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Abstract

Using a counterfactual approach, this paper empirically investigates the impact of an educational programme recently introduced in the Province of Trento (North-East of Italy). The aim of the policy is to foster university enrolment of students from low-income families and to reduce inequalities in access to higher education. The programme, known as Grant 5B, consists in generous incentives: it targets the university students from low-income families and is awarded upon both merit and demonstrated financial need. We exploit data from an ad hoc survey conducted on a sample of upper secondary graduates and employ a regression discontinuity design to estimate the impact of the intervention on the university enrolment decisions. We find that the programme has no significant effect on enrolment rates, but it exerts a positive effect on redirecting students already bound for university to enrol outside the place of residence. Relying on the relative risk aversion theory, we explain why a relaxation of the eligibility rules based on merit might be more effective in reducing social inequalities in access to university.

1. Previous literature

The financing of higher education is an extremely debated topic in many advanced countries. Typically, public contributions to higher education are justified on the ground of positive externalities of education on the society at large. Moreover, policies that foresee financial aid to foster university enrolment aim at persuading low-income families to invest in higher education for their children by reducing the costs connected to the university attendance, thus reducing or containing inequalities.

Despite the considerable public spending for this kind of interventions, the effect of these financial aids is not uncontroversial. The empirical evidence (see Leslie and Brinkman (1988) and Heller (1997) for a review) so far has not been able to give a definitive answer about the effectiveness of financial assistance on university attendance in US, as well as in Europe. In Italy, where the participation in higher education has largely expanded in the recent decades, little has been done to address this policy question. The evaluation problem considered in this paper represents a unique opportunity to fill the knowledge gap. In particular, we consider an intervention recently implemented in a well defined area in the North-East of Italy (the province of Trento) providing significant monetary incentives for university enrolment decisions. This programme, known as Grant 5B, is a means-tested scholarship given according to merit and demonstrated financial need. Using a Regression discontinuity design, we first study whether the university enrolment probability of students is affected by the eligibility to the Grant 5B, and, second, if there is a redirection of students already bound to university. In particular we analyse the choice of students enrolled in terms of the field of study, location and prestigious of the chosen university. This allows us to contribute to the literature of the optimal school choice, focusing on decisions made at the higher education level and looking at the interplay between family income and monetary incentives, as well as the related debate about the financing of university attendance and the choice of eligibility criteria for this kind of policies.

There is a large amount of studies aimed at investigating the effects of financial assistance on university enrolment[1], but the general policy recommendation is controversial. In the following, we present a review of some applied studies on the evaluation of educational programmes aimed to sustain the transition from secondary to tertiary education. We focus on interventions which have been introduced by national and local governments in different periods of time and with diverse peculiarities, such as the exact amount of the benefit or its duration. However, even though there is heterogeneity in programme rules, which may well lead to heterogeneity in the programmes' effects, all of them are characterized by the fact that, first, they all allow a non-negligible reduction of the educational costs through financial transfers or tuition cuts, and, second, they assign incentives to students depending on their merit and/or financial need. Table 1 briefly summarizes the context, the kind of treatment and requirements of each considered intervention and reports their results in terms of effects on university attendance. Regarding US, where educational costs are particularly high Van der Klaauw (2002) studies the effects of college aid offers on student enrolment decisions and his findings show the importance of financial aid as an effective instrument in competing with other colleges for students. There is also some clear evidence that indicates that the student choices to enrol college responds positively to public financial transfers (Dynarski 2003), as well as fees reduction (Manski and Wise 1983; McPherson and Schapiro 1991; Kane 1994). Instead, Hansen (1983) does not find any significant effect of the American program BEOG on the access to higher education. These contrasting results are by no means peculiar to the US, since they follow a similar pattern in many European

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[1] Also, there are some studies of the effects of public contributions on university completion and other measures of academic achievement. For an example and a review of previous studies see Belot et al. (2007).

countries, where the cost of attending university is quite cheaper, despite some considerable heterogeneity. Lauer (2002) and Stenier and Wrohlich (2008) find that the monetary benefits positively raise the enrolment rates of German students, as well as Fredriksson (1997) and Nielsen et al. (2010) in Sweden and Denmark, respectively. But, as for the US, there are studies that find different conclusions in Europe too: in Germany Baumgartner and Steiner (2006), for instance, find a non significant effect of financial incentives on student decision of attending university.

As a matter of fact, recently there has been a shift toward programmes based on merit rather than financial need. The assessment of these policies suggest that they seem to be more effective, though the results are not conclusive. Studying the Georgia's HOPE programme, Dynarski (2000) and Cornwell et al. (2006) report that merit based incentives have positive and significant effects on the probability of university enrolment. Oppositely, Binder and Ganderton (2002), exploiting data referred to a means-test policy set up in New Mexico also based on merit, find no empirical evidence that it boosted college attendance. Instead, they point out that the main remarkable effect of the programme appears to be a redirection of students already bound for college in different institutions and type of courses. Nevertheless, from the theoretical point of view, the debate about the merit based incentives is still open. Some scholars argue that these kind of incentives will favour well off students due to the strong correlation between social origins and educational attainment (Orfield 2002).

Table 1 A review of studies that investigates the effects of financial aid on university enrolment decisions.

Study	Context (programme)	Eligibility criteria	Effect on university enrolment
Baumgartner and Steiner (2006)	Germany (BAFoeG)	Financial need	Non significant
Binder and Ganderton (2002)	US/New Mexico	Merit and Financial need	Non significant
Cornwell et al. (2006)	US/Georgia (HOPE)	Merit	Positive
Dynarski (2000)	US/Georgia (HOPE)	Merit	Positive
Dynarski (2003)	US (SSSBP)	Financial need	Positive
Goodman (2008)	US/Massachusetts	Merit	Positive
Hansen (1983)	US (BEOG/Pell)	Financial need	Non significant
Kane (1994)	US (BEOG/Pell)	Financial need	Positive
Lauer (2002)	Germany	Financial need	Positive
Manski and Wise (1983)	US (BEOG/Pell)	Financial need	Positive
McPherson and Schapiro (1991)	US	Financial need	Positive
Nielsen et al. (2010)	Denmark	Financial need	Positive
Steiner and Wrohlich (2008)	Germany (BAFoeG)	Financial need	Positive
Van der Klaauw (2002)	US/East-cost colleges	Merit	Positive

Obviously, the central question is about the efficacy of the financial aid. Drawing robust conclusions on this issue requires to understand how students and their families react to exogenous variation in the educational costs. The idea of the researches reviewed is that there is a liquidity constraint that affects the decision to enrol in university. If so, a generous set of grants will foster university enrolment reducing the direct and indirect costs of attendance. Several studies have found that there is a direct influence of family income on child's attainment, although there is substantial variation in the strength of the identified relationship (for example see Mayer 1997, Hobcraft 1998, Gregg and Machin 2000, Levy and Duncan 2000, Houston et al. 2001, Clark-Kaufman et al. 2003). These studies find that the negative effect of low income on children's attainment is still present even after controlling for family background and other key factors assumed to affect educational outcomes. Besides, economic models underlying the relationship between scholarship programmes and optimal

school choice are straightforwardly derived from the standard human capital framework (Becker 1993, Griliches 1977), suggesting that financial aid programmes should increase overall university enrolment, though they allow a sub-optimal choice equilibrium (Dynarski 1999, Binder and Ganderton 2002). Cameron and Heckman (2001) and Carneiro and Heckman (2002) challenge this approach arguing that the long-run family and environmental factors shape the ability and expectations of children. As a consequence, students from disadvantaged background do not enrol for a lack in abilities and not for liquidity constraints. This research strand suggests that financial aid is not effective and that it is necessary to intervene on children motivation during their school career, and, especially, on social origins when they are very young. Indeed, cognitive abilities are formed very early in life and it is more difficult intervene as children grow up (Heckman 2005, Cunha and Heckman 2009). Also the sociological literature stresses the leading role of social origins in influencing the educational outcomes (Shavit and Blossfled 1993, Shavit et al. 2007, Breen et al. 2009).[2] It is also possible that the scarce effectiveness of some programmes is due to some imperfections in the policy design and in particular in the targeted population. It could be the case that grants are directed to students that would have enrolled even in the absence of the programme.

To sum up, the research on this topic produced some controversial results and there is no empirical evidence for Italy.[3] Our contribution is an attempt to understand how this kind of policies works in Italy and, moreover, we are also interested in understanding if and how financial incentives should affect the enrolment decision in terms of redirection of students towards different locations or more prestigious institutions, in order to match their career and life preferences.

Exploiting data resulting from an *ad hoc* survey conducted on a sample of upper secondary graduates – the target population of the programme – and administrative archives, we find that financial aid provided by the province of Trento has no effect on university enrolment probability, but it exerts large (about 40%) positive effect on the decision to enrol outside the place of residence, especially in fields of study not covered by the local university. As for the chosen university, our estimates show that, conditional on not being influenced in the enrolment decision by the monetary aid, eligibility rule affects the decision about the location and the field of study. Hence, we conclude that Grant 5B allows for a better match between individual preferences and budget constraints.

The remainder of the paper is organized as follows. In the next section we describe the main characteristics of the Italian educational system, and we present the Grant 5B and the context where this programme has been introduced. The third section is devoted to the illustration of the data and some descriptive results, while the fourth one explain the evaluation strategy. In the fifth section we show the main empirical results, and the last section is reserved for some conclusive remarks and policy implications.

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[2] The sociological literature do not address directly the effect of monetary incentives on the inequality structure, the interest lies much more in the trend of the association between social origins and educational outcomes. They found that this association is strong, but there is evidence that in the last decades it is declining.

[3] A partial exception is given by Garibaldi et al. (2011) which do not study the effects of financial aid on enrolment, but rather how the time to complete a degree should be affected by tuition fees reduction in a famous Italian institution

2. Description of the Grant 5B programme

2.1. Context: the Italian education system and the province of Trento

The Italian education system is currently organised into three stages: primary, secondary and tertiary. In the Sixties, a set of reforms made the Italian educational system more egalitarian, partially removing the tracking system. Indeed, currently, the only constraint that the Italian students have to face to access the university is to complete a five-years upper secondary school, and pass the so-called *Esame di maturità*, a leaving exam that students have to take at the end of upper secondary school. Passing the *Esame di maturità* allows the access to higher education regardless of the final score obtained, which is in a range between 60 and 100.[4] This means that, if a student graduates from a five-years technical or vocational school, he could enrol in university. In any case, there is a set of high schools – the so called *licei* – specifically devoted to prepare students for university. Recently, the higher education in Italy has been changed after the introduction of the "Bologna Process" in 2001. A sector of shorter vocational higher education (*diplomi universitari*) created in 1990s had been removed. The current Italian tertiary education is now based on a sequential 3+2 system, which comprises a 3-year bachelor, which awards the *laurea triennale*, and a 2-year master which leads to the *laurea magistrale*.

Our research focuses on the access to higher education in the province of Trento (Trentino from now on) a small area in the North-East of Italy. Trentino is a well-developed area, with a rather tight labour market and a per capita GDP about 20% higher than the national average. Figure 1 shows that this difference appears to be stable in the last decade (panel a), and this trend is mirrored in the rate of poor families, which is lower in Trentino than in the rest of Italy (panel b). This figure is consistent with the evidence that the level of income inequality is definitely lower for about 7% than in the whole country.[5] Focusing on the youth, though the onset of 2009 economic crisis, labour market conditions are relatively favourable in the province of Trento (panel c). Furthermore, it is worth noting that, for students in Trentino, the enrolment rate at university is higher than in the rest of Italy, however this difference tends to decrease (panel d). This means that in Trentino students and their families value education investments, although the outside option is good. In the last years, more than a half of upper-secondary graduates who decided to invest in higher education enrolled at the University of Trento (UniTN from now on), which is the sole tertiary education institution in the province. Among Italian public universities, the UniTN is a really well-ranked university. It offers a large variety of courses, but fundamental schools, such as medicine and architecture, are still missing. As for the administrative and policy making perspective, Trento is an autonomous province, which means that it enjoys a large degree of autonomy[6] in fields like welfare, health, and education. Combined with the public concern for the effects of the economic crisis, the autonomy leads the local government to play a leading role in sustaining poor families facing financial troubles. Since the government of Trentino is particularly sensitive to educational issues, one of the dispositions is related with the participation in higher education.

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[4] *Esame di maturità* is composed by three written texts and an oral *colloquium*, which results weight on the final score for 45% and 35%, respectively (the remaining 20% depends on school career). More precisely, the first two written texts are decided by the Ministry of Education while the rest of the exam is school specific. The exam committee is formed by 4 out of 7 teachers of other schools.
[5] This indicator is measured by the Gini index using data from Survey on Household Income and Wealth (Bank of Italy) and Trentino Household Panel (Province of Trento Statistical Office).
[6] Because of historical and cultural reasons, in order to guarantee autonomy the Italian Constitution recognizes five autonomous regions, and only in one of these there are two autonomous provinces, which one is Trentino.

Fig. 1. Italy and Trentino at a glance: some macro indicators

a. *Per capita GDP*	b. *Family poverty rates*

c. *Youth unemployment rates*	d. *Enrolment rates at university*
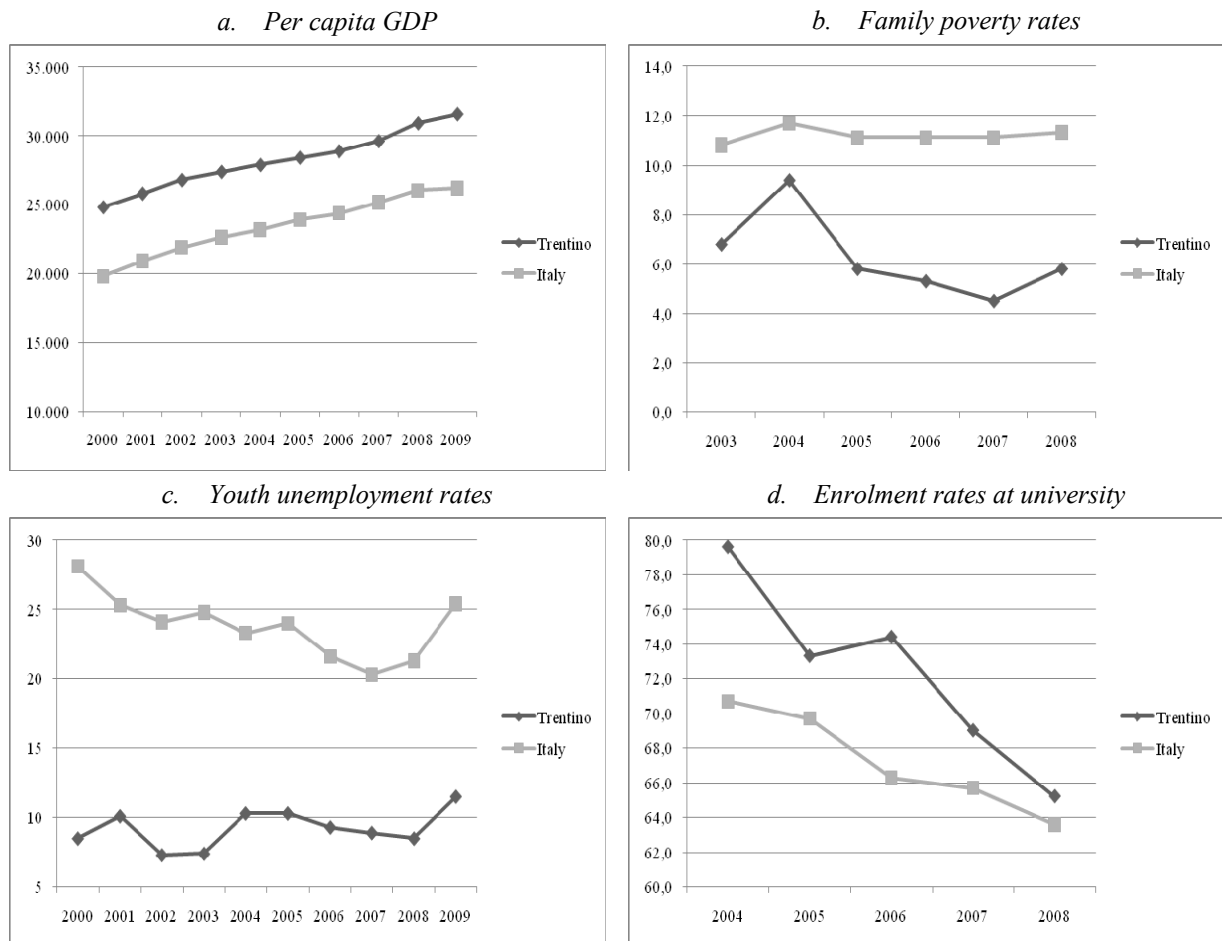
Source: ISTAT (Italian Statistical Agency) and Province of Trento Statistical Office.

2.2. The Grant 5B

Starting from the academic year 2009/2010, the local government assigns merit-based financial incentives to students from low income families wishing to enrol at university. The introduction of such an intervention represents a major innovation at the local and national level. It is worth noting that the use of means-tested benefits represents an innovation in the field of transfer programs in Italy as well as Southern Europe. The grant 5B should cover the indirect costs connected with the participation in Higher Education. Usually in Italy there are limited programmes, called *Diritto allo studio* (Right to study), implemented by the universities aimed at cover the direct costs (tuition, accommodation, teaching material, *etc*.). Students can access to *Diritto allo studio* on the basis of family income and academic performance. The novelty of the Grant 5B is that it works as a generous top-up of these usual schemes allowing a remarkable reduction in educational costs.

The Grant 5B was introduced after it emerged that there is a worrying negative trend in the enrolment rate (fig. 1, panel d) together with a persistence of inequalities between social classes[7] (fig. 2). Indeed, in the last three years the enrolment rate falls from about 74% to 67% together with a class polarization between upper (service class and routine nonmanual) and other classes (working class and self-employed). Setting up this programme, local policy makers intend to reverse the negative trend in the enrolment rate and at the same time to reduce inequalities between social classes.

The monetary aid is awarded upon both the demonstrated financial need and the merit of students. Specifically, the scholarship is paid to those who have successfully completed the last year of secondary school (*Esame di maturità*) obtaining a final score which fall above 93/100 and whose family equivalent income is below a certain threshold, set around € 30,000.[8] In addition, students are expected to have been residing in Trentino for at least 3 years. The amount of benefit varies depending on the family income and geographic location of the chosen university. Students enrolling in universities located within the province of Trento are entitled to financial aid ranging from € 1,200 to € 4,800 per year; while students enrolling in universities outside the province and moving there are offered scholarships from € 1,800 up to € 6,000 per year. However, table 2 reveals that more than 80% of Grant 5B recipients receive an amount larger than € 4,500 per year, which means a monthly scholarship in the range € 375–500. The monetary aid is renewable upon determining whether or not a student is still eligible to qualify for help from the programme and the total expenditure for the first year of the introduction of the programme amounts to some € 630.000.

Table 2. Amount of Grant 5B

Amount per year (€)	N	%
Less than 1.500	5	4
1.501 – 3.000	7	5
3.001 – 4.500	10	8
4.501 – 6.000	111	83
Total	133	100

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[7] Social class is build according to the European Socio-economic Classification (Rose and Harrison 2010) and is based on the employment relations characterising different groups of similar occupations. We identify four social classes: a) Salariat: large employers, higher grade professional and managerial occupations; b) White collar: clerical and administrative occupations; c) *Petite bourgeoisie*: small employer and self-employed occupations; d) Working class: skilled and non-skilled manual occupations.

[8] This predetermined threshold is measured by an *ad hoc* index called Icef which summarize incomes and assets of each family using a certain scale of equivalence that is not far from to the OECD one. But, since it takes into account family components assets as well as income, the interpretation of this indicator is far from straightforward. However, a family with € 30,000 of equivalent income measured by Icef is not a proper "poor" family, since the sixty percent of the median incomes in the Province of Trento is around € 8.300.

Fig. 2. Enrolment rate according to parental social class, Trentino (2004-2009)
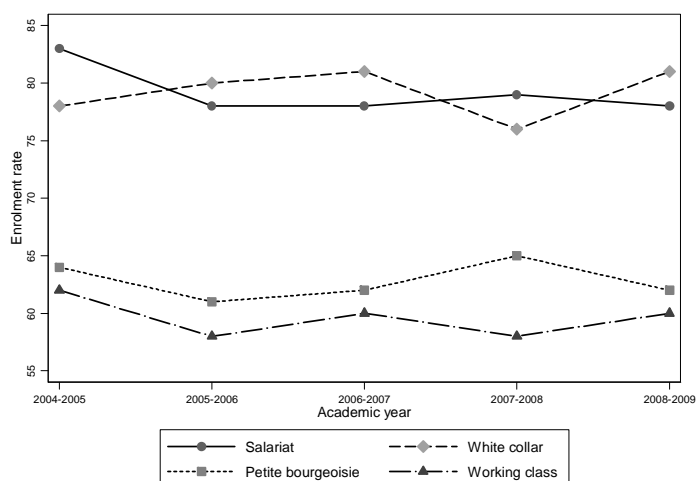
Source: *Survey on the secondary schools graduates in Trentino*, University of Trento

3. Data and descriptive evidence

We exploit data resulting from the linkage between the archives of *Opera Universitaria* – the agency in charge of the administration of the programme – and an *ad hoc* survey administered to gather information for the quantitative evaluation of the programme. Data collection has been carried out by IRVAPP and University of Trento and the questionnaires were administered by CATI (Computer-Assisted Telephone Interviewing) and CAWI (Computer-Assisted Web Interviewing) procedures.

The reference population consists of the 3,168 high school graduates in Trentino for the year 2008/2009 who could enrol at the university in the academic year 2009/2010. The aim of the survey is censual and we were able to interview 2,744 students with a high response rate (87%). We gathered information about: a) Socio-demographic characteristics (gender, family size, geographic area of residence, age); b) Social origins (parental social class, parental education, economic resources, parental support); c) School career (school type, final score at *Esame di maturità*, final score at *Licenza media*[9]).

Table 3 reports information about the enrolment rate at the university for the high school graduates in Trentino. It emerges that about 39% of the enrolled students decides to attend universities outside Trento and a huge proportion of these students choose schools absent from UniTN. It is interesting to notice how, on average, they choose locations that are not too far from Trento (fig. 3). Indeed more than 60% of the students outside Trento move to an university located in a radius of 150 km.[10]

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[9] More precisely, *Esame di maturità* and *Licenza media* are exit exams. The first is at the end of the high school, while the second concludes the lower secondary school.

[10] This measure correspond to about 93 miles.

Table 3. Enrolment rate at university

|	N	%	%	%	Grant 5b recipients
Total graduates a.s. 2008/09	2,737	100.0			
Not enrolled	821	30.0			
Enrolled at University	1,916	70.0	100.0		133
in Trento	1,172		61.2		75
outside Trento	744		38.8	100.0	58
in schools <u>absent</u> from Trento	483			66.6	40
in school <u>present</u> in Trento	242			33.4	18

Fig. 3. Enrolment locations outside Trento.
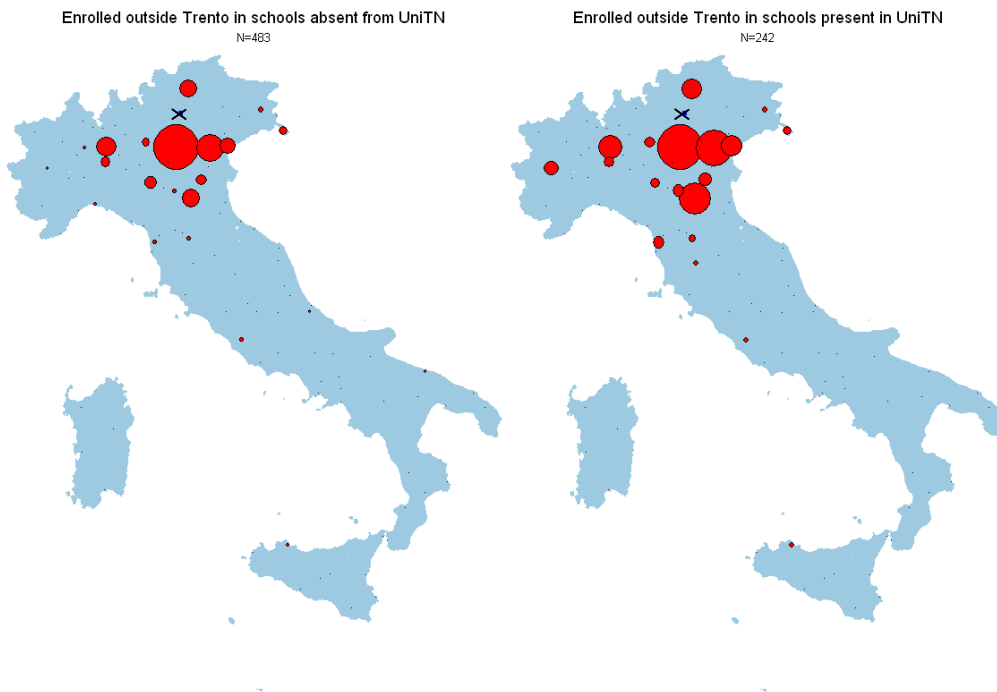
Note: *Trento is marked by cross (X) .*

In general the higher educational demand in Trentino follows what is known in literature (Brand and Xie 2010) and that the main factors that could influence the enrolment probability are: social origins, parental style, family structure and school career.[11] An interesting point emerges if we consider the interaction between social class and the final score obtained at the *Esame di maturità*. Indeed, figure 4 shows that the class differences in the enrolment behaviour tend to disappear once the final score is considered. In particular, working class children with high scores behave similarly to the offspring of other social classes. As a consequence, we have that the so called risk aversion (Breen and Goldthorpe 1997; Checchi et al. 2008) is weak for pupils from disadvantaged background but with a high school achievement. Our empirical analysis for Trentino shows that the disadvantaged families

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[11] The analysis are available from the authors on request.

will tend to invest in higher education if their children go well at school. This evidence is Trentino specific: in the rest of Italy we do not observe this reduction in inequalities. In fact, in the rest of the country the distance between social classes remains constant even after controlling for the final score at *Esame di maturità*.[12]

Fig. 4. Enrolment rate according to social class and final score at *Esame di maturità*[13] *(N=2458)*.
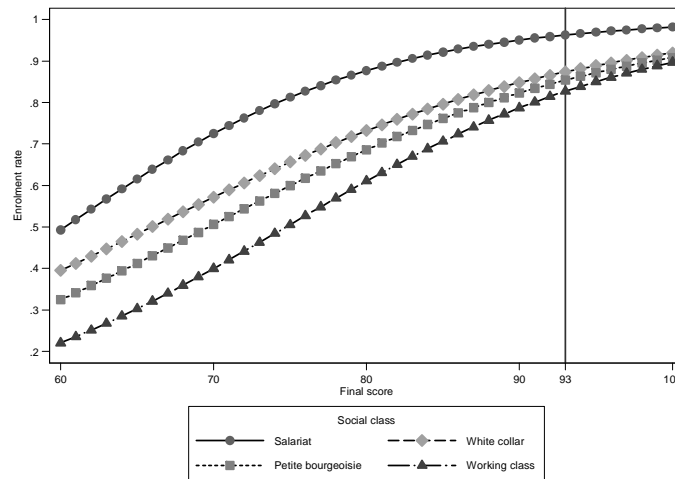
4. Evaluation strategy

In this paper we refer to the so-called counterfactual model of causality.[14] The primary goal of the causal analysis is the investigation of selected effects of a particular cause rather than the search for all possible causes of a particular outcome (Morgan and Harding 2006). The approach foresees the effect of the programme is evaluated as the difference between the individual behaviours after the introduction of the policy compared to what would have been happened in the absence of this programme.

Throughout the remainder of this paper we follow the notation of the *potential outcome approach* to causal inference[15], except for an important distinction: in our case study the 'treatment' is not receiving the Grant 5B, but the 'eligibility' to it. Therefore let E be the binary variable denoting the eligibility status indicator, with $E=1$ for those students eligible to the cash transfer and $E=0$ otherwise, and (Y_1, Y_0) be the two potential outcomes that would be realized whether the student is eligible and if the student is not, respectively. In the context of this paper, Y_1 and Y_0 represent higher education enrolment decisions so that they can stand for university attendance, location and prestige of the chosen university, corresponding to the students being eligible and ineligible, respectively. The *causal*

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[12] Schizzerotto and Barone (2006) finds for Italy that there is any reduction in the distances between the different social classes also controlling for marks.

[13] The graph represents the interaction between the final score and social class on the all sample (even if for 279 students information about social class is missing). Figure 2 has been build using the Stata routine *predxcon* (http://ideas.repec.org/c/boc/bocode/s402602.html).

[14] The counterfactual model of causality is widespread in the social sciences. See for example: Heckman et al. (1999), Pearl (2000), Shadish et al. (2002), Morgan and Winship (2007), Imbens and Wooldridge (2009).

[15] See Rubin (1974), Heckman (1979) and Holland (1986) for a deeper explanation of the potential outcome approach.

effect of the eligibility to the Grant 5B on enrolment decisions is then defined as the difference between these outcomes, $Y_1 - Y_0$, which is not observable at the individual level since being eligible reveals Y_1 but conceals Y_0. Indeed, though Y_1 and Y_0 are potentially observable and since a certain student can either being eligible or ineligible but not both, only one of these two potential outcomes can be realized. As a result, if a student is eligible to claim the aid ($E=1$), then Y_1 will be realized and Y_0 will (*ex post*) be a counterfactual outcome and *vice versa*. Accordingly, though not observable, $Y_1 - Y_0$ represents the change in the propensity to decide whether to enrol and attend a university with certain characteristics, corresponding to a change in the eligibility status of the student and his/her family, which is our quantity of interest.

Since $Y_1 - Y_0$ is likely to vary across individuals and observing both Y_1 and Y_0 for the same individual is impossible, there is no way to pin down the individual causal effect of being eligible to the aid.[16] Hence, following the statistic and econometric literature on programme evaluation, we focus on average causal effects for the subpopulation of individuals actually eligible to the financial aid defined as $E[Y_1-Y_0|E=1]$, the so-called Average Treatment Effect on the Treated (ATT). Notwithstanding, it is straightforward to obtain the following identity:

$$E[Y_1|E=1] - E[Y_0|E=0] = E[Y_1 - Y_0|E=1] + \{E[Y_0|E=1] - E[Y_0|E=0]\}$$

where the observable difference between the mean outcome experienced by the eligible group and the mean outcome experienced by the comparison group is decomposed into two terms: the first one is the ATT, and the second term is the *selection bias* induced by the differential composition of the two groups with respect to the eligibility condition. Hence in the observable difference between eligible students and those students who do not have access to the programme, we need to disentangle the causal effect of being eligible to the aid from the effect of the different composition of the two groups.

In our case study, in order to be eligible, students must have obtained very good results at *Esame di maturità* and come from low-income families. It is widely known that merit and income influence the enrolment decisions. As a consequence, the difference in the enrolment propensity and preferences between eligible and ineligible could remain even in the absence of the programme. To solve this problem we should consider that the eligibility depends on administrative rules that identify two threshold of assignment criteria (merit and financial need). As a consequence, a discontinuity in the treatment is determined, because only students with the final score above 93/100 and from families with an equivalent income below € 30,000 are eligible, while other students are excluded. The more suitable identification strategy consists in comparison between the enrolment rates around the threshold values. This strategy is known as Regression Discontinuity Design (Rdd in what follows).[17]

The basic idea underlying Rdd is that a little change in the assignment variables, should not have significant impacts on the individuals' behaviours. Indeed, in our case, albeit the final score depends also on the previous scholastic career and so that is a determinant of the enrolment decisions, it is feasible to suppose that slightly variations in the score (one-two points) are not influential. As a consequence, we could compare subjects immediately below and just above a given threshold, because we can consider them equivalent excepted for the eligibility to the treatment. In the case of the Grant 5B, we have two different threshold and so that we have to deal with four subpopulations (Table 3):

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[16] Holland (1986) refers to this issue as "the fundamental problem of causal inference".

[17] For recent development regarding Rdd see Imbens and Lemieux (2008) and Lee and Lemieux (2010). Rdd was developed in the Sixties by (Thistlethwaite and Campbell 1960) but it experienced a renew interest only in the last decade (especially since the seminal contribute of Hahn *et al.* 2001). For a review of the usage of Rdd in the social sciences see Cook (2008).

- Eligible group: students with a mark above or equal to 93/100 and income lower € 30,000.
- A control group: individuals with a final score below 93/100 and income lower € 30,000.
- B control group: subjects with a mark of at least 93/100 and income above € 30,000.
- C control group: those with a final score below 93/100 and income above € 30,000€.

Table 4. Subpopulations for the high school graduates academic year 2008/09

		Final score on Esame di maturità	
		≥ 93	< 93
Income	≤ € 30,000	Eligible group (N=182)	A control group (N=1,121)
	> € 30,000	B control group (N=14)	C control group (N=96)

In such cases, it is possible to exploit all the control groups that arise from the double assignment criterion (Rosenbaum 1987).[18] Unfortunately, we have completed data only for a representative sample of students from low-income families, that are the eligible and the A control groups (table 4). As a consequence, the only meaningful comparison that we can perform is around the merit requisite so that, henceforth, we focus our analysis on 1.303 students below the income threshold.[19]

In this case, the algebraic difference between the sample mean of the enrolment rate immediately below and just above the mark threshold provides an unbiased estimate of the effects of the Grant 5B. Let S be the variable denoting the score at *Esame di maturità* and values $S=93^+$ and $S=93^-$ denoting individuals marginally above and marginally below $S=93$, respectively, so that an unbiased estimate of the mean causal effect is provided by the empirical counterpart of

$$E[Y_1 |E=1, S=93^+] – E[Y_0 |E=0, S=93^-]$$

that is the ATT at the 93 threshold.

As Imbens and Lemieux (2008) point out, the drawback of the identification strategy considered is that Rdd has a limited degree of external validity, which means that if the programme's impact is heterogeneous across students, as it likely to be in most cases, then it just allows to identify the causal effect for individuals around the threshold. Nevertheless, Rdd ensures the internal validity of the estimates. In fact, Rdd could be seen as a local randomized experiment, because around the threshold it creates a situation similar to a social experiment (Lee and Lemieux 2010, p. 289).

The condition for this result to hold is that the conditional expectation $E[Y_0 | S]$ is a continuous function of the final score determining, in the case at hand, the eligibility condition, especially in the neighbourhood of $S=93$, that is the classic *sharp* Rdd identifying restriction, which will be maintained throughout the remainder of this paper. Indeed, though not observable for eligible students, there is no reason to believe that $E[Y_0 | S]$ is not continuous, since there are no other enrolment incentives based

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[18] More precisely, Battistin and Rettore (2008) and Lee (2008) are examples that consider more than one control group. Usually, with more control groups scholars produce separated analyses for every assignment variables even if it possible to conduct Rdd with multiple assignment variables jointly considered.
[19] See the appendix for a deeper discussion of the validity of this choice.

on this threshold value. Hence, we can impute any differences at the threshold to the introduction of the Grant 5B. However, following McCrary (2008) in section 6.3 we carry out a test to validate this assumption: the underlying idea is that a sufficient condition for the continuity of the $E[Y_0 \mid S]$ is that individual densities of the eligibility-determining variable are smooth. In the case considered here, this implies that there is no way for students and their teachers to manipulate the final score at *Esame di Maturità* and as long as their control over the score is imprecise, eligibility condition is randomized around the threshold.

5. Empirical results

In a Rdd setting the goal is to verify the existence of a possible discontinuity around the threshold attributable to the programme. Then, as for the estimation perspective, the idea is to model the outcome variable considering the final score. Following the recent development in Rdd (Hahn et al. 2001; Imbens and Lemieux 2008), in order to estimate the conditional expectations in samples around the threshold, the main approach is to use Local Linear Regression (henceforth Llr). The basic idea underlying the Llr is to run simple linear regressions allowing for different slopes of the regression function in the neighbourhood of the threshold. In this vein, assuming that a similar pattern characterizes outcomes as a function of population, a simple comparison for the mean predicted value just above and below the threshold provides an unbiased estimate of the causal effects of being eligible to claim the Grant 5B on outcomes related to university enrolment decisions.

5.1. The effect on university enrolment

To start with, we consider enrolment at the university as the first outcome. Let Y be the variable taking value 1 if a student is enrolled at the university 0 if she/he does not so that $E[Y|S=s]$ represents the mean enrolment rate at the university for students with a final score of *s*. Panel a in figure 5 clearly shows actual and fitted values for $E[Y|S=s]$. It is straightforward to see that just above and below the threshold, fitted expected values of the transition rates are substantially identical. The results is also confirmed by the perfect overlapping of the two confidence intervals for the fitted values (marked by the grey area).

As a consequence, since Rdd allows to disentangle the effect of the programme from other confounding factors, we can conclude that there is no impact of the eligibility to the Grant 5B on university enrolment decisions. In different words, we can affirm that the aim of the policy makers to boost higher education participation has not been reached, because the target population is made up of students who would have enrolled at the university even in the absence of the Grant 5B.

This result – combined with the empirical evidence that worthy students' families are inclined to invest in tertiary education regardless their social-economic background – seems to suggest that the programme does not work, because it has been addressed to the wrong target population. Indeed, for students with a score at *Esame di maturità* of at least 93/100, liquidity constraints are definitely not an issue in the decision to enrol at university.

However, it should be possible that monetary incentives affect other decisions about university attendance, which means that students already bound for university can be redirected by the eligibility to the Grant 5B. Although liquidity constraints do not affect university enrolment decision, financial aids can affect students' behaviour allowing a better match with their preferences regarding the location of the chosen university, its prestige, or field of study. Thus, in the following, we try to move the policy makers' goalpost to study other possible effects, basically, which have not been expected in Grant 5B design and implementation.

Fig. 5. The effects of the Grant 5B, Llr estimates

a. University attendance: enrolment rate (N=1.303)   *b. Location: enrolment rate outside Trento (N=985)*
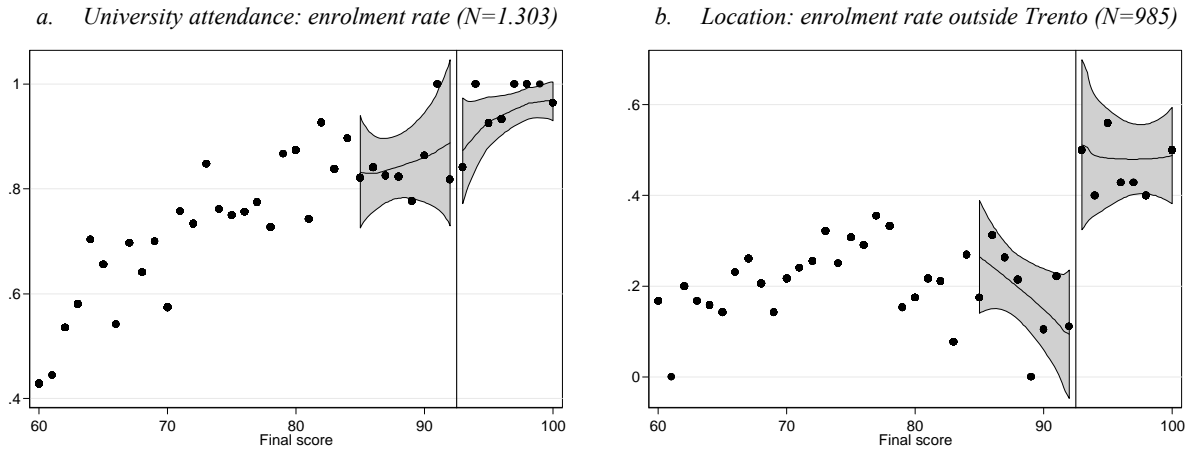
5.2. The effects on redirecting students already bound for university

Since monetary transfer provided by the Grant 5B cannot foster university participation, enrolled students are not a selected subsample of the population of graduate students entitled to enrol at university. Thus, we can focus on the 985 enrolled students below the income threshold to study the effects of the Grant 5B on their enrolment decisions without any loss of generality.

Following previous results, mentioned above about the effects of financial aid to students, we further replicate the Rdd in order to investigate the effects of the programme in redirecting students already bound for university in different locations. Now, let Y be the variable summing up the location of the chosen university: it takes value 0 if the student is enrolled at the University of Trento and 1 if she/he is enrolled outside Trento. This leads to define $E[Y|S=s]$ as the mean enrolment rate at universities located outside Trento, conditioning on s.

From our analysis, it clearly emerges that monetary incentives favour the decision to enrol outside Trento (fig. 5, panel b). In fact, the predicted values of the enrolment rate outside Trento at the threshold are dramatically higher (about 40%) for eligible students than for ineligibles. This means that, albeit the eligibility to the Grant 5B does not affect the enrolment rate, it gives the chance to move outside Trento, solving potential mismatch problems between preferences and economic constraints. A straightforward explanation is that eligible students see a conspicuously reduction in the moving costs and they have the possibility to follow their preferences with less constraints.

We do not model choices directly, but we try to provide evidence in favour of the leading characteristics of the chosen university comparing enrolled eligible and ineligible students in the Rdd setting described above. Indeed, considering that monetary aids should permit to widen the alternative options, students eligible to the Grant 5B are more likely to choose a course or a school that is not present at the University of Trento or that perform better in the national rankings.

Exploiting data related to the absence of the faculty which has been chosen by freshmen, it clearly emerges that eligible students decide to enrol outside Trento in order to attend schools or faculties that are not present at UniTN, such as Medicine, Veterinary science and Pharmacy. The fitted values of the enrolment rate in schools absent from UniTN (in panel a of fig. 6) for eligible students is some 42% higher than for ineligibles to the Grant 5B. The Rdd applied to the distance between Trento and the chosen university shows that, on average, there is a barely significant impact of less than 50 Km. This

result is coherent with the fact that students enrolled at university from the province of Trento do not choose to attend institutions far away from their hometowns (fig. 6, panel b).[20]

Fig. 6. Redirection: Llr estimates (enrolled students, N=985)

a. Schools absent from UniTN

b. Distance from Trento

c. Normalised prestigious score

d. Rent for a room
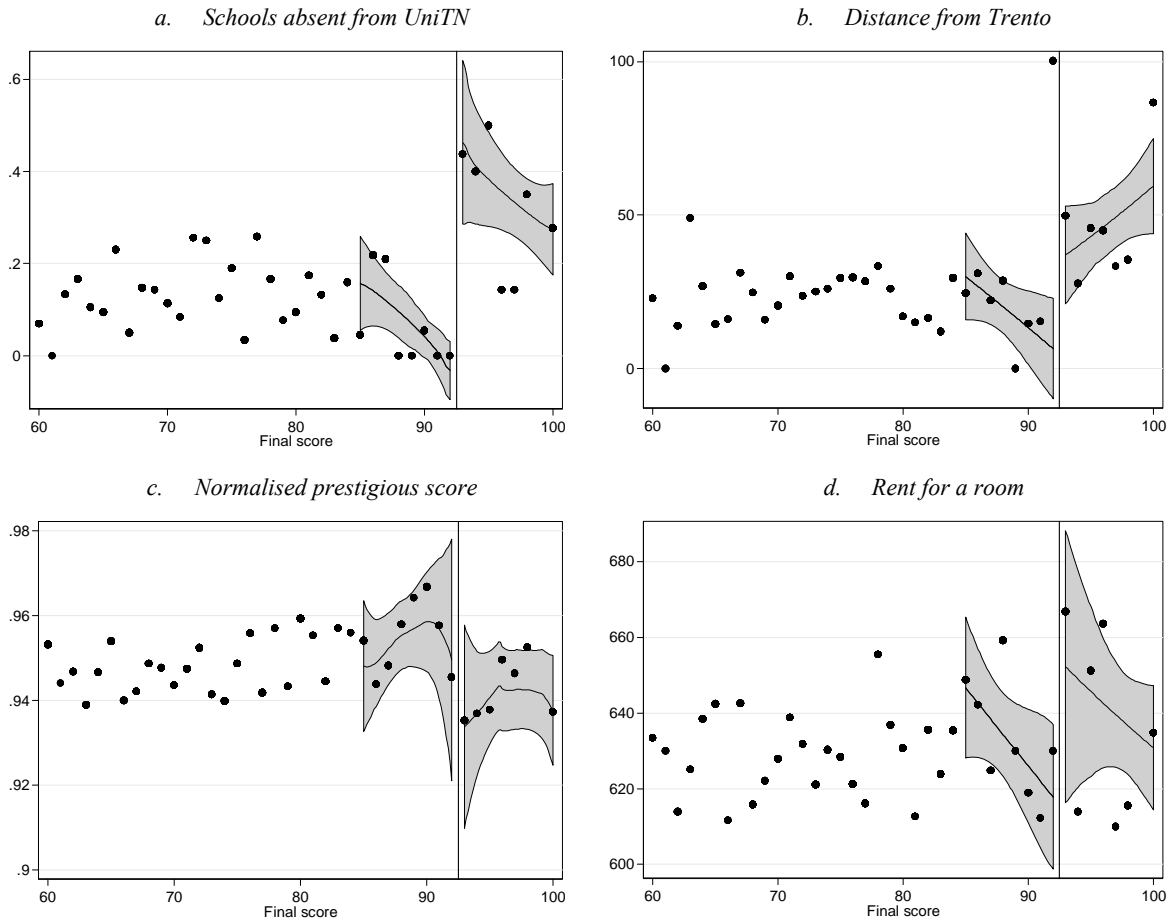
Furthermore, we also investigate whether the decision to enrol outside Trento is fostered by the chance to attend top universities according to the national rankings.[21] Panel c of figure 6 clearly shows that the eligibility for the financial aid does not shift choices towards more prestigious schools, since the estimated impact is negative (less than .2 score points), though not significant. A possible explanation is due to the fact that that UniTN performs very well in the national rankings with a set of schools (Sociology, Law and Natural Sciences) at the first place in the schools rankings considered here. A similar result is shown by the impact of the programme on the measure of the cost-of-living provided by the mean price to rent a room in the city of the chosen university. In this case the impact is positive but not significant as well.

To sum up, we can stress that, even though financial aid do not foster university attendance, the Grant 5B has a clear effect in redirecting students already bound for university to attend schools which are not present at UniTN.

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[20] This result confirm the descriptive evidence emerging from figure 3.

[21] We gather data about the prestigious of each school in the chosen university, measured by an Italian very widespread ranking published every year and advertised by national media, i.e. the Censis Guide from La Repubblica newspaper (CENSIS 2008).

5.3. Testing Rdd assumption

As just mentioned, in Rdd a sufficient condition for the continuity of the potential outcome in absence of the programme is that it is no possible to manipulate the score variable. Testing this assumption is indispensable to demonstrate that in the absence of the treatment there would have not been any discontinuities on the threshold (McCrary 2008). The McCrary test is relevant in our setting, indeed, the threshold value (93/100) was known by students and teacher before the assignment of the final mark. Anyway, there's no room to think that a manipulation of the final score takes place. Indeed, in figure 7, it is possible to notice a slight discontinuity on the threshold, but this jump is not statistically significant neither for the target population overall, nor for the enrolled students. Furthermore there are larger jumps at different values (e.g. 70, 80, 100). For this reason we can retain our estimates of the effects of the Grant 5B unbiased.

Fig. 7. McCrary test: manipulation of the score variable, Llr estimates

a.   *All students below the income threshold (N=1,303)*   b.   *Enrolled students (N=985)*
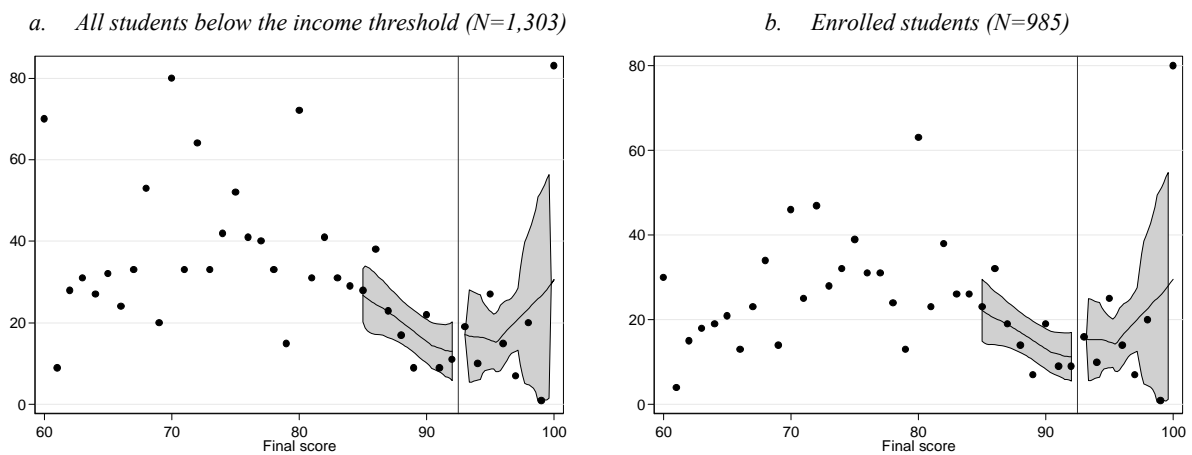
5.4. Robustness checks

In the previous subsections we presented Llr estimation results obtained with epanechnikov kernel and implementing the optimal bandwidth choice algorithm suggested by Imbens and Kalyanaraman (2010). However, in order to check the robustness of these results, we try different bandwidths and exploit the use of different kind of kernel function to weight local polynomial. Appendix B shows that, though slight changes in the estimates of the ATT at the threshold and in their standard errors probably due to the relatively few observations in a local neighbourhood of s=93, conclusions about the effects of the Grant 5B do not change.

Moreover, we carried out parametric estimation of the effect through the specification of two linear probability models, one for the eligible and one for the ineligible students below and above the threshold, respectively (table 4). The parametric approach leads to conclusion about significance of the estimates which are not different from what we have obtained non-parametrically. To ensure that findings are not driven by functional form assumptions, we run estimates with various covariates specifications, and with non-linear models (logit and probit). We conclude that results are not sensible

to different estimation strategies, hence we can retain that the results presented in the previous sections 6.1 and 6.2 are robust. [22]

Table 5. The effects of the Grant 5B, parametric estimates

	N	ATT estimate	Std. Er.
Effects on enrolment decisions:			
university attendance: enrolment rate	1,303	0.01	0.095
university location: enrolment rate outside Trento	985	0.40 ***	0.109
Preferences on enrolment decisions:			
schools absent from UniTN	985	0.45 ***	0.092
distance from Trento	985	46.05 **	19.860
normalised prestige score	985	-0.03 **	0.012
rent for a room	985	41.11	40.010

*** :$p<0.01$; ** : $p<0.05$; * : $p<0.10$

6. Concluding remarks

Monetary aids could be an important tool to weaken the influence of the social background on the tertiary education and to make it accessible to the students that otherwise would not consider the possibility to enrol at the university. In our research we study the effects of the introduction of the Grant 5B in the province of Trento, which provides merit-based financial aids for students from low-income families, and we find two main results. First of all, despite to a considerable reduction of indirect costs connected to university attendance, the programme does not bear an effect on the enrolment rate. Nevertheless, it exerts a remarkable influence on the moving decision, since students who are eligible to receive the monetary incentive choose to attend an institution outside their place of residence.

The null effect on the enrolment decision could be a sign of the absence of liquidity constraint and, as a consequence, of the presence of the long-run family effects advocated by Heckman and colleagues. At the same time, it is possible this policy has not been design properly. More precisely, the programme is addressed to a target population who would have enrolled at the university in the absence of the Grant 5B as well. Indeed, we show that the difference in the enrolment rate between the various social classes surprisingly decline when the marks increase. This means that worthy students and their families are willing to invest in higher education even if they come from disadvantage background. In other words, we find that the risk aversion for low-income families is very low. Maybe the outstanding results of their offspring are a good signal of the future academic success.

Thus, in order to improve the effectiveness of the programme one solution could be the reduction of the final score threshold in order to favour the enrolment of students that otherwise would not go to university. In fact, if the aim is to increase the enrolment, the policy has to be focused on students who are not highly inclined to go to the university, and the most problematic students are those of the working class. For this reason, a policy recommendation could be to target financial incentives to

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[22] Our estimates are also robust to different sample stratification (kind of secondary school attended, parental education, social class, economic condition). The analysis are available from the authors on request.

students from "true" low-income families. Therefore, in this particular case, since also middle-income students are eligible to the scholarship, we suggest to reduce the financial threshold, together with the merit constraint, to improve policy efficacy.

As for the interpretation of the second outcome, the effect on redirecting students already bound for university, we find a remarkable effect of the Grant 5B. So, even though financial aid is not able to foster enrolment, they influence the choice of university. Specifically, empirical evidence shows that eligible students tend to study at university located outside the province of Trento, in schools which are not present at UniTN. This means that, thanks to the monetary incentives provided, eligible students can take decisions about the choice of the university and school to attend, without limitations given by budget constraints. This evidence deserve more attention and in future researches we plan to investigate the determinants of university enrolment decisions with particular attention in order to take into account the characteristics of the students' potential choices.

Appendix A

In this appendix we handle with the problem of missing values on the income variable. As reported in note 9, the economic condition of the year 2009 is measured by the Icef index and we do not have the Icef 2009 information for more than the half of the sample. In order to avoid a sample selection we linked to the individuals the Icef concerning the year 2008 as well.[23] The difference between Icef 2008 and 2009 (for those subjects both data are available) are barely noticeable (fig. A1) and it is almost zero around the income threshold.

The non-response rate remains quite large also after this imputation (48.8%). We believe that people with high income and with a good economic condition do not present the Icef documentation, because they are aware of their non eligibility. To test this assumption, we model the non-response rate in order to understand if the data is missing at random. If our assumption is credible, we can conclude that our sample is representative for the population under the Icef threshold.

It emerges (table A1) that there is quite a clear pattern in the missing values. More precisely, we find that the more disadvantage families (in terms of class and education) are more likely to present the Icef documentation. The same is true for the larger families and for families in which one parent is missing. In general, we have that the missing values are more concentrated in the richer strata of the population. This result confirm the validity of our evaluation study (section 5), indeed we consider only students from low-income families for which we have all the relevant information. Moreover, the results in table A1 show that disadvantages families tend to present the Icef documentation and this imply that our sample for low-income families is representative.

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[23] For this operation we exploit an administrative database supplied by Clesius, the agency in charge of the calculation of Icef.

Table. A1. Logistic regression for the probability of submit Icef: point estimates and standard errors

	Coeff.	S.E.
Constant	-0.336**	0.154
Parental social class		
Salariat *(ref.)*		
White collar	0.202*	0.124
Petite bourgeoisie	-0.487**	0.172
Lower white collar	0.559***	0.160
Working class	0.373**	0.151
Parental education		
University *(ref.)*		
Upper secondary	0.458***	0.134
Lower secondary	0.715***	0.153
Primary	0.881*	0.530
Family size		
One-two *(ref.)*		
Three	0.440***	0.108
More than three	0.544***	0.132
Type of family		
Only one parent *(ref.)*		
Both parents	-0.863***	0.140
Type of school		
Non academic *(ref.)*		
Academic	0.300***	0.090
Pseudo-R^2=0.04		
N=2,401		
***:$p<0.01$; **: $p<0.05$; *: $p<0.10$		

Fig. A1. Icef comparison between 2008 and 2009 (the income threshold is marked by the vertical line).
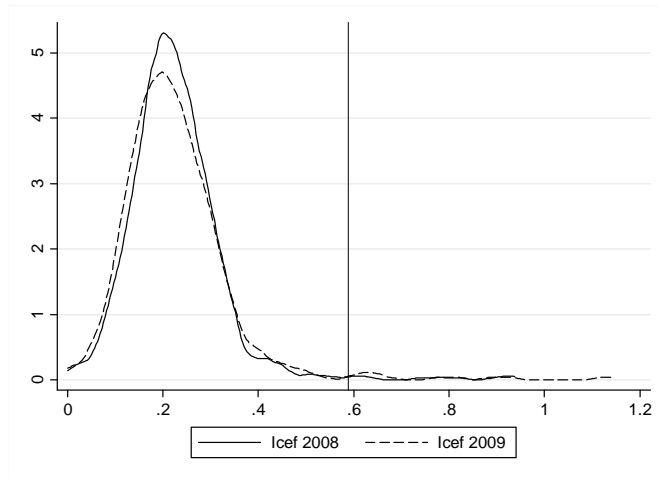
Appendix B

Because different bandwidth choices can produce different estimates, in this appendix we carry out a sensitivity analysis to show that estimates presented in section 6 are robust to different bandwidth specification. For each outcome considered, figure A.2 shows Rdd estimates using twice and half the bandwidth used in the main results and the same kernel.

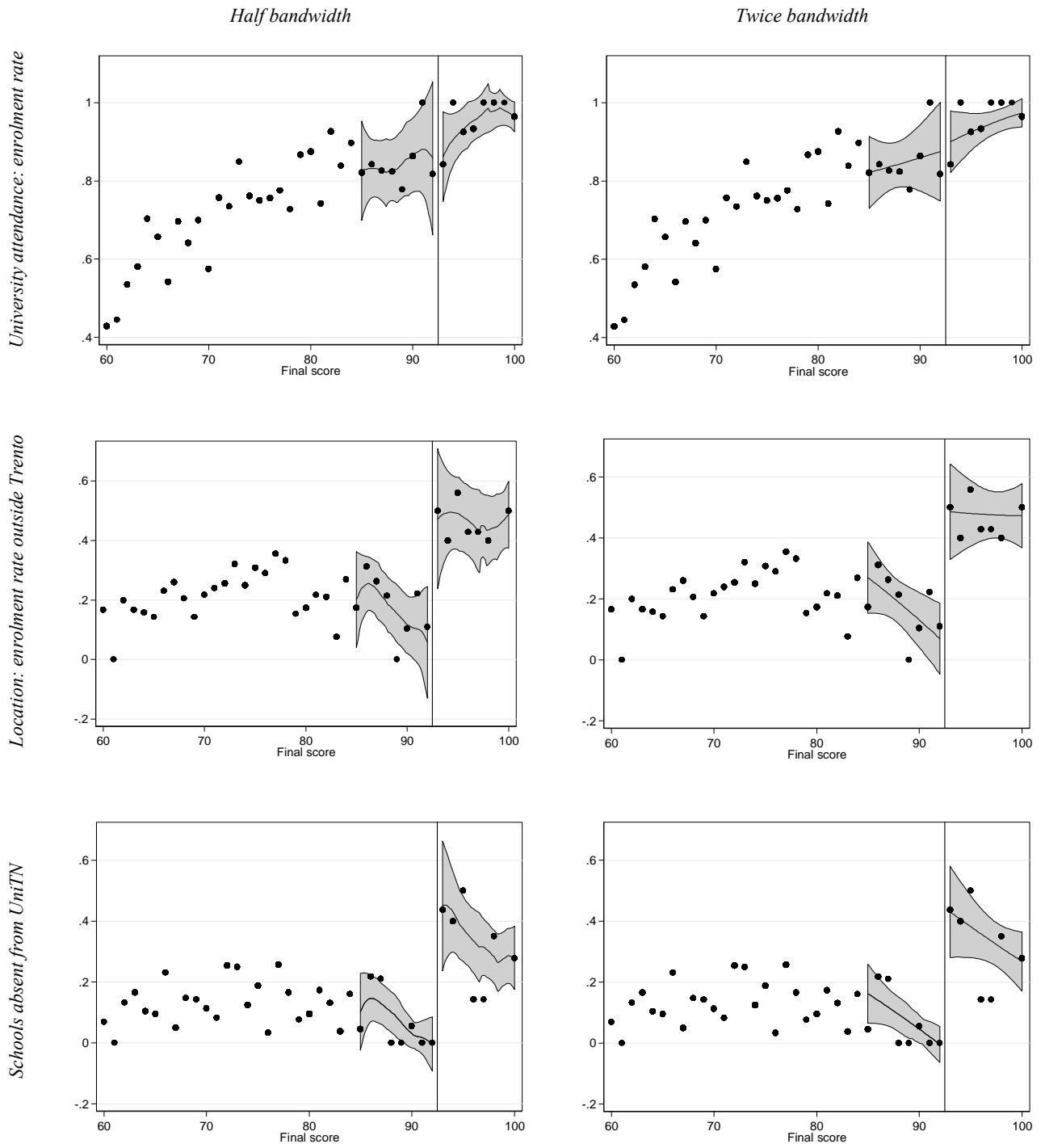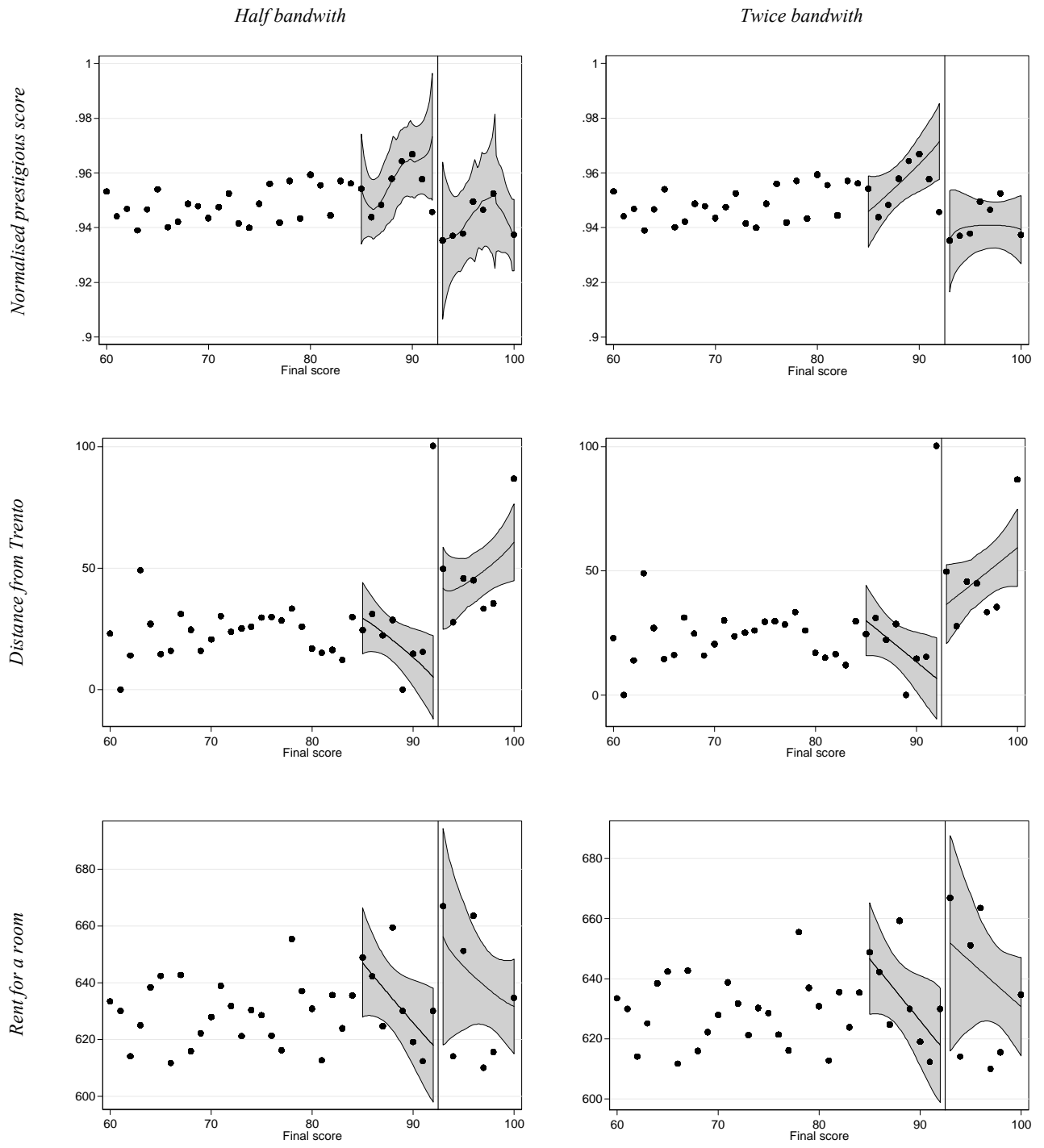Fig. A2. Sensitivity analysis: twice and half the bandwidth used in section 6.

Half bandwidth

Twice bandwidth

Fig. A2. *(continue)*

Half bandwith   *Twice bandwith*

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