The Short and Long-term Effects of Monetary Incentives in Education

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Abstract

Financial aid programs decrease the costs of acquiring additional education. The main contribution of this work is to study how this liquidity provision affects the enrollment, the academic achievement after enrollment, and the labor market outcomes after graduation of the recipients. In this work, I use administrative data to exploit the assignment of different levels of monetary incentives - from full-scholarships to small tuition fee discounts - to students positioned in a wide range of the social ladder (from low-income to high-income families). Using a Regression Discontinuity Design, I show that the performance of students whose cost of education is fully subsidized are lower than the achievement of those who pay some of their college cost. Since this difference in performance persists until the third year of college, I observe a gap in the time to graduation. The additional contribution of this paper is to look at the difference in the labor market outcomes between subsidized and un-subsidized students.

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JEL classification: H5, I2, I3, J2, C2.

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1 Introduction

Higher education is often promoted to foster individual development and to increase the wealth of a society more generally. Given the extensive private and social benefits resulting from human capital investments, many advanced countries have launched several programs aimed at broadening the access to tertiary education and at fostering the performance of students into these programs (OECD, 2019).

The Human Capital model (Becker, 1975) suggests that choices of investment in education are essentially driven by a benefit-cost analysis, where the individual compares the direct (tuition fees, equipment, accommodation, etc.) and indirect (forgone labour earnings) costs with the expected benefits of this investment. From a theorethical point of view, financial aid programs, by decreasing the price of college should induce an increase in the demand for tertiary education. While the relationship between these type of monetary incentives and enrollment is theoretically clear, the effects of this liquidity provision on performance after enrolment are more ambiguous. After enrollment, there are several ways in which higher aids may influence the performance of students, i.e "inframarginal students". As underlined by Fryer et al. (2011), first, by relaxing the budget constraints, higher benefits may induce students to spend more time studying rather than working. Second, if students are myopic or not aware of the returns from schooling or lack intrinsic motivation, higher monetary incentives may encourage them to exert more effort. However, if students lack the resources or knowledge on how to convert effort into achievement or if external rewards exhaust intrinsic motivation, the opposite results might be true. In addition, as underlined in Scott-Clayton and Schudde (2016), if financial aid programs are not attached to strong requirements for renewal, they may induce moral hazard behavior. This is indeed a central problem in the design of an efficient financial aid program, especially considering the interdependence between the choices on the level of generosity and on the academic requirement. Higher financial incentives, attached to weak requirements for the renewal, may encourage enrollment and persistence of students who underperform in college, creating moral hazard concerns. However, less generous incentives can have the unintended side effect of inducing some students to drop out.[1]

This paper investigates the causal effects of an Italian financial aid program, called the "Right to Study" (RTS), on a wide set of students' outcome: enrollment, credits accumulation,

[1]The trade-off between minimum academic requirements and performance it has been analyzed in the principal-agent model builded on Bénabou and Tirole (2000) and Bénabou and Tirole (2002) and extended with academic standards and financial aid by Schudde and Scott-Clayton (2016).

GPA, drop-out and re-enrollment rates, and on-time graduation probability. I use a Regression Discontinuity Design (RDD) that exploits sharp discontinuities in the eligibility thresholds, based on a family income indicator, to estimate the impact of different levels of aids on students' outcomes. The RTS financial aid program is a large-scale government intervention offering need-based incentives (of different generosity) under a low performance requirements for the renewal. In particular, using administrative data, covering the universe of students at the University of Bologna applying for the RTS program for the 2009 and 2010 academic years, I can identify how changes in the generosity of this program affect the performance of students during college, on top of the effects of the academic requirements attached to the benefit. The dataset includes several outcome measures, signaling both the quantity and quality dimensions of the studying effort (GPA, accumulated credits, dropout, major choice, year of graduation, etc.).

The results show that a more generosous benefit does not generate a higher enrolment of new students. This result is in line with previous studies looking at the effects of the Pell-grant program in the US and it is mainly due to the late notice of the grant eligibility.[2] Moreover, receiving a higher benefit of around 3500 €, under weak academic requirements, decreases the number of accumulated credits of about 8 credits at the first year of college (approximately 1 and a half course), which corresponds to a decrease of approximately 20 percent with respect to the baseline mean, and a 21 percent of the standard deviation of the dependent variable. This gap in performance persists over time, significantly slowing the degree completion of the fully subsidized recipients. In particular, these students have a 3% lower probability of graduating on time. In contrast, I find no robust effects of the aid generosity on the GPA level. These results are in line with the literature showing that financial aid programs work through incentives on academic achievement, and not simply through the relaxation of the budget constraints (Scott-Clayton, 2011). In particular, since the accademic requirements for the renewal of the financial aid are set to a low level, subsidized students target these requirements and under-perform with respect to those students who suffer a higher cost of college.[3] No differential effects are instead found on the re-enrollment and drop-out rates.[4]

One of the main challenges in identifying the role of financial aid generosity on student performance is that the empirical evidence is usually only able to capture the combined impact

[2] As suggested in Bettinger et al. (2012), Dynarski and Scott-Clayton (2006), Dynarski and Scott-Clayton (2008), Dynarski and Wiederspan (2012), Dynarski and Scott-Clayton (2013).

[3] This result is indeed in line with Garibaldi et al. (2012), who study the effects of an increase in college cost on on-time completion rates at a private University in Italy. The authors find that those students, who may potentially pay a higher fee for an additional extra year of education, have higher incentives to finish on-time.

[4] This result is in line with Mealli and Rampichini (2012) and with Sneyers et al. (2016), who find no effects of the "Right to Study Scholarship" on students' drop-out.

of the awarded cash amounts and of the academic requirements. In particular, previous studies analyzing the impact of need-based financial aid programs have often compared eligible with non-eligible candidates. However, these two groups of students not only receive different levels of aid but they are also subject to different minimum performance requirements.[5] Futhermore, most of the existing literature focuses more on narrowly defined rather than large-scale national programs, implemented in the US for in a specific University or State.[6] Moreover, most of the evidence relates to merit-based programs, which are targeting high or medium achieving students (Scott-Clayton, 2011), hence it is often difficult to generalized to the full population of college students.[7]

This paper makes several contributions to the literature on financial aid. First, this paper isolates the impact of the generosity of a national need-based scholarships from the total effect of financial aid and minimum academic requirements, using a linked administrative dataset on the universe of students applying for need-based grants at the University of Bologna over the period 2009-2011 with data on academic performance. The second contribution relies on the identification of the impact of aid generosity both on the intensive and extensive margins of performance. In particular, the analysis takes advantage of the fact that, in this program, financial aid applications have to be renewed every year, therefore it is possible to identify the impact on enrollment decisions and on the performance of those who are already enrolled in higher education. Most of the evaluated programs look at the simultaneous effects of both the extensive and intensive margins: the average performance depends on both the "marginal" students (those who would not have attended college without financial support) and the "inframarginal" students (those who would have attended college irrespective of the financial aid). Few papers have been able to isolate the effect of financial aid on the intensive margin (Goldrick-Rab et al. (2016), Denning (2018)).[8] However, Goldrick-Rab et al. (2016) cannot

[5]For example, the Federal Pell Grant Program, which is the largest need-based financial aid program in the United States, computes the initial eligibility purely on financial need, but it conditions the renewal to certain satisfactory academic progress (SAP) requirements. Therefore, the estimated effects on the performance of the eligible candidates, when using non-eligible students as controls, is the combination of two mechanism: cost-of-college and minimum academic requirements (Schudde and Scott-Clayton, 2016). Other examples of this types of evaluations can be found in Scott-Clayton (2011) or Barrow et al. (2014).

[6]See for example Deming and Dynarski (2009) and Dynarski and Scott-Clayton (2013).

[7]Not to mention that several program evaluations include the impact of additional treatments, such as academic and support services, which make it difficult to isolate the specific role of academic requirements (Angrist et al. (2009), Angrist et al. (2014)).

[8]While the model of human capital investments (Becker, 1964) predicts an inverse relationship between the price of college and enrollment, the empirical evidence is partially consistent with this prediction. Researchers have indeed shown that financial aid programs with transparent eligibility criteria significantly increase enrollment (for a review see Deming and Dynarski (2009) and Dynarski and Scott-Clayton (2013)). However, the effects of the Pell Grant, one of the major financial aid program in the US, are more mixed. Several studies looking at

disentangle the impact of aid generosity from the overall effect of financial aid, and Denning (2018) focuses on the impact of financial aid only on those students who are declared financially independent from their parents. The third contribution of this paper aims at identifying the effect of aid generosity on both the quantity and quality dimensions of the studying effort (credits, gpa, re-enrollment, time to graduation, final graduation mark) and on the labor mrket outcomes after graduation (employment probability, wages, sector and region of employment, etc.).

The paper is organized as follow. Section 2 analyses the institutional framework and Section 3 describes the data and the methodology. In section 4, I will present and discuss results on the causal effects of monetary incentives on different measures of academic achievement. Section 5 presents the robustness checks performed, and Section 6 concludes.

2 The Institutional Framework

Tertiary education in Italy is accessible to students with a High-School diploma, independently of the type obtained (scientific, classical, professional). The Italian Constitution acknowledge, in art. 34, the "Right to Study" principle of the Universal Declaration of Human Rights by guaranteeing the access even to students at the bottom of the social ladder and reports that:[9]

> "Pupils of ability and merit, even if lacking the financial resources, have the right to attain the highest grades of studies. The Republic furthers the realization of this right by providing scholarships, allowances to families, and other means, to be assigned through competitive examinations."

To meet the purposes of providing equal opportunity and fair access, all the public Universities in Italy must offer a financial aid program. Genereally, these programs could include different types of services: allowances for international mobility, housing and meals services, services for people with disability, vouchers for education programs (Master,

the Pell Grant aid program eligibility or generosity find no impact on enrollment (Kane (1995); Carruthers and Welch (2019); Turner (2017); Marx and Turner (2018); Denning (2018)). While Seftor and Turner (2002) find a positive effects on older students. The prevailing explanations in the literature on this scarce effects of the Pell Grant regard mostly the complexity of the application process and late notice of the grant eligibility (Bettinger et al. (2012); Dynarski and Scott-Clayton (2006); Dynarski and Scott-Clayton (2008); Dynarski and Wiederspan (2012); Dynarski and Scott-Clayton (2013)).

[9] http://www.un.org/en/universal-declaration-human-rights/index.html

High-level education, etc.), fiduciary loans, and part-time working possibilities. The present project focuses on the RTS financial aid program at the University of Bologna. In particular, the program offers full scholarships and different levels of stipends, as well as certain tuition fee discounts to students enrolling into a Bachelor or Master degree of the University of Bologna.

The RTS financial aid program at the University of Bologna has a large coverage, both regarding the number of recipients and the amount of financial resources provided. For example, in the academic year 2008/2009, 13.475 students received a scholarship over a total of 77.892 students (17,3%).[10] Furthermore, in the same academic year just to finance the full scholarships, the government contributed: 151.986.000 €from national resources, 158.120.201 €from regional resources, 171.085.441 €from regional taxes, making a total of 481.191.642 €.[11]

In this perspective, it becomes quite important to know how these public financed benefits shape students' incentives and, in particular, whether they have any effects on students' academic achievements. This question is of paramount importance in Italy, given that the students' profiles and performance in tertiary education are below average. In fact, it has been estimated that, in the Bachelor degree, 42% of students are "Fuori Corso", i.e. those who are enrolled in the University system beyond the legal length of degree program, and that the average time to complete the Bachelor degree is of 5.1 years instead of 3, and for the Master degree the average duration is 2.8 years instead of 2. In addition 21,7% of students drop-out from the system.[12] In this context, therefore, properly designed public policies could play a role not only in providing fair access into tertiary education but also in fostering students' performances.

The agency appointed for the distribution of the "Right to Study" services at the University of Bologna is ER.GO, and, from 2008 onward, the agency had fully covered all the financial aid applicants, a 100% success rate. The application for all the types of the benefits should be made before the start of the academic year.[13] However, the eligibility results are only published in December. The first instalment of the benefit (50% of the yearly allowance) is paid at the end of the calendar year, while the second half of the incentive is bind to the satisfaction of precise credit requirements, which are *ex-ante* known. The credit requirements are all the same, independently from the level of the benefit received.

In the following paragraphs, I describe the structure of the benefits offered by ER.GO, starting

[10]Data from "Ministry of Education, University and Research - MIUR"
[11]Data from "Ministry of Education, University and Research - MIUR"
[12]AlmaLaurea - Annual Report on University Graduates 2013
[13]At the University of Bologna all the courses last from September/ October to June/July of each year.

from the design of the full-scholarship scheme.

The full-scholarship scheme vary according to the student "status", which is defined depending on the declared residence: "In sede", which identifies the students who live in the city where the University centre is located or who do not live more than 45 minutes far away from the University centre (by public transport); "Fuori sede", i.e. the students who live more than 90 minutes far away from the University centre (by public transport), "Pendolari", i.e. the students who are commuting and in particular who are living from 45 to 90 minutes away from the University centre (by public transport). Within groups, "In Sede", "Fuori Sede", "Pendolari", different level of stipends are assigned according to three thresholds based on the family income indicator, i.e. ISEE. Furthermore, eligibility is always conditional on a maximum value of a wealth indicator of the household, ISPE, which should not exceed €40.000,00. The ISEE indicator is given by the annual after-tax income plus the 20% of family assets and it is adjusted for the family size by means of an equivalence scale; the ISPE is instead an indicator based just on the family assets (movable and real properties) and it is adjusted for the family size by means of the same equivalence scale. The amount of the stipends, specified by ISEE thresholds and student "status", are summarized in table 1:

Table 1: Scholarships' Assignment

ISEE Thresholds	"Fuori Sede"	"Pendolari"	"In Sede"
Up to €12713.21	€5073.78	€3043.88	€2255.11
From €12713.21 to €15386.29	€3942.83	€2420.89	€1828.83
From €15386.29 to €19152.97	€2811.88	€1796.93	€1402.53

Moreover, on top of these stipends, the system provides a full-scholarship, namely a 100% discount rate on the yearly tuition fees. Those students with an ISEE indicator just above €19152.97 and with an ISPE indicator of maximum €60.000,00 can instead only apply for a tuition fees discount, following the ISEE threshold described in table 2.

Figure 1 of the Appendix plots the schedule of the above financial aid program for illustrative purposes. The figure shows how the stipends and the tuition fee discounts change as a (discontinuous) function of the income indicator, ISEE. The figure considers as benchmark case a tuition fee equal to €3000, which is approximately equal to the average full tuition fee of the first year of tertiary education in Italy.[14] First, consider that the sample of

[14] Estimate from the *7th Report on the costs of the Italian universities* of the national non-profit organization

Table 2: Assignment of Tuition Fees Discount - 2009

ISEE Thresholds	Fess Discount
From €19152.98 to €22500	50%
From €22501 to €26000	40%
From €26001 to €30000	30%
From €30001 to €35000	20%
From €35001 to €40000	10%

full-scholarship recipients, namely those with an ISEE smaller than €19152.97 (solid blue vertical line), are exempted from paying any tuition fees, so they receive a benefit of + 3000 €, i.e. a 100% fee discount, and on top of that they receive a stipend, which depends on the income indicator and the student "status". As illustrated in figure 1, the average stipend at the first threshold is of around 3457 €, while for those students positioned immediately after the first threshold the average stipend decreases to 2731 €. The second discontinuity arises at the second threshold, where the stipend is lowered from 2731 €to an average of 2004 €, thus generating a difference of around 800 €. The highest discontinuity in the benefit received is at the third threshold, where students with an income indicator of around €19152.97 receive extremely unequal benefits. Indeed, the difference is on average of around €3500.[15] Finally, after this threshold, the discontinuity in the benefit around all the subsequent thresholds is of about 300 €, i.e. a 10% difference in the tuition fees discount rate.[16]

These discontinuities provide the source of exogenous variations which I exploit in identifying the effect of changing the benefit level on the academic performance of students during the first year and following years of their studies. The academic performance is observed both in term quantity and quality. In particular, data on credits and on the weighted average GPA at the end of each academic year is observed to study the effects of the different benefits both on the speed and accuracy of performance.

"Federconsumatori"

[15] Given by the average of the lowest stipend €2004 plus the 50% percent difference in the tuition fee discount, namely around 1500 €

[16] The schedule on the tuition fee discounts slightly increased in the academic year 2010/2011, see table A2 of the Appendix. However, such changes do not represent a problem for the estimation since this change was unannounced.

As previously anticipated, all the recipients, regardless of the level of the benefit received, are subjected to the same performance requirements for non-returning the amount of aid received and for applying for its renewal. Table 3 and Table 4 show the total credit load and the credit requirements by year of study and by type of degree.

In particular, for the undergraduate freshman, stipends and tuition fee discounts are assigned just on the basis of the two economic indicators, the ISEE and the ISPE. The master freshman should have obtained, in addition, at least 150 credits in the undergraduate program at the time of the application. After the first year, the maintenance of the benefit is conditioned to precise yearly credit requirements. Namely, Bachelor students should obtain 25 credits (out of 60) by the end of the first academic year, and Master students should obtain 30 credits (out of 60) by the end of the first academic year. Therefore at the second year, the assignment of the benefits is granted on the basis of the two economic indicators, the ISEE and the ISPE, and of the credits obtained in the first year of study. At the end of the second year, recipients are required to achieve a cumulative number of 80 credits (both for the Bachelor and Master program). At the end of the third year, Bachelor students can obtain additional aid to cover an extra-six month period, but they need to have at the time of the application a cumulative number of 135 credits.

Table 3: Credits load by years and programs

Type of course	1st Year	2nd Year	3rd Year
Bachelor	60	60	60
Master	60	60	-

Table 4: Credit requirements by years and programs

Type of course	1st Year	2st Year	3rd Year
Undergraduate	25	80	135
Master	30	80	-

3 Data and Methodology

The data are provided by the regional agency ER.GO, which is in charge of the RTS program, and by the University of Bologna. These are administrative dataset containing detailed information on the characteristics of each applicant such as the levels of both the family income and wealth indicators, i.e. the ISEE and the ISPE, the academic performance, both in term of quantity (credits) and quality (GPA), students' demographic characteristics and university-related variables: high-school grade, the macro-region of origin (north, centre, south, Islands), fields of studies, levels of degrees, type of scholarships obtained ("In Sede", "Fuori Sede", "Pendolari"), type of tuition fee discount received ("50%","40%", etc.).[17]

The data covers the academic years from 2009/2010 to 2010/2011 and the sample includes the universe of students, applying for the benefit and enrolled in any of the twenty-three faculties of the University of Bologna.[18]

Table A1 in the appendix provides information on the descriptive statistics of the students at the first year of their studies, *per* threshold and *per* type of benefit received. On average 60% percent of the students are female, of approximately 21 years old. The geographical distribution is quite mixed as 50% of students are coming from the North, around 22% from the Center, 20% from the South of Italy and 7% from the Island (Sicily and Sardinia). The High School grade in Italy ranges from 60 to 100; the sample mean is of around 80 points.

The average number of credits obtained during the first year of enrolment is around 27 in the full sample and the weighted GPA is of about 26.[19]

To study the effect of scholarships on students' performances, I use a Regression Discontinuity Design. The RDD has been widely used in economics and behavioral sciences and was firstly introduced by Thistlethwaite and Campbell (1960). The attractiveness of this design is that it allows to identify and estimate the treatment effects in a context similar to a formal randomized experiment. The RDD identification and estimation techniques were formalized in the work of Hahn et al. (2001), which, in particular, show the minimum set of conditions under which it is possible to non-parametrically identify the treatment effect.

The idea of an RDD is to exploit discontinuities in the relationship between an assignment

[17] The information on the family income and wealth indicators is subject to legal verification from the agency and the calculus of the indicators must be certified by a professional institution.

[18] From September 2012, the University of Bologna has changed its organisation passing from 23 Faculties to 11 Schools and 33 Departments.

[19] Grades in the Italian university system range from a minimum of 18 to a maximum of 31.

variable and a treatment variable. In the present context, these are respectively the family income indicator, i.e the ISEE, and the level of the benefit received. The intuition is that if the treatment (stipend and tuition fee discounts) is expected to have an effect on given outcomes, as for credits and GPA, there should also be a discontinuous relationship between the outcomes and the assignment variable of interest.

To test for discontinuities and to identify the Local Average Treatment Effect (LATE) in the data, I apply a local regression, using different polynomial specifications, following the parametric model of the form:

$$Z_i = \alpha + \gamma_1 D_i + \gamma_2 F(Y_i - c) + \epsilon_i \text{ where } |Y_i - c| \leq h \tag{1}$$

where the set of outcome variables, Z_i, is composed by the enrollment probability, the number of credits, the GPA level at the end end of each year of education, the re-enrollment and drop-out rates, and the on-time graduation probability. Y_i is the ISEE indicator centred around the threshold c, $F(\cdot)$ is the polynomial function of the regressor $Y_i - c$, h is the bandwidth used and D_i is a dummy variable taking the value 1 for $(Y_i - c) \leq 0$.[20] Given the above specification, it is possible to demonstrate that:

$$\gamma_1 = E[Z_i|Y_i - c = 0^+] - E[Z_i|Y_i - c = 0^-]$$

identifies the mean change in the outcome variable at the discontinuity and it is an unbiased estimator of the LATE.

4 The Effect of Financial Aid on Performance

Following Imbens and Lemieux (2008), Ipresent the results first by graphically plotting the relationship between the running variable and the outcomes of interest and then by showing formal regression analysis. I especially focus on the relationship between the generosity of the RTS benefit and several outcome variables: enrollment rate; credits and GPA accumulated at each year of education, drop-out and re-enrollment after the first year, and the probability of on-time graduation. I selected these outcomes to explore the effect of the RTS benefit on access,

[20]Notice that several functional forms are tested to determine which specification better fit the data. Results are shown in the Appendix and will be discussed in the following sections.

persistence and success outcomes.

4.1 Graphical Analysis

In figure 13 and 14 I look at how the generosity of the RTS financial aid program has affected students' enrollment at the University of Bologna. Ex-ante, a more generous aid may induce more low-income students to enroll into college (extensive margin), i.e "marginal students". The figures show the results on a novel local polynomial density estimator developed by Cattaneo et al. (2016), which improves previous approaches available in the literature.[21] By visual inspection, it appears that the generosity of the RTS financial aid program has no effect on enrollment. In particular, the figures show that there are no significant discontinuities in the density of the observations near each of the thresholds, suggesting that higher benefits do not significantly change the probability of enrollment at the University of Bologna.

In the following, I explore how students' performance are affected by the generosity of the RTS financial aid program. In particular, figures 2-4 show how the raw data on credits at the end of the first year relate to the ISEE for 2009 and 2010 separately and jointly. From these graphs, it is possible to notice that the amount of credits obtained by students at the end of their first year of study is relatively flat among the full-scholarship recipients and mainly centred around 25-30 credits. Even if the level of the benefit received decreases at the first two thresholds, the graphical evidence shows that there are no sharp changes in the credits earned by these students. Notice that the mean performance of this group of students is actually close to the first year credit requirements for non-returning the benefit, see table 4. On the contrary, at the third threshold where there is the highest inequality in the levels of the benefits received, I notice a high and somehow persistent jump in performance. In particular, students from the right-hand side of the third threshold earn consistently more credits than those on the left-hand side, even if they are receiving a significantly smaller benefit. Regarding the subsequent thresholds, the graphs are somewhat noisier, but the amount of credits earned seems to be constantly centred around 40, suggesting no sharp effect of decreasing the discount of the tuition fees amount.

To investigate whether the results on credits may have generated any side effects on the quality dimension of the study effort, similar graphs are drawn for the GPA. Figures 5-7 show how the raw data on GPA are distributed. As it is possible to notice, in this case, the data

[21] McCrary (2008) introduced a test based on the nonparametric local polynomial density estimator of Cheng et al. (1997), which requires pre-binning of the data and hence introduces additional tuning parameters. The Cattaneo et al. (2016) improves this method.

seem to be more flat, and somehow more noisy in the top end of the income indicator, therefore, it is not possible to catch any clear discontinuity. Notice, moreover, that there is a positive relationship between the GPA and the ISEE indicator.[22]

It is worth noting that the evidence presented in these figures is not peculiar to a particular year (both for credits and for GPA) since similar patterns appear in both years, even if the pool of recipients has changed. Figures 8 and 9 include also the local linear regression of the underlying individual observations computed with a triangular kernel and optimal bandwidth selection from Calonico et al. (2014b). Moreover, the results are confirmed when more automatic, data-driven procedures are used to select the number of bins to compute the local sample means developed by Cattaneo et al. (2016). In particular, figures 10 and 11 show the data driven regression discontinuity plot around each of the thresholds. As it is possible to notice from the graphical evidence, both the raw data and the newly developed data-driven non-parametric discontinuity plots show that there is a significant difference in the number of credits obtained at the end of the first year of college between the full-scholarship recipients and the partially subsidized students.

I now turn to the discussion of how this liquidity provision has affected performance at the second year of college, and graduation rates more generally. However, before looking at these outcomes I check whether the drop-out and re-enrollment rates differ systematically across thresholds. Figures 15 and 16 show that on average 22% of students drop-out and 6% re-enroll at the first year but these rates are not significantly different around each of the thresholds, suggesting that these incentives have not changed dropping-out or re-enrollment decisions differently.

At the second year of college, students have to obtain a cumulative amount of 80 credits for not reimbursing the University of the benefit received during the second year. Remember that this requirement is the same independently from the level of the benefit received. Moreover, even during the second year no requirements apply to the GPA level. Figure 17 and 18 show the raw data on performance at the second year. While figures 19 and 20 show the non-parametric data-driven results around each of the thresholds on the total number of credits and GPA at the end of the second year. Notice that the gap in the total number of credits obtained by the fully subsidized and the partially subsidized students still persist at the second year. In particular,

[22]This evidence may be explained by a pure income effect. Since students on the right tail of the income distribution may have better living conditions or more educated parents, than those at the bottom. This reasoning is further strengthened by the fact that the renewal of the benefit is not conditioned on a minimum GPA, therefore, no direct effects of the benefits are expected.

the former group targets its performance again around the yearly requirement, i.e 80 credits, and it earns around 16 less credits with respect to the latter group. However, the GPA level at the end of the second year is the same for the two groups. Given the persistence of a significant gap in performance at the second year of college, I expect to find a significant difference in the probability to graduate on time between the two groups of students. In particular, I define on-time graduation as having obtained 180 credits at the end of the third year for the Bachelor students or 120 credits at the end of the second year for the Master students. Figure 21 shows indeed that at the third threshold there is jump in the raw probability of graduating on-time computed as described above. Figure 22 confirms this results by plotting non-parametrically how this probability is distributed around each threshold.

The next subsection will present the results more formally and by pooling all the yearly data.

4.2 Estimation Results

The regression results on the performance at the first year of college are reported in table A3 and A4, where the estimates are computed for each threshold separately. The tables show the treatment effects of receiving different levels of benefit on the obtained credits and final year GPA. The estimates confirm what the graphical inspection has first enlightened. The performance of those students positioned near the first two thresholds do not change in response to a change in the benefit level of around 800 €. Notice also that the mean number of credits among these students is concentrated near the requirements (25/30 credits). On the other hand, the number of credits obtained by those students positioned above the third threshold are significantly higher of around 8 credits (approximately one and a half course). In particular, the students just below the third threshold are not paying any tuition fee and on top of that they receive a stipend of about 2000 €, while those just above this threshold are not receiving any stipend and they have to pay half of the first year tuition fee, approximately 1500 €. This suggest that at this threshold there is a difference of about 3500 €in the level of the benefit received. While the subsidized students earn 20% fewer credits, they do not have a different GPA. This, on one hand, suggests that while there is a significant difference in the studying quantity, no difference emerge in the studying quality. On the other hand, it also suggests that in this setting having just some requirements on the number of credits seems to do not induce any effect on the GPA.

Taking this evidence together, Ican say that those students, who are not completely subsidized are incentivized to study more since they do not want to suffer an extra-cost given by delayed graduation, a result which is in line with Garibaldi et al. (2012). Notice that the results are stable even after including a set of controls in the regressions. This robustness indicates that the potential problem of spurious regressions, which could arise from a global discontinuity in the data, should not be of much concern. Regarding the subsequent thresholds, it seems that no clear effects are in place. However, notice that as Ifocus on wealthier students, namely on those around the later thresholds, Iget more noisy estimates.

As first shown by the graphical inspection of the data, this gap in the accumulated number of credits persists even at the second year of college. In particular, from table A5 it is possible to see that, even during this academic year, the group whose cost of education is completely subsidized perfectly target the yearly requirement for non-returning the benefit (80 credits). While those students who are paying some share of the tuition fee tend to obtain more credits even at the end of the second year of college, despite having the same requirements for the financial aid program renewal. Table A6 shows the estimated results on the GPA. During the second year, a mild different emerges on the GPA levels obtained by those students positioned around the third threshold. This result points toward the possibility that this financial aid program might have generated moral hazard problems. In particular, while one could presume that subsidized students might take more time in completing their degree to build a better curriculum, this explanation seems to be rejected by the evidence on the second year GPA. However, this result is not robust to other parametric specification, see Table A10 in the Appendix.

Finally, Table A7 shows that this gap in the yearly number of accumulated credits has generated a significant difference in the probability of graduating on-time between those students positioned at the third threshold.

4.3 Gender Differentials

When talking about academic performance at higher education, it becomes quite important to distinguish between groups of subjects which have been shown to reach quite different achievements on this dimension.[23] To gain some insights on these performance differentials in education, I investigate how the results vary with the gender dimension. The results are displayed in Table A11 and A12 of the Appendix. Academic performance seems to differ substantially between female and male students, both in terms of credits and GPA. In particular, female students obtain a significantly higher amount of credits and better grades at almost all the thresholds of the ISEE indicator. This evidence suggests that gender

[23]See for a review Buchmann et al. (2008)

differentials in education are independent from the level of income of the family. Female students perform better than the males, independently of the students' socio-economic background. For what concern the sensitivity to the monetary incentives, there is not much difference across genders at almost all the levels of initial wealth.

5 Robustness Checks

One essential advantage of using a Regression Discontinuity approach is that the main assumptions identifying the parameters of interest correctly have directly testable implications. The first prediction is that the conditional expectation of all the ex-ante determined characteristics must be smooth around the thresholds. Secondly, there should be no discontinuity in the density of the assignment variable.

In order to test if the first implication is satisfied in this context, I exploit the information on the age, gender, high-school grades, and the region of origin, and I show through a graphical inspection, the results of the pre-treatment continuity test. Additional tests on other covariates are reported in the next subsection. Figure 12 shows how the covariates move with respect to the ISEE indicator. The graphs do not display any sharp discontinuity around each the thresholds. The right-hand side part of each plot reveals a more noisy pattern since the number of observations tends to decrease as Imove on the top of the social ladder. However, even if the variance increases, it seems that there is no difference in the mean around any of the thresholds.

To further test whether any discontinuity exists in the density of the assignment variable around each threshold, I run the non-parametric density test by Cattaneo et al. (2016). This test may fail if students manipulate their ISEE to get a higher benefit. First, one must consider that, in this context, the ISEE indicator must be certified by a professional agency and that violations are legally persecuted. Moreover, the ISEE indicator is calculated on the previous year family income, so it must be that any ISEE manipulations should have been undertaken one year ahead of the financial aid program application. Finally, the exact formula computed to calculate the indicator is not well know or easily traceable. Figures 13 and 14 confirm that this manipulation possibility is not undertaken by the subjects in my sample. As it is possible to notice from these figures, observations are smoothly distributed around each threshold, suggesting that there is no systematic and strategic manipulation of the ISEE indicator, both in 2009 and 2010.

Moreover, notice that the treatment effects in tables A3 - A6 are estimated allowing for different specifications on the two sides of each threshold. In the Appendix, Tables A9 and A10 evaluate the sensitivity of the above estimates with respect to the functional form of the ISEE indicator, i.e. the term $F(Y_i - c)$ included in equation 1. Specifically, I included second-degree polynomials on both sides of the third threshold. This robustness exercise supports the validity of the main results reported in A3 - A6. Notice, however, that given the small size of the ISEE windows around each of the threshold and the plots of the raw data, the local linear estimation is preferred.

To further check the robustness of the results, non-parametric estimates are reported in table A8 of the Appendix, following the procedure in Calonico et al. (2014b) and in Calonico et al. (2014a). Even this estimation strategy shows strongly significant results around the third threshold and in the direction expected from the graphical analysis and the parametric estimation.

To conclude, this quasi-experimental evidence confirms that students, who are mostly entirely subsidized for their education, take longer to complete their degrees since they each year obtain a smaller fraction of the total credits load, whit respect to those who are actually paying a share of their education cost. However, no robust difference emerges on their GPA between these two groups of students.

6 Discussion

This paper studies the effects of different levels of financial aids on students' academic achievement. The main finding is that those students who are receiving a lower benefit and, therefore, have a positive cost of going to college, surprisingly perform better than those whose cost is completely subsidized. Given that students face similar requirements for the renewal of the benefit (independently from the level awarded), the evidence can be rationalized by the cost-of-college mechanism. A lower benefit, relatively to a higher aid, increases the cost of attending college, and, consequently, it motivates students to finish early and not pay the extra cost of a delayed graduation.

It is interesting to compare the overall findings with the results in the literature. The null enrollment effect is in line with some of the previous findings on financial aid programs. Indeed, while theoretically there should be an inverse relationship between the price of college and enrollment, the empirical evidence is only partially consistent with this prediction. Several studies looking at the Pell Grant aid program eligibility or generosity find indeed no impact on enrollment.[24] The prevailing explanations are mainly related to the complexity of the application process and to late notice of the grant eligibility.[25] In this context, it is indeed the case that students know about their eligibility only around December each year, while typically most of the Bachelor and Master programs start around mid September. This lag between the start of the program and the eligibility notice might explain why I find no effect of the RTS program generosity on enrollment.

Among the full-scholarship recipients, namely those students who are not paying any tuition fee and who are receiving a stipend, I find that a higher benefit does not generate any difference in the yearly performance, both in terms of GPA and accumulated credits. This result is in line with the literature showing that financial aid programs work through incentives on academic achievement and not simply by relaxing the budget constraints (Scott-Clayton, 2011). In particular, since the accademic requirements for the renewal of the financial aid are set to a low level, subsidized students target these requirements and under-perform with respect to those students who suffer a higher cost of college. This effect has indeed been formalized in the principal-agent model by Bénabou and Tirole (2000), Bénabou and Tirole (2002) and in the extension by Schudde and Scott-Clayton (2016).

The overall evidence is also in line with Belot et al. (2007), who show that the reduction in the maximum duration of a Dutch grant increases performance. The idea is that studying effort reacts positively to an increase in the extra-cost of a delayed graduation. Garibaldi et al. (2012) proposes a similar explanation in the context of a private Italian University. The authors, indeed, show that a potential increase in the tuition fee, could significantly reduce the probability of late graduation. In addition, in line with Mealli and Rampichini (2012), the RTS program does not generate any difference in the dropping-out decisions among the recipients. Finally, interesting comparisons among different groups of students have shown striking evidence. Gender differentials in academic achievement persist at each year of college education and for a wide range of the social ladder (from zero family income to more than 40.000 euro per year). Incentives seem not effective in reducing these gender gaps.

[24]See Kane (1995); Carruthers and Welch (2019); Turner (2017); Marx and Turner (2018); Denning (2018).

[25]See Bettinger et al. (2012); Dynarski and Scott-Clayton (2006); Dynarski and Scott-Clayton (2008); Dynarski and Wiederspan (2012);Dynarski and Scott-Clayton (2013).

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7 Appendix A

Figure 1: Benefit Level Schedule - Scholarship and Tuition Fee Disocunt

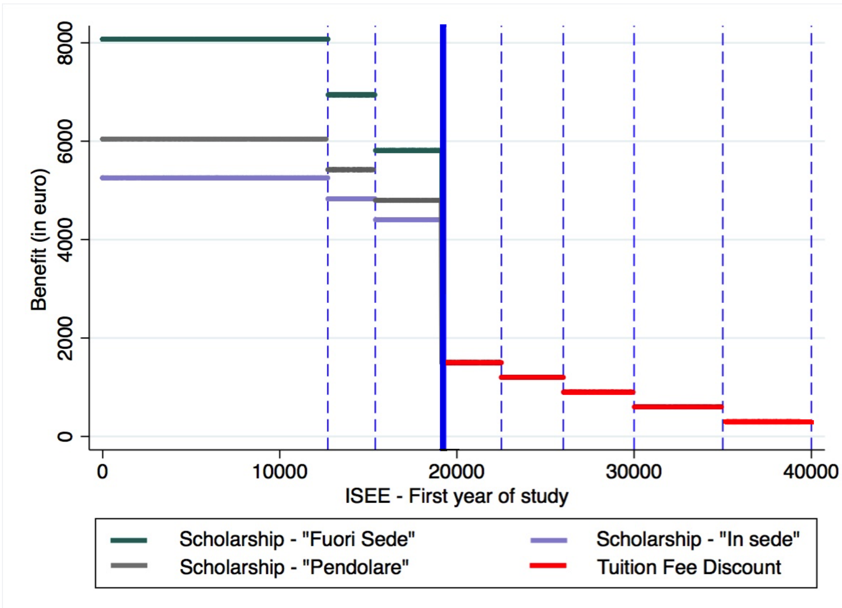

Table A1: Summary Statistics

Panel A	*Scholarship Recipients*							
Variable	Full Sample		First Threshold		Second Threshold		Third Threshold	
	Mean	St.Dev	Mean	St.Dev	Mean	St.Dev	Mean	St.Dev
Percentage of Undergraduate students	0.672	0.469	0.688	0.463	0.662	0.473	0.647	0.477
Age	21,259	3,620	21,277	3,617	21,288	3,655	21,167	3,489
Undergraduate Grade	96,535	10,336	96,789	10,106	96,952	10,240	97,199	11,576
Area (frequency)								
Centre	21.92		20.91		20.06		20.89	
North	50.27		46.68		49.55		50.29	
South	20.38		24.18		22.17		20.77	
Islands	7.42		8.23		8.22		8.04	
High-School Grade	80,448	12,661	79,568	12,474	80,932	12,626	81,265	12,912
ISEE	15.121	2.213	12.685	773	15.331	760	18.122	1.900
ISPE	7.803	8.568	6.321	7.569	7.937	8.720	11.087	11.087
Credits	27,082	1,746	26,213	1,776	27,308	1,808	30,029	1,704
GPA	26,239	2,681	26,037	2,756	26,335	2,704	26,349	2,594
Gender	0.586	0.492	0.586	0.492	0.604	0.489	0.583	0.493
Observations	6043		1010		1001		1670	

Panel B	*Tuition Fee Discount Recipients*							
Variable	Fourth Threshold		Fifth Threshold		Sixth Threshold		Seventh Threshold	
	Mean	St.Dev	Mean	St.Dev	Mean	St.Dev	Mean	St.Dev
Percentage of Undergraduate students	0.590	0.494	0.653	0.478	0.765	0.427	0.352	0.492
Age	20,842	2,344	20,488	2,137	19,992	1,933	22,352	3,121
Undergraduate Grade	102,869	6,305	99,823	6,550	99.2	9,148	103,667	5,686
Area (frequency)								
Centre	21.85		25.26		25.10		25.28	
North	54.04		53.16		54.25		55.76	
South	17.70		16.18		15.79		14.50	
Islands	6.41		5.39		4.86		4.46	
High-School Grade	86,033	12,824	84,545	13,196	83,274	13,508	73,222	15,393
ISEE	22,810	2,039	25,511	2,103	30,221	2,267	32,814	2,452
ISPE	38,237	3,293	43,465	3,223	48,249	3,190	57,023	1,876
Credits	39,219	1,577	37,244	1,518	36,464	1,434	38,588	1,408
GPA	26,709	3,048	26,448	2,685	26,551	2,912	27,536	2,455
Gender	0.5	0.502	0.6	0.492	0.607	0.492	0.294	0.469
Observations	842		758		494		268	

Note: Statistics for the freshman who enrolled at University of Bologna in the 2009/2010 and 2010/2011 academic years by type of benefits and by thresholds. Notice that the third threshold of statistics in Panel A group together the scholarship recipients and students who receive the 50% tuition fee discount.

Table A2: Assignment of Tuition Fees Discount - 2010

ISEE Thresholds	Fess Discount
From €19152.98 to €22838	50%
From €22839 to €26390	40%
From €26391 to €30450	30%
From €30451 to €35525	20%
From €35526 to €40600	10%

Figure 2: Credits - 2009

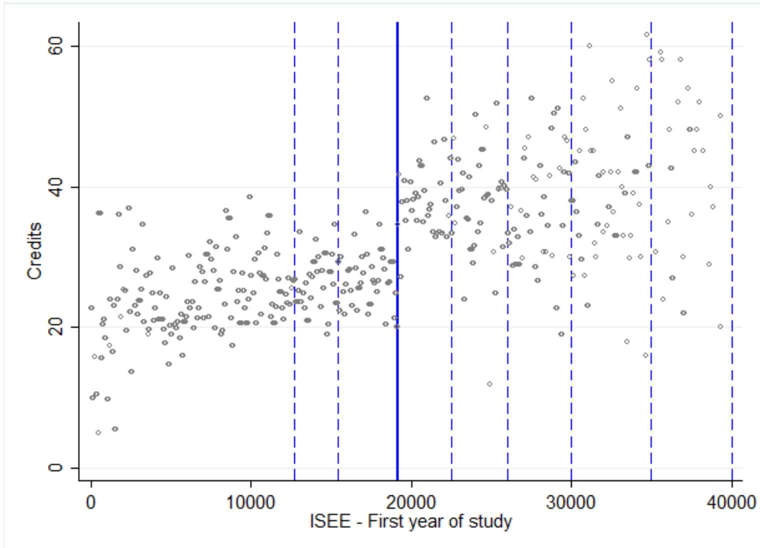

Figure 3: Credits - 2010

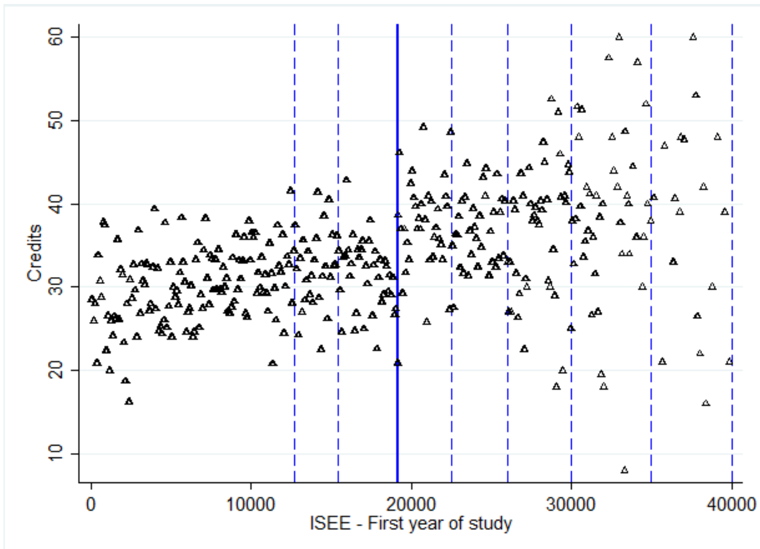

Figure 4: Credits - 2009 and 2010

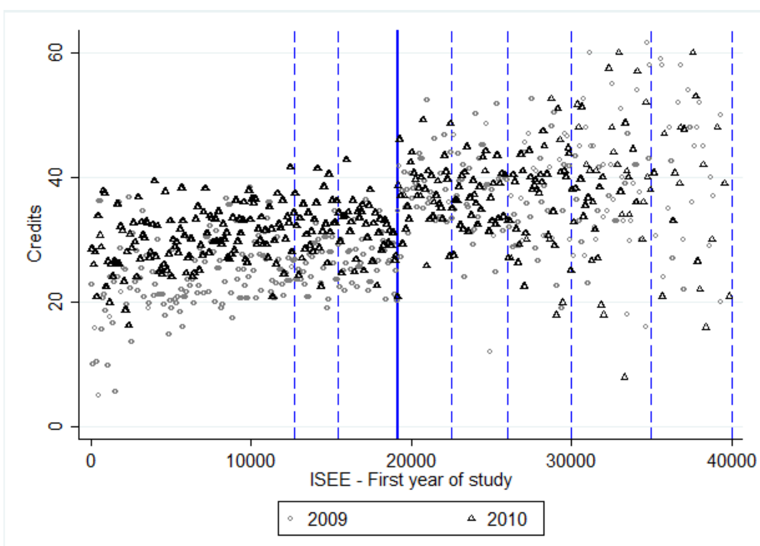

Figure 5: GPA - 2009

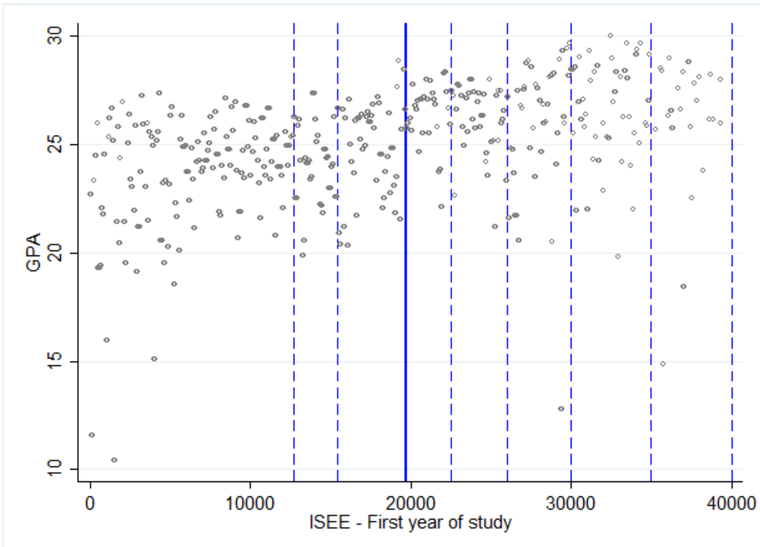

Figure 6: GPA - 2010

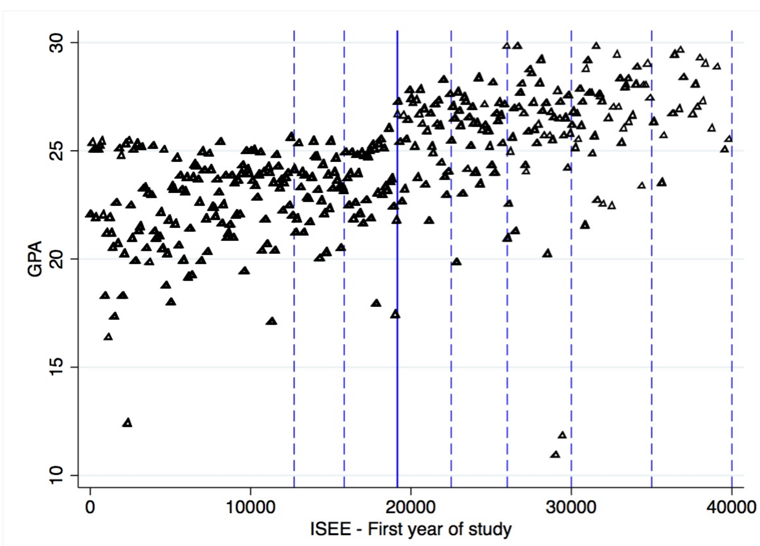

Figure 7: GPA - 2009 and 2010

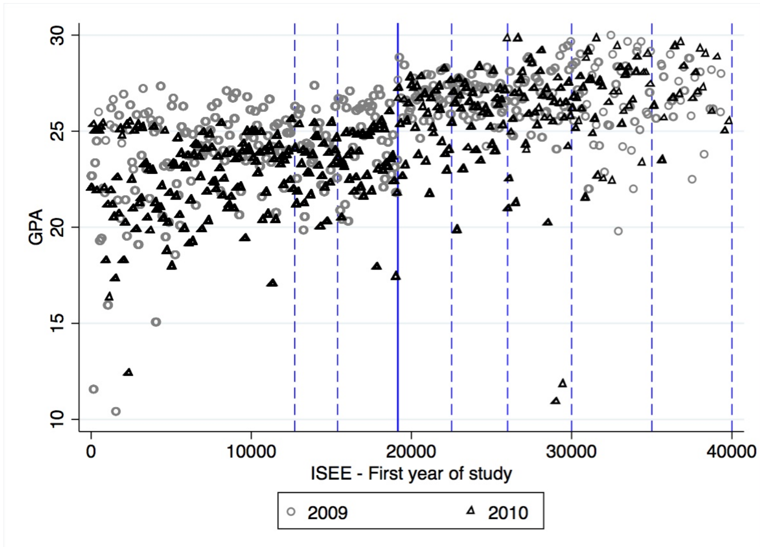

Figure 8: Credits and Local Linear Regression - 2009 and 2010

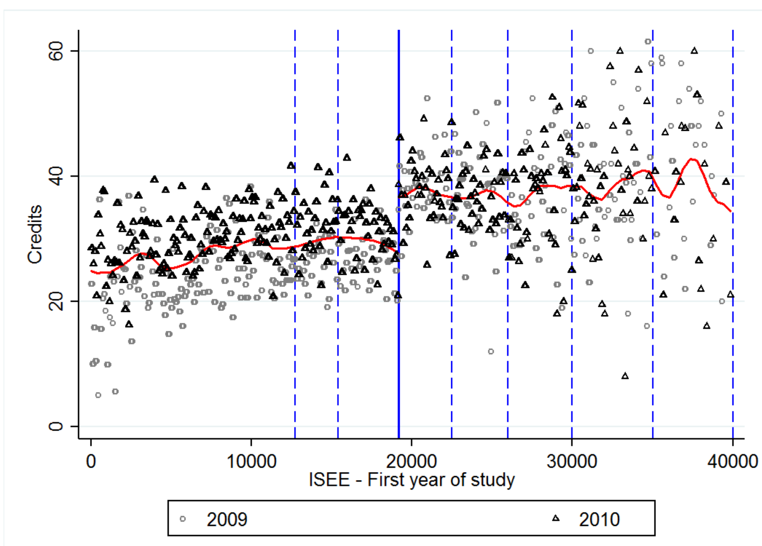

Figure 9: GPA and Local Linear Regression - 2009 and 2010

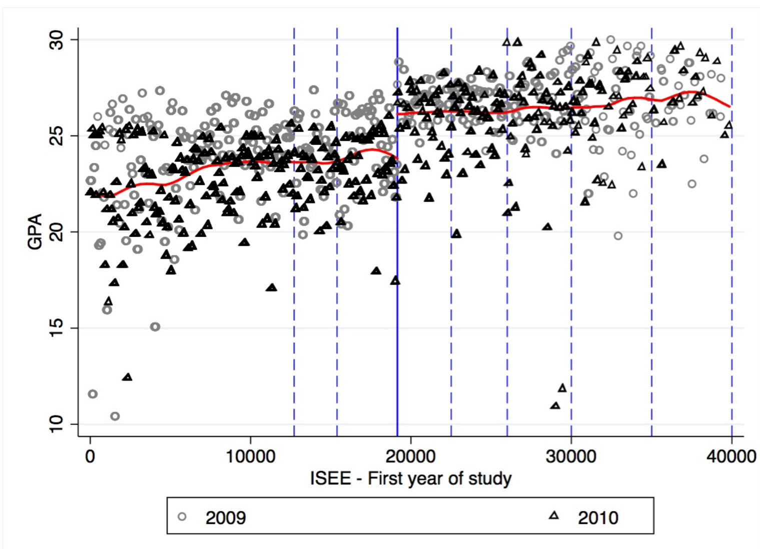

Figure 10: Non-parametric plot of Credits - First year

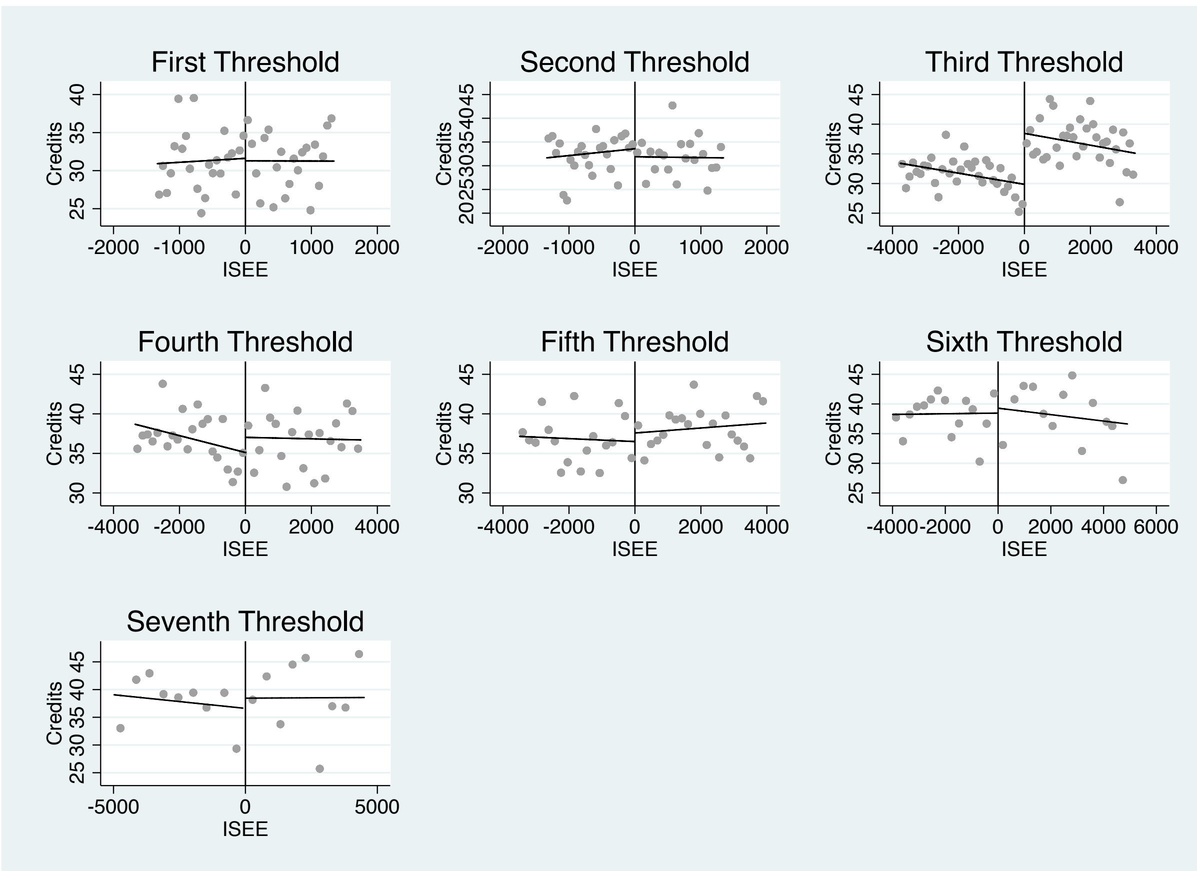

Figure 11: Non-parametric plot of GPA - First year

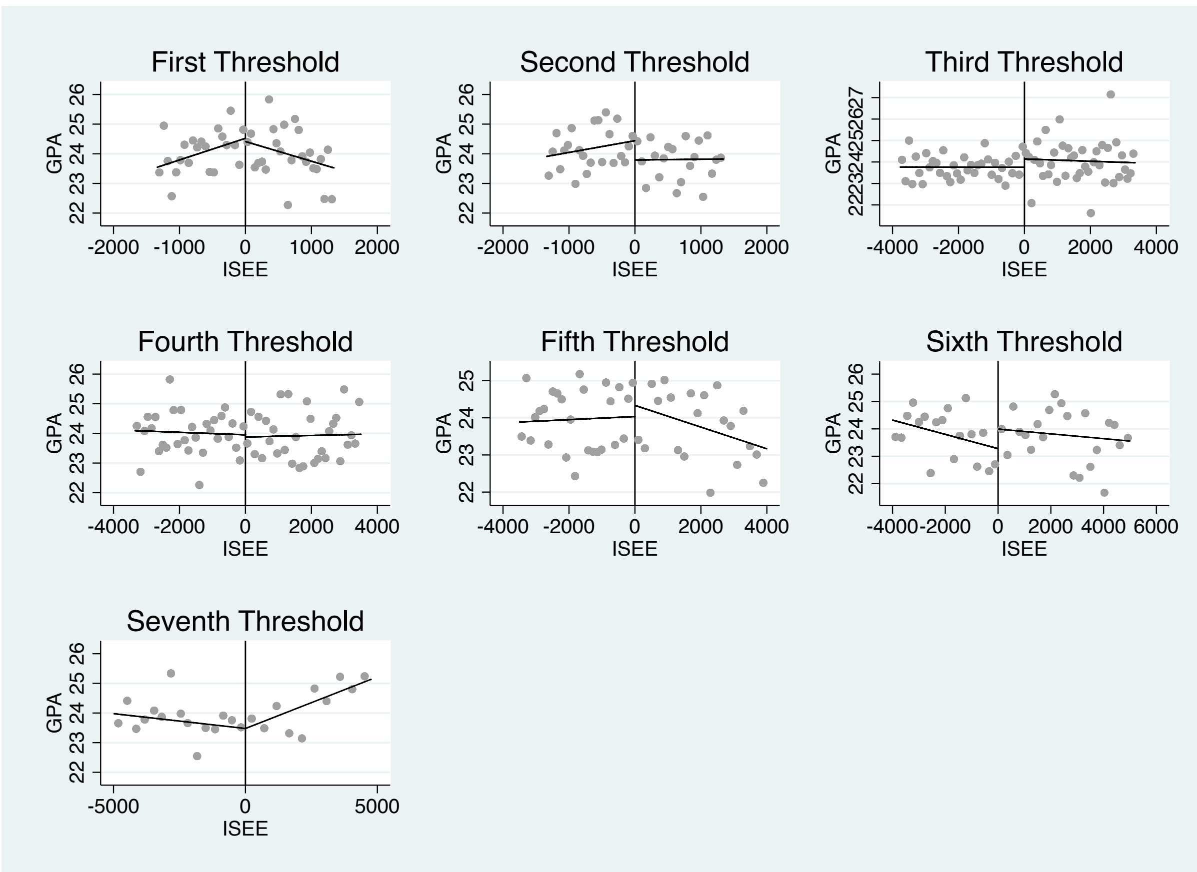

Figure 12: Student characteristics - 2009 and 2010

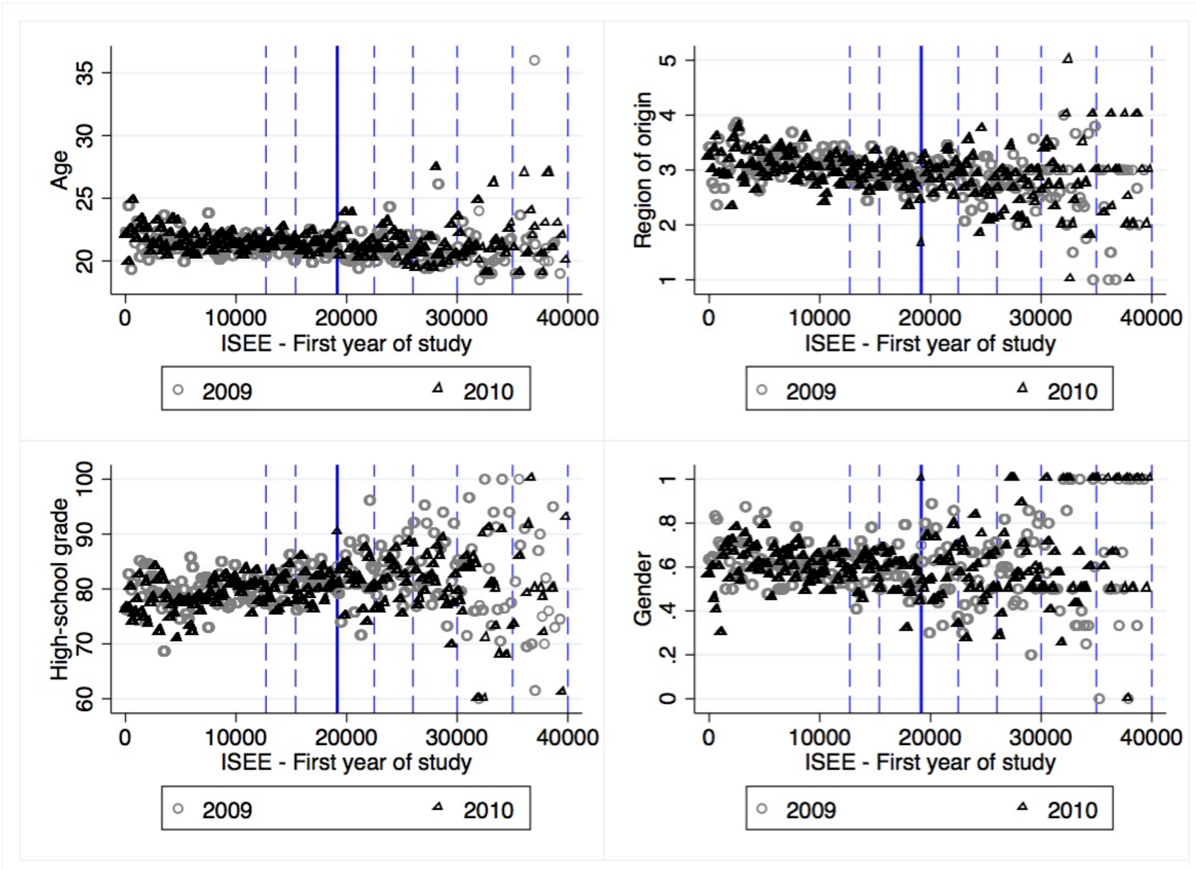

Figure 13: Cattaneo, Jansson, and Ma (2017a) density tests: individual thresholds

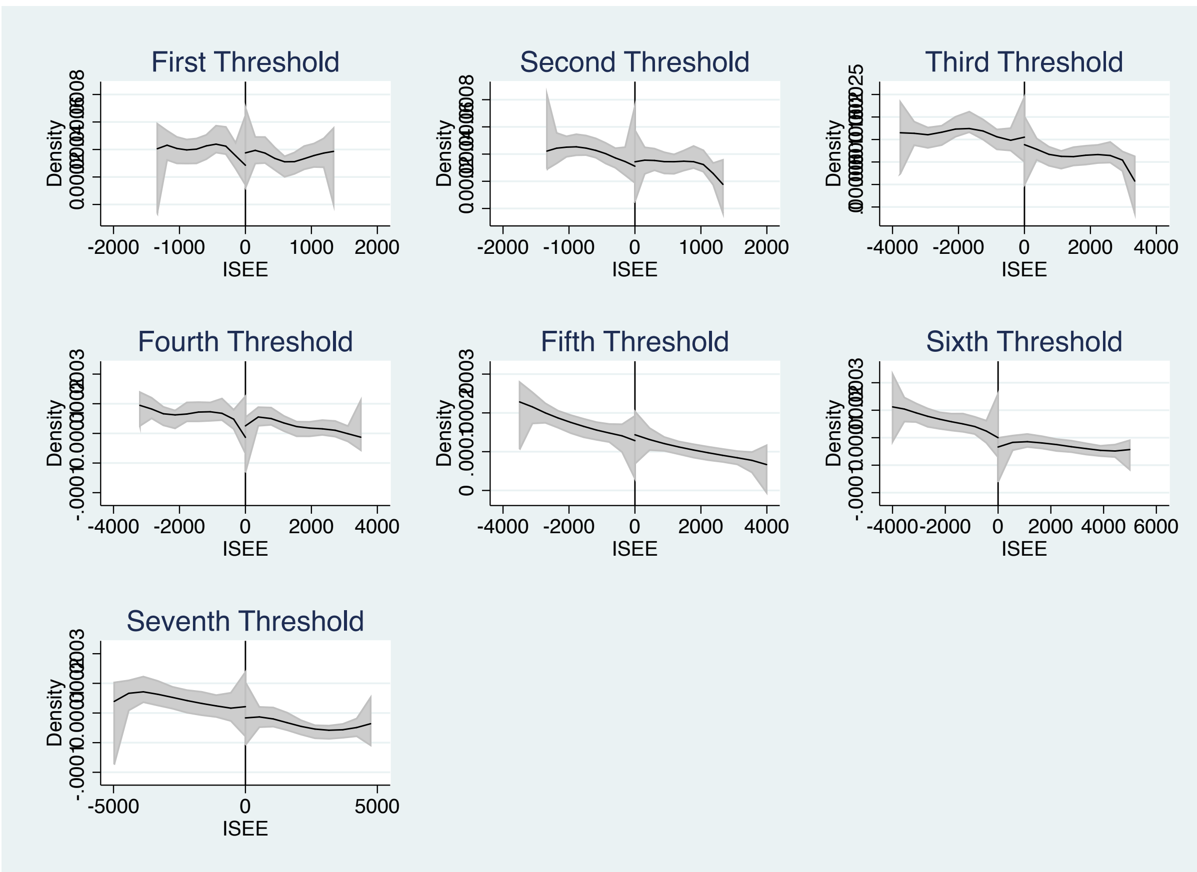

Figure 14: Cattaneo, Jansson, and Ma (2017a) density tests: individual thresholds

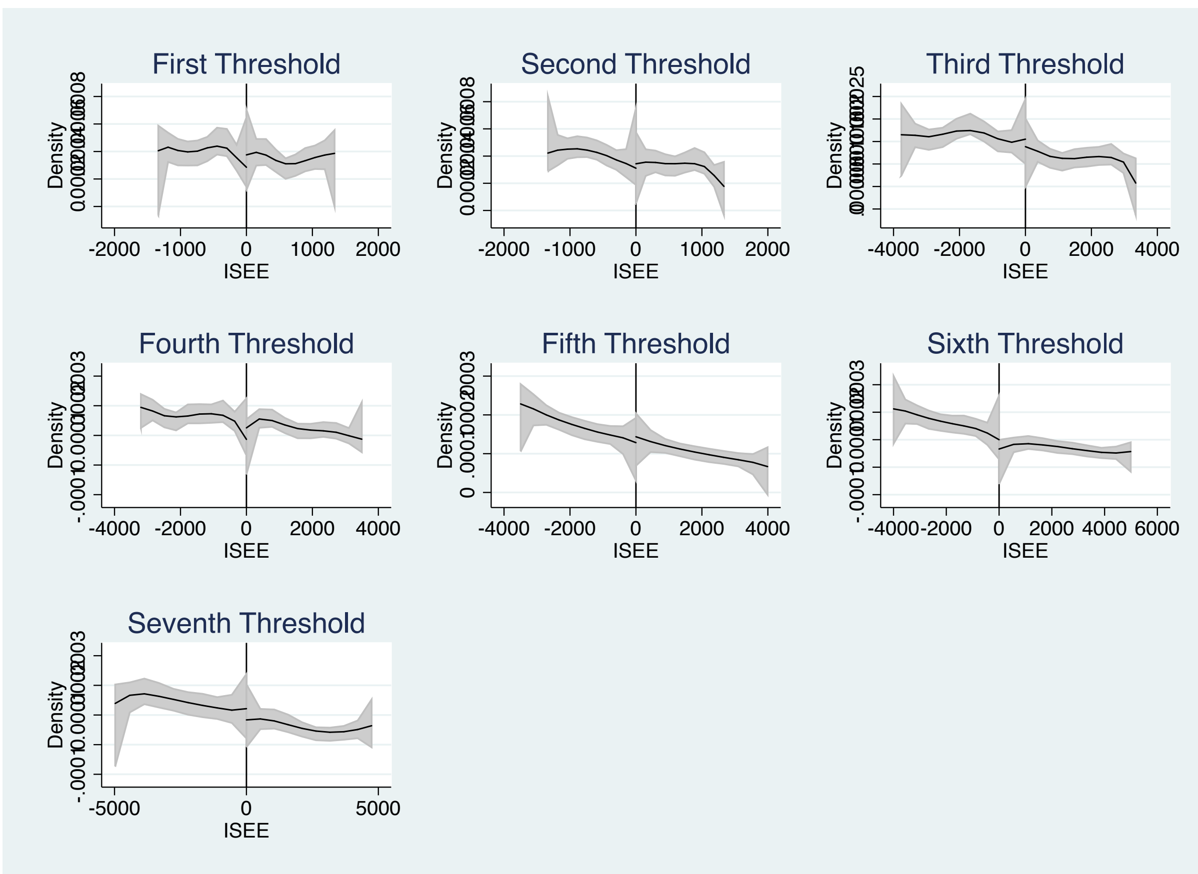

Figure 15: Drop-out rates

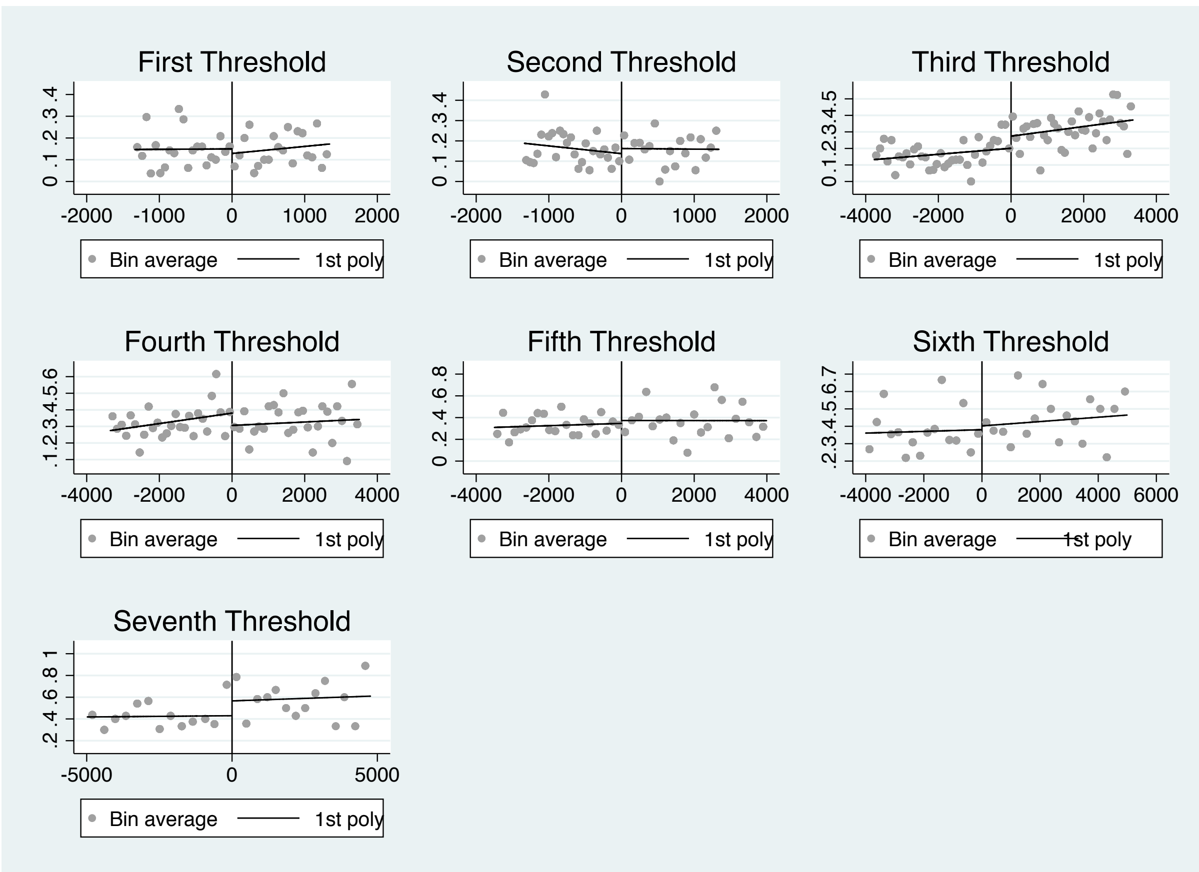

Figure 16: Re-enrollment rates

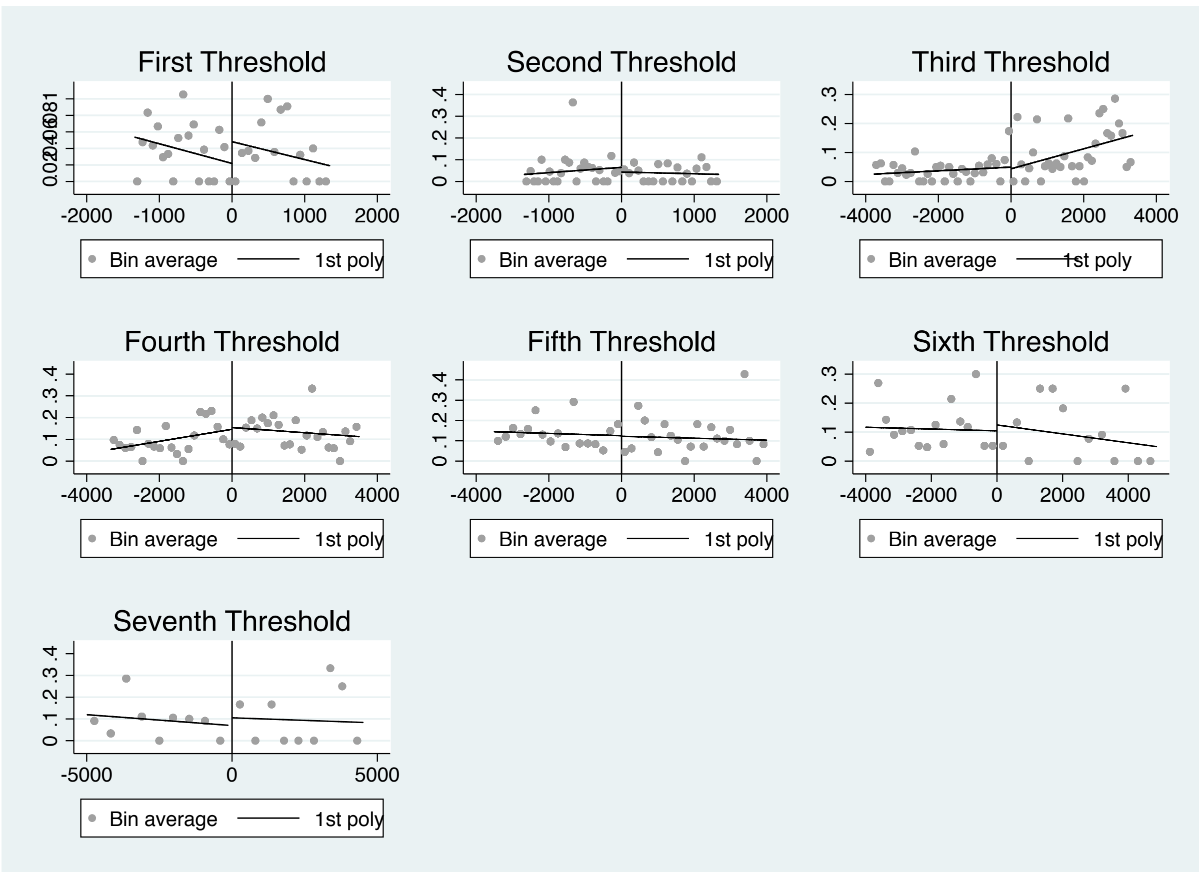

Figure 17: Credits and Local Linear Regression - Second Year

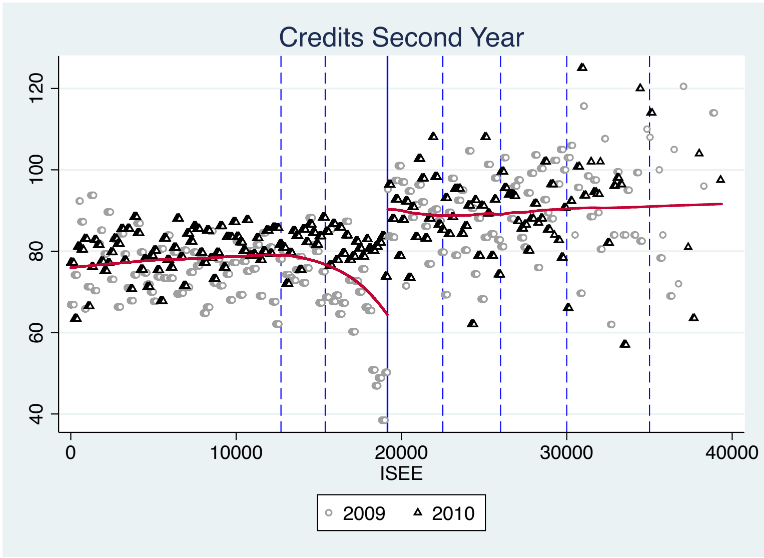

Figure 18: GPA and Local Linear Regression - Second Year

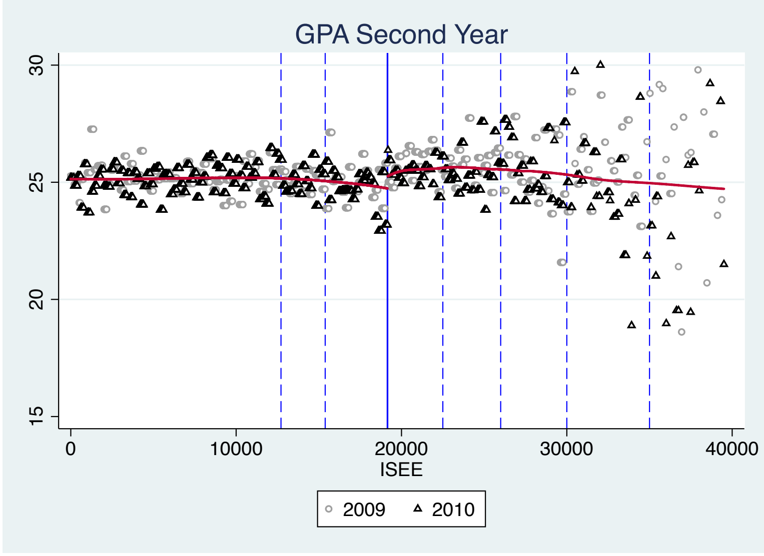

Figure 19: Non-parametric plot of Credits - Second Year

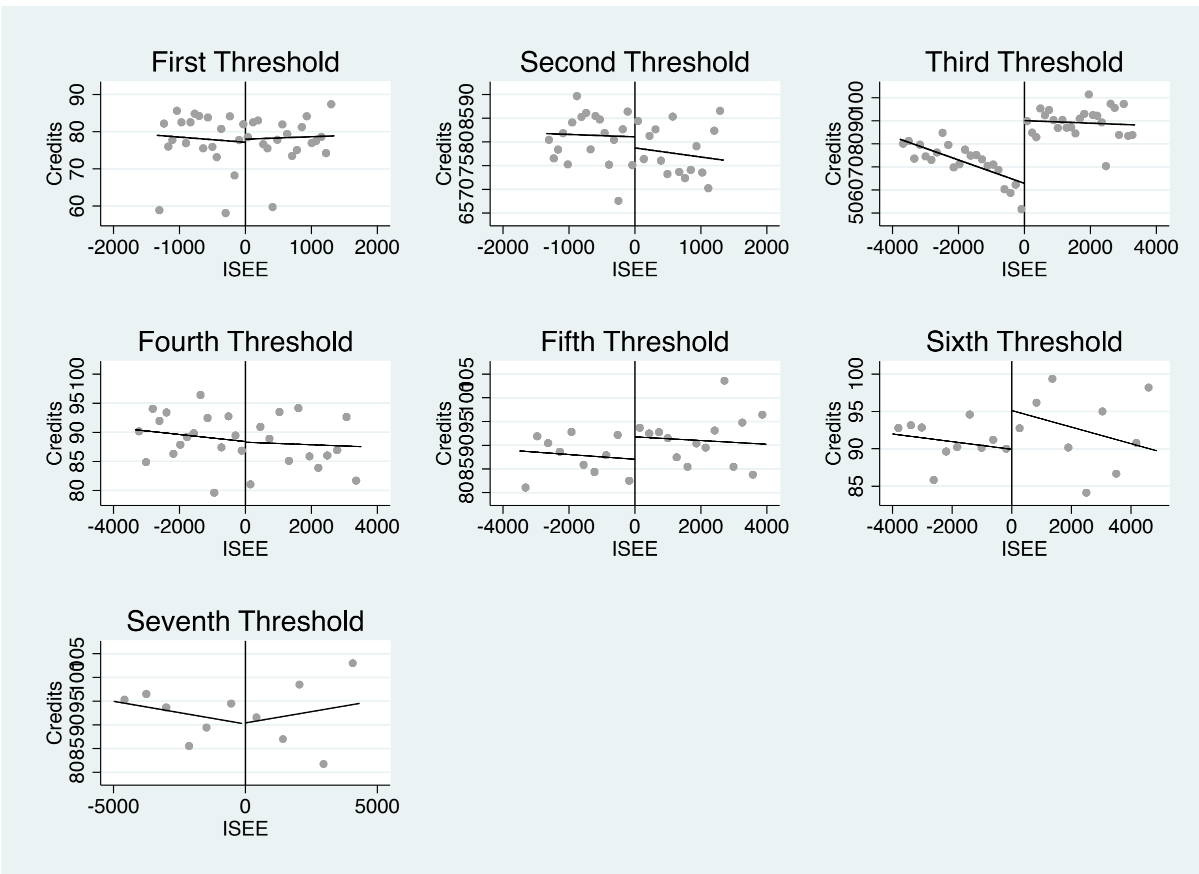

Figure 20: Non-parametric plot of Credits - Second Year

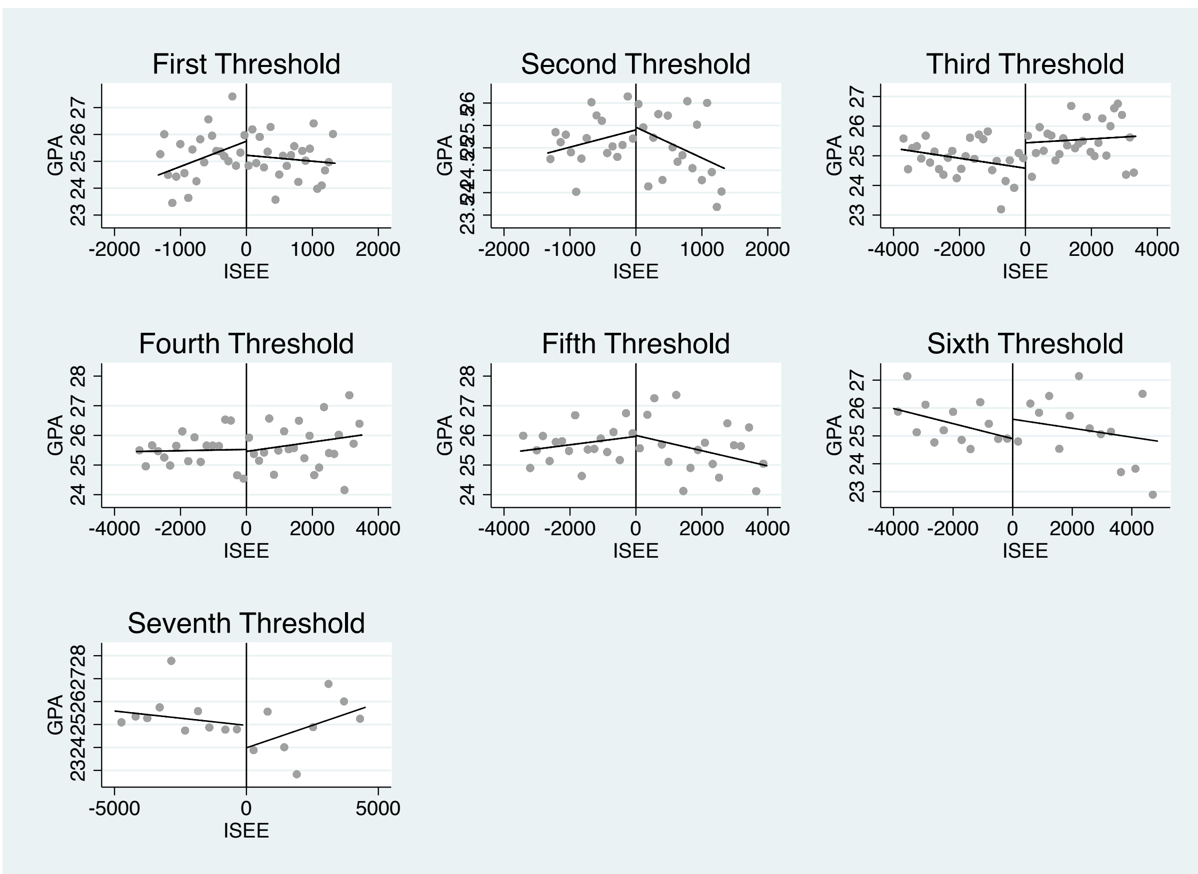

Figure 21: Probability of On-Time Graduation

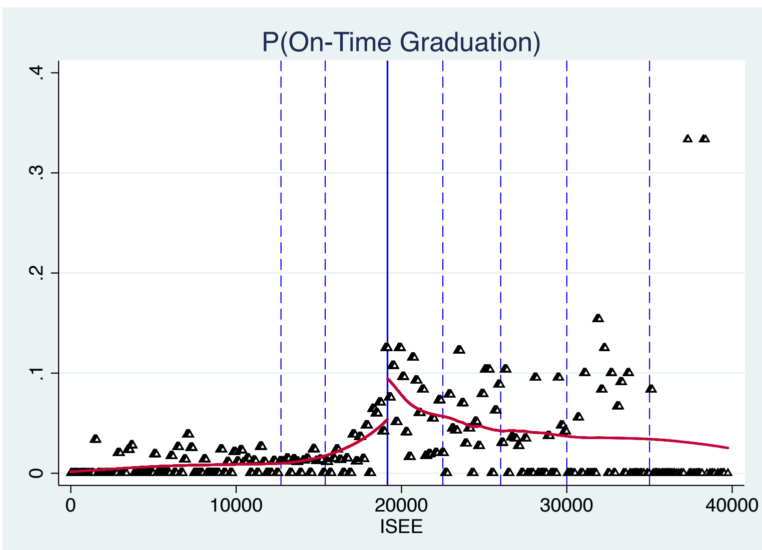

Figure 22: Non-parametric plot of the Probability of On-Time Graduation

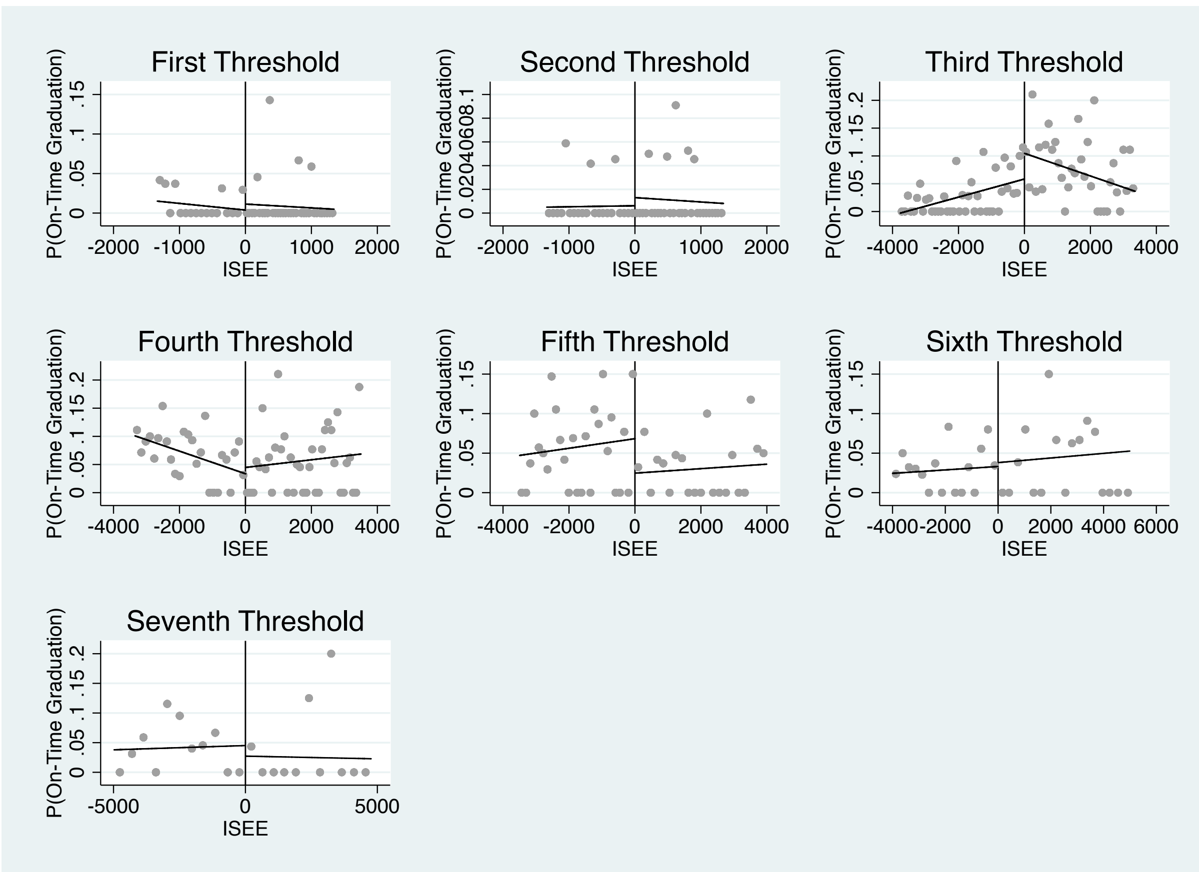

Table A3: Effects of benefits on Credits per threshold - First year

	(1) Credits 1st b/se	(2) Credits 1st b/se	(3) Credits 1st b/se	(4) Credits 1st b/se
$1st$ **Threshold** - Effect of higher aid	0.151	0.801	0.150	0.795
	(2.023)	(1.970)	(2.024)	(1.970)
ISEE	0.000	0.001	-0.000	-0.000
	(0.001)	(0.001)	(0.002)	(0.002)
Effect of higher aid x ISEE			0.001	0.001
			(0.003)	(0.003)
Constant	31.217***	37.867***	31.467***	38.239***
	(1.138)	(3.336)	(1.439)	(3.434)
$2nd$ **Threshold** - Effect of higher aid	1.819	2.197	1.759	2.167
	(2.092)	(2.027)	(2.095)	(2.030)
ISEE	0.001	0.001	-0.000	0.001
	(0.001)	(0.001)	(0.002)	(0.002)
Effect of higher aid x ISEE			0.002	0.001
			(0.003)	(0.003)
Constant	31.296***	34.508***	31.889***	34.732***
	(1.175)	(3.385)	(1.514)	(3.460)
$3rd$ **Threshold** - Effect of higher aid	-8.735***	-8.008***	-8.750***	-8.007***
	(1.457)	(1.435)	(1.543)	(1.519)
ISEE	-0.001***	-0.001***	-0.001	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)
Effect of higher aid x ISEE			0.000	-0.000
			(0.001)	(0.001)
Constant	38.426***	43.015***	38.452***	43.012***
	(0.849)	(2.477)	(1.251)	(2.621)
$4th$ **Threshold** - Effect of higher aid	-2.058	-2.259	-1.916	-2.110
	(1.943)	(1.920)	(1.948)	(1.925)
ISEE	-0.001	-0.001	-0.000	-0.000
	(0.000)	(0.000)	(0.001)	(0.001)
Effect of higher aid x ISEE			-0.001	-0.001
			(0.001)	(0.001)
Constant	37.912***	41.521***	37.028***	40.506***
	(1.109)	(3.311)	(1.436)	(3.444)
$5th$ **Threshold** - Effect of higher aid	-1.108	-1.250	-1.081	-1.221
	(2.177)	(2.163)	(2.179)	(2.165)
ISEE	0.000	-0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Effect of higher aid x ISEE			-0.001	-0.000
			(0.001)	(0.001)
Constant	38.050***	39.799***	37.578***	39.314***
	(1.258)	(3.531)	(1.584)	(3.693)
$6th$ **Threshold** - Effect of higher aid	-0.653	-0.439	-0.828	-0.596
	(2.590)	(2.600)	(2.611)	(2.618)
ISEE	-0.000	-0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Effect of higher aid x ISEE			0.001	0.001
			(0.001)	(0.001)
Constant	38.577***	35.551***	39.291***	36.139***
	(1.552)	(4.151)	(1.999)	(4.291)
$7th$ **Threshold** - Effect of higher aid	-2.255	-0.908	-1.845	-0.472
	(4.039)	(4.061)	(4.256)	(4.262)
ISEE	-0.000	-0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Effect of higher aid x ISEE			-0.001	-0.001
			(0.002)	(0.002)
Constant	39.209***	32.072***	38.452***	31.020***
	(2.344)	(6.495)	(3.381)	(7.192)
Controls	No	Yes	No	Yes

Notes: *Credits* is the outcome variable, which measures the number of credits obtained at the end of the first year of college. *ISEE* is the running variable indicator of the student's family income. Column (1) and (2) show the point estimates of the linear effect of receiving a higher benefit at each threshold, with and without controls respectively. Columns (3) and (4) report the local linear effects of receiving a higher benefit at each threshold, with and without controls respectively. Standard errors in parentheses. Significance levels: $*p < 0.10, **p < 0.05, ***p < 0.01$.

Table A4: Effects of benefits on GPA per threshold - First year

	(1) GPA 1st b/se	(2) GPA 1st b/se	(3) GPA 1st b/se	(4) GPA 1st b/se
1st **Threshold** - Effect of higher aid	0.519	0.516	0.517	0.511
	(0.429)	(0.430)	(0.428)	(0.429)
ISEE	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			0.001***	0.001**
			(0.001)	(0.001)
Constant	23.765***	23.596***	24.268***	24.041***
	(0.241)	(0.729)	(0.304)	(0.748)
2nd **Threshold** - Effect of higher aid	0.543	0.545	0.526	0.529
	(0.426)	(0.428)	(0.427)	(0.429)
ISEE	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			0.000	0.000
			(0.001)	(0.001)
Constant	23.695***	24.203***	23.868***	24.327***
	(0.240)	(0.715)	(0.309)	(0.731)
3rd **Threshold** - Effect of higher aid	-0.264	-0.264	-0.300	-0.305
	(0.319)	(0.320)	(0.327)	(0.328)
ISEE	0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			0.000	0.000
			(0.000)	(0.000)
Constant	24.053***	23.839***	24.141***	23.935***
	(0.179)	(0.546)	(0.253)	(0.572)
4th **Threshold** - Effect of higher aid	0.063	0.050	0.073	0.061
	(0.377)	(0.378)	(0.378)	(0.379)
ISEE	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			-0.000	-0.000
			(0.000)	(0.000)
Constant	23.940***	24.154***	23.879***	24.092***
	(0.216)	(0.605)	(0.280)	(0.630)
5th **Threshold** - Effect of higher aid	-0.303	-0.314	-0.301	-0.314
	(0.446)	(0.447)	(0.445)	(0.447)
ISEE	-0.000	-0.000	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			0.000	0.000
			(0.000)	(0.000)
Constant	24.030***	23.531***	24.334***	23.841***
	(0.255)	(0.669)	(0.319)	(0.700)
6th **Threshold** - Effect of higher aid	-0.770	-0.730	-0.715	-0.692
	(0.563)	(0.569)	(0.568)	(0.574)
ISEE	-0.000*	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			-0.000	-0.000
			(0.000)	(0.000)
Constant	24.202***	23.904***	23.993***	23.759***
	(0.334)	(0.874)	(0.436)	(0.916)
7th **Threshold** - Effect of higher aid	-0.158	-0.105	0.001	0.032
	(0.714)	(0.724)	(0.718)	(0.727)
ISEE	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			-0.000*	-0.000
			(0.000)	(0.000)
Constant	24.065***	24.247***	23.476***	23.637***
	(0.398)	(1.081)	(0.528)	(1.147)
Controls	No	Yes	No	Yes

Notes: *GPA* is the outcome variable, which measures the grade point average at the end of the first year of college. *ISEE* is the running variable indicator of the student's family income. Column (1) and (2) show the point estimates of the linear effect of receiving a higher benefit at each threshold, with and without controls respectively. Columns (3) and (4) report the local linear effects of receiving a higher benefit at each threshold, with and without controls respectively. Standard errors in parentheses. Significance levels: $*p < 0.10, **p < 0.05, ***p < 0.01$.

Table A5: Effects of benefits on Credits per threshold - Second year

	(1) Credits 2nd b/se	(2) Credits 2nd b/se	(3) Credits 2nd b/se	(4) Credits 2nd b/se
$1st$ **Threshold** - Effect of higher aid	-1.392	-0.644	-1.450	-0.680
	(3.490)	(3.497)	(3.491)	(3.499)
ISEE	-0.001	-0.000	0.001	0.001
	(0.002)	(0.002)	(0.003)	(0.003)
Effect of higher aid x ISEE			-0.003	-0.003
			(0.005)	(0.005)
Constant	79.858***	85.391***	78.740***	84.253***
	(1.960)	(6.045)	(2.451)	(6.228)
$2nd$ **Threshold** - Effect of higher aid	1.540	0.972	1.397	0.925
	(3.610)	(3.602)	(3.619)	(3.612)
ISEE	-0.001	-0.001	-0.003	-0.002
	(0.002)	(0.002)	(0.004)	(0.004)
Effect of higher aid x ISEE			0.003	0.001
			(0.005)	(0.005)
Constant	79.822***	93.221***	80.833***	93.449***
	(2.025)	(6.069)	(2.635)	(6.172)
$3rd$ **Threshold** - Effect of higher aid	-16.739***	-17.049***	-15.342***	-15.708***
	(3.340)	(3.348)	(3.594)	(3.597)
ISEE	-0.001*	-0.001*	0.000	0.000
	(0.001)	(0.001)	(0.002)	(0.002)
Effect of higher aid x ISEE			-0.002	-0.002
			(0.002)	(0.002)
Constant	91.678***	103.998***	89.356***	101.770***
	(1.956)	(5.407)	(2.951)	(5.831)
$4th$ **Threshold** - Effect of higher aid	1.730	1.114	1.705	1.138
	(3.870)	(3.611)	(3.877)	(3.618)
ISEE	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Effect of higher aid x ISEE			0.000	-0.000
			(0.002)	(0.002)
Constant	88.020***	124.246***	88.284***	124.022***
	(2.175)	(6.096)	(2.800)	(6.300)
$5th$ **Threshold** - Effect of higher aid	-4.727	-4.386	-4.720	-4.386
	(4.155)	(4.006)	(4.162)	(4.013)
ISEE	-0.000	-0.001	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Effect of higher aid x ISEE			-0.000	0.000
			(0.002)	(0.002)
Constant	91.869***	119.521***	91.764***	119.526***
	(2.402)	(6.841)	(3.027)	(7.090)
$6th$ **Threshold** - Effect of higher aid	-4.897	-3.816	-5.187	-4.147
	(4.982)	(5.027)	(5.092)	(5.122)
ISEE	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.002)	(0.002)
Effect of higher aid x ISEE			0.001	0.001
			(0.002)	(0.002)
Constant	94.345***	97.497***	95.119***	98.499***
	(2.955)	(9.018)	(4.000)	(9.463)
$7th$ **Threshold** - Effect of higher aid	-2.081	-3.516	-0.230	-1.272
	(9.521)	(9.896)	(10.350)	(10.697)
ISEE	-0.001	-0.000	0.001	0.002
	(0.002)	(0.002)	(0.004)	(0.004)
Effect of higher aid x ISEE			-0.002	-0.002
			(0.004)	(0.004)
Constant	93.365***	101.793***	90.408***	97.759***
	(5.731)	(18.064)	(8.563)	(19.486)
Controls	No	Yes	No	Yes

Notes: *Credits* is the outcome variable, which measures the number of credits obtained at the end of the first year of college. *ISEE* is the running variable indicator of the student's family income. Column (1) and (2) show the point estimates of the linear effect of receiving a higher benefit at each threshold, with and without controls respectively. Columns (3) and (4) report the local linear effects of receiving a higher benefit at each threshold, with and without controls respectively. Standard errors in parentheses. Significance levels: $*p < 0.10, **p < 0.05, ***p < 0.01$.

Table A6: Effects of benefits on GPA per threshold - Second year

	(1) GPA 2nd b/se	(2) GPA 2nd b/se	(3) GPA 2nd b/se	(4) GPA 2nd b/se
1st **Threshold** - Effect of higher aid	0.510	0.490	0.522	0.494
	(0.403)	(0.407)	(0.402)	(0.406)
ISEE	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			0.001**	0.001**
			(0.001)	(0.001)
Constant	24.841***	24.853***	25.225***	25.222***
	(0.227)	(0.700)	(0.284)	(0.718)
2nd **Threshold** - Effect of higher aid	-0.001	0.014	-0.058	-0.040
	(0.422)	(0.424)	(0.422)	(0.425)
ISEE	-0.000	-0.000	-0.001*	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			0.001*	0.001*
			(0.001)	(0.001)
Constant	25.078***	24.870***	25.459***	25.129***
	(0.237)	(0.727)	(0.308)	(0.738)
3rd **Threshold** - Effect of higher aid	-0.980***	-0.957***	-0.849**	-0.816**
	(0.326)	(0.325)	(0.341)	(0.339)
ISEE	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			-0.000	-0.000
			(0.000)	(0.000)
Constant	25.697***	26.422***	25.436***	26.142***
	(0.186)	(0.564)	(0.270)	(0.595)
4th **Threshold** - Effect of higher aid	0.052	0.097	0.065	0.110
	(0.403)	(0.393)	(0.404)	(0.393)
ISEE	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			-0.000	-0.000
			(0.000)	(0.000)
Constant	25.581***	27.374***	25.460***	27.255***
	(0.229)	(0.686)	(0.293)	(0.707)
5th **Threshold** - Effect of higher aid	-0.021	0.036	-0.033	0.023
	(0.485)	(0.474)	(0.484)	(0.473)
ISEE	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			0.000*	0.000*
			(0.000)	(0.000)
Constant	25.626***	27.677***	25.998***	28.101***
	(0.279)	(0.767)	(0.350)	(0.803)
6th **Threshold** - Effect of higher aid	-0.738	-0.535	-0.699	-0.518
	(0.621)	(0.607)	(0.628)	(0.614)
ISEE	-0.000*	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			-0.000	-0.000
			(0.000)	(0.000)
Constant	25.731***	27.273***	25.598***	27.223***
	(0.372)	(0.943)	(0.486)	(0.975)
7th **Threshold** - Effect of higher aid	0.575	0.180	0.978	0.642
	(0.942)	(0.935)	(0.986)	(0.971)
ISEE	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			-0.001	-0.001*
			(0.000)	(0.000)
Constant	24.743***	25.940***	23.985***	24.891***
	(0.551)	(1.434)	(0.785)	(1.560)
Controls	No	Yes	No	Yes

Notes: *GPA* is the outcome variable, which measures the grade point average at the end of the first year of college. *ISEE* is the running variable indicator of the student's family income. Column (1) and (2) show the point estimates of the linear effect of receiving a higher benefit at each threshold, with and without controls respectively. Columns (3) and (4) report the local linear effects of receiving a higher benefit at each threshold, with and without controls respectively. Standard errors in parentheses. Significance levels: $*p < 0.10, **p < 0.05, ***p < 0.01$.

Table A7: Effects of benefits on the probability to graduate on time

	(1) P(On-time) b/se	(2) P(On-time) b/se	(3) P(On-time) b/se	(4) P(On-time) b/se
1*st* **Threshold** - Effect of higher aid	-0.008	-0.007	-0.008	-0.007
	(0.012)	(0.012)	(0.012)	(0.012)
ISEE	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			-0.000	-0.000
			(0.000)	(0.000)
Constant	0.013*	0.011	0.011	0.010
	(0.007)	(0.020)	(0.008)	(0.021)
2*nd* **Threshold** - Effect of higher aid	-0.007	-0.006	-0.007	-0.006
	(0.011)	(0.011)	(0.011)	(0.011)
ISEE	-0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			0.000	0.000
			(0.000)	(0.000)
Constant	0.011*	-0.012	0.013	-0.011
	(0.006)	(0.019)	(0.008)	(0.019)
3*rd* **Threshold** - Effect of higher aid	-0.030*	-0.029	-0.047**	-0.045**
	(0.018)	(0.018)	(0.018)	(0.018)
ISEE	0.000	0.000	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			0.000***	0.000***
			(0.000)	(0.000)
Constant	0.065***	0.084***	0.105***	0.122***
	(0.010)	(0.031)	(0.014)	(0.032)
4*th* **Threshold** - Effect of higher aid	-0.015	-0.016	-0.011	-0.012
	(0.025)	(0.024)	(0.025)	(0.024)
ISEE	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			-0.000**	-0.000**
			(0.000)	(0.000)
Constant	0.069***	0.282***	0.045**	0.257***
	(0.014)	(0.039)	(0.018)	(0.041)
5*th* **Threshold** - Effect of higher aid	0.044*	0.049**	0.044*	0.049**
	(0.025)	(0.025)	(0.025)	(0.025)
ISEE	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			0.000	0.000
			(0.000)	(0.000)
Constant	0.022	0.173***	0.025	0.176***
	(0.014)	(0.037)	(0.018)	(0.038)
6*th* **Threshold** - Effect of higher aid	-0.005	-0.003	-0.005	-0.004
	(0.027)	(0.027)	(0.027)	(0.027)
ISEE	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			-0.000	0.000
			(0.000)	(0.000)
Constant	0.039**	0.157***	0.038*	0.157***
	(0.016)	(0.041)	(0.021)	(0.043)
7*th* **Threshold** - Effect of higher aid	0.019	0.016	0.018	0.014
	(0.039)	(0.039)	(0.040)	(0.040)
ISEE	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE			0.000	0.000
			(0.000)	(0.000)
Constant	0.024	0.162***	0.027	0.171***
	(0.022)	(0.059)	(0.029)	(0.063)

Notes: *P(On-time)* is the outcome variable, which measures the probability to graduate on time for Bachelor students (within 3 years) and for Master students (within 2 years). *ISEE* is the running variable indicator of the student's family income. Column (1) and (2) show the point estimates of the linear effect of receiving a higher benefit at each threshold, with and without controls respectively. Columns (3) and (4) report the local linear effects of receiving a higher benefit at each threshold, with and without controls respectively. Standard errors in parentheses. Significance levels: $*p < 0.10, **p < 0.05, ***p < 0.01$.

Table A8: Effects of benefits on Credits and GPA per threshold - Non parametric

	(1)		(2)	
	Credits	GPA	Credits	GPA
Effect of higher benefit (conventional)	-10.265***	-0.524	-33.430***	0.659
	(2.870)	(0.756)	(7.194)	(0.659)
Effect of higher benefit (bias_corrected)	-10.666***	-.774	-35.206***	0.485
	(2.870)	(0.756)	(7.194)	(0.659)
Effect of higher benefit (robust)	-10.666***	-.774	-35.206***	0.485
	(3.480)	(0.879)	(8.653)	(0.782)
Bandwith for Loc. Poly (h)	1423.22	912.84	1461.27	923.40
Bandwith for bias (b)	2165.77	1471.24	2210.07	1446.62
Number of observations	1919	2135	1333	2135

Notes: Non-parametric estimates of the effect of higher benefit on performances: credits obtained and GPA reached at the end of the first year of college, columns (1) and (2), and second year of college, columns (3) and (4). Following Calonico et al. (2014b) and Calonico et al. (2014a), I report the optimal bandwidth for the local polynomial (h) and for the bias (b). The treatment effects are computed for: the local polynomial estimator (conventional), the bias-corrected estimator proposed by Calonico et al. (2014b) and the same estimator with robust standard errors. The running variable is the distance of the ISEE indicator from the threshold value: $(Y - c)$. Significance levels: * at 10%; ** significant at 5%; *** significant at 1% or better.

Table A9: Effects of benefits on Credits and GPA per threshold - 2nd degree polynomials

	(1)	(2)	(3)	(4)
	Credits 1st	Credits 1st	GPA 1st	GPA 1st
	b/se	b/se	b/se	b/se
3rd **Threshold** - Effect of higher aid	-9.395***	-9.222***	-0.314	-0.316
	(2.327)	(2.286)	(0.493)	(0.495)
ISEE	0.004	0.003	0.000	-0.000
	(0.003)	(0.003)	(0.001)	(0.001)
Effect of higher aid x ISEE	-0.010***	-0.009***	0.000	0.000
	(0.003)	(0.003)	(0.001)	(0.001)
ISEE_2	-0.000*	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE_2	0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	35.815***	40.799***	24.103***	24.059***
	(1.880)	(2.965)	(0.378)	(0.641)
Controls				

Notes: *Credits* and *GPA* are the outcome variables, which measures the number of credits and the grade point average at the end of the first year of college. *ISEE* is the running variable indicator of the student's family income. *ISEE_2* is the squared root of the running variable. Column (1) and (2) show the point estimates of the local linear effects interacted with the 2nd degree polynomial of the ISEE, with and without controls respectively. Columns (3) and (4) report the point estimates of the local linear effects interacted with the 2nd degree polynomial of the ISEE, with and without controls respectively. Standard errors in parentheses. Significance levels: $*p < 0.10, **p < 0.05, ***p < 0.01$.

Table A10: Effects of benefits on GPA per threshold - 2nd degree polynomials

	(1) Credits 2nd b/se	(2) Credits 2nd b/se	(3) GPA 2nd b/se	(4) GPA 2nd b/se
$3rd$ **Threshold** - Effect of higher aid	-16.711***	-17.291***	-0.614	-0.575
	(5.523)	(5.509)	(0.520)	(0.516)
ISEE	-0.000	0.000	0.001	0.001
	(0.006)	(0.006)	(0.001)	(0.001)
Effect of higher aid x ISEE	-0.003	-0.004	-0.001	-0.001
	(0.007)	(0.007)	(0.001)	(0.001)
ISEE_2	0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Effect of higher aid x ISEE_2	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	89.558***	101.745***	25.094***	25.829***
	(4.451)	(6.680)	(0.404)	(0.664)
Controls				

Notes: *Credits* and *GPA* are the outcome variables, which measures the number of credits and the grade point average at the end of the second year of college. *ISEE* is the running variable indicator of the student's family income. *ISEE_2* is the squared root of the running variable. Column (1) and (2) show the point estimates of the local linear effects interacted with the 2nd degree polynomial of the ISEE, with and without controls respectively. Columns (3) and (4) report the point estimates of the local linear effects interacted with the 2nd degree polynomial of the ISEE, with and without controls respectively. Standard errors in parentheses. Significance levels: $*p < 0.10, **p < 0.05, ***p < 0.01$.

Table A11: Effects of benefits on Credits by gender and thresholds

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
females	3.644**	2,338	3.007***	3.170*	2.967*	4.560**	4.487**	4,309
	(1.548)	(1.643)	(1.127)	(1.707)	(1.534)	(1.864)	(2.147)	(3.578)
female * effect of higher benefit	-6.22*	2.10	-1.98	-1.30	-0.59	-0.379	-1.27	-6.01
	(3.38)	(3.51)	(2.43)	(2.53)	(3.61)	(3.66)	(4.18)	(5.86)
effect of higher benefit - Threshold 1	3,432							
	(2.870)							
effect of higher benefit - Threshold 2		-0.311						
		(3.034)						
effect of higher benefit - Aggregate Thresholds Scholarship			1,582					
			(2.086)					
effect of higher benefit - Threshold 3				-7.507***				
				(2.435)				
effect of higher benefit - Threshold 4					1,444			
					(3.094)			
effect of higher benefit - Threshold 5						4,187		
						(3.132)		
effect of higher benefit - Threshold 6							5,075	
							(3.626)	
effect of higher benefit - Threshold 7								7,374
								(5.295)
Constant (males)	27.290***	28.685***	27.979***	34.713***	34.557***	31.072***	32.916***	35.713***
	(1.762)	(1.849)	(1.276)	(2.000)	(1.625)	(2.010)	(2.274)	(3.931)
R-squared	0.004	0.003	0.004	0.040	0.002	0.011	0.027	0.026
Obs.	1010	1001	2011	1670	842	758	494	268

Notes: OLS estimates of linear equation 1 where Z_i is the outcome variable Credits; $F(Y_i - c)$ is a vector whose elements are two linear functions (one for each side of the threshold) of the absolute difference between the ISEE indicator and the threshold value; D_i is a dummy taking value 1 for students on the left side of the threshold. Robust standard errors in parentheses. Significance levels: * at 10%; ** significant at 5%; *** significant at 1% or better.

Table A12: Effects of benefits on GPA by gender and thresholds

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
females	1.547**	1.273*	1.412***	1.426**	1.357**	2.056***	0.811	2.193**
	(0.628)	(0.659)	(0.454)	(0.656)	(0.530)	(0.679)	(0.781)	(1.063)
female * effect of higher benefit	-0.036	0.850	0.394	-0.285	0.570	-1.440	1,871	-2.943*
	(1.37)	(1.41)	(0.982)	(0.975)	(1.24)	(1.335)	(1.523)	(1.741)
effect of higher benefit - Threshold 1	1,120							
	(1.166)							
effect of higher benefit - Threshold 2		0.192						
		(1.218)						
effect of higher benefit - Aggregate Thresholds Scholarship			0.667					
			(0.841)					
effect of higher benefit - Threshold 3				-0.922				
				(0.936)				
effect of higher benefit - Threshold 4					-0.966			
					(1.068)			
effect of higher benefit - Threshold 5						1,033		
						(1.141)		
effect of higher benefit - Threshold 6							-1,119	
							(1.320)	
effect of higher benefit - Threshold 7								3.882**
								(1.573)
Constant (males)	22.855***	22.902***	22.876***	24.910***	25.503***	24.039***	25.516***	23.870***
	(0.715)	(0.742)	(0.514)	(0.769)	(0.561)	(0.732)	(0.828)	(1168
R-squared	0.006	0.003	0.007	0.012	0.008	0.014	0.020	0.016
Obs.	1013	1003	2016	1671	842	758	494	268

Notes: OLS estimates of linear equation 1 where Z_i is the outcome variable GPA; $F(Y_i - c)$ is a vector whose elements are two linear functions (one for each side of the threshold) of the absolute difference between the ISEE indicator and the threshold value; D_i is a dummy taking value 1 for students on the left side of the threshold. Robust standard errors in parentheses. Significance levels: * at 10%; ** significant at 5%; *** significant at 1% or better.