution.

The paper is organized as follows: section 2 presents a literature review on the effects of university financial aids; section 3 discusses the characteristics on student subsidies in the Italian higher education system. Section 4 provides details about the method that we apply to analyze the data presented in section 5. Results on both between and within universities are reported in section 6; whereas in section 7 robustness tests are carried out. Finally section 8 discusses the results and concludes. We also detail in Appendix the matching quality by means of the balance checking.

2. Literature Review

The effect of university financial aids on students' enrolment and academic career has been widely investigated in the literature. Nevertheless, earlier theoretical and empirical research estimates average effects for a population, failing to consider the heterogeneous effects on sub-populations. A recent review by Dynarski & Scott-Clayton (2013) confirms that university incentives positively affect the enrolment; however, the question remains whether the financial aids are correlated to the student characteristics as well as to academic outcomes, such as persistence, performance, and completion. This policy issue is particularly on the edge for decades in the United States, where also the most recent and methodologically robust empirical studies were developed.

Since the causal effect of financial aids on student performance is not so easy to identify in observational data, several studies focus on programs that randomly assign students to the financial aids. The randomization overcomes endogeneity issues arising from selection bias. For instance, Angrist et al. (2009) investigated the Student Achievement and Retention Project (STAR) implemented in 2005 at one of the larger Canadian universities. Students enrolled in the first year were randomly assigned to one of the following treatments: Student Support Program that provided academic support services; Student Fellowship Program that supplied financial incentives for good grades; and a third intervention that offered both services. Students assigned to the control group were not involved in the STAR Project. The results suggested that support services without fellowships did not help treated students in improving their academic performance with respect to the control group. The combined treatment, instead, increased only the academic level of women and these effects persisted until the end of the second year, despite the incentives were supplied in the first year. This

gender dissimilarity has been broadly observed in the literature. Dynarski (2008) evaluated the impact of tuition subsidy programs on college completions, finding that effects are stronger among women, while Goldin et al. (2006) reported that American women had substantially higher college attendance and completion rates than men. Bettinger (2015) assessed the Ohio College Opportunity Grant initiative, and, through a difference-in-differences identification strategy, highlights its positive effect on first year performances, such as a reduction in dropout rates, and an increase in grade points averages.

A further critical aspect concerns the outcome under study. While most educational policies aim at long-term effects, such as performance and graduation, most of the research focuses on the short-term effects, such as enrolment and retentions. As Bettinger (2015) claims, it is instead necessary to explore how need-based aid policies have an (in)direct effect on the long-term outputs, such as completion and academic performance. Among the few researches that consider several dimensions of students' performances and graduation, Dynarski (2008) estimated, using a treatment-comparison research design, that the scholarships awarded by the program HOPE in Arkansas and Georgia increased the number of graduates in these two states. Scott-Clayton (2012) investigated the effect of a large financial incentive program, the West Virginia's PROMISE scholarships, which consisted of free tuition for students who obtain good academic performances. The author found significant impact on many end-of-college outcomes, with particularly large impacts on time-to-degree. Castleman & Long (2012) examined the impact of the Florida Student Access Grant (FSAG) on long-term outcomes such as college persistence and degree completion. Using a regression-discontinuity strategy, the authors found that the aid positively affects persistence and the cumulative number of credits earned by students. Moreover, the grant also increased the likelihood of bachelor's degree by 4.6-point percentage.

As far as the European context is concerned, there is limited evidence on how financial aid influences higher education outcomes. Häkkinen & Uusitalo (2003) evaluated the Finnish's reform on student financial aid designed to shorten the duration of university studies. Using a duration model on data of all Finnish students enrolled in the first year between 1987 and 1995, the authors observed that the effect of the reform on the graduation time was modest and concentrated in the fields with long average duration. Glocker (2011), who focuses on two aspects, gains similar results: the duration of the students' career and the probability of actually graduating with a degree. Applying a discrete-time duration model on German university students from 1984 to 2007, she found that students who obtained aid actually experienced lower dropout, but did not graduate faster. Several outcomes of academic performances have been considered by Arendt (2013) to assess the Danish reform on student grant and loan system, which consisted in increasing the amount of the aid. The results suggested positive impact on lowering the dropout rates, but no overall effect on completion rates; further, the heterogeneity of this effect has been investigated for peculiar subgroups of students. The author shows the positive influence of increasing grants' amount on reducing dropout for student workers, while there is no evidence of higher completion rates. Finally, Belot et al. (2007) studied the impact of a reform in the case of 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 -passing the first-year exam, drop-out and graduation mark—

showing, through a difference-in-differences approach that the reform positively affects students' results.

Among the recent Italian literature on the effect of higher education scholarships, Mealli & Rampichini (2006) analyzed the effect of financial aids on two dimensions of the educational process: persistence (enrolment in the second year) and productivity (exams taken in the second year). The analysis focuses on 11 universities evenly distributed throughout Italy and considered students enrolled in the academic years 1998/99, 1999/2000 and 2001/02. The causal effect of the grant is estimated by employing a regression discontinuity design. The effectiveness of the grant on the probability of enrolment in the second year is demonstrated only for 'far from home' students in 9 of the 11 observed universities, while it is almost never effective for commuters and resident students. In the second year, and with respect to the completion of the exams, students who receive the grant show larger efficacy. Subsequently, Mealli & Rampichini (2012) examined the impact of the scholarship on student dropout enrolled in the academic year 1999 in four Italian universities. The effectiveness of the grant on the probability of enrollment in the second year for non-applicant students is significant at the threshold for all universities, while the effect of the treatment on the applicant students at the cut-off point is not significant for 3 out of 4 universities. Furthermore, the authors, under some relatively weak assumptions, show how the effect of the grant on the continuation of studies decreases with a decrease in income. In other words, for the poorest students, receiving the grant does not affect the decision to dropout. A randomized experiment was conducted by De Paola et al. (2012) at the University of Calabria involving 462 students enrolled in the academic year 2008/09. Students were assigned to three different groups: two treated groups (a top award group and a modest award group) and a control group (without any awards). Bonuses were assigned to the 30 best performing students in each treated group. The authors observed that financial aid effects are positive on student performance both in terms of collected formative credits and exam grades. High ability students strongly react whereas the effect is null for low ability students. Graziosi (2014) investigated the impact of different forms of incentives – income-based and merit-based financial aid– on both the probability of enrolling in the second year and graduating within the regular time frame at the university of Trieste. Applying matching techniques, the author demonstrated that income-based grants reduce dropout, while merit-based ones allow students to graduate in time. With respect to the effect of grants on the completion of studies for students enrolled at the Bocconi university, Garibaldi et al. (2012) report evidence that if the economic incentives were increased by 1,000 euros, the probability that students would graduate on time would decrease by 5.2%. Finally, Agasisti & Murtinu (2014) assess the impact of receiving a grant for a cohort of students enrolled at the 'Politecnico di Milano' in 2007/2008 academic year. The empirical analysis focus on both a wider range of academic results, i.e. dropout, formative credits acquired and time for graduation, and various dimensions of effects' heterogeneity, related to students' characteristics and course attended. The authors find that obtaining a grant positively affected academic performance, especially for immigrants, students whose family reside in another region and those attending engineering courses.

The attention to study the role of need-based aid on students' performance is particularly important in Italy, as previous studies demonstrates that higher education attendance and results are still very dependent by students' socioeconomic background (Bratti et al., 2009; Triventi & Trivellato, 2009). While most prior Italian researches focused on single

universities or short-term outcomes, this paper provides an empirical analysis employing an innovative micro data set of 5 Italian universities. Furthermore, the aim is to understand both the relationship between scholarships and several students' performance indicators and the heterogeneity effect of the scholarships for different subpopulations of students, thus pointing out the real effectiveness of grants to help students in improving their academic performances.

3. Setting: student subsidies in the Italian higher education system

The Italian student financial support system mainly relies on public scholarships to targeted groups, while other forms of incentives, such as loans and transfers to other private entities, are negligible. Also, the main 'rules of the game' – such as eligibility criteria, the amount of grants, etc. - are defined centrally by the Ministry of Education, and are not directly under the responsibility of single universities. Another key feature of the system is that the overall financial aid system involves a low percentage of students, around 19% (OECD, 2014) and depends heavily on public funding. In the relevant years for the analysis (i.e. 2007/08), the proportion of students who received a need-based grant was 13%, with some regions where this proportion was relatively low (i.e. Campania and Lombardy: 8.9%) and others in which it was substantially higher (i.e. Piedmont: 17.9% and Calabria: 19.3%) (source of data: Regional Observatory of University System in Piedmont).

3.1 The need-based grant

In the financial aid system (that operated in 2007/08)³ students are ranked on the basis of their (i) *economic needs*, measured by an indicator that considers family income and assets, and of their (ii) *merit*, the latter measured by the final high school grade based on a national standardized exam (at the moment of the enrolment) and, after the first year, by the amount of formative credits earned. In our analysis, applicants enrolled in the first year provide their family income indicators (only one University required also a merit criterion related to the high school mark) that, in order to be eligible for income-based scholarships, must not exceed €21,000. The beneficiaries are exempted from paying universities' fees and receive a first stage of the grant for covering educational costs. For maintaining the scholarship, students must acquire a certain number of formative credits by the middle of August. This number depends on the degree course and typically runs from 20 up to 40 formative credits for enrolling in the second year (a full academic year consists of 60 credits) and 80 to access the third year. If students do not reach the minimum number of formative credits, they do not receive the second stage of the grant. Moreover, if the merit criterion is not achieved by the beginning of the second year, students must return the first half of the scholarship.

The amount of the scholarship is fixed, but it is subject to some (small) degrees of flexibility. On the one hand, it depends on the income indicators of the student and his/her

³ The recent Italian university reform (Law 30 December 2010 n. 240) establishes both minimum standards of services for students from low socio-economic background and a national merit-fund to support the most successful students; nevertheless, the income-based scholarships remain the main tool for promoting investment in tertiary education and reducing socio-economic inequalities. The actual implementation of the reform is still not operating (it is expected to be effective from 2015/16), so in reality the only existent financial aid is represented by the traditional grants discussed in this paper.

family. On the other hand, it varies according to the *status* of the students, classified as follow: ‘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). Depending on the combination of both economic indicators and student’s status, the grant amount starts from 1,500 € up to 5,700€ this latter being provided to lowest economic level students whose are also classified as ‘far-from-home’. Students who are awarded by the grant receive the exoneration from the payment of tuition fees and the exemption (or reduction) from other educational costs, e.g., accommodation, meal and so on.

3.2 Underlying mechanisms for need-based grants to be effective

Having outlined the main features of the student support system, it is worth discussing why it is reasonable to expect that a grant can have an impact on students’ performance, and where we see the potential heterogeneity of this effect *a priori*. First, the grant can act on liquidity constraints; for instance, the most disadvantaged students can be forced to work during their studies for covering maintaining costs. Obtaining a subsidy can reduce the time for this duty, and making more time free for studying (Avdic & Gartell, 2015). The exemption from fee payments, which is automatic for students eligible for grants, also acts in this direction. Given that the amount of the grant is different for various categories of students (see above), it is also likely that its eventual effect is not homogenous for the different groups. The second source of grant’s impact is on motivation; students who receive the grant can feel to have a better opportunity than others, and can consider it as a stimulus for studying more effectively and with more devotion. In this perspective, it is not the amount of aid that matters, but the motivation that moves students to choose different courses.

There are also mechanisms that make us expect a heterogeneous effect of the need-based grant. First, since immigrants tend to enroll at university less frequently and have a higher probability of dropping out than native students, we can expect the scholarship will have a higher impact on immigrants (Cingano & Cipollone, 2007). Next, some studies (e.g., Catalano & Figà Talamanca, 2002) show that the most important expenditures for higher education are related to residential services. Therefore, we also suppose that relatively poor students who move to another region/city to attend university will need more financial aid compared to near-home students. The receipt of the scholarship can have a positive impact on the academic performance of students from different regions, since they do not need to work to cover their expenses. We expect that students moving from regions different from the one in which the university is located, will benefit more from receiving the scholarship than near-home students. Furthermore, courses at different departments are by construction different from each other. So scholarships can have a heterogeneous impact on students in different departments.

4. Methodology

4.1 Intuition

In order to investigate the causal effect of receiving the grant on student's performance we apply a counterfactual analysis. According to the potential outcome model, each student has two outcomes (Rubin, 1974): Y^T represents the students' performance when he/she received the scholarship (i.e., the Treated), Y^{UT} represents the students' performance when he/she did not receive the scholarship (i.e., Untreated). Since we do not observe both outcomes at the same time for any student, the outcome that is not observed is referred to as the counterfactual outcome (Holland, 1986), and depicts how treated students would behave if they had not been exposed to the treatment.

The average effect of the receipt of the scholarship on the students' performance is the Average Treatment effect on the Treated (ATT), i.e. the average difference between Y^T and Y^{UT} , conditionally to the treatment:

$$ATT = E(Y^T - Y^{UT} | T = 1) = E(Y^T | T = 1) - E(Y^{UT} | T = 1) \quad (1)$$

where $T = \{0,1\}$ is the indicator of exposure to treatment. While the first outcome, $E(Y^T | T = 1)$, is (relatively) simple to estimate using observations for treated students, the second outcome, $E(Y^{UT} | T = 1)$, i.e., the counterfactual outcome, is unobserved and must be estimated referring to the untreated student, balanced with respect to all explanatory variables. Due to the limited number of students who received a need-based grant (see section 3), it is reasonable to assume that the potential outcome of students is independent of the assignment to other students. This corresponds to the Stable Unit Treatment Value Assumption (SUTVA) (Rubin, 1980), which states that the outcomes of students should not be influenced by each other.

Since in observational studies assignment of units to the treatment is not random, the estimation of the treatment effect may lead to mistakes due to selection bias. In order to avoid this, we choose to apply a Propensity Score Matching (PSM) approach (Rosenbaum and Rubin, 1983). PSM is a two-step procedure, which starts with estimating the Propensity Score (PS) for each student through a logit model where the dependent variable is the receipt of the grant. In the next step, we will match each treated with the most similar untreated students (i.e., the student with the closest propensity score) who did not receive the grant. This approach will help us to balance the control and treatment groups with respect to all the pre-treatment variables that could affect the outcomes. In this way, we are able to meet the Conditional Independent Assumption (CIA) which states that, conditionally to the observable pre-treatment variables X , the allocation to the program is independent on the potential outcomes. The other assumption behind the PSM technique is that by controlling for a wide range of observable factors we create a balanced control group in which also the unobservable factors are similar between the control and treatment group.

In our PSM approach, the treatment is defined as:

- the receipt of the grant in the first academic year, if the dependent variables are the number of formative credits obtained in the first year or the dropout rate by the end of the first year;
- the receipt of the scholarship in the first, second, and third year, if the dependent variable is graduation (either in the legal duration of the academic program or after four years).

4.2 Formal exposition

First we define the two ‘states of nature’: (1) the treated students (who received the grant), and (2) the untreated students (who did not receive the grant). Once the states of nature are defined, we employ PSM, i.e., the estimated probability $\hat{\pi}$ of being treated, to match each treated student with a similar one in all X pre-treatment variables.

$$P(T = 1 | X) = \pi(X) \quad (2)$$

where π is a continuous variable. Rosenbaum & Rubin (1983) proved the balance property, that is X and T are conditionally independent on PS,

$$X \perp T | \pi(x). \quad (3)$$

This property means that the distribution of X is the same for all units with equal PS in both treated and control groups. Moreover, there is a second required property for the PS: the Common Support:

$$0 < P(T = 1 | X) < 1. \quad (4)$$

If both CIA and Common Support are satisfied, the ATT could be written as:

$$\widehat{ATT}^{PS} = E_{\pi(X)|T=1} \{E[Y(1) | T = 1, \pi(X)] - E[Y(0) | T = 0, \pi(X)]\} \quad (5)$$

where the average difference between the outcome of both treated and untreated students is weighted according to the distribution of the PS.

Since we condition the matching procedure on the propensity score, it has to be checked if the distribution of covariates is balanced in both the treatment and control group (Caliendo & Kopeinig, 2008). One suitable indicator proposed by Rosenbaum & Rubin (1985) is the Absolute Standardized Bias (ASB), i.e., a measure of both the average imbalance in each covariate X and the overall matching performance between treated and control units.

$$ASB = \left| \frac{\bar{X}_T - \bar{X}_{UT}}{\sqrt{0.5(s_T^2 + s_{UT}^2)}} 100 \right| \quad (6)$$

where $\bar{X}_T - \bar{X}_{UT}$ is the difference in the average value of X in the treated and untreated group, and $\sqrt{0.5(s_T^2 + s_{UT}^2)}$ calculates the average standard deviation in the two samples. As general rule, the balancing is acceptable for values of the ASB smaller of 5%, after matching.

5. Data

We collect a unique dataset on the universe of first-year students who entered at five large and traditional universities located in Northern Italy. Interestingly, the universities under analysis differ in terms of size and educational offer. Three of them are located in the Northwest of Italy. University A, the smallest one, is specialized in communication strategies and foreign languages, i.e., humanities; University B covers three thematic areas: architecture, design and engineering, i.e., science; while University C offers science, social and medicine undergraduate courses. The other two universities are based in the Northeast of Italy and provide a wide-range of undergraduate courses: University D covers all the academic disciplines, but University E does not provide medicine courses. As can be

observed from Table 1, the five universities provide evidence for 5 different typologies: specialized, broad, comprehensive with medical center and comprehensive without medical center.

For all universities, we include the students that enrolled in the first bachelor in the academic year 2007-2008, except for University E which considers students enrolled in 2008-2009 (due to some practical issues in the data collection process). We follow a total of 7,415 students for four years (i.e., until the academic year 2010/11 or 2011/12).

Table 1: Typology of the analyzed universities

University	A	B	C	D	E
Typology	Specialized	Specialized	Broad	Comprehensive incl. Medical Center	Comprehensive excl. Medical Center
Humanities	<i>x</i>			<i>x</i>	<i>x</i>
Sciences		<i>x</i>	<i>x</i>	<i>x</i>	<i>x</i>
Social			<i>x</i>	<i>x</i>	<i>x</i>
Medicine			<i>x</i>	<i>x</i>	

Note: This table shows the education provided by universities, gathered in different typologies: specialized, broad, comprehensive with medical center and comprehensive without medical center.

In order to consider the most relevant students' characteristics that simultaneously influence the treatment and the outcome, we follow the approach by Sianesi (2004) and include the following observables as control variables: a dummy that takes the value 1 if the student is a male; a dummy that equals 1 if the focal student is a 'regular' student⁴; three mutually exclusive dummies that takes the value 1 if the student was born in the region where the university operates⁵, in an Italian region different than the region where the university operates, or in a foreign country; four mutually exclusive dummies that equal unity when the secondary school attended by the student was a Lyceum (i.e., general education), Technical school, Vocational school and Foreign school; and an indication for the socio-economic status (SES) of the student. With respect to SES, we do not have direct information. However, for three universities we are able to collect indirect information regarding the SES of students as at these universities, the students' fees are calculated on the basis of her/his family's income. University A defines 3 levels, which correspond to an increasing fee. Universities B and E define 10 and 8 levels, respectively. Students who refuse to declare their family's income are classified in the highest scale and are subject to pay the highest fee. Hence, students coming from disadvantaged backgrounds have a strong incentive to declare their family's income. In addition, in order to receive the scholarship, information about the income level needs to be provided. We observe for the University B,

⁴ At universities A, B, C, D we follow the cohort of students of the academic year 2007-08. Hence, regular students (i.e. students who followed the regular education track without delays) for these universities are the students who are born in the year 1988 or 1989. For the University E, we have data of a later cohort. Therefore, regular students are students born in the year 1989 or 1990.

⁵ For universities A, B, C the near home region is Lombardy. For universities D and E the near home region is Friuli-Venezia Giulia and Veneto, respectively.

that 96% of the students who received the scholarship are classified in level 2 of the fee scale. At the University *A*, 92% of the students with grants are classified in level 1 while at the University *E*, 80% is classified in level 1, 2, 3 or 4. Students in similar fee levels are expected to have the same SES. We need to mention that we do not have any information about the fee level of students at universities *C* and *D*. Therefore, we will do a robustness check whereby we exclude all the information regarding the income level (see section 7).

Some students are in the eligible fee scale, but did not receive a grant. Meetings with university officers learn us that there are multiple reasons for why a student did not get a grant although he/she is in the eligible fee scales. First, students may not request the treatment because they lack the appropriate information or fear the administrative burdens. This prevents them the access to the procedure for obtaining the scholarship. Second, students may be able to cover their living expenses without the scholarship (by living at parents' home) and prefer this solution. Third, some students may have applied for the scholarship but did not receive it because of errors in the administrative procedure. It is clear that not receiving a grant does not necessarily correspond to unobserved heterogeneity or differences in ability among students.

We define four output variables regarding the academic performance of students: (i) the number of formative credits obtained after the first year; (ii) the dropout status at the first year (1=yes, 0=no); (iii) graduation in the legal (three year) duration of the course (1=yes, 0=no); and (iv) graduation within four years (1=yes, 0=no).

Table 2 provides for the unmatched sample descriptive statistics on the control and treatment group for each university. We only include students who are in the eligible fee scale and who have no missing data. Our sample comprises of 6,058 untreated students (i.e., the control group) and 1,357 treated students. If we look at the total in column 11 and 12, we observe some interesting differences between the control and treatment group. First, the proportion of students who followed the regular education track without delays, i.e. regular, is barely lower for the control group (63.3% vs. 66.4%). Second, the proportion of students living close to home is significantly higher in the control group (64.8% vs. 40.2%), but not for University *E*, while the proportion of other region students is in-significantly lower in the control group (27.3% vs. 28.8%). Not surprisingly, the proportion of immigrants students is very high among the treated students (32.5% vs. 8.6%). Further, fewer students who received a grant, on average, attend a lyceum and technical high school (42.8% vs. 52.1% and 27.0% vs. 39.3%, respectively). For the unmatched sample, it is clear that the characteristics of the students differ significantly on some of the variables. This strengthens the importance of using the PSM technique.

A glance at the four performance indicators already reveals that:

- (i) the average number of formative credits (CFU) acquired by the beneficiaries in the first-year is higher than the credits obtained by the untreated students;
- (ii) the percentage of students that dropout of the first year is lower for the students who received a grant;
- (iii) the proportion of students who graduate in the legal duration of the course is higher in the treated group;
- (iv) a higher proportion of treated students graduated within four year compare to the control group.

Table 2: Descriptive statistics of the unmatched sample

Variable	University A		University B		University C		University D		University E		Total	
	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated	Untreated	Treated
Number of Observations	396	35	869	354	1319	153	3037	442	437	373	6058	1357
Male (=1)	28.5%	14.3%	65.1%	58.2%	47.9%	37.2%	40.4%	44.6%	32.7%	24.9%	44.2%	41.1%
Regular (=1)	58.8%	68.6%	73.65%	63.0%	53.7%	77%	65.7%	64.5%	59.5%	71.0%	63.3%	66.4%
Living close to home (=1)	48.7%	17.1%	58.9%	20.3%	84.1%	60.8%	59.8%	25.3%	67.5%	70.2%	64.8%	40.2%
Living in another region (=1)	44.9%	77.1%	23.0%	39.3%	11.8%	13.7%	32.2%	21.0%	32.5%	29.8%	27.3%	28.8%
Immigrant (=1)	3.0%	2.8%	18.1%	40.4%	4.1%	25.5%	7.8%	53.6%	13.9%	5.6%	8.6%	32.5%
Lyceum (=1)	59.3%	71.4%	57.5%	52.5%	52.4%	42.5%	49.7%	28.1%	50.1%	48.5%	52.1%	42.8%
Vocational (=1)	13.1%	14.3%	1.8%	0.8%	8.7%	9.2%	0.1%	0%	8.0%	10.5%	3.6%	4.5%
Technical (=1)	26.3%	14.3%	29.0%	15.3%	36.5%	30.1%	45.9%	27.37%	35.5%	37.5%	39.3%	27.0%
Foreign (=1)	1.2%	0%	11.6%	31.4%	2.4%	18.3%	4.4%	35.8%	5.0%	2.4%	4.8%	26.1%
Formative credits (number)	31.30	50.14	34.32	42.43	40.48	46.95	32.29	34.56	45.27	51.91	35.24	43.18
First-year dropout (% of all students)	12.6%	0%	21.1%	8.2%	2.1%	0%	20.0%	10.4%	2.97%	0.8%	14.5%	5.7%
Graduation in the legal duration of the course (% of all students)	29.5%	57.1%	19.6%	26.5%	39%	49%	13%	12%	20.6%	29.5%	21.2%	26.1%
Graduation within four years (% of all students)	46.7%	77.1%	41.1%	49.7%	53.5%	70.6%	37.3%	33.7%	47.1%	60%	42.7%	50.4%

Note: This table presents the summary statistics before applying the propensity score matching technique (i.e. the unmatched sample). The last four rows present the outcome variables of the analysis, while row 2-10 provide summary statistics on the control variables. 'Treated' indicates that a student received a need-based grant. 'Untreated' indicates that a student did not receive a need-based grant.

Panel A of Figures 2 to 6 show the entire distribution of the number of first-year credits acquired by both the control and the treatment group by university. Panel B, on the other hand, illustrates the cumulative credits obtained at the end of the third year. We observe that in both cases the distribution of the treated students dominates that of the untreated students. Hence, we observe that there are already some significant differences in student performance between students who did receive the scholarship and those who did not. However, this evidence must be interpreted with caution, as we did not control for the composition of the control and the treatment group. The matching analysis should circumvent this.

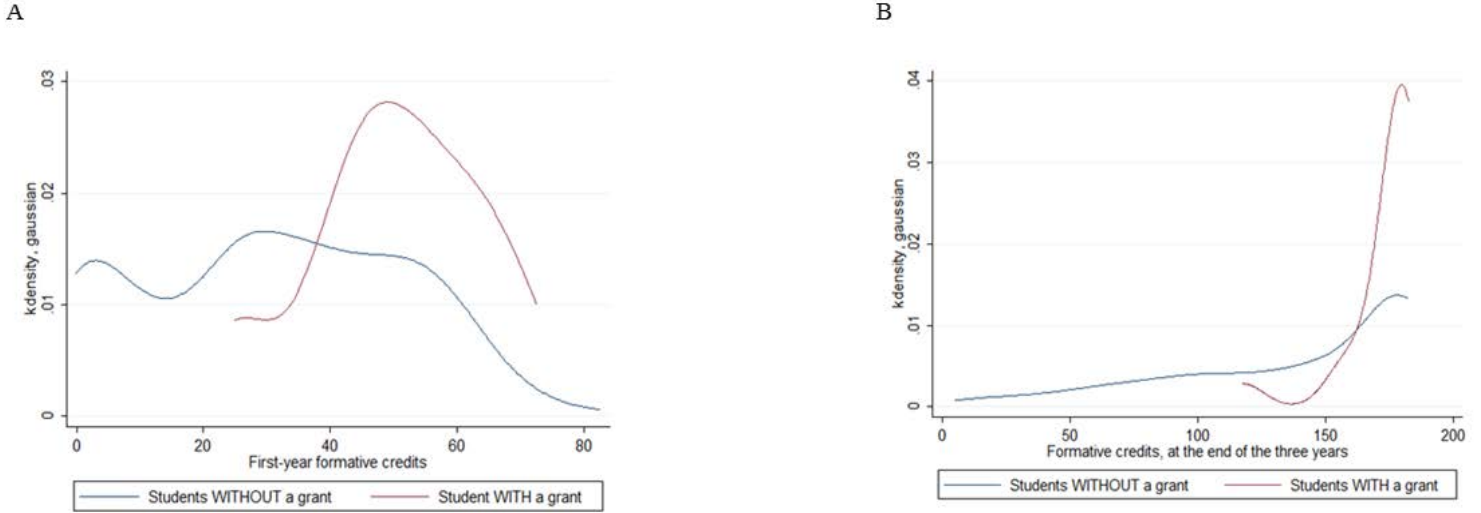


Figure 2: University A. Panel A: Kernel density of the number of formative credits (Cfu) acquired by treated and matched control group students at the end of the first year (2007-08); Panel B: Kernel density of the number of formative credits (Cfu) acquired by treated and matched control group students at the end of the third year (2009-10). Total number of observations: 426 (of which 35 treated and 391 controls).

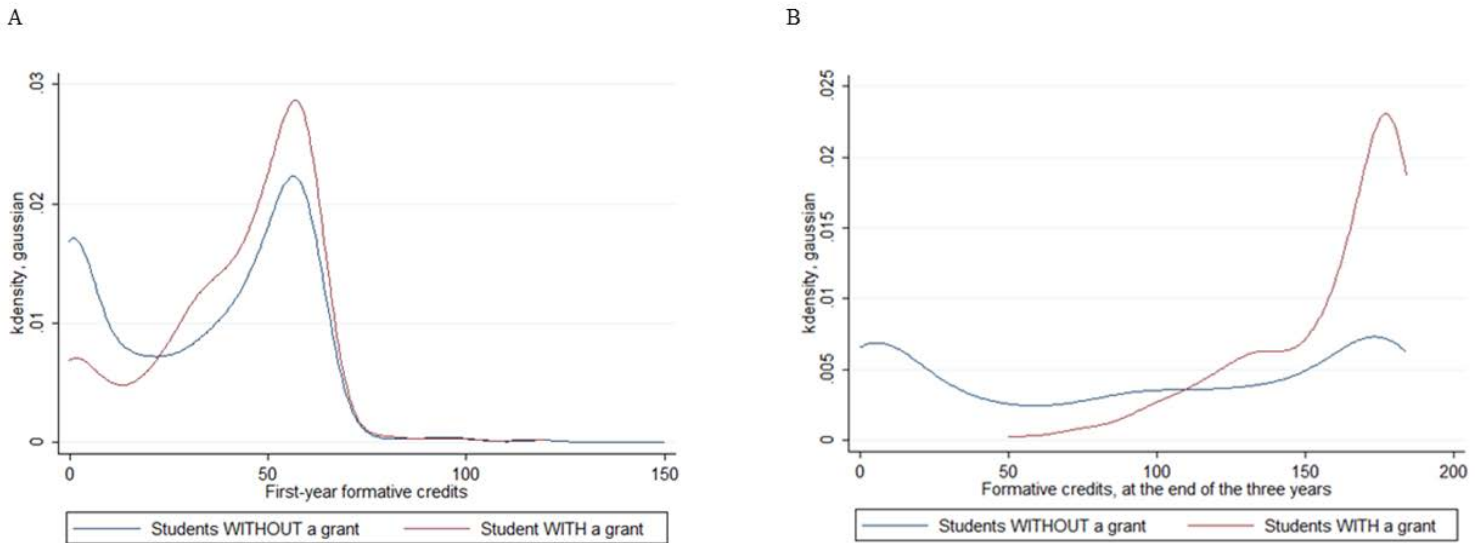
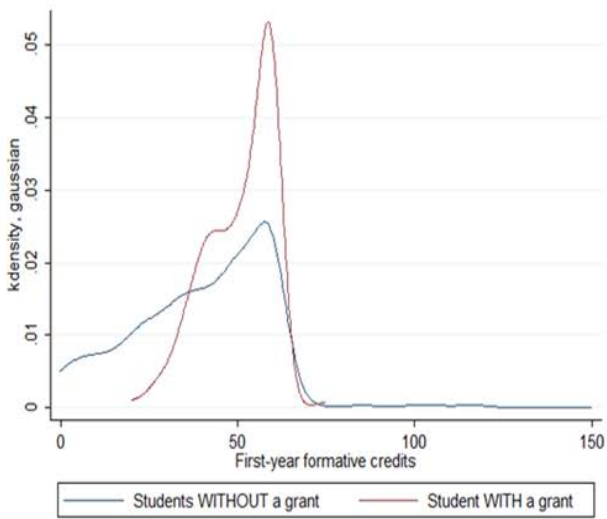


Figure 3: University B. Panel A: Kernel density of number of formative credits (Cfu) acquired by treated and matched control group students at the end of the first year (2007-08); Panel B: Kernel density of number of formative credits (Cfu) acquired by treated and matched control group students at the end of the third year (2009-10). Total number of observations: 1,223 (of which 354 treated and 869 controls).

A



B

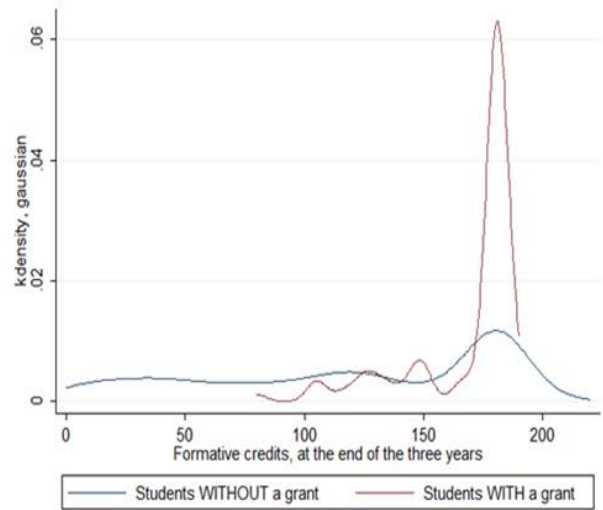
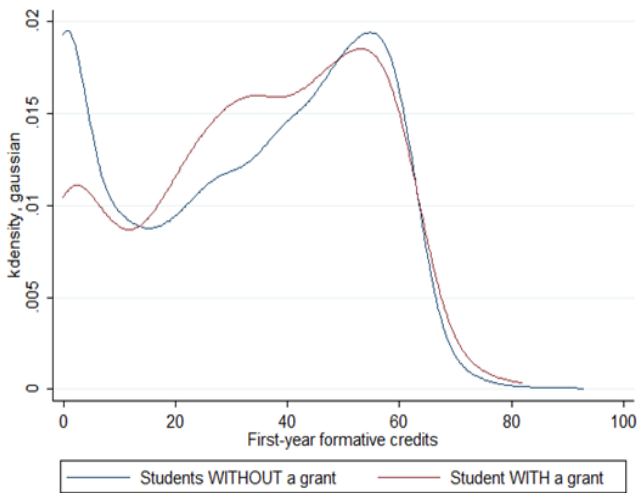


Figure 4:University C. Panel A: Kernel density of number of formative credits (Cfu) acquired by treated and matched control group students at the end of the first year (2007-08); Panel B: Kernel density of number of formative credits (Cfu) acquired by treated and matched control group students at the end of the third year (2009-10). Total number of observations: 1,472 (of which 153 treated and 1,319 controls).

A



B

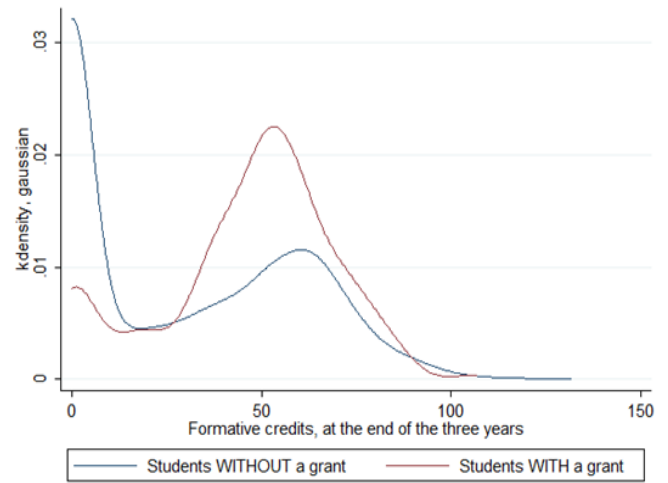
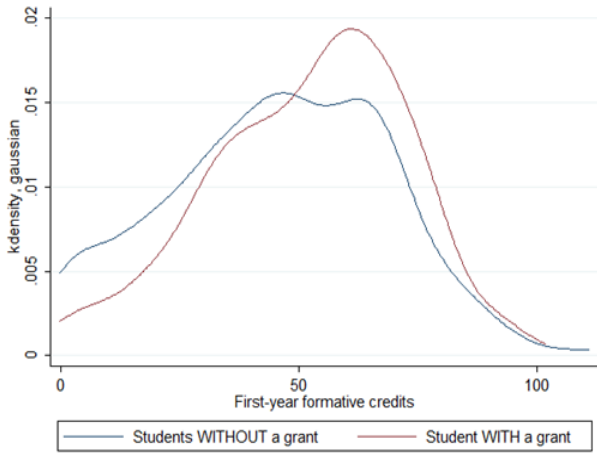


Figure 5:University D. Panel A: Kernel density of number of formative credits (Cfu) acquired by treated and matched control group students at the end of the first year (2007-08); Panel B: Kernel density of number of formative credits (Cfu) acquired by treated and matched control group students at the end of the third year (2009-10). Total number of observations: 3,477 (of which 442 treated and 3,035 controls).

A



B

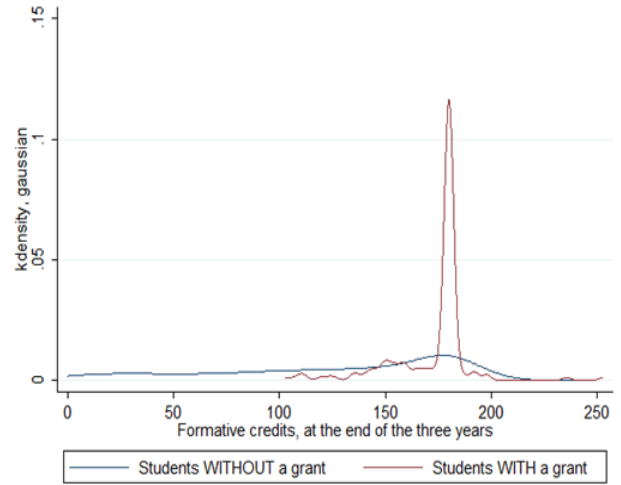


Figure 6: University E. Panel A: Kernel density of number of formative credits (Cfu) acquired by treated and matched control group students at the end of the first year (2008-09); Panel B: Kernel density of number of formative credits (Cfu) acquired by treated and matched control group students at the end of the third year (2010-11). Total number of observations: 810 (of which 373 treated and 437 controls).

6. Results

6.1 *The effect of the scholarship*

In order to assess the matching quality, we check the distribution of the covariates in both the control and treatment group. First, consider Table 3 in the Appendix, which display the summary of the Absolute Standardized Bias (ASB) distribution before and after matching. The results point toward a satisfactory reduction of the original imbalance as in most empirical studies a bias reduction below 3% or 5% is seen as sufficient (Smith and Todd, 2005). Panel A of Figures from 7 to 16 illustrates the distribution of the propensity scores before matching. Panel B shows the distribution of the propensity scores after matching. We observe that in most cases the distributions of the propensity score are similar. This also shows that the covariates are balanced after matching.

The estimated impact of receiving a scholarship on students' performance is reported in Table 4. The PSM estimates point towards a positive impact of receiving the grant for all performance indicators for all universities, except for the comprehensive universities: university D and E. For the latter two universities, the impact of the grant is not significantly different from 0 with respect to the acquired credits and the first-year dropout. The scholarship increases the probability of acquiring formative credits from 9.2% to 23.1% for the universities A and C. This is a large effect, as it should be compared to the average number of formative credits of 39.2 for treated and untreated students. An increase of 9% to 23% indicates that the formative credits soar to 42 till 48 (out of 60 in a regular year). This large growth in study efficiency suggests that grants might be an effective and potentially a cost-effective tool to increase learning efficiency.

As students acquire more credit points, they drop less frequently out from the first year. For universities A and C, receiving the grant reduces the probability of dropping out in the first-year from 3.4% up to 22.8%, with respect to the mean. This corresponds to a decrease in the dropout rate from 10% to 9.7%-7.72%. For university B, the dropout rate reduces by 17% thanks to the grant.

Considering the in-time graduation and graduation by the end of the fourth year, we notice a positive and significant effect of the scholarship for all universities, except specialized University A (positive but no significant effect, which is mainly due to the low number of treated observations and the corresponding lack of power in the analysis). We observe an increase in the probability of graduating on time between the range of 10% and 29.9%, while the probability of graduation within 4 years rises from 21.7% to 31.9%. Compared to their respective means, these are, again, large improvements in the outcome variables.

We can conclude that the impact of the scholarship is positive and relatively large for all performance indicators.

Table 4: Impact of receiving the need-based grant on students' performance

	Matched Observations		Formative credits	First-year Dropout	Matched Observations		Graduation in time	Graduation within 4 years
	Controls	Treated	\widehat{ATT}	\widehat{ATT}	Controls	Treated	\widehat{ATT}	\widehat{ATT}
University A	396	35	23.071 (5.28)	-.228 (-3.17)	304	17	.294 (1.80)	.176 (1.46)
University B	869	354	10.289 (5.83)	-.169 (-6.20)	670	166	.277 (2.59)	.319 (2.55)
University C	1,319	147	9.198 (4.64)	-.034 (-2.27)	1,236	87	.299 (4.16)	.299 (4.65)
University D	3,035	436	-1.964 (-.051)	-.037 (-.52)	2,354	180	.1 (2.47)	.217 (4.20)
University E	437	373	4.571 (.67)	-.064 (-.86)	597	155	.264 (4.98)	.271 (5.71)

Note: T-statistic is reported in brackets. The table presents the estimated Average Treatment effect on the Treated (ATT), which corresponds to the difference between the outcomes of the treated and the outcomes of the matched sample of untreated students. The matching variables in the analysis include gender, regular student (i.e., without study delay), proxy for distance to the university, type of secondary education school, and socio-economic status of the student. We consider four outcome variables: formative credits, first-year dropout, graduation in time (i.e., in three years) and graduation within 4-years. A positive sign suggests a favorable impact of the need-based grant on the outcome variables.

6.2 *The heterogeneous impact of the scholarship*

This section investigates whether the effect of receiving the scholarship is conducive to different results for (i) native vs. immigrant students, (ii) near-home students vs. students from different regions, and (iii) students from different departments. There are a number of reasons for expecting a heterogeneous effect within and between universities, as discussed in section 3.

6.2.1 *Native students vs immigrants*

The results presented in Table 5 do not provide a clear-cut pattern between the two subpopulations. The most prominent differences are observed university-wise (to be noted: university A is excluded for the excessively low number of observations for immigrant students). A positive significant impact of the scholarship on the number of formative credits acquired is observed for immigrants in both universities B and C. In those universities the number of formative credits increases by 10 and 8%, respectively. Compared to the average number of credits for natives (41.14) and immigrants (24.43), the grant increases the formative credits to 47.38 and 35.12, respectively. These are clearly significant increases. Given that the ATT is almost double for immigrants than for natives, it is likely that the mechanism of liquidity constraint dominates the other mechanisms (see section 3.2). Only for university D we observe a negative ATT for immigrants, although this is not significantly different from zero.

With respect to first year dropout, we observe that receiving the grant significantly reduces dropout. Nevertheless, the difference is not very outspoken as for university B, D and E either the ATT on the natives or on the immigrants is not significantly different from zero.

The grants have also a positive influence on both the subpopulation of immigrants and Italian students with respect to the probability to graduate on time and with one year of delay. Some of the ATT are insignificant, but this might be due to the low power of the sub-analysis. Overall, we observe that the in-time graduation increases by about 24% for natives and 13% for immigrants for university B. Other universities have similar effect sizes. This ATT should be compared to the average graduation rate of 23% and 12% for natives and immigrants.

Summarizing, a general positive effect for immigrant students is detectable and can raise the attention of policy makers as for promoting inclusion via financial aid.

Table 5: Heterogeneity of the impact of receiving the scholarship: Native Italian students versus immigrants

	Matched Observations		Formative credits	Dropout first-year	Matched Observations		Graduation in time	Graduation within 4 years
	Controls	Treated	\widehat{ATT}	\widehat{ATT}	Controls	Treated	\widehat{ATT}	\widehat{ATT}
University B								
Native Italian students	711	210	10.131 (4.88)	-.128 (-4.24)	574	104	.135 (1.96)	.211 (3.92)
Immigrants	157	143	17.098 (2.05)	-.091 (-.68)	96	62	.242 (1.85)	.371 (2.07)
University C								
Native Italian students	1,265	114	8.111 (3.99)	-.017 (-1.42)	1,178	69	.304 (3.87)	.232 (3.33)
Immigrants	54	32	12.659 (2.42)	-.093 (-1.79)	58	18	.333 (1.21)	.666 (2.52)
University D								
Native Italian students	2,783	205	1.860 (0.91)	-.054 (-1.53)	2,113	84	.131 (2.02)	.238 (3.30)
Immigrants	237	228	-2.756 (-.41)	-.061 (-.55)	234	97	.072 (1.45)	.227 (3.37)
University E								
Native Italian students	437	373	-1.892 (.28)	-.019 (-.26)	597	156	.288 (5.54)	.288 (5.54)
Immigrants	61	21	4.809 (.30)	-.095 (-1.45)	64	6	.1667 (1.00)	.667 (2.00)

Note: T-statistic is reported in brackets. The table presents the estimated Average Treatment effect on the Treated (ATT), which corresponds to the difference between the outcomes of the treated and the outcomes of the matched sample of untreated students. The matching variables in the analysis include gender, regular student (i.e., without study delay), proxy for distance to the university, type of secondary education school, and socio-economic status of the student. We consider four outcome variables: formative credits, first-year dropout, graduation in time (i.e., in three years) and graduation within 4-years. A positive sign suggests a favorable impact of the need-based grant on the outcome variables. University A has been excluded from the analysis due to too few observations in the sub-samples.

6.2.2 Near-home students versus students from other regions

Within the group of native Italian students, the impact of receiving the scholarship might be different between near-home students and students from other regions as the latter group may suffer from higher living costs and thus may benefit more of the scholarship. From Table 6, we observe that students from other regions have a higher probability to both acquire formative credits in all universities (except for university E, where we do not observe a significant ATT). Receiving a grant reduced significantly dropout for students from other regions for most universities (exception is university B and C). Distributing the grant among students from other regions results in a significant increase in graduation in-time, and graduation with a one-year delay.

To sum up, albeit the direction of the effect is not unequivocal, the general tendency is towards a stronger effect of aid on students who decide to move from their place for studying – this evidence is somehow coherent with the idea of aid as a tool for lowering maintenance costs.

6.2.3 Different departments

Finally, concerning the department effect, the estimates in Table 7 reveal that receiving the scholarship has a different impact on the performance of students depending on both the department they attended and the outcome considered. The effect of receiving a grant on formative credits and dropout, when significant, is positive for humanities and social departments. As regards the science department, the positive impact of the scholarships is detected only at University C (the broad university), while no significant effect is observed for both comprehensive universities: University D and E. A potential explanation for science faculties is that a non-negligible students' self-selection effect is at work. It is particularly interesting to note that for medicine this effect is never significant – this result is coherent with the selection procedure of students in this faculty, which includes a test at the beginning (thus, students are self-selected and aid would not play a decisive role for subsequent performance). As regards the probability of graduation, we observe different impact of the scholarship with respect to both the department attended by students and the time for graduation. Receiving the scholarship has a positive significant effect on the likelihood to take the degree within four years and to graduate on time for students enrolled in humanities and social sciences; further, the effect of the scholarship significantly depends on the interaction between University and attended courses.

We can conclude that the results show a heterogeneous impact, with the effect of scholarships more diverging within universities (i.e. between departments) than across them. Although in most cases, the direction of the baseline results is maintained, we observe different significance levels depending on the investigated subpopulation within each institution. This finding points toward the use of scholarships as a general policy, as it is not proven to be particularly effective for specific disciplinary areas.

Table 6: Heterogeneity of the impact of receiving the scholarship: Near-home students versus students from other regions

	Matched Observations		Formative credits	Dropout first-year	Matched Observations		Graduation in time	Graduation within 4 years
	Controls	Treated	\widehat{ATT}	\widehat{ATT}	Controls	Treated	\widehat{ATT}	\widehat{ATT}
University A								
Near home students	193	5	18.5 (1.70)	-.2 (-1.00)	150	2	-	-
Students from other regions	178	27	22.685 (4.36)	-.222 (-2.73)	136	14	.214 (1.15)	.214 (1.49)
University B								
Near home students	497	72	11.764 (3.24)	-.125 (-2.49)	397	34	-.059 (-.49)	.029 (.29)
Students from other regions	200	138	12.866 (1.26)	-.087 (-.48)	177	70	.286 (3.54)	.371 (5.79)
University C								
Near home students	1,109	93	8.784 (3.94)	-.011 (-1.00)	1,045	58	.313 (3.54)	.259 (3.26)
Students from other regions	156	21	14.328 (2.74)	-.048 (-1.00)	119	11	.545 (2.34)	.273 (1.17)
University D								
Near home students	1810	112	-.279 (-0.10)	-.009 (-.18)	1367	43	.163 (1.77)	.279 (2.66)
Students from other regions	973	93	3.784 (1.21)	-.150 (-2.84)	746	41	.097 (1.06)	.146 (1.33)
University E								
Near home students	295	262	6.565 (.75)	-.382 (-.32)	414	113	.257 (4.16)	.221 (3.99)
Students from other regions	142	110	3.236 (0.38)	-.109 (-1.36)	183	41	.341 (3.30)	.366 (3.99)

Note: T-statistic is reported in brackets. The table presents the estimated Average Treatment effect on the Treated (ATT), which corresponds to the difference between the outcomes of the treated and the outcomes of the matched sample of untreated students. The matching variables in the analysis include gender, regular student (i.e., without study delay), proxy for distance to the university, type of secondary education school, and socio-economic status of the student. We consider four outcome variables: formative credits, first-year dropout, graduation in time (i.e., in three years) and graduation within 4-years. A positive sign suggests a favorable impact of the need-based grant on the outcome variables. The near home students for university A have been excluded from the analysis due to too few observations in the sub-sample.

Table 7: Heterogeneity of the impact of receiving the scholarship: Different departments

	Matched Observations		Formative credits	Dropout first-year	Matched Observations		Graduation in time	Graduation within 4 years
	Controls	Treated	\widehat{ATT}	\widehat{ATT}	Controls	Treated	\widehat{ATT}	\widehat{ATT}
University C								
Sciences	156	17	20.470 (4.16)	-	148	10	.7 (4.58)	.9 (9.00)
Social	618	68	8.956 (2.85)	-.073 (-2.31)	561	43	1.860 (1.76)	.256 (.102)
Medicine	538	60	7.107 (1.34)	-	520	34	.441 (2.86)	.147 (1.07)
University D								
Humanities	1,230	168	5.482 (2.34)	-.098 (-2.32)	912	75	.08 (1.34)	.293 (3.78)
Sciences	984	161	-1.903 (-.27)	.025 (.17)	792	57	0 (0.00)	-.017 (-.21)
Social	573	72	1.903 (.30)	-.153 (-1.35)	418	23	.348 (2.62)	.391 (2.16)
Medicine	248	37	-1.405 (-.22)	-.027 (-.27)	232	25	.16 (.84)	.24 (1.26)
University E								
Humanities	243	215	-.819 (-.09)	-.065 (-.67)	319	104	.260 (3.87)	.221 (4.00)
Sciences	27	27	9.297 (.86)	-.185 (-.98)	36	9	.222 (1.51)	.222 (.97)
Social	167	129	13.279 (1.67)	-.039 (-.33)	231	41	.390 (5.06)	.707 (3.53)

Note: T-statistic is reported in brackets. The table presents the estimated Average Treatment effect on the Treated (ATT), which corresponds to the difference between the outcomes of the treated and the outcomes of the matched sample of untreated students. The matching variables in the analysis include gender, regular student (i.e., without study delay), proxy for distance to the university, type of secondary education school, and socio-economic status of the student. We consider four outcome variables: formative credits, first-year dropout, graduation in time (i.e., in three years) and graduation within 4-years. A positive sign suggests a favorable impact of the need-based grant on the outcome variables. University A and B, as well as the dropout rate for university C has been excluded from the analysis. This is due to the fact that every university does not offers academic programs in all four departments – see the case of A and B Universities, which are classified as humanities and science, respectively.

7. Robustness tests

The socio-economic status (SES) of a student is an important driver to successfully complete higher education. Although none of the universities collect information regarding the students' SES, three universities provided an indirect proxy (see Section 5), which we used in the earlier results. However, due to lack of information from both Universities *C* and *D*, we could not identify this control group for all the universities. Consequently, it is possible that the results of the latter universities are biased. We try to get an idea on the robustness of the results by using students from all income levels, also for universities *A*, *B* and *E*. If we observe significant changes in the new set of results, the previous results might be questionable.

The robustness results are presented in Table 8. We observe similar directions of the impact of scholarships for the four performance indicators at the three universities compared to the baselines results. We also see robust results regarding the significance level with the exception of the performance indicators 'formative credits' and 'first-year drop-out' at the comprehensive University *E* (as in the previous analysis), and 'graduation on time' at the specialized University *B*. Further, at the baseline results we observe no significant positive impact of the receipt of a grant on graduation on time and graduation within for years for specialized University *A*. Now, we find a significant positive result for both outcomes. However, since this is the only notable change, and given that all the other results are qualitatively and quantitatively similar, we can fairly conclude that our results are robust to this proxy of SES.

Table 8: The impact of receiving scholarships while not keeping the income level into account

	Matched Observations		Formative credits	First-year Dropout	Matched Observations		Graduation in time	Graduation within 4 years
	Controls	Treated	\widehat{ATT}	\widehat{ATT}	Controls	Treated	\widehat{ATT}	\widehat{ATT}
University A	1,047	37	17.703 (4.28)	-.108 (-2.09)	1,065	19	.421 (3.27)	.421 (3.27)
University B	4,300	379	9.108 (5.19)	-.224 (-8.04)	3,260	173	.046 (.88)	.173 (3.53)
University E	437	373	4.571 (.67)	-.064 (-.86)	597	155	.264 (4.98)	.271 (5.71)

Note: T-statistic is reported in brackets. The table presents the estimated Average Treatment effect on the Treated (ATT), which corresponds to the difference between the outcomes of the treated and the outcomes of the matched sample of untreated students. The matching variables in the analysis include gender, regular student (i.e., without study delay), proxy for distance to the university, and type of secondary education school. We consider four outcome variables: formative credits, first-year dropout, graduation in time (i.e., in three years) and graduation within 4-years. A positive sign suggests a favorable impact of the need-based grant on the outcome variables. University C and D have been excluded from the analysis due to the lack of information on this sub-criterion.

8. Discussion and concluding remarks

This paper argued for a rich and novel dataset of Italian universities, that obtaining a need-based grant improves the academic performance of students. By matching students with a scholarship on multiple observed characteristics to students without a control group, we simulated an experimental setting. The matching variables included, among others, gender, distance to the university, and a proxy for socio-economic status. The results indicate that receiving a scholarship results in a higher probability of acquiring formative credits. In comparison to students with similar observed characteristics, students with a scholarship have a significantly lower probability of dropping out at the end of the first year. In particular, their odds decreased by 3% to 22%. Moreover, students who receive the grant are more likely to graduate (between 18% and 32%) and also to graduate on time (between 10% and 30%). All these estimations are statistically significant, and also robust to alternative specifications.

In terms of policy conclusions, the role of financial aid seems positive as it leads to higher performances of disadvantaged students, this way sustaining better performances of universities as a whole. In this perspective, the interventions do not solely deal with equity issues, but instead aim at developing higher efficiency of the higher education system. In this context, financial aid is a tool that can create the right incentives. Indeed, if universities compete with each other to attract better students (as in Agasisti, 2009) the financial aid that helps students obtaining better results are coherent with the strategic target of improving overall performance through market mechanisms.

The study should be interpreted with caution when debating its external validity. Two factors undermine its extensive interpretation for the whole (Italian) higher education system. First, the group of universities is not completely representative of the articulated and diversified reality of the university setting: all the selected institutions are located in the North of Italy, where education institutions have a relatively high performance (see Agasisti & Dal Bianco, 2006). Second, not all the disciplines/subjects are adequately represented in the proportion they exist in the entire spectrum of formative offer. Keeping these limitations in mind, we can conclude that the findings suggest positive effects of the financial aid system for improving students' results in most cases. In such perspective, a potential practical implication is to devote more money to this policy – eventually, reducing proportionally other lines of direct funding to universities.

However, we do not explore here the exact mechanism through which financial aid improves students' results. Further research would be needed in this respect, also for drawing coherent policy consequences. For instance, if students look at the 'merit threshold' as a goal (i.e. the number of formative credits to be acquired), then gradually increase this requirement can act towards efficiency improvement of academic performances. If, instead, the main positive factor is related to the removal of liquidity constraints, the amount of the grants should be periodically revised to test adequate levels that turn out to be more effective for helping needy students.

In a political economy sense, our results can also inform the rethinking of the whole articulation of responsibilities for higher education funding. At the present stage, low fees and limited financial aid availability characterize the Italian higher education system. Empirical evidence shows that in many contexts there was not a negative effect of introducing or increasing fees on enrolment (see Bruckmeier & Wigger (2014) for Germany, and Chapman & Ryan (2005) for Australia), so coherently with a cost-sharing framework (Johnstone, 2004) fees could slightly increase further in the Italian universities⁶. With the money raised from fees, increases in the amount and number of grants can be funded, for improving

⁶ Garibaldi *et al.* (2012) even conclude that in an Italian private university, an increase in tuition fees led to an improvement of time-for-graduation.

the general academic results of Italian universities, by contextually targeting the financial incentives to the disadvantaged and promising students, so leaving the market mechanisms working more properly.

Lastly, the study of the effects of grants on performances should be further deepened in the future, by increasing the collection of fine-grained administrative datasets. To the extent that researchers will be able to understand more of the single students' and institutional characteristics that are associated with stronger positive effects, it would be more and more possible developing predictive models for maximizing the effectiveness of financial aid policies and interventions. Such a perspective is in line with the evolution of big data usage in Higher Education (Timms, 2015) and must be considered as a future priority for policy makers and analysts in the field.

APPENDIX A

In order to assess the matching quality, we check the distribution of the covariates in both the control and treatment group. Matching quality is mainly based on the balancing of covariates obtained by comparing the situation before and after matching and checking if there remain any differences after conditioning on the propensity score (Caliendo and Kopeinig, 2008).

Table 3: Summary of the distribution of the Absolute Standard Bias (ASB) before and after matching

	Formative credits and Dropout first-year		Graduation in time and Graduation within 4 years	
	% ASB before matching	% ASB after matching	% ASB before matching	% ASB after matching
University A	32.84 (27.771)	0 (0)	40.74 (26.408)	0 (0)
University B	27.03 (25.176)	3.68 (3.283)	34.00 (23.878)	.11 (.368)
University C	22.66 (22.555)	2.2 (2.270)	23.10 (19.99)	3.60 (2.349)
University D	36.95 (41.476)	.44 (.519)	36.24 (37.76)	1.57 (2.13)
University E	10.82 (8.341)	1.46 (1.342)	18.62 (13.74)	3.03 (2.991)

Note: Standard deviations are reported in brackets. The table presents the ASB for both treatments: the receipt of the grant in the first academic year, if the dependent variable is the number of formative credits and dropout first year; the receipt of the scholarship in the first, second and third year, if the dependent variable is graduation. The ASB is an indicator to assess the overall distance in marginal distributions of the X variables in both the control and treatment group before and after matching. As general rule, the balancing is acceptable for values of the ASB smaller of 5%, after matching.

As reported in table 3, the % of ASB after matching is below 5% and, in most cases, lower than 3%. For achieving a good balance, we employ the Nearest Neighbor matching without replacement, but for both University B, with respect to the outcomes Graduation on time and Graduation within 4 years, and University E, with respect to the outcomes Formative credits and First-year Dropout, we match treated

and control units with replacement. This choice implies a tradeoff between bias and variance: the average quality of the matches increases, thereby the bias decreases, but the variance of the estimator increases (Smith and Todd, 2005).

Panel A of Figures from 7 to 16 illustrates the distribution of the propensity scores before matching. Panel B shows the distribution of the propensity scores after matching. We observe that in most cases the distributions of the propensity score are similar. This also shows that the covariates are balanced after matching.

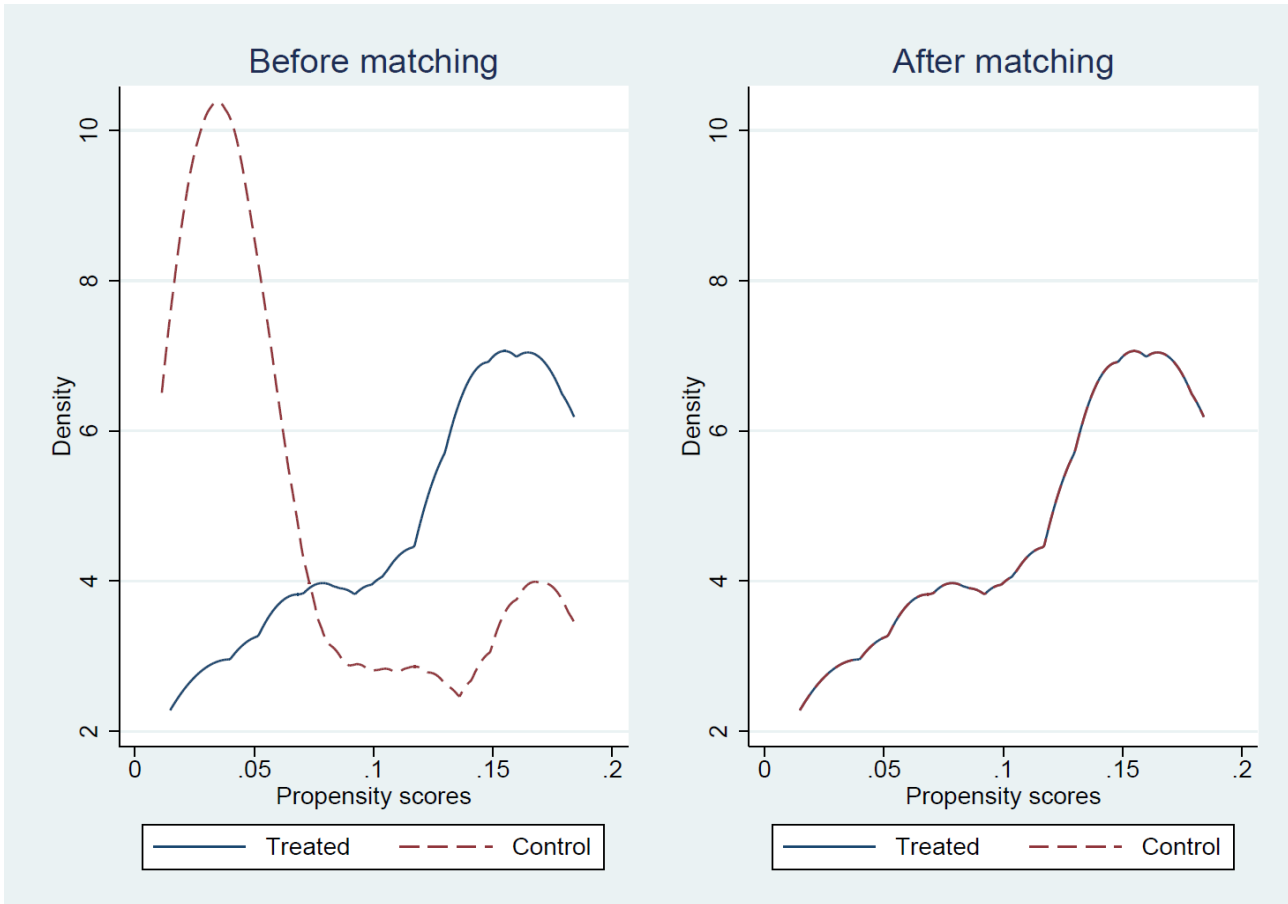


Figure 7: University A. Panel A: Density plot of the propensity scores for the treatment and control group before matching for the number of formative credits in the first year and the first-year dropout; Panel B: Density plot of the propensity scores for the treatment and control group after matching for the number of formative credits in the first year and the first-year dropout.

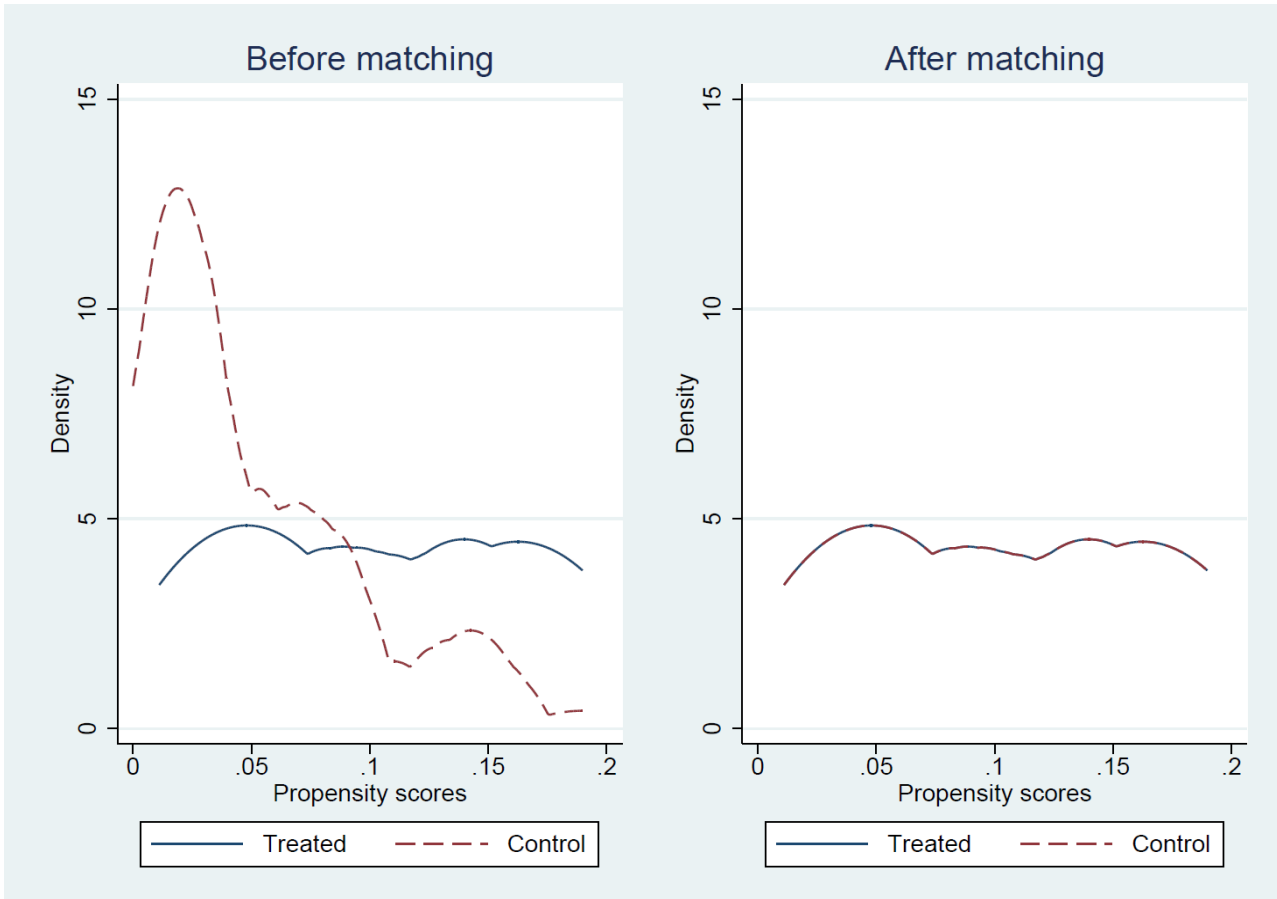


Figure 8: University A. Panel A: Density plot of the propensity scores for the treatment and control group before matching for graduation in time and graduation within 4 years; Panel B: Density plot of the propensity scores for the treatment and control group after matching for the number of formative credits in the first year and the first-year dropout.

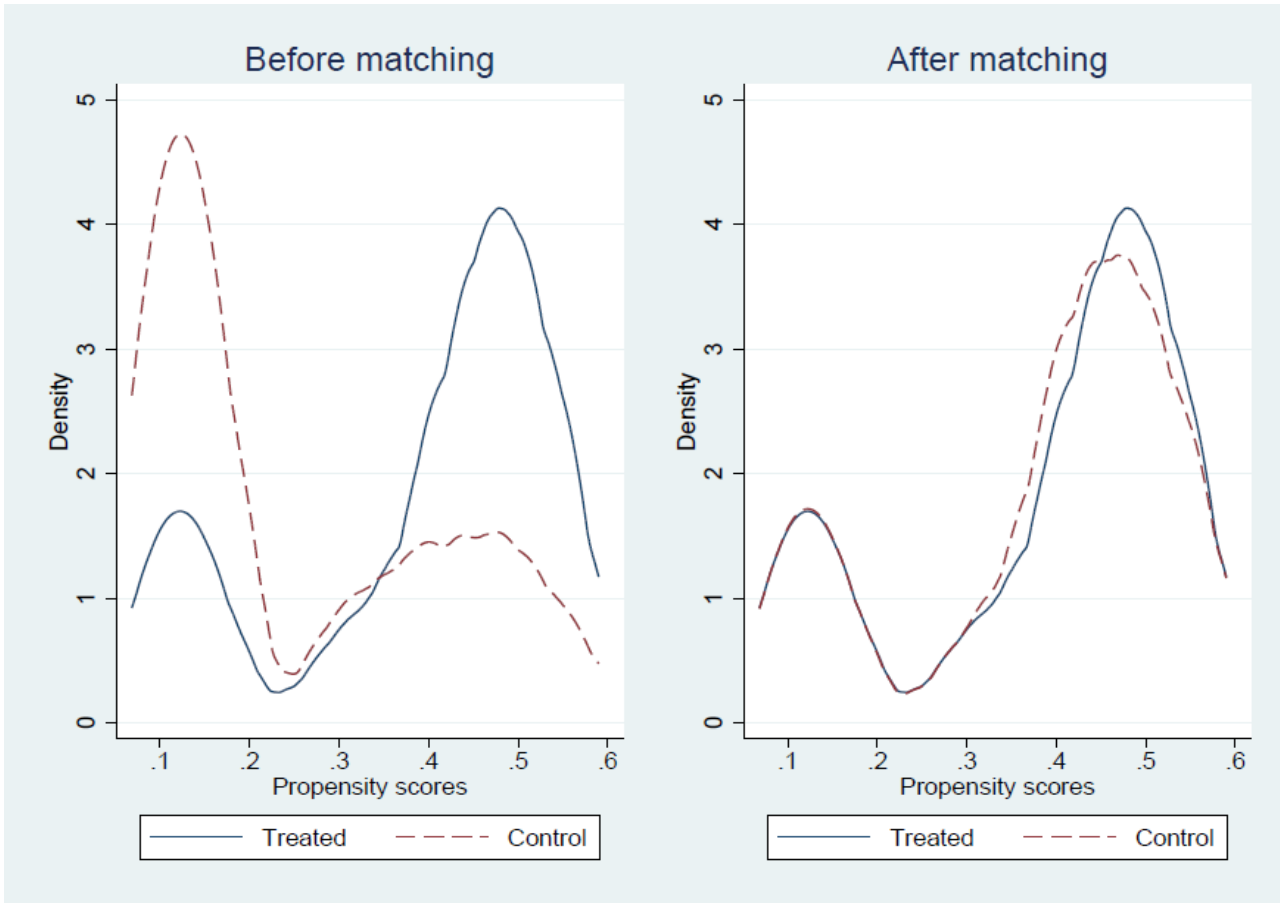


Figure 9: University B. Panel A: Density plot of the propensity scores for the treatment and control group before matching for the number of formative credits in the first year and the first-year dropout; Panel B: Density plot of the propensity scores for the treatment and control group after matching for the number of formative credits in the first year and the first-year dropout

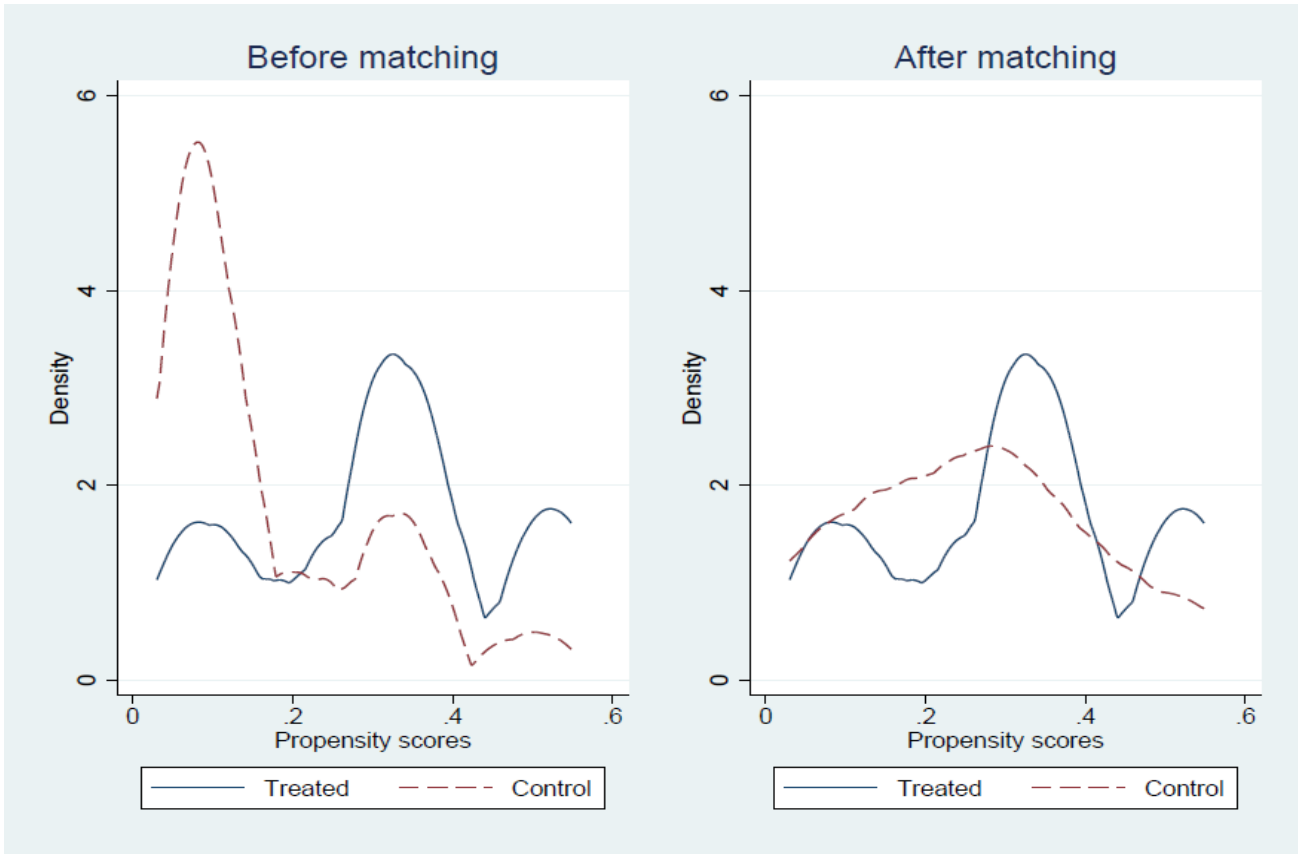


Figure 10: University B. Panel A: Density plot of the propensity scores for the treatment and control group before matching for graduation in time and graduation within 4 years; Panel B: Density plot of the propensity scores for the treatment and control group after matching for the number of formative credits in the first year and the first-year dropout

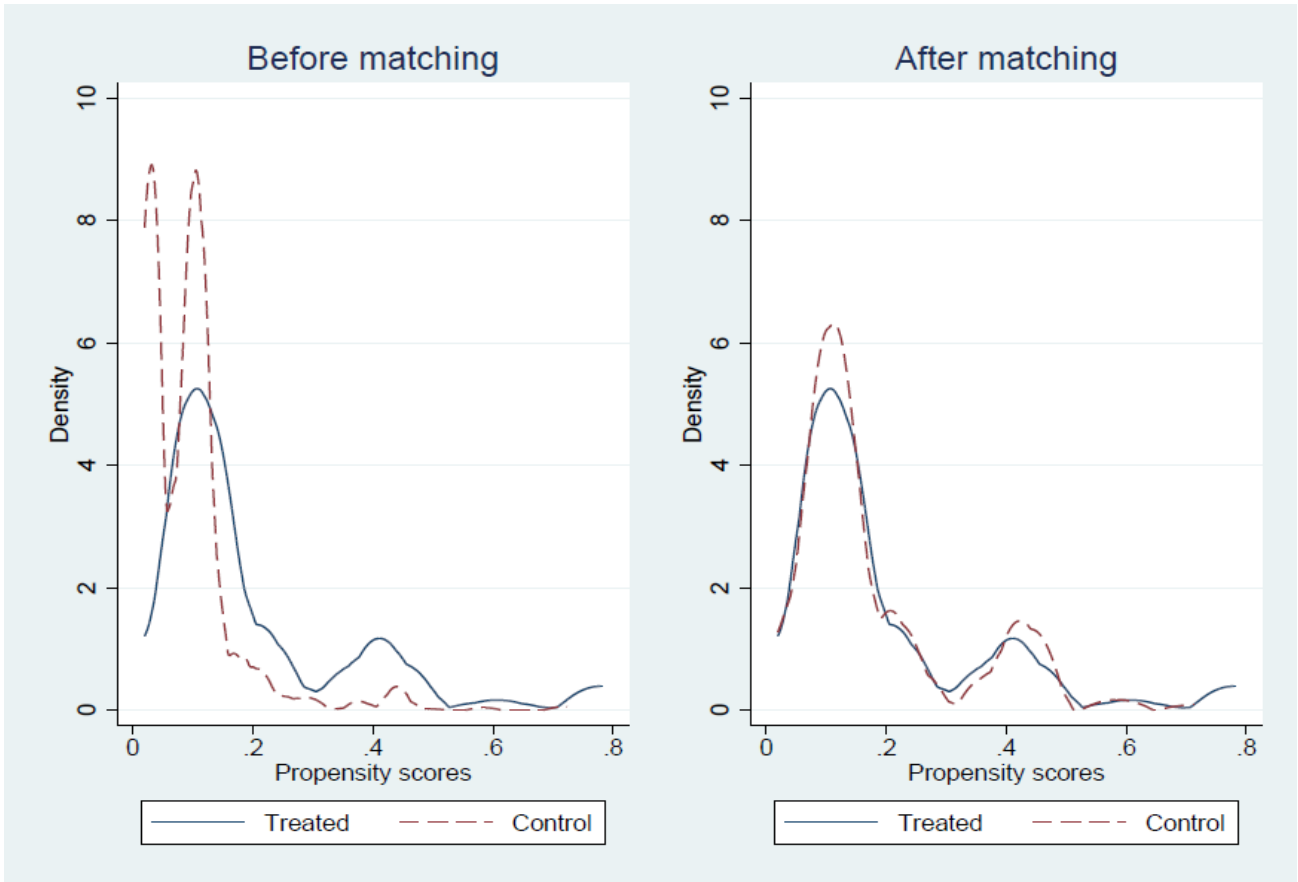


Figure 11: University C. Panel A: Density plot of the propensity scores for the treatment and control group before matching for the number of formative credits in the first year and the first-year dropout; Panel B: Density plot of the propensity scores for the treatment and control group after matching for the number of formative credits in the first year and the first-year dropout

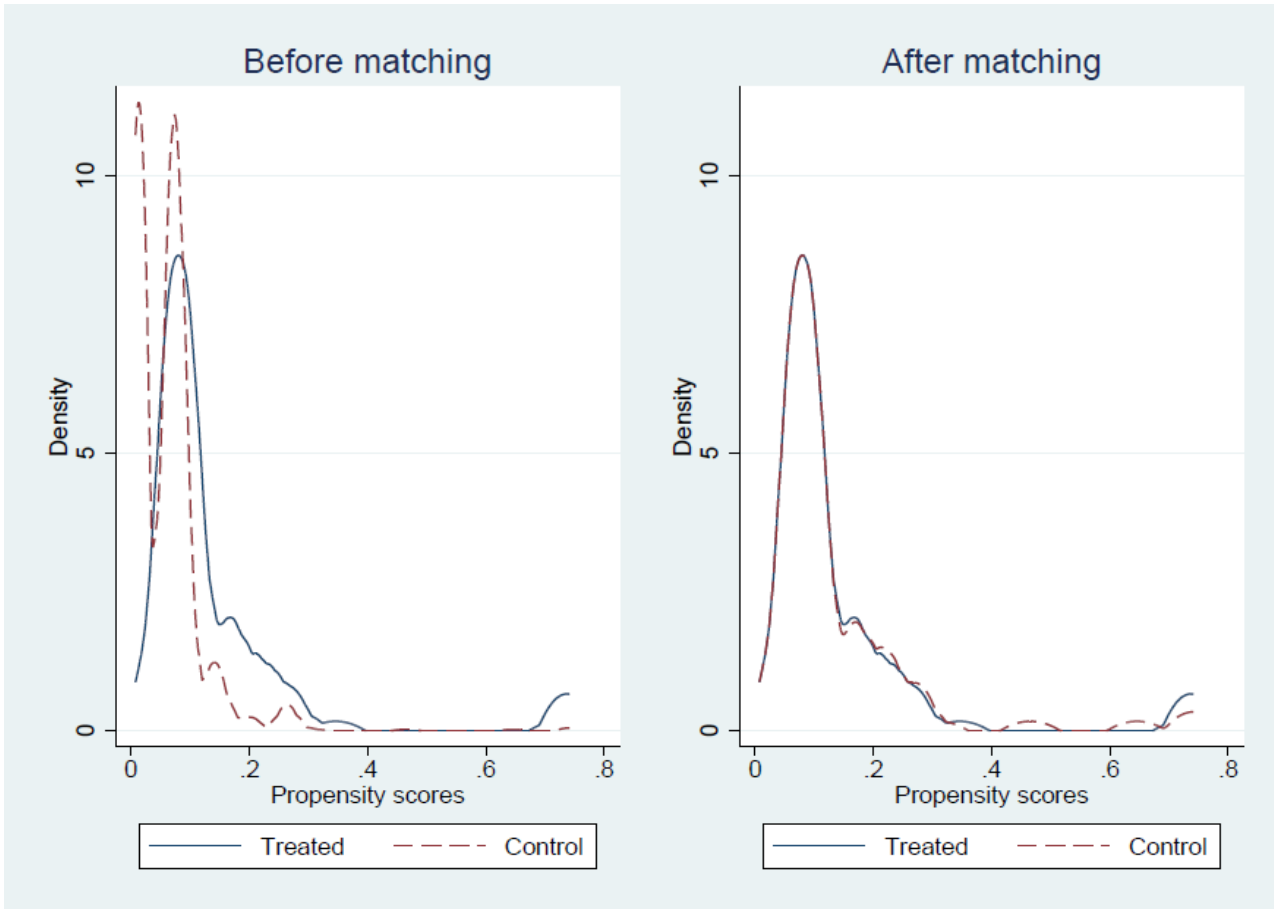


Figure 12: University C. Panel A: Density plot of the propensity scores for the treatment and control group before matching for graduation in time and graduation within 4 years; Panel B: Density plot of the propensity scores for the treatment and control group after matching for the number of formative credits in the first year and the first-year dropout

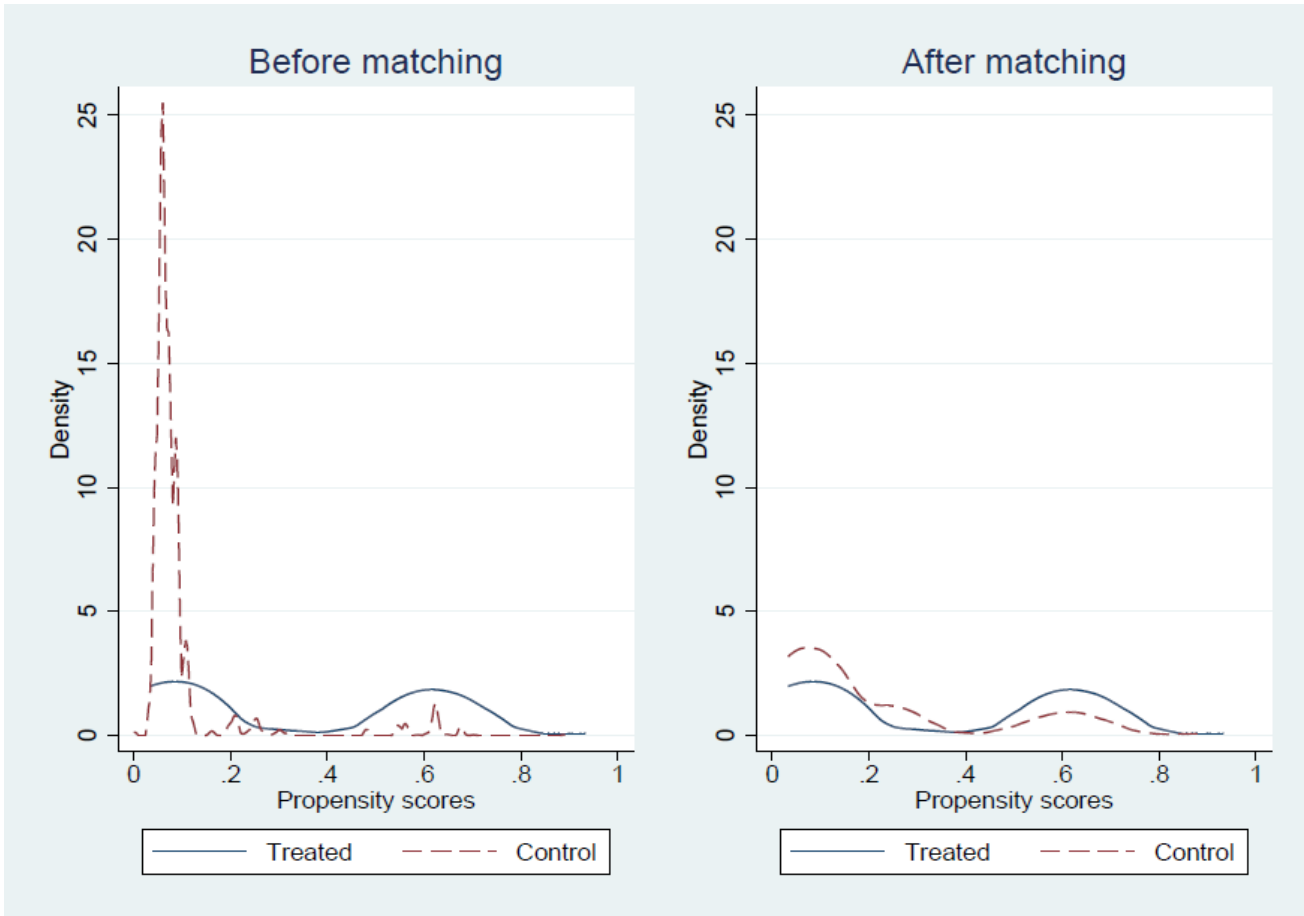


Figure 13: University D. Panel A: Density plot of the propensity scores for the treatment and control group before matching for the number of formative credits in the first year and the first-year dropout; Panel B: Density plot of the propensity scores for the treatment and control group after matching for the number of formative credits in the first year and the first-year dropout

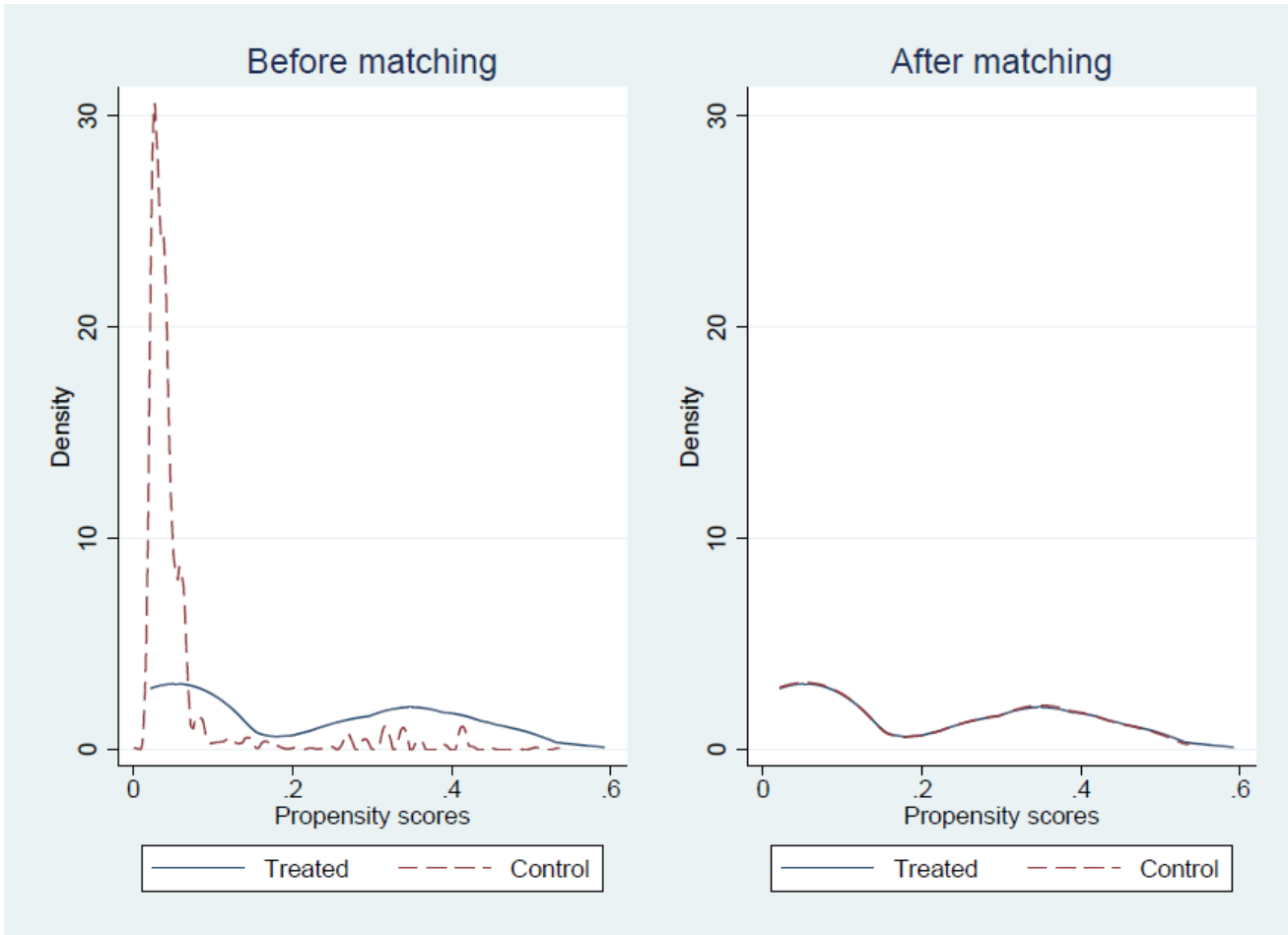


Figure 14: University D. Panel A: Density plot of the propensity scores for the treatment and control group before matching for graduation in time and graduation within 4 years; Panel B: Density plot of the propensity scores for the treatment and control group after matching for the number of formative credits in the first year and the first-year dropout

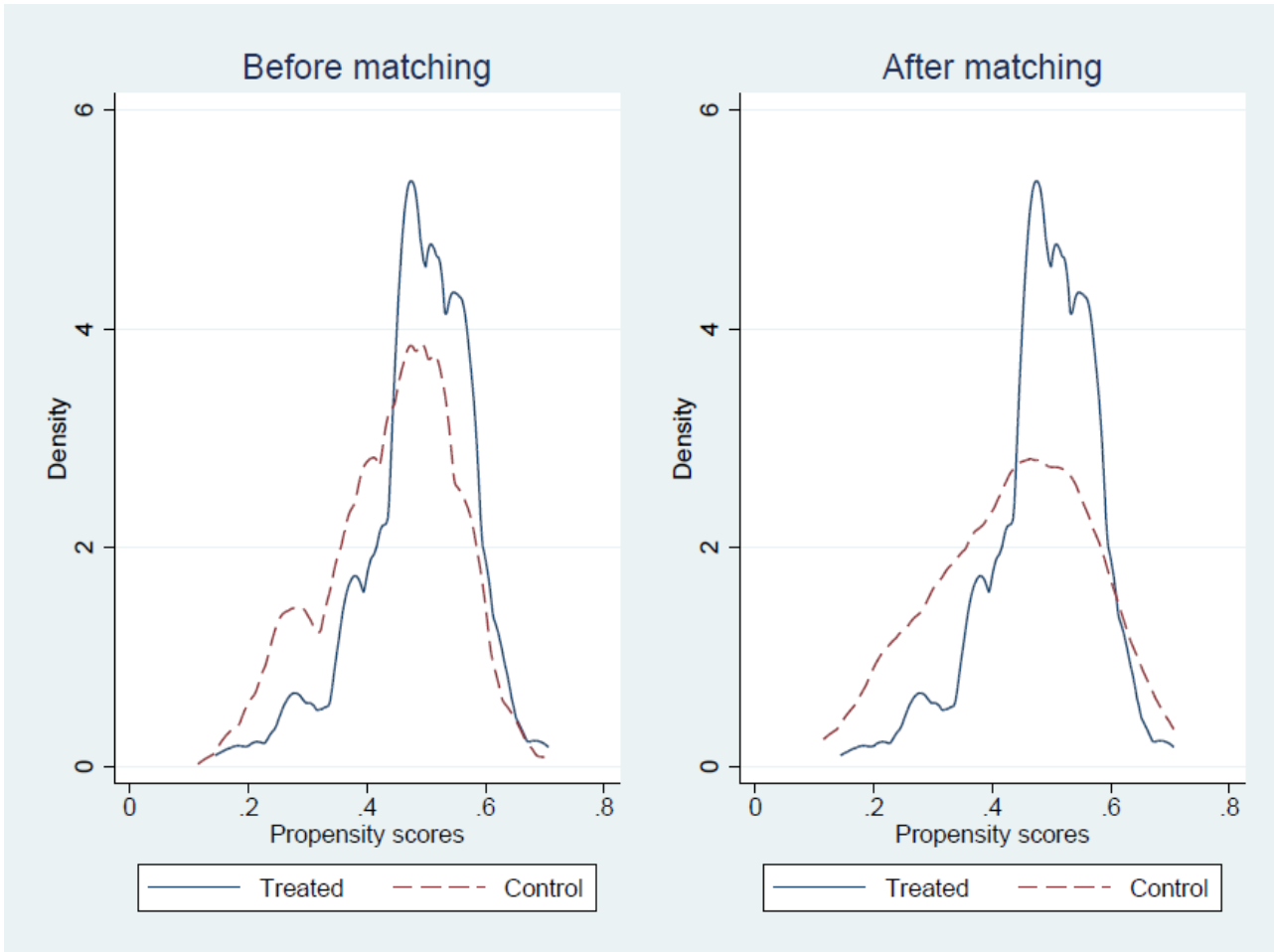


Figure 15: University E. Panel A: Density plot of the propensity scores for the treatment and control group before matching for the number of formative credits in the first year and the first-year dropout; Panel B: Density plot of the propensity scores for the treatment and control group after matching for the number of formative credits in the first year and the first-year dropout

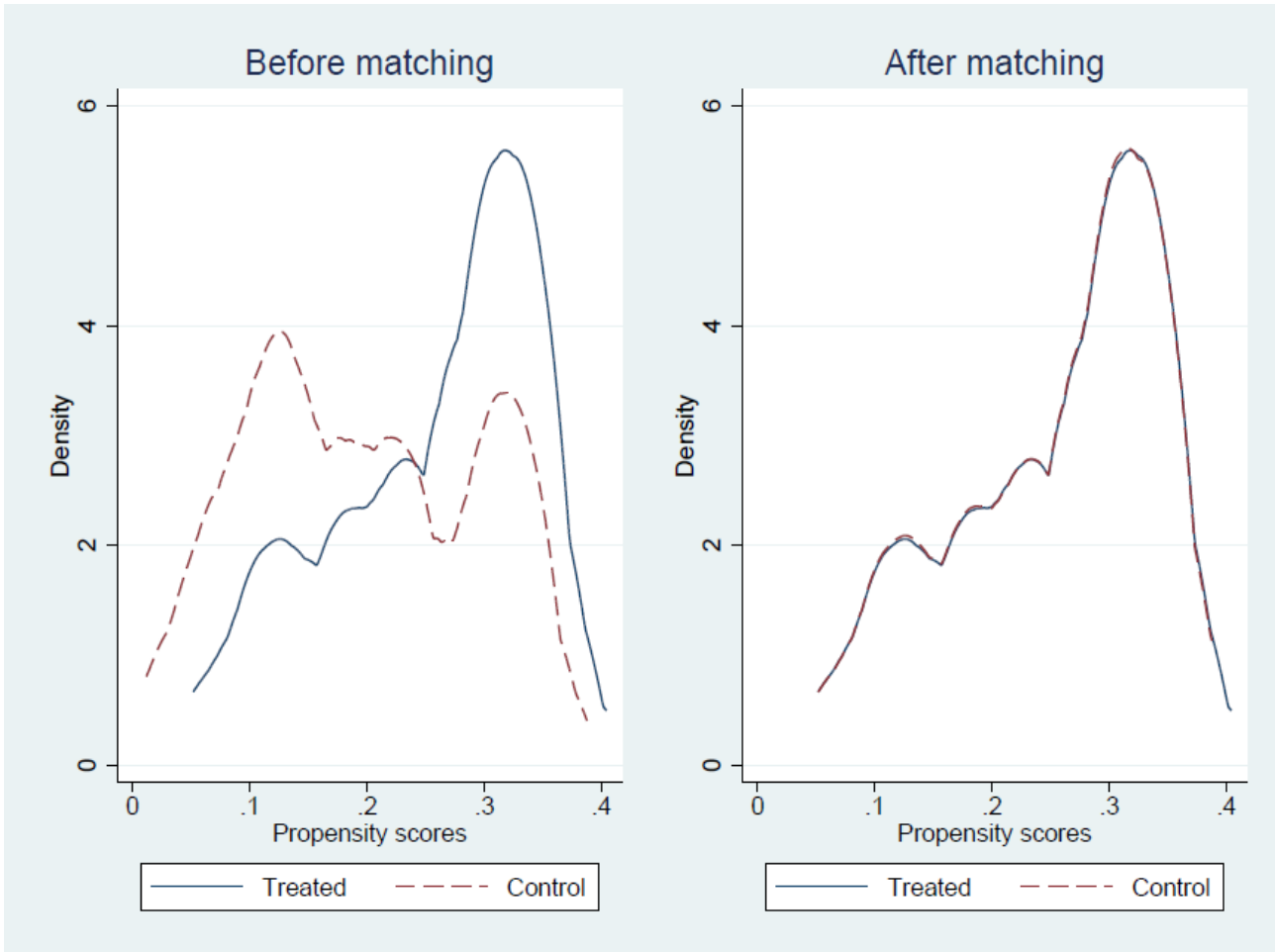


Figure 16: University E Panel A: Density plot of the propensity scores for the treatment and control group before matching for graduation in time and graduation within 4 years; Panel B: Density plot of the propensity scores for the treatment and control group after matching for the number of formative credits in the first year and the first-year dropout

REFERENCES

- Agasisti, T., & Dal Bianco, A. (2006). Data envelopment analysis to the Italian university system: theoretical issues and policy implications. *International Journal of Business Performance Management*, 8(4), pp. 344-367.
- Agasisti, T. (2009). Market forces and competition in university systems: theoretical reflections and empirical evidence from Italy. *International Review of applied economics*, 23(4), pp. 463-483.
- Agasisti T. and Murtinu S. (2014). Grants in Italian university: a look at the heterogeneity of their impact on students' performances, *Studies in Higher Education – ahead of print* (2014), pp. 1-27
- Angrist J., Lang D., and Oreopoulos P. (2009). Incentives and Services for College Achievement: Evidence from a Randomized Trial, *American Economic Journal: Applied Economics*, 1(1), pp. 1-28.
- Arendt, J.N., (2013). The effect of public financial aid on dropout from and completion of university education: evidence from a student grant reform, *Empirical Economics*, 44(3), pp. 1545-1562.
- Avdic, D. & Gartell, M. (2015). Working while studying? Student aid design and socioeconomic achievement disparities in higher education. *Labour Economics*, 33, pp. 26-40.
- Bettinger, E. (2015). Need-Based Aid and College Persistence The Effects of the Ohio College Opportunity Grant. *Educational Evaluation and Policy Analysis*, 37(1s), pp. 102S-119S.
- Bratti M., Checchi D., & de Blasio G. (2008). Does the Expansion of Higher Education Increase the Equality of Educational Opportunities? Evidence from Italy, *Labour* 22 (Special Issue), pp. 53-88.
- Bruckmeier, K. & Wigger, B. U. (2014). The effects of tuition fees on transition from high school to university in Germany. *Economics of Education Review*, 41, pp. 14-23.
- Caliendo, M. & Kopeinig, S. (2008). Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys*, 22(1), pp. 31-72.
- Castleman, B.J. & Long, B.T., (2013). Looking beyond enrolment: the causal effect of need-based grants on college access, persistence, and graduation, NBER Working Paper n. 19306
- Catalano, G. & Figà Talamanca, A. (2002). Eurostudent: le condizioni di vita e di studio degli studenti universitari italiani [*Eurostudent: Living and Studying Conditions of Italian University Students*]. Bologna, Italy: Il Mulino.
- Chapman, B. & Ryan, C. (2005). The access implications of income-contingent charges for higher education: lessons from Australia. *Economics of Education Review*, 24(5), pp. 491-512.
- Checchi, D., Fiorio, C.V. & Leonardi, M., (2013). Intergenerational persistence of educational attainment in Italy, *Economics Letters*, 118(1), pp. 229-232.

- Cingano, F. & Cipollone, A. (2007). University Drop-out - The Case of Italy. Bank of Italy, Working Paper, No. 626
- De Paola, M., Scoppa, V. & Nisticó, R. (2012). Monetary Incentives and Student Achievement in a Depressed Labor Market: Results from a Randomized Experiment, *Journal of Human Capital*, 6 (1), pp. 56-85.
- Dynarski, S. (2008). Building the Stock of College-Educated Labor, *Journal of Human Resources*, 43(3), pp. 576-610
- Dynarski, S. & Scott-Clayton, J., (2013). Financial aid policy: lessons from research, NBER Working Paper n. 18710: Cambridge (MA; USA).
- EQUNET (2010). Evolving Diversity. An Overview of Equitable Access to HE in Europe, Technical Report, Working for Equitable Access to HE in Europe, Lifelong Learning Program of the European Commission.
- Garibaldi, P., Giavazzi, F., Ichino, A. & Rettore, E. (2012). College Cost and Time to Complete a Degree: Evidence from Tuition Discontinuities, *Review of Economics and Statistics*, 94 (3), pp. 699-711.
- Glocker, D. (2011). The effect of student aid on the duration of study, *Economics of Education Review*, 30(1), pp. 177-190.
- Goldin, C., Katz L.F. & Kuziemko, I. (2006). The Homecoming of American College Women: The Reversal of the College Gender Gap, *Journal of Economic Perspectives*, 20(4), pp. 133-56.
- Graziosi, G. (2014). The Role of Merit-based and Need-based financial aid: Evidence from Trieste University's Grant Programs, *Rivista Italiana degli Economisti [Italian Economic Journal]*, XIX(1), pp. 103-126
- Häkkinen, I & Uusitalo, R (2003). The effect of a student aid reform on graduation: a duration analysis. Working paper 2003:8. Uppsala University, Uppsala
- Holland, P.W. (1986). Statistics and causal inference (with discussion). *Journal of the American Statistical Association*, 81, pp. 945-970.
- Johnstone, D. B. (2004). The economics and politics of cost sharing in higher education: comparative perspectives. *Economics of education review*, 23(4), pp. 403-410.
- Mealli, F. & Rampichini, C. (2006). I metodi e i modelli per la valutazione degli effetti delle borse di studio, in *L'efficacia delle politiche di sostegno agli studenti universitari. L'esperienza italiana nel panorama internazionale*, L. Biggeri and G. Catalano, ed., Il Mulino, pp. 139-155.
- Mealli, F. & Rampichini, C. (2012). Evaluating the effects of university grants by using regression discontinuity designs, *Journal of the Royal Statistical Society A*, 175, pp. 775-798.

OECD (2013). OECD Skills Outlook 2013. First Results from the Survey of Adult Skills, OECD Publishing. [http://dx.doi.org/ 10.1787/9789264204256-en](http://dx.doi.org/10.1787/9789264204256-en)

OECD (2014). Education at a Glance 2014: OECD Indicators, OECD Publishing.

Rosenbaum, P.R. & Rubin, D.B. (1983). The Central Role of the Propensity Score in Observational Studies for Causal Effects, *Biometrika*, 70 (1), pp. 41-55.

Rosenbaum, P. & Rubin, D.B. (1985). Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician* 39(1), pp. 33–38.

Rubin, D.B. (1974). Estimating causal effects of treatments in randomized and nonrandomized studies, *Journal of Educational Psychology*, Vol 66(5), Oct 1974, pp. 688-701.

Rubin, D. B. (1980). Randomization Analysis of Experimental Data: The Fisher Randomization Test Comment, *Journal of the American Statistical Association*, 75 (371), pp. 591-593.

Sianesi, B. (2004). An Evaluation of the Active Labour Market Programmes in Sweden, *The Review of Economics and Statistics*, 86(1), pp. 133–155.

Scott-Clayton, J. (2012). On money and motivation. A quasi-experimental analysis of financial incentives for college achievement, *Journal of Human Resources*, 46(3), pp. 614-646.

Smith, J.P. & Naylor, R.A. (2001). Dropping out of university: A statistical analysis of the probability of withdrawal for UK university students. *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 164.

Smith, J. & Todd, P. (2005). Does matching overcome LaLonde's critique of nonexperimental estimators? *Journal of Econometrics* 125(1–2), pp. 305–353.

Timms, M. (2015). Big data in education: a guide for educators, Centre for Strategic Education, Occasional Paper #139.

Triventi, M. & Trivellato, P. (2009). Participation, performance and inequality in Italian higher education in the 20th century. *Higher Education*, 57(6), pp. 681-702.

Van Damme, D. (2014). How Closely is the Distribution of Skills Related to Countries' Overall Level of Social Inequality and Economic Prosperity? OECD Education Working Papers, No. 105, OECD Publishing, Paris.