Means-Tested Grants and Students' Higher Education Decisions in France: a Regression Discontinuity Approach*

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Abstract

This paper evaluates the impact of France's largest financial aid program for low-income students on enrollment decisions, dropout behavior and graduation rates in higher education. The amount of financial aid that a student may receive is a step function of parental income and of a family needs assessment score. Combining comprehensive administrative data on means-tested grant applicants and on students enrolled in French universities over the period 2008-2010, we show that the discontinuities in the amount of financial aid awarded provide a credible source of identification of its effect on students' decisions at different stages of the college curriculum. Using a regression discontinuity approach, we find that being eligible to a grant of 1,500 euros per year is associated with a 2 to 4 percentage points increase in the probability of initial enrollment or re-enrollment. Moreover, our estimates indicate that the impact of means tested-grants is not short-lived. For students starting an undergraduate or a post-graduate program, we find that a 1,500 euros grant has a positive impact on retention rates and, for postgraduate students, on degree completion. For students finishing an undergraduate or a postgraduate degree, being awarded such a grant increases the probability of graduating on time by 2 to 3 percentage points. We interpret our findings as evidence that means-tested grants improve the educational outcomes of low-income students, both on the extensive margin of access to higher education and on the intensive margin of academic achievement in university.

JEL Classification H52, I22, I28, J24, J38
Keywords Means-tested grants; college enrollment; student persistence; degree completion

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1 Introduction

College going has risen substantially over the past three decades in France, as in many OECD countries (OECD, 2011). In France, the rate of access to higher education is about 53 percent among recent cohorts (MESR, 2011a). However, inequalities in post-secondary education remain a major concern. Children from low socio-economic backgrounds are underrepresented in higher education institutions and many of them drop out after one or two years of study. These differences in educational attainment translate into persistent earning inequalities.

In order to reduce the inequalities in access to higher education, the French Ministry of Higher Education operates a large-scale financial aid program targeted at low-income students called *Bourses sur critères sociaux*. This program provides tuition waivers and cash transfers to about a third of students enrolled in French higher education institutions and is very similar to broad means-tested programs implemented in other countries, such as the Pell grants in the US, the Maintenance Grant in the UK or the Spanish *Becas*.

Our study focuses on the impact of this financial aid program on the educational attainment of low-income students along two main dimensions. First, we analyze how the grants awarded to applicants affect their decision to enroll or re-enroll in college. Second, we study the impact of these grants on persistence and degree completion. The theoretical impact of financial aid on educational attainment can be studied in a standard static model of educational investment, in which students compare the short-term costs and long-run benefits of an additional year of education when deciding whether or not to enroll in college. The main justification for the public provision of financial support to low-income students is the existence of credit constraints which prevent these students from choosing the optimal level of education. Economic theory predicts a positive effect of financial aid on initial enrollment but makes more ambiguous predictions about its impact on dropout and degree completion. The impact of financial aid on dropout and graduation rates depends not only on the choices of the "marginal" students, i.e. those who would not have enrolled in college without the grant, but also on the choice of "inframarginal" students, i.e. who would have attended college even in the absence of financial aid. If credit constraints are not a major obstacle to college enrollment, marginal students would be expected to be of lower average ability than inframarginal students, and be more likely to drop out after one or two years of post-secondary studies. In this case, the impact of financial aid on graduation would be lower than its impact on initial enrollment. However, if credit constraints are important, the average ability of marginal students could be high and trigger a positive effect of financial aid on degree completion. Moreover, the provision of financial support could improve the learning conditions of students by keeping them more focused on their studies. In France, many students are constrained to work to finance their studies[1] and this has been found to negatively affect their educational attainment (Beffy et al., 2010). By allowing students to devote more time to their studies, financial aid may help them to progress more rapidly and increase their chances of completing their degree. Finally, a number of studies point out that in order to better analyze dropout decisions, we need take into account the fact that students have only imperfect information about the benefits of their "college experience" before entering university, but learn about their college aptitude and educational returns after enrolling.[2] Financial aid may therefore induce some students to enroll into college in order to learn about their college aptitude but eventually trigger high dropout rates if these students later learn that their expected returns to college graduation are low.[3]

The combined empirical analysis of the impact of means-tested grants on initial enrollment, progress through college and degree completion will provide us with a better insight into the type of students who benefit from the program. In order to evaluate the efficiency of such broad-based programs, it is indeed important to know whether the main beneficiaries of financial aid are weak students who drop out after a few years, or higher ability students who graduate on time. Estimating the impact of financial aid is an empirical challenge, as grant eligibility is usually correlated with other, often unobservable, characteristics that directly affect academic attainment. In the case of means-tested programs such as the French *Bourses sur Critères sociaux* or the US Pell Grant, financial aid recipients are mostly from low income families and have lower educational achievement than students from higher socio-economic backgrounds. A failure to control properly for this confounding factor would yield downward biased estimates of the impact of financial aid. Several papers have exploited policy designs or policy changes as quasi-experiments in order to study the impact of financial aid on enrollments. While most of these studies

[1] A recent survey conducted by the *Observatoire de la vie étudiante* (OVE, OVE (2011)) indicates that over 20 percent of students work on a regular basis during the academic year

[2] For a review of the limitations of the standard model of educational choice when looking at college attainment, see Bound and Turner (2011) and Stange (2012). See also Arcidiacono (2004) and for studies on French data, Beffy et al. (2012) and Brodaty et al. (2012).

[3] Even if they eventually drop out, students may still value the possibility to learn about their ability.

find positive effects of specific types of grants on enrollment, the empirical evidence on the impact of broader means-tested grant programs remains fairly limited, despite the fact that these programs usually represent the bulk of public financial support schemes targeted at low-income students[4]. Moroever, there is only limited evidence on the impact of financial assistance programs on persistence and degree completion.

Most of the existing evidence comes from US data. A number of authors have investigated the impact of the aforementioned Pell Grant program, which shares many similarities with the French system of means-tested grants, in terms of duration (the application has to be renewed every year, amounts distributed (a few thousand euros per year) and scope (both are federal programs).)[5] These studies find very limited effects of the program on enrollment.[6] Bettinger (2004) is the only paper to look at other outcomes such as persistence, using discontinuities in the Pell grant formula, but the results are mixed as his estimates are sensitive to the choice of specification. Several studies suggest that the weak effect of the Pell Grant program may be due to the complexity of the application procedure and advocate a simplification of the process to improve its enrollment effects (Dynarski and Wiederspan (2012); Dynarski and Scott Clayton (2008), and Bettinger et al. (2009)).[7] Other studies have found a positive impact of both enrollment and attainment of more narrowly defined programs such as Veterans' educational benefits (Angrist, 1993; Stanley, 2003; Bound and Turner, 2002, 2003.) or the Social Security student benefit program, which formerly covered the college costs of deceased, disabled or retired Social Security beneficiaries (Dynarski, 2003). These results cannot, however, be easily generalized as the programs studied are targeted at specific populations. More recently, researchers have focused on the merit-based aid programs that are implemented in a number of US States.[8] Most of these studies find positive effects of financial aid on enrollment, with an additional $1000 dollar in aid yielding increasing col-

[4]US Federal spending on student aid was indeed very recently increased, as spending on Pell grants was almost doubled from around $ 23 billion in the 2010 budget to around $ 42 billion in 2011. The other main large federal program is a program of subsidized loans

[5]The main difference is that Pell grants are restricted to undergraduate students, whereas French grants can also cover graduates.

[6]For a review of the empirical studies on the Pell Grant program, see Kane (2006), Deming and Dynarski (2009), and also Kane (1995) and Seftor and Turner (2002).

[7]Moreover, recent papers have studied the incidence of Pell grants and shown that part of the subsidy has been translated into higher tuition and fee cost, limiting their efficiency (Goldin and Riegg Cellini (2012) and Turner (2012)). This is not likely to happen in the French case, as most of higher education institutions are public, and their tuition fees are determined by the State.

[8]Studies include Dynarski(2000;2008), Abraham and Clark (2006), Cornwell et al. (2006), Goodman (2008) Kane (2007). For a review, see Deming and Dynarski (2009).

lege enrollment by 3 to 5 percentage points. Among the very few studies that investigate other outcomes, Dynarski (2008) and Scott Clayton (2011) find positive effects on degree completion. In the case of the PROMISE Scholarship in West Virginia, which has been studied by Scott Clayton (2011), grant renewal is tied to academic requirements, which may reinforce the positive impact on attainment. Many grants, including the French *Bourses sur critères sociaux* and the US Pell Grant have some requirements regarding attendance and academic progress for renewing the grant. Recent policy initiatives have focused on policies that aim at retaining enrolled college student, offering them financial incentives and mentoring in order to help them progress through college and reduce their dropout rates.[9] Overall, US studies show that some types of financial aid have a positive impact on enrollment but the evidence of the efficiency of broader means-tested programs is limited.[10] Existing evidence on the impact of financial support programs in Europe is even more limited and mixed.[11]

Our paper makes several contributions to this literature. First, we combine administrative data on the universe of students applying for means-tested grants in French higher education with data on students enrolled in French universities for the years 2008 to 2010. These very large micro data sets allow us to precisely follow the educational record of students entering university, keeping track of them even if they transfer to other institutions and move to other regions. Second, unlike most previous studies, we account for the fact that grant renewal is not automatic and that the amount of grant awarded may change every year. We can therefore estimate the effect of financial aid on students' decisions at each level of study, i.e. for those entering university and for those already enrolled in college. Third, we investigate the impact of aid on a broader set of outcomes than most previous studies, analyzing not only enrollment effects but also persistence and degree completion.

We exploit discontinuities in the grant eligibility formula to estimate the impact of financial aid on students' outcomes using Regression Discontinuity Design (such as in Van Der Klaauw (2002) and Bettinger (2004)). We find that being eligible to a conditional level 1 grant of 1,500 euros per year increases college enrollment or re-enrollment by 2.5 to 3 percentage points. Moreover, our estimates indicate that the impact of means tested-

[9]Se Angrist, Lang and Oreopoulos (2009), DesJardins et al.

[10]Several studies also investigate how subsidized loans can alleviate credit constraints (including Stinebrickner and Stinebrickner (2008), Gurgand et al. (2012) and Solis (2012))

[11]See Nielsen et al. (2010); Steiner et al. (2006; 2011); Dearden et al. (2011).

grants is not short-lived. For students starting an undergraduate or a post-graduate program, we find that a level 1 grant has a positive impact on persistence and, for post-graduate students, on degree completion. For students in their final year of an undergraduate or a postgraduate degree program, we find that being eligible for a level 1 grant increases the probability of graduating on time by 2 to 3 percentage points. We interpret our findings as evidence that simple broad-based means-tested grant programs improve the educational outcomes of low-income students, both on the extensive margin of access to higher education and on the intensive margin of academic achievement in university

The remainder of this paper is as follows. Section 2 provides some institutional background on higher education in France. Section 3 presents the estimation strategy. Section 4 describes the data. Section 5 discusses the validity of the regression discontinuity design and presents the main results on the effect of means-tested grants, as well as robustness checks. Section 6 concludes.

2 Institutional background

2.1 Higher Education in France

The French system of higher education comprises various institutions, which can be broadly classified into three main paths: public academic universities, vocational education and elite schools. A vast majority of students (nearly 55 percent in 2010)[12] are enrolled in public universities which offer academic undergraduate degrees (mainly three-year degrees such as *Licence*), graduate degrees (*Master*) and doctorate diplomas. French universities are not selective as the only requirement for admission is to have passed the high school graduation exam (*Baccalauréat*). The main other path is vocational higher education, which is chosen by 15 percent of students. Over 2,000 public and private institutions offer two-year vocational degree programs (*Brevet de Technicien supérieur* and *diplômes universitaires de technologie*, the latter being taught in universities) with a strong practical orientation in various professional areas. The admission process to enter such vocational studies is usually more selective than for general subjects, as the number of seats for each degree program is limited. Finally, a minority of students choose the

[12]These statistics refer to students registered in 2010, see chapter 10 in MESR (2011b). In total, around around 2,3 million students were enrolled in higher education institutions.

selective track of *Grandes Écoles*. Students seeking admission to these elite schools usually need to undertake a two-year preparatory course before taking a highly competitive entrance exam. In addition to these three main paths, many other smaller schools or institutions offer specific degree programs (such as schools of art, architecture, journalism, etc.).

The cost of higher education in France is mainly driven by living expenses, as admission fees in public institutions are set at a a fairly low level (in 2009, university fees were set at 175 euros per year for undergraduate students and 236 euros for graduate students). The cost of living can however be relatively high, as many higher education institutions are located in large cities. Subsidized university residences are in very limited supply and housing costs in the private sector can be substantial in some areas, even if students living on their own can receive housing benefits. Surveys on student's social and economic conditions show that on average, students attending university and living away from they their parent's home spend around 700 euros a month to cover their living expenses[13] and housing costs account for 47 percent of their budget, even after deduction of the housing benefits that they may receive. The other main expenditures items are food (19 percent), utility bills (11 percent) and transportation costs (8 percent). In addition, students have to pay annual tuition fees and social security contributions if they are over 18 years of age (the annual social security contributions for students are around 200 euros). In total, the average budget for an academic year (9 months) amounts to 6,540 euros.

2.2 Means-tested grants

The *Bourses sur Critères Sociaux* program is the main public financial support scheme for low-income students in France. It benefits to a third of students enrolled in higher education, for a total cost of 1.7 billion euros in 2010.[14] Other forms of financial support, such as State-guaranteed student loans or merit grants, which exist on a large scale in many countries, are almost non-existent in France.[15]

[13]This monthly amount, expressed in 2011 euros, is calculated by the authors from the *Enquête Conditions de vie* survey which was conducted by the *Observatoire de la Vie Etudiante* (OVE) during the academic year 2009-2010.

[14]Parents can also get tax deductions if their children are enrolled in higher education institutions.

[15]A program of state-guaranteed loans has been put in place since 2008, but with very limited success so far, since less than 0.3 percent of students have contracted such loans over the first three years of the program. Publicly provided Merit-aid grants exist but are awarded every year to less than 1,000 undergraduate and graduate students eligible for means-tested grants.

The amount of financial aid varies with parental income and students' characteristics. The *Bourses sur Critères Sociaux* program consists of seven levels of grants (referred to as *échelons*), which range from 0 to 6. Students eligible to a level 0 grant are exempt from paying tuition fees (if they attend public universities) and social security contributions, but do not receive any cash benefit. In addition to fee waivers, students eligible to a level 1 grant receive a cash allowance of approximately 1,500 euros a year, which covers about a third of the average living expenses of eligible students who are not living with their parents (see table 1). At of the next level of grant increases the annual allowance increases by 200 to 700 euros (the average increment being 600 euros) up to a maximum of 4,228 euros, which covers 90 to 95 percent of the living expenses of eligible students living on their own.[16] The amounts distributed through this program therefore cover a substantial part of the costs of higher education.

2.2.1 Eligibility rules

Eligibility to means-tested grants is conditional on being registered as a full-time student in a French public or private higher education institution and on being under 28 years of age at the beginning of the academic year. The amount of grant that applicants may receive is a deterministic function of their parental income and of a discrete-valued family needs assessment (FNA) score that takes into account several criteria. Parental income is the taxable income that appears on the parents' tax notice received in year $t-2$.[17] Since 2008, the two criteria that are taken into account to assess family needs are distance to university and number of siblings.[18] Each sibling counts for 2 points (4 points if enrolled in a higher education institution). Additional points are awarded if the distance between the university and the parents' place of residence is greater than 30 km: 1 point up to 249 km and 2 points beyond. These points are added together to compute the family needs assessment score, which is capped at 17 points. The median score among applicants is 3 points.

The income thresholds that determine eligibility to the different levels of grant depend on the applicant's score, generating multiple discontinuities (see Figure 1 and table 12

[16]Note that students eligible for grants have lower gross expenses than non-eligible students.

[17]When parents are divorced or single, applicants are requested to indicate the taxable income of the custodial parent.

[18]Before 2008, the FNA score included additional criteria, such as single parent status or disability, which were easier to manipulate. Our analysis focuses on the years after the reform, i.e. 2008-20010.

in the appendix). For example, an applicant with a zero score in 2009 would be eligible for a level 0 grant if her parental income in 2007 were comprised between 23,538 and 34,611 euros, for a level 1 grant if her parental income were comprised between 19,023 and 23,537 euros, and so forth. Figure 1 provides a graphical representation of how the income eligibility cutoffs increase with the FNA score. For the median student applicant, whose FNA score is 3, the income eligibility cutoff for the highest level of grant was 10,509 euros in 2008, which corresponds approximately to the bottom quintile of the income distribution of households in France[19]. The student would not be eligible for any level of grant if her parental income was higher than 46,145 euros, which falls into the top quintile of the income distribution.

A specific feature of the French system is that grants are only awarded for the following academic year. They can be renewed up to seven times but students must apply every year, their parental income and FNA being reassessed each time. In addition, grant renewal is subject to academic requirements: a student will loose her right to a grant if she fails twice to obtain 60 ECTS[20] (which correspond to the number of credits that a student can obtain in a typical university year) in two consecutive years. In other words, a student is allowed to repeat once, but no more. Moreover, eligible student are also required to comply with the attendance requirements set by their university and to take all the exams. Failure to comply with these requirements may lead to the repayment of the allowance received by the student.

2.2.2 Application process

The means-tested grant application process for student willing to enroll in a higher education institution starts in January of the year of enrollment and spans over several months. The application steps can be summarized as follows.

Official online application campaign (January 15 – April 30) Students apply jointly for means-tested grants and student housing (optional) on a dedicated online website.[21] Applicants are requested submit up to four pre-registration choices, as they

[19]Source: authors' calculations from the distribution of taxable income in 2007, computed from *Enquête Revenus Fiscaux et Sociaux* 2008.

[20]The European Credit Transfer and Accumulation System (ECTS) is a standard for comparing the study attainment and performance of students of higher education across the European Union and other collaborating European countries credits.

[21]https://dse.orion.education.fr/depot/

may still be uncertain about the institution or degree program they will attend in the next academic year. To get a rough idea of their grant eligibility, applicants can use an online simulator which is hosted on a separate webpage[22] and is based on the current year's schedule and not on the actual schedule that will be used to determine their eligibility to the different grant levels. It is therefore not possible for applicants to figure out the income cutoffs that will be apply to them.

Processing of application (May 1 – June 31). Applicants receive a pre-filled application form, which must be returned within 2 weeks with the required supporting documents (including a copy of their parents' tax noting indicating their taxable income and number of dependent children). Once the application has been processed, a conditional grant notification letter is sent to the applicant, which is based on the current year's schedule.

University registration and payment of grant (July 1 onwards). The grant schedule is updated in the middle of the summer. Applicants receive a final grant notification, which is based on the new income eligibility cutoffs. College enrollment starts in July and lasts until the end of September. Grant recipients receive their first monthly payment in October. The final monthly payment is made in June of the following year.

One might be concerned that applicants could manipulate their parental income or their FNA score based on their knowledge of the scheme. Two key institutional features of the French system of means-tested grants mitigate this concern. First, the exact values of the 126 income thresholds that determine the amount of financial support for a given FNA score are unknown to candidates when they submit their application. To estimate the amount of grant for which they would be eligible, applicants have to rely on an online simulator which is based on current year cutoffs. Applicants are informed that these cutoffs will be updated at a later stage and that this might affect the amount of grant to which they would be entitled. The new income thresholds are not known before July or August and cannot be precisely inferred from the previous ones, since the adjustment usually goes beyond the inflation factor. The ability to predict the value of the new cutoffs is further complicated by the fact that the online simulator does not explicitly provide the

[22] http://www.cnous.fr/_vie__dossier_264.757.265.htm

value of the income thresholds that are currently used, but rather computes the amount of grant based on the applicant's stated score and parental income. In light of these practical aspects of the application process, it seems unlikely that applicants would have sufficient knowledge to accurately determine how far away they are to the new cutoffs.

The second key obstacle to manipulating the information that enters the financial aid award formula is that students are requested to submit supporting documents for their grant application. The only admissible proof of parental income is a paper copy of the tax notice that the applicant's parents received in the year immediately preceding the application. The tax notice is also used to determine the number of dependent children in the applicant's family. The points awarded for siblings enrolled in post-secondary education are conditional on the submission of university enrollment certificates. Finally, the distance between the parents' home address (as shown on the tax notice) and the chosen university is computed by the student service agency using a geocoding tool.

Although the scope for manipulation of the grant eligibility requirements appears fairly limited, it could be argued that the assignment of applicants around the income thresholds is not random because of endogenous selection around the cutoffs. This would be the case, in particular, if students immediately above the thresholds were less likely to submit an application than those immediately below because of lower expected gains. This type of behavior would represent a threat to identification if the probability of submitting an application changed discontinuously at the updated income thresholds. The main argument for ruling out this possibility is that because these cutoffs are not knwon before the end of the application phase, they are unlikely to influence students' decision to submit an application for a means-tested grant. Moreover, it should be noted that around most of the cutoffs considered in this study, students have an incentive to submit an application even if their parental income is above the threshold, because they would remain eligible for some form of financial support. This is not only true for the sequence of income cutoffs that determine eligibility to grants of level 1 to 6 (all of which provide support in the form of monthly cash payments) but also for the income cutoffs that separate level 1 and level 0 grants. Although students whose parental income falls above these thresholds are not eligible for the level 1 annual stipend of 1,500 euros, it is nonetheless in their interest to submit an application in order to benefit from fee waivers. The only income cutoffs that are associated with a clear change in the incentives to submit an application are those that determine eligibility for a level 0 grant vs. no grant. Around these cutoffs, the number of applications can be expected to decrease rapidly as a function of parental income. However, as long as students cannot predict exactly the location of the new cutoffs, this decreasing pattern will be continuous.This issue will be examined in more detail in section 5.1.

A small fraction of late applications are made after the end of the official application campaign, when the new income eligibility cutoffs are already known. We are able to exclude those students from our analysis as the date of submission of each application is recorded in the data.

3 Data and Descriptive Statistics

Our analysis uses linked individual-level administrative datasets that allow us to track the enrollment decisions and academic progress of all college applicants who filled an application for a means-tested grant.

Data The two datasets that we combine are AGLAE[23], which covers the universe of applicants to means-tested grants, and SISE[24], which covers all students enrolled in public universities. These two datasets were provided to us by the Ministry of Higher Education and Research for the years 2008 to 2010.[25] The AGLAE dataset provides basic information on the socio-demographic characteristics of applicants (gender, age, place of residence, etc.), the full set of variables that determine grant eligibility (including declared parental income), the amounts of conditional and final grant awarded as well as the degree program in which the student is enrolled (for grant holders only).[26]

The SISE dataset covers approximately two thirds of students enrolled in higher education (*i.e.* all students enrolled in university, both academic and technical tracks), and includes basic socio-demographic variables as well as detailed information on the university, name and year of the degree program attended by each student, and on whether the

[23] *Application de Gestion du Logement et de l'Aide à l'étudiant.*

[24] *Système d'information sur le suivi de l'étudiant.*

[25] At our request, the data on means-tested grant applicants in 2008 were enriched by the ministry with information retrieved from the previous round of applications (2007) as well as information on the applicants' college enrollment in 2007-2008.

[26] All years of data (including 2008) were enriched with information on the previous year's applications and college enrollment.

student successfully completed a degree during the academic year. Both datasets could be matched using an encrypted national student identifier. For years 2009 and 2010, we also have data on the registration of students in vocational education and preparatory classes to elite schools from the *Base Centrale de Scolarité*, which we use to perform a number of robustness checks.

We restrict our sample to applicants to means-tested grants who listed a university program in each of their pre-registration choices (62 percent of all applicants) and who submitted and completed their application before July, i.e. before the income thresholds were updated.

Descriptive statistics. Table 2 shows the characteristics of our sample of means-tested applicants. We split our sample into three groups, corresponding to the three grant eligibility cutoffs: (i) the "L0/No grant cutoff", which pools all applicants whose parental income is close to the income cutoffs between grant ineligibility and a level 0 grant (column (3)), (ii) the "L1/L0 cutoff", which groups applicants whose parental income is close to the income cutoffs between level 0 and level 1 grants (column (2)) and (iii) the "L6/L5 to L2/L1 cutoffs", which pools all applicants close to the cutoffs between levels 2 to level 6 grants (column (1)). The high proportion of female applicants (around 60 percent) reflects the fact that women are more likely to go to college, especially in the academic tracks of Universities (see table 3). Similarly, the proportion of applicants is highest in the first year of undergraduate studies, and decreases as we move up the curriculum, reflecting the fact that on average, many students drop out of university after one or two years of study.

By construction, the average parental income of applicants in the "L6/L5 to L2/L1 cutoffs" group is smaller than for students in the other two groups. These applicants also tend to have a larger FNA (which reflects their higher number of siblings). Average distance to university is very similar across all groups (around 110 kilometers). The proportion of students who are awarded a grant is 92 percent for the "L6/L5 to L2/L1 cutoffs" and "L1/L0 cutoff" groups and 62 percent for the "L0/No grant cutoff" group, reflecting the fact that most students in the first two groups are eligible for a grant[27], whereas students whose parental income is above the level 0 grant cutoff are not eligible

[27]The proportion does not reach 100 percent because some applicants' files are disqualified, usually because of missing supporting documents.

for any grant.

The descriptive statistics reported in table 3 are computed from the SISE dataset and allow us to compare the characteristics of grants recipients and non-recipients among students enrolled in undergraduate and graduate university degrees in the years 2008 to 2010. Information on the socio-economic status of the main parent clearly shows that students receiving financial aid come from less privileged backgrounds than other students. Grant recipients are also more likely to be registered in undergraduate studies than other students. Finally, raw averages show that the proportion of students who complete their degree is larger among grant recipients than among other students (82 vs. 75 percent for undergraduate degrees). This statistic should not be interpreted as a causal effect, since the difference in degree completion rates could be driven by composition effects or differences in unobservable characteristics of the two groups (low-income students who decide to go to college might be be positively selected on their ability or motivation). We detail below our empirical strategy to estimate the causal impact of financial aid on college enrollment, persistence and graduation.

4 Empirical Strategy

We estimate the impact of means-tested grants on students' outcomes in higher education using a regression discontinuity design framework. This approach takes advantage of the existence of sizeable discontinuities in the amount of financial aid that applicants can receive depending on their parental income and family needs assessment score.

Our goal is to estimate the causal effect of means-tested grants on the outcomes of applicants:

$$y_i = \alpha + \beta G_i + u_i \tag{1}$$

where y_i is the outcome of interest for applicant i (e.g. college enrollment), G_i is a dummy variable equal to one if the applicant has been awarded a grant and u_i is the unobservable error term. A simple OLS regression of equation (1) would yield a biased estimate of β because grant eligibility is correlated with parental income, and therefore endogenous. Even after controlling for family income, the OLS estimation of equation (1) would still be biased due to the the endogenous selection of means-tested grants applicants. Since not all eligible individuals participate in the program, the decision to apply for a grant is likely to be correlated with unobservable characteristics that are correlated with the outcome of interest.

In order to identify the treatment effect of means-tested grants, we exploit the discontinuities in the amount of financial aid awarded to applicants that result from grant eligibility rules. The intuition behind our empirical strategy is the following. Assuming that the income thresholds between different levels of grant are exogenously given and that students are unable to manipulate their parental income and FNA score, the amount of aid to which applicants in the vicinity of a threshold are entitled can be considered as randomly assigned. Under the additional assumption that, in the absence of treatment, the outcome of interest is a smooth function of income, the causal effect of means-tested grants can be identified by comparing the average outcome of applicants immediately below the income thresholds ("treatment group") with that of applicants immediately above ("control group"). Any observed difference between these two groups can be attributed to the entitlement to a higher amount of financial support for the treatment group members.

Grant eligibility rules. Let $T_{i,k}$ denote a dummy variable which takes the value one if applicant i is eligible for a grant of level k ($0 \leqslant k \leqslant 6$). For expositional simplicity, we define the eligibility to a level k grant as the eligibility to all level of grants up to k, i.e. $T_{i,k} = 1 \Rightarrow T_{i,k'} = 1 \; \forall \; k' < k$.

Eligibility to a level k grant is a function of the applicants' taxable income and FNA score:

$$T_{i,k} = \mathbb{1}\{z_i \leqslant \overline{z}_k(s_i)\} \tag{2}$$

where z_i is the applicant's parental income, s_i the FNA score, $\mathbb{1}\{.\}$ is the indicator function and $\overline{z}_k(s_i)$ is a deterministic function that returns the income eligibility cutoff for a level k grant when the applicant's score is s_i.

The amount of conditional aid to which applicant i is entitled is a step function of her eligibility to each level of grant:

$$A_i = \sum_{k=0}^{6} a_k T_{i,k}$$

where A_i is the amount of conditional grant awarded and a_k are the allowance increments attached to the different levels of grant.

Reduced form equation. We model the relationship between grant eligibility and the outcomes of interest using the following reduced-form equation:

$$y_i = \alpha + \sum_{k=0}^{6} \beta_k T_{i,k} + \epsilon_i \tag{3}$$

where y_i is the outcome of interest and ϵ_i is the unobservable error component. In equation (3) the parameters of interest β_k are the treatment effects of switching applicants' eligibility status from a level $k-1$ grant to a level k grant:

$$\beta_k = E(y_i|T_{i,k} = 1) - E(y_i|T_{i,k-1} = 1)$$

Under the assumption that the conditional mean function $E(\epsilon|z, s)$ is continuous in parental income z at the income eligibility cutoff $\overline{z}_k(s)$, the treatment effect β_k will be identified by the difference:

$$\lim_{x \uparrow \overline{z}_k(s)} E(y|z, s) - \lim_{x \downarrow \overline{z}_k(s)} E(y|z, s) \tag{4}$$

Pooling of income eligibility cutoffs In contrast with standard applications of regression discontinuity, there are a large number of discontinuity points in out setting, which vary across applicants because they depend on the FNA score and the grant level considered. As can be seen in figure 1, there are in total 126 different income cutoffs (7 grant level cutoffs for each of the the 18 possible values taken by the FNA score). Due to sample size restrictions, separate estimations at each income cutoff would yield very imprecise estimates. Instead, we decide to pool the income cutoffs into three different treatment groups. Our estimates are therefore not limited to applicants in the neighborhood of a single discontinuity but are applicable to a more general population.

The first group, which we will refer to as the "L0/No grant cutoff", pools the 18 income cutoffs that separate grant ineligibility from eligibility to a level 0 grant:

$$\text{L0/No grant cutoff: } \left\{\overline{z}_0(s)\right\}_{s=0}^{17}$$

At these cutoffs, we identify the treatment effect β_0 of fee waivers.

The second group, which we refer to as the "L1/L0 cutoff", pools the 18 income cutoffs that separate grant the eligibility to a level 1 grant from the eligibility to a level 0 grant:

$$\text{L1/L0 cutoff: } \left\{\overline{z}_1(s)\right\}_{s=0}^{17}$$

At these cutoffs, we identify the treatment effect β_1 of being granted an annual allowance of a 1,500 euros (applicants on both sides of the cutoffs being exempt from fees).

Finally, the third group is referred to as the "L6/L5 to L2/L1 cutoffs". It pools together the 90 income cutoffs that separate grant levels 2 to 6:

$$\text{L6/L5 to L2/L1 cutoffs: } \left\{\{\overline{z}_k(z)\}\middle|k \in \{2, ..., 6\}, s \in \{0, ..., 17\}\right\}$$

At these cutoffs, the treatment effect is a weighted average of the treatment effects β_2 to β_6, i.e. of being eligible for an incremental annual allowance of approximately 600 euros, with weights equal to the fraction of applicants around each grant level cutoff.

Bandwidth selection To identify the causal impact of being eligible for a grant of level k in a given year t, we need to compare the outcomes of applicants above and below the relevant income thresholds, in a narrow interval $I_{k,t}(s)$ around them:

$$I_{k,t}(s) = \left[\overline{z}_{k,t}(s) - h^l_{k,t}(s); \overline{z}_{k,t}(s) - h^r_{k,t}(s)\right]$$

where $h^l_{k,t}(s)$ and $h^r_{k,t}(s)$ are the chosen bandwidths to the left and to the right of income eligibility cutoff $\overline{z}_{k,t}(s)$, respectively.

The bandwidths around each income cutoff are chosen so as to meet the following three conditions: (i) they should be symmetric around the cutoff; (ii) they should be identical for all income cutoffs that separate the same two consecutive levels of grants and (iii) the interval around income cutoffs should not include the previous or next cutoffs (a detailed description of the bandwidth selection procedure is provided in the Appendix). For each grant level cutoff, the selected bandwidth is set equal to the widest bandwidth that satisfies these three conditions.

The income bandwidths resulting from this calculation are shown in figure 2 together with the income eligibility cutoffs in 2009. The bandwidths are slightly above 6,000 euros for the L0/no grant cutoff, 4,000 euros for the L1/L0 cutoff and 1,000 euros for the L6/L5 to L2/L1 cutoffs. For graphical convenience, we decided to restrict the bandwidths to exactly these numbers. Despite the fact that the bandwidth available around the L5/L6 to L2/L1 grant is very narrow, the number of included observations turns out to be high enough to yield precise estimates of the treatment effect.

Estimation Alternative estimation methods have been proposed to implement equation (4). In this study, we apply both the split polynomial approximation used by Lee (2008) and the local linear regression approach advocated by Lee and Lemieux (2010).

The split polynomial approximation approach uses the maximum bandwidth and chooses a flexible polynomial specification to fit the relationship between the outcome y_i and the forcing variable z_i (parental income) on either side of the cutoff. The treatment effect is estimated as the discontinuity at a given grant level cutoff $\overline{z}$. Specifically, we estimate the following model using OLS:

$$y_i = \alpha + \beta.T_i + \sum_{s=1}^{p} \delta_s (z_i^*)^s + T_i \sum_{s=1}^{p} \gamma_s (z_i^*)^s + \epsilon_i \tag{5}$$

where T_i is a treatment dummy equal to one if $z_i \leqslant \overline{z}_k$, p is the order of the polynomials and the normalized variable $z_i^* = z_i - \overline{z}$ allows us to interpret β as the jump between the two regression lines at $\overline{z}$. In our empirical specifications, we use polynomials or order 2 to 4.

A possible concern with the split polynomial approach is that it may be sensitive to outcome values for observations far away from the cutoff (Imbens and Lemieux, 2008). The second method we implement avoids this problem by fitting linear regression functions to the observations distributed within a distance h on either side of the income cutoffs. In other words, we restrict the sample to applicants in the interval $z_i \in [-h, +h]$ and estimate the following model using OLS:

$$y_i = \alpha + \beta.T_i + \delta z_i^* + \gamma.T_i.z_i^* + \epsilon_i \tag{6}$$

To assess the sensitivity of our estimates to the choice of h, we also present results for bandwidths set to twice and half the size of the chosen bandwidth.

5 Results

In this section, we assess the validity of the regression discontinuity design before analyzing the reduced form effects of grant eligibility on college enrollment or re-enrollment, persistence and graduation.

5.1 Validity of the research design

A key condition for a regression discontinuity design to produce unbiased estimates of an intervention is that their is no systematic manipulation of the forcing variable. In the context of means-tested grants, this assumption would be violated if applicants had precise knowledge of the cutoff values that determine the amount of grant awarded and were able to manipulate their parental income or their FNA score in order to receive a higher level of financial aid. In this case, the assignment of treatment above and below the grant level cutoffs would not be exogenous. Systematic differences between applicants located on both sides of the cutoffs could also arise in the absence of manipulation of the forcing variable, if the knowledge of the cutoff values induces some prospective students to refrain from submitting an application because their parental income lies "just above" the income threshold below which they would be eligible for a higher level of financial support.

To formally check for the absence of manipulation of the running variable at the grant level cutoffs, we test the null hypothesis of continuity of the density of parental income at the income eligibility cutoffs using the test developed by McCrary (2008). Second, we check whether the observable characteristics of students are balanced around these cutoffs.

A rather intuitive way of testing whether the assignment of applicants around the income thresholds is locally random is to examine the aggregate density of applicants around these cutoffs. Evidence of discontinuities in the number of applicants at the cutoffs would suggest that some students know the precise location of the income thresholds and use this information to decide whether or not to apply for a grant and/or to manipulate the documentary evidence submitted to the student service agency. We address this concern by applying the test of manipulation proposed by McCrary (2008).

We perform the McCrary test using all years of available data (2008 to 2010) and separately for each of the three groups of grant level cutoffs that are considered in this study: a) the L6/L5 to L2/L1 grant level cutoffs (1,500 euros difference in the theoretical amount of financial aid awarded); b) the L1/L0 cutoff (600 euros difference in the amount of aid); c) the L0/No grant cutoff (exemption from the payment of tuition fees and social security contributions).

In figure 3, we plot the frequency of applications around each group of income cutoffs, using different bin sizes for the distance between parental income and the cutoff (in euros). Visual inspection of the graphs shows that although the number of applications tends to decrease with income for the L1/L0 and the L0/No grant cutoffs, there is no evidence of clear discontinuities in the number of applicants at the cutoffs.

As explained in section 2.2.2, the grant application process minimizes the scope for manipulation of the assignment variables. We should not therefore expect discontinuous changes in the number of applicants on in their observable characteristics at the income eligibility cutoffs. We formally test for the presence of discontinuities in the density of the forcing variable in figure 4 where a McCrary test is performed by running kernel local linear regressions of the log of the density separately on both sides of the cutoffs. The corresponding estimates are presented in table 4 for each group of grant level cutoffs. In column (1), the test is performed using all available years (2008 to 2010). Columns (2) to (4) show the results obtained when the test is run separately by year. For each test, the table reports the estimated discontinuity in the density function of the assignment variable at the threshold (θ), its standard error, the t-test, the estimated optimal bandwidth and bin size and the number of observations. The results show that the log-difference between the frequency to the right and to the left of the grant level cutoffs is not statistically significant in any of the three groups, which suggests that the income thresholds do not influence the decision to submit an applications and that that applicants immediately above these thresholds are unable to manipulate their FNA score or parental income to reach a higher level of financial aid.

An alternative approach for testing the validity of the RD design is to check whether the observable characteristics of applicants are “locally” balanced on either side of the grant level cutoffs. If there was non-random sorting, we should expect some of these characteristics to differ systematically between applicants immediately above and immediately below a given cutoff. The available characteristics are those that students are requested to provide when filing their application. They include the applicants' gender, age, parental income, the number of siblings, the number of choices submitted, the level of the chosen degree program (ranging from one to five) and the distance to the university which was listed as the applicant's first choice. We also know if a student applied for accommodation in university residence halls and whether this application was successful[28]. Finally, we complement the analysis using information from the previous round of applications, in order to detect potential manipulations of parental income or FNA score by students who applied for a grant in consecutive years.

The balance tests are performed by replacing the dependent variable in equations (5) and (6) with each of the observed baseline covariates. The RDD estimates are reported in table 5. The coefficients obtained with a split polynomial approximation are reported in columns (1) to (3) for different choices of the polynomial order p while columns (4) to (6) report the coefficients from the local linear regression approach using different bandwidths. The results suggest that observable variables are well balanced on both sides of the grant level cutoffs, since less than 10% of the coefficients are significant at the 10% level, which corresponds to the expected fraction of tests that would turn out to be statistically significant by chance when we the type I error rate is set at $\alpha = 0.10$. Interestingly, for applicants who applied for a grant in the previous year, we observe no significant discontinuity at the current year cutoffs in the parental income and FNA score that were recorded in their previous application. This lends support to the assumption that there is no manipulative sorting around the income thresholds[29].

The empirical evidence presented so far supports the validity of the regression discontinuity design to evaluate the impact of means tested grants on students' higher education choices. The next section presents our main results.

[28]In France, the allocation of university accommodation does not involve eligibility income cutoffs. If the demand for a particular hall of residence exceeds the number of rooms available, students are ranked by order of priority based on their "social index" which is computed as the ratio between their parental income and their FNA score plus one. The admission cutoff therefore varies from one hall of residence to another and there is no reason to expect the probability of obtaining a place in residence to change discontinuously at the income thresholds that separate the different levels of grant.

[29]Suppose that some applicants were able to falsify their parents' tax notice to fall just below a given income cutoff. In this scenario, the incomes below the grant level cutoffs would be more likely to have been undervalued than the incomes above. We would therefore expect the average income of applicants below the current year cutoffs to be higher their previous year's application than the average income of applicants above the same cutoffs.

5.1.1 First stage estimates: discontinuities in the amounts of grant

We start by checking whether discontinuities in the eligibility to different levels of study grants induce discontinuities in the average amount of conditional grant awarded to applicants.

We evaluate the discontinuities in the grants awarded along three dimensions: a) the fraction of students who were awarded a conditional grant (which at the minimum consists of fee waivers); b) the predicted amount of conditional grant that an student would be entitled to based on the information provided in her online application; c) the actual amount of conditional grant that was awarded by the student service agency.

Figure 5 plots, for the different groups of grant level cutoffs, the fraction of applicants who were awarded a conditional grant against the income distance to the cutoffs. The solid lines are the fitted values from a third-order polynomial approximation which is estimated separately on both sides of the cutoffs. These graphs indicate that approximately 90% of theoretically eligible applicants are awarded a conditional grants. The remaining 10% are mostly students whose application was not processed because they did not to return the paper form that was sent to them by the students service agency or because they failed to provide all the supporting documents. Moreover, the fact that hardly any applicants above the level 0 cutoff were awarded a conditional grant (fee waiver, in this case) indicates that the assessment formula is not breached for students marginally above the threshold. Figure 6 plots the predicted and actual amount of grant awarded to applicants against the distance to cutoff. These graphs show that the allocation of grants almost fully complies with the assessment formula, since the actual amount of grant awarded to applicants is close to 90% of the predicted amount. Most of the observed discrepancy can be attributed to the fact that for the reasons mentioned above, approximately 10% of applications were not processed.

Table 6 presents the RD estimates of the discontinuities in the grants awarded to applicants at the different cutoffs. The results for pooled L6/L5 to L2/L1 cutoffs, L1/L0 cutoff and the L0/No grant cutoff are reported in panels A, B and C, respectively. Column (1) indicates the mean value of the dependent variable above the cutoff. Columns (2) to (4) report the estimates obtained using second, third and fourth order split polynomial approximations, respectively. Columns (5) to (7) report the local linear estimates using different bandwidths (0.75, 0.5 and 0.25 of the full bandwidth, respectively). The estimates are remarkably stable across specifications and confirm that the discontinuities in the actual amount of conditional grant awarded to applicants are very close to the predicted discontinuities. The estimated discontinuity in the actual amount of conditional grant awarded to students at at the pooled L6/L5 to L2/L1 cutoffs is approximately 520 euros vs. 570 euros for the predicted discontinuity. The estimates for the L1/L0 cutoff are 1,340 euros (actual) vs. 1,490 euros (predicted). The L0/No grant cutoff exhibits a 82 percentage points discontinuity in the fraction of applicants who are exempt from fees and, as expected, no significant discontinuity in the amount of allowance.

The first stage estimates confirm that discontinuities in the eligibility status of applicants are associated with significant changes in the amount of aid awarded by the student service agency, which are very close to the predicted ones. We no examine how these differences affect college enrollment, persistence and graduation.

5.1.2 Impact on college enrollment

The first outcome that we consider is the applicants' decision to enroll or re-enroll in college.

Full Sample. We first consider the full sample of applicants, irrespective of their level of study. The sample therefore includes both students who apply to college for the first time and students who were previously enrolled. Figure 7 plots, for each of the three groups of grant level cutoffs, the college enrollment or re-enrollment rates of applicants against their income distance to the threshold. The solid lines are the fitted values from a third-order split polynomial approximation. Although the enrollment rates of applicants are fairly similar across the different levels of grants (between 80 and 85%), the three treatments appear to have strikingly different effects on applicants' enrollment decisions. Enrollment rates seem to be unaffected by fee waivers (fig. 7(c)) but exhibit a clear 3 percentage points jump when students become eligible for the 1,500 euros annual stipend (fig. 7(b)). The impact of subsequent increments in the amount of financial aid (fig. 7(a)) on enrollment rates appears slightly positive but of negligible magnitude.

The RD estimates reported in table 7 confirm the graphical evidence in showing that applicants' enrollment decisions are affected by the cash allowance component of the means-tested grants but not by the fees exemption component. Moreover, our estimates suggest that providing a cash allowance of 1500 euros to students who are only eligible for fee exemption has a larger impact on enrollment than increasing the amount of the allowance for those who are already eligible for a smaller amount. The coefficients from the split polynomial and local linear regressions indicate that being eligible for fee exemption has no significant impact on college enrollment (panel C). In contrast, the entitlement to a level 1 grant (panel B) is estimated to increase the enrollment rate by 2.3 to 2.9 percentage points depending the specification. Finally, subsequent 600 euros increases in the amount of cash allowance for higher levels of grants are estimated to have a small positive but non-significant impact on enrollment rates between 0.4 and 0.8 percentage point.

Subgroups. We examine the potential heterogeneity in the college enrollment impact of means tested grants by running separate regressions for different subsamples of applicants (table 8). The dimensions that we consider are the year of application, the applicants' gender, level of studies and income level.

Estimates for the impact of means-tested grants on college enrollment are fairly comparable across the different years, which suggests that our results are not driven by a single campaign of applications. The estimated effects of being eligible to a 1,500 euros allowance on college enrollment (L1/L0 cutoff) are positive and significant in all years and range between 1.8 and 3.2 percentage points. When comparing estimates for male and female applicants, point estimates suggest that the effect of the grant on enrollment are larger for males (columns (4) and (5)). The subgroup analysis also show significant differences in the effect of the grant on enrollment in the first years of undergraduate and graduate degrees (which corresponds to the fourth year in university) compared to other levels of study. The enrollment effect of a 1,500 euros increase in the allowance is twice as large when we consider the first year of a given degree program as the effect for subsequent years (4 percentage points compared to 1.4 to 2.5 percentage points for other years). This suggests that the decision to enter university or to pursue graduate studies is more heavily influenced by the provision of financial aid than the decision to pursue into the second or third year of a degree program.[30].

Fees exemptions (L0/No grant cutoff) and incremental changes in the amount of the

[30]This result would suggest that when they decide whether or not to go to college, students take into account not only the cost of the first year of study, but also the cost of the subsequent years until graduation.

allowance are not associated with any significant changes in the enrollment rates of the subgroups analyzed in table 8. For the sake of brevity, the persistence and degree completion effects which are discussed in the next sections will only be reported for the L1/L0 cutoff, as these effects are not significant for the other cutoffs.[31]

5.1.3 Impact on persistence

In order to study the impact of financial aid on persistence, we focus on students who apply for an undergraduate or a graduate degree program and we follow their progress over time. Our data allow us to follow their enrollment up to three years after their first application. The enrollment of 2008 applicants can be measured in 2008, 2009 and 2010, although information of graduation rates is only available in 2008 and 2009.

Figure 8 shows that the college enrollment effect of the 1,500 euros allowance is not short-lived, since being awarded a level 1 grant to start a degree program has a similar impact on college enrollment in the year of application than in the following year. We investigate more precisely the effect of financial aid on persistence in table 9 and 10, looking separately at undergraduate and graduate students, and focusing on other dimension of persistence, such as progress throughout the years and graduation rates.

Table 9 shows the impact of financial aid on persistence for first year undergraduates. For the sample of 2008 and 2009 first year students, the 1500 euros allowance is estimated to increase the initial enrollment rate by approximately 5 percentage point (column (1)), the effect being of similar magnitude in the following year (column (2)).[32] In order to have a more complete picture of the progress made by first-year students throughout college, it is important to analyze wether they proceed to the second year or whether they repeat the first year. Our results suggest that financial aid has a positive impact on the probability of being enrolled as a second-year student after one year (column (3)). However, the point estimates are smaller than for the overall enrollment effect and only significant in the local linear specification (at the 10 percent level). Similarly, the estimated impact of financial aid on the probability of having obtained a total of 120 ECTS credits after two years of undergraduate studies is positive but not statistically significant. Estimates

[31] Results are available upon request.

[32] Using the *Base Centrale de Scolarité* dataset, we investigated whether students who disappear from the university records are registered in other higher education institutions. We found this proportion to be negligible. Indeed, these other tracks tend to be more selective than universities and students who were not admitted in these institutions in the first year are unlikely to join them in subsequent years.

for the persistence two years after the application are even smaller and not significant (columns (5) and (6)). These results have to be interpreted with caution, since the lack of significance of the enrollment effects after two years could be due to the fact that they are estimated on a relatively small sample (only 2008 applicants can be followed over three years). Nevertheless, these smaller point estimates suggest that the effect of a level 1 grant awarded in the first year fades out after two years.

Table 10 shows that the effects of financial aid on persistence are stronger for graduate students than for undergraduate students. Graduates who receive a 1,500 euro allowance are not only more likely to enroll in Master's degree program (column (1)), they are also more likely to successfully complete their first year of graduate studies (column (2)), proceed to the second year (columns (3) and (4)) and graduate on time (column (5)). The estimated effects on enrollment and progression are of similar magnitude (approximately 4 percentage points). The point estimates are even larger for graduation, although less precise (the effect is only significant at the 10 percent level in the local linear specification) as the sample size becomes smaller. Overall, these results suggest that there is no evidence that financial aid would weaken the average level of graduate students. On the contrary, the grant seems particularly effective as it increases not only enrollment, but also graduation rates.

5.1.4 Impact on degree completion

Figure 9 and table 11 complete the analysis by showing the impact of financial aid for students who apply for a grant before starting the final year of a degree program, which they are expected to complete by the end of the year. This sample includes students applying for the second year of a vocational diploma, the third year of an academic undergraduate degree, and the second year of a Master's degree. For this groups of applicants, receiving a level 1 grant not only has a significant and positive 2 percentage point impact on enrollment but also a significant and positive impact on degree completion of similar magnitude (about 3 percentage points). When we split the sample into undergraduate and graduate degrees, the effect seems to be more precisely estimated for the large sample of undergraduate students than for the smaller sample of Master's students (columns (2) and (3)). Overall, these results suggest that low-income students who stayed in university until the graduation year are positively selected on their academic performance, which explains why subsidizing them has a positive impact on degree completion.

6 Conclusion and Discussion

Our results provide new estimates for the impact of means-tested study grants on the college enrollment decisions, persistence and graduation of low-income students, using an RDD approach based on French administrative data. Our estimates of the college enrollment effects of this particular form of financial aid are similar in magnitude to existing estimates for merit-based grant programs in the US, but larger than estimates for means-tested grant program such as the Pell Grant. Our results show a significant impact of being awarded a 1,500 euros cash allowance on enrollment, not only in the first year of studies, but at higher levels in the university curriculum. We also find evidence of a positive effect of financial aid on persistence. First-year applicants who are awarded a grant are not only more likely to go to college, but also to stay enrolled the next year, even though the effect seems to fade out after two years. For graduate students, the effects are even more persistent, as graduate applicants who receive a 1,500 euros grant are not only more likely to pursue graduate studies, but also to complete their Master's degree after two years. At this level of studies, there is no evidence that financial aid would lead to a decrease in the average ability of students. These finding are consistent with the selection process occurring in French universities, where entry is not selective but where the weakest students tend to drop out early. Our findings suggest that the academic prospects of first-year undergraduates who start college because they are awarded a grant are similar to those of other students, many of whom drop out along the way. But as students progress through the curriculum, only the more able remain, and means-tested grant appear particularly effective in subsidizing students at these higher levels of studies. Consistent with this interpretation, we also find positive effects on degree completion for students in their graduation year. These results are found for students who are already eligible for fee waivers and receive an additional cash grant of 1,500 euros. Fee waivers alone and further increments in the amount of grant (of 600 euros) are not found to have any significant impact on enrollment decisions, persistence and graduation.

Several characteristics of the French system could play a key role in explaining the positive effects found for this program. Compared to the US Pell grants, the application process to the *Bourses sur critères sociaux* is relatively simple. Moreover, the different levels of grant cover a substantial part of students' expenses and prevent eligible applicants from having to make upfront payments for tuition fees and social security contributions. Finally, for students already enrolled, grant renewal is conditional on attendance and academic requirements, and it is possible that these conditions play a role in explaining the grant's positive impact on academic progress.

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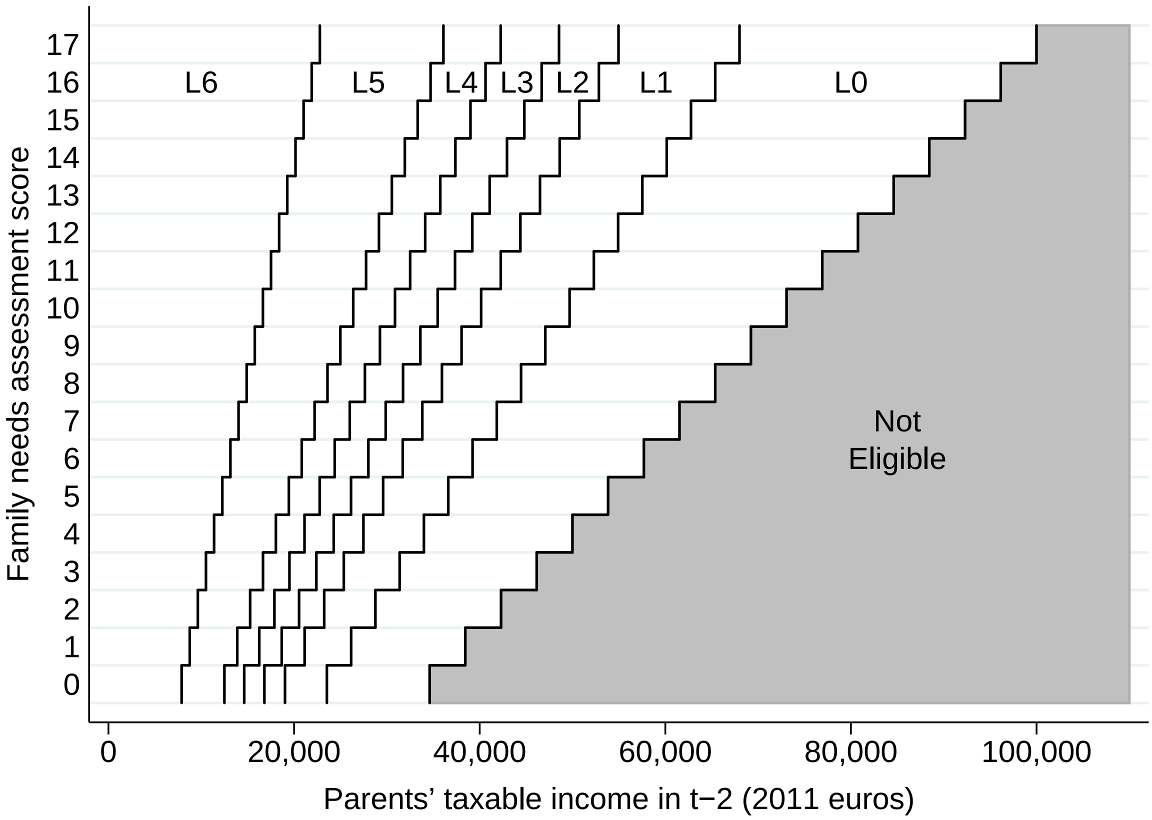
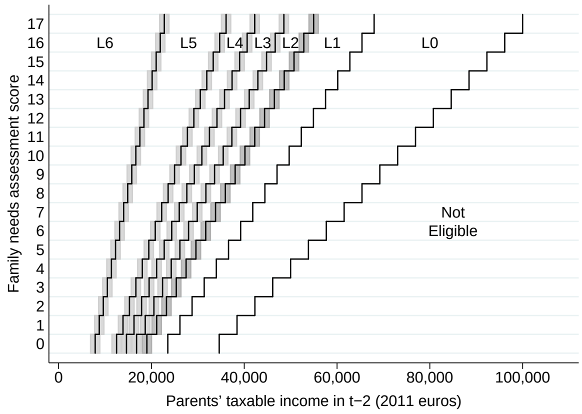
Figure 1: Income Eligibility Cutoffs Between the Different Grant Levels in 2009



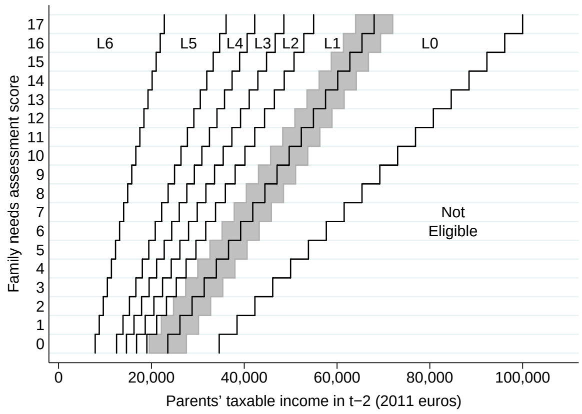
Notes: The figure shows the income eligibility cutoffs for the different levels of means-tested grants in 2009. These income thresholds apply to parental taxable income two years before the year of application. Their value varies with the applicant's family need assessment score which is measured on a scale from 0 to 17 (the median value being 3). Source: *Circulaire 2009-1018 du 2-7-2009, Bulletin officiel de l'Education Nationale no 30 du 23 juillet 2009.*

Figure 2: Chosen Bandwidths Around the Income Eligibility Cutoffs

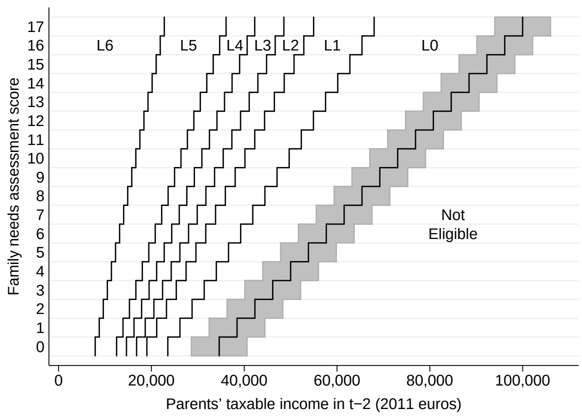
(a) L6/L5 to L2/L1 cutoffs



(b) L1/L0 cutoff

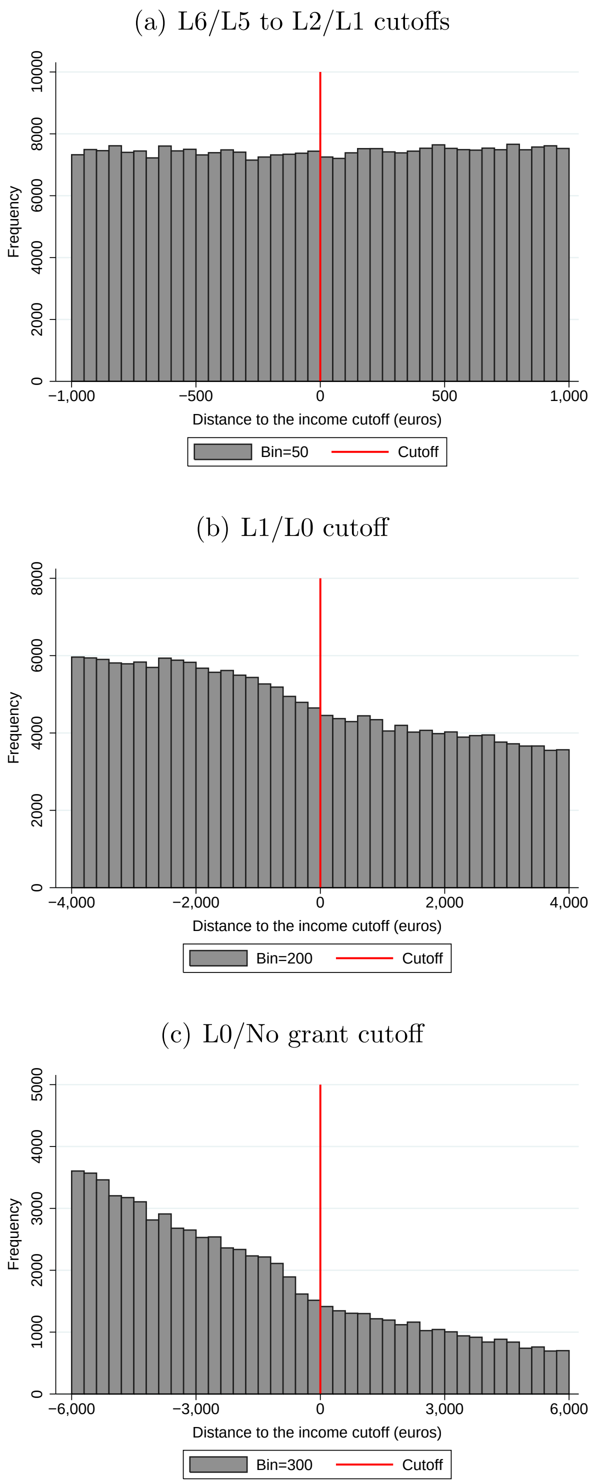


(c) L0/No grant cutoff



Notes: The figure superimposes the income eligibility cutoffs for the different levels of means-tested grants in 2009 and the bandwidths that we construct to select observations around the cutoffs.

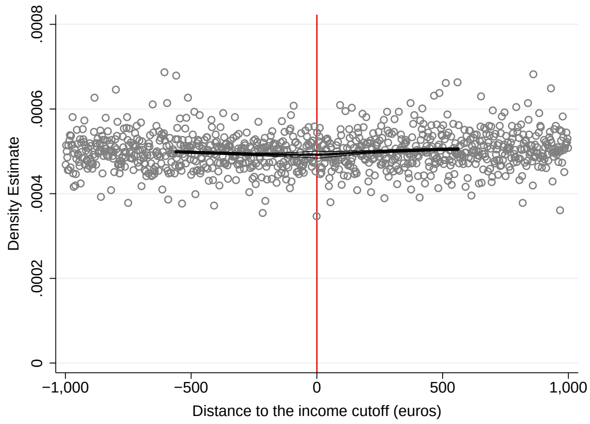
Figure 3: Distribution of Applicants around the Income Eligibility Cutoffs



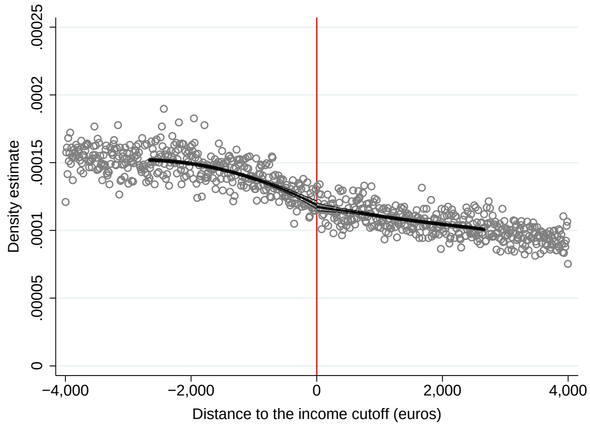
Notes: The figure shows the histogram of applicants to means-tested grants around three groups of grant level cutoffs: a) Pooled L6/L5 to L2/L1 cutoffs; b) L1/L0 cutoff; c) L0/No grant cutoff. The x-axis is the distance (in euros) between the applicant's parental income and the income threshold between two grant levels. The histograms are plotted using different bin sizes. The vertical lines identify the grant level cutoffs.

Figure 4: McCrary (2008) Test for Manipulation of the Assignment Variable

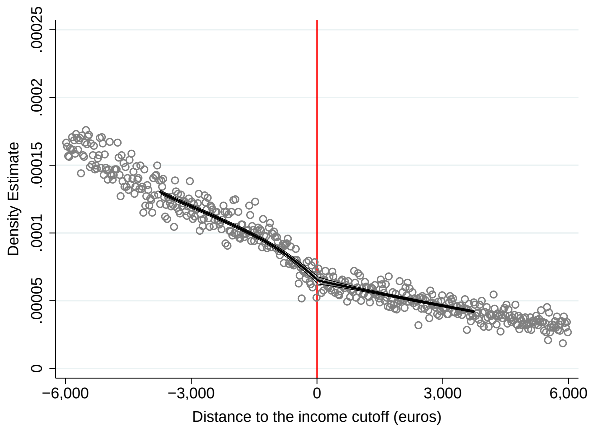
(a) L6/L5 to L2/L1 grant level cutoffs



(b) L1/L0 cutoff



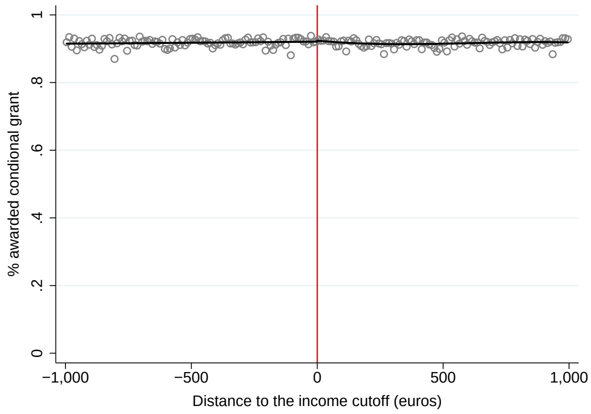
(c) L0/No grant cutoff



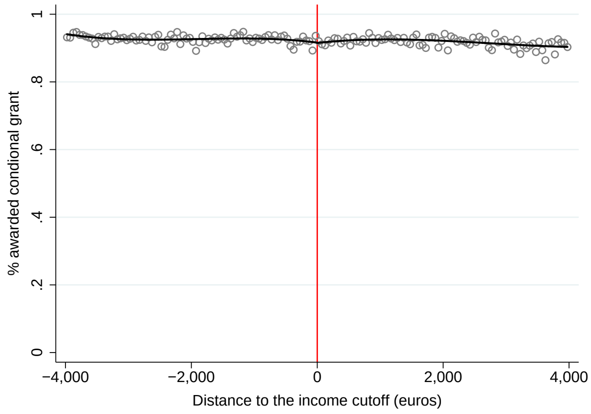
Notes: Weighted kernel density estimation performed separately on either side of the grant level cutoffs. The x-axis is the distance (in euros) between the applicant's parental income and the grant level income threshold. The optimal bandwidth and binsize are obtained using the automatic selection procedure proposed by McCrary (2008).

Figure 5: Fraction of Applicants Awarded a Conditional Grant

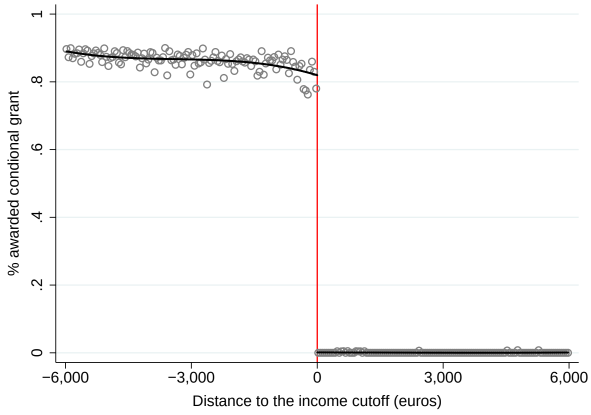
(a) L6/L5 to L2/L1 cutoffs



(b) L1/L0 cutoff

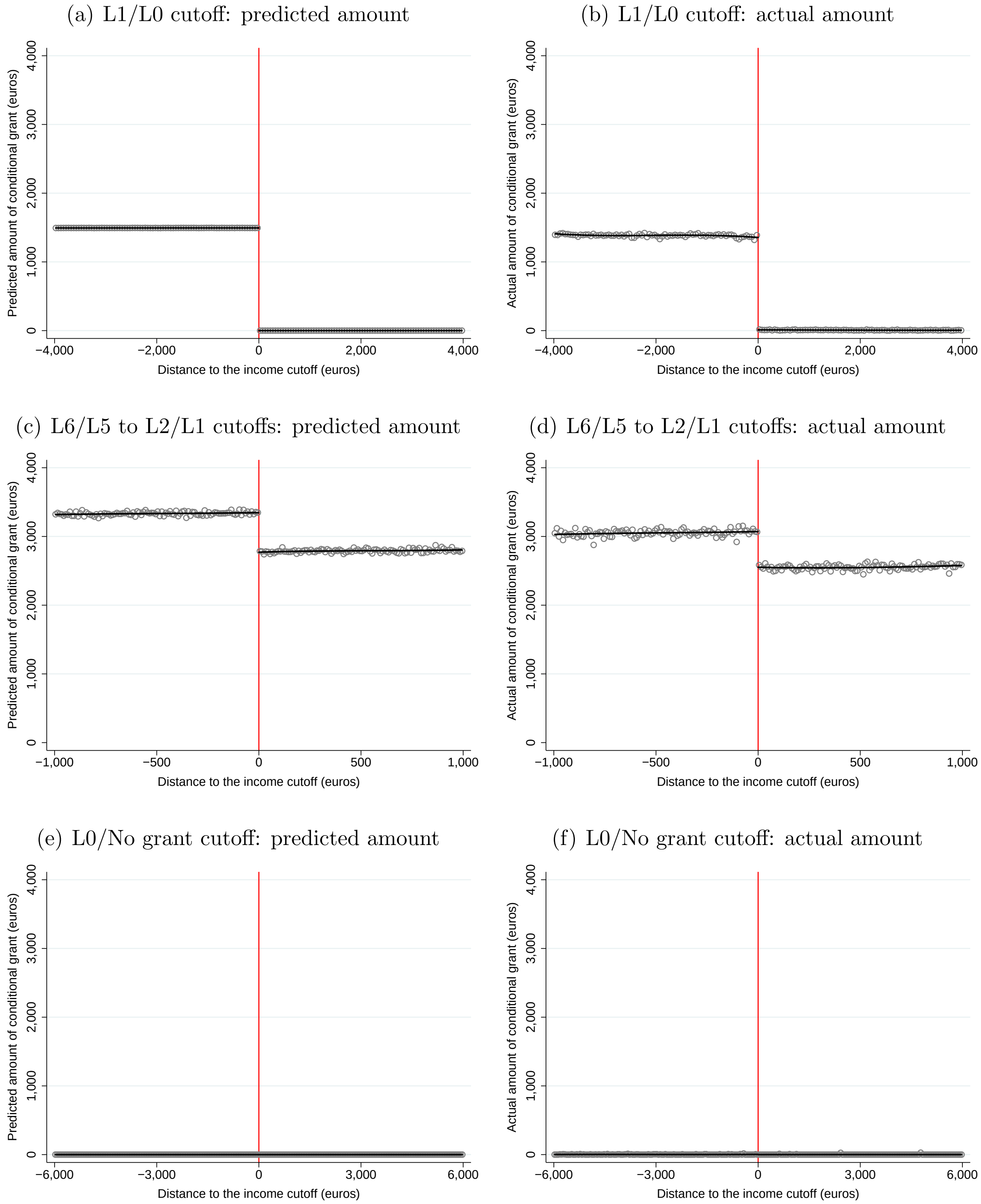


(c) L0/No grant cutoff



Notes: The circles represent the average fraction of applicants who were awarded a conditional grant per interval of income distance to the grant level cutoff. The solid line are the fitted values from a third-order polynomial approximation which is estimated separately on both sides of the cutoff. The verticals line identify the grant level cutoffs.

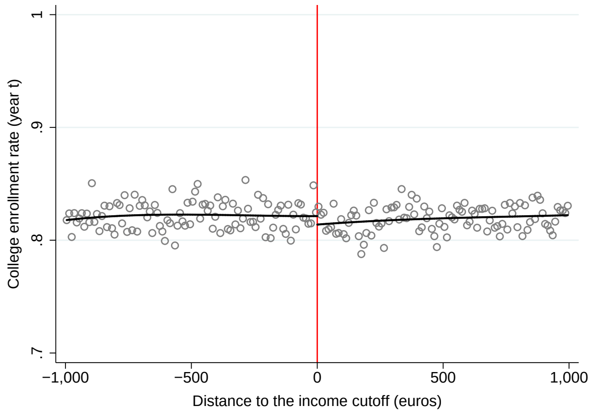
Figure 6: Predicted and Actual Amount of Conditional Grant Awarded to Applicants



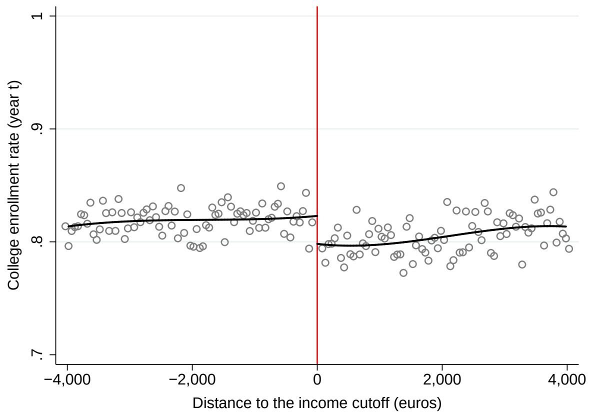
Notes: The circles in the left hand side graphs represent the predicted amount of conditional grant awarded to applicants. The circles in the right hand side graphs represent the actual amount of conditional grant awarded. The solid line are the fitted values from a third-order polynomial approximation which is estimated separately on both sides of the cutoff. The vertical lines identify the grant level cutoffs.

Figure 7: College Enrollment of Means-Tested Grant Applicants Around the Different Grant Level Cutoffs.

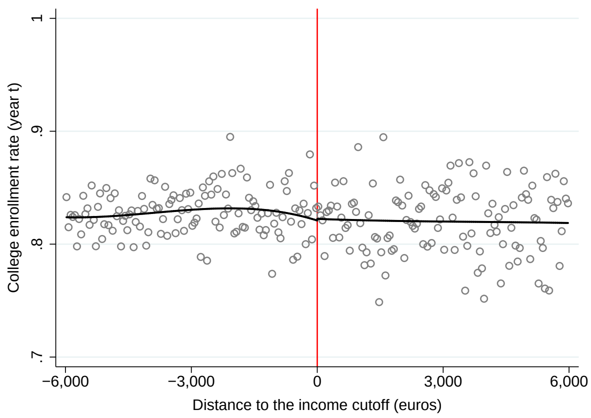
(a) L6/L5 to L2/L1 cutoffs



(b) L1/L0 cutoff



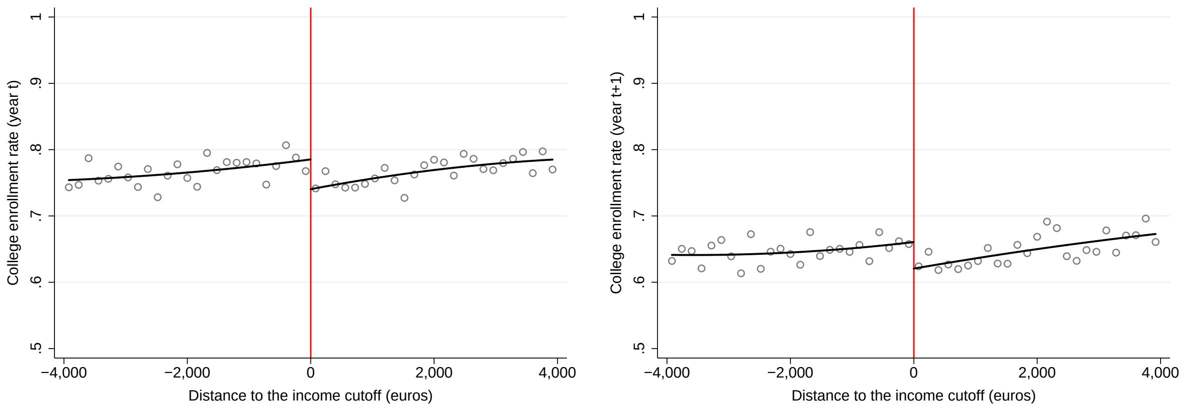
(c) L0/No grant cutoff



Notes: The circles in the figures represent the mean college enrollment rate of applicants per interval of income distance to the grant level cutoff. The solid line are the fitted values from a third-order polynomial approximation which is estimated separately on both sides of the cutoff. The vertical lines identify the grant level cutoffs.

Figure 8: College Enrollment and Persistence of First-Year Undergraduate or Graduate Means-Tested Grant Applicants at the L1/L0 Grant Level Cutoff.

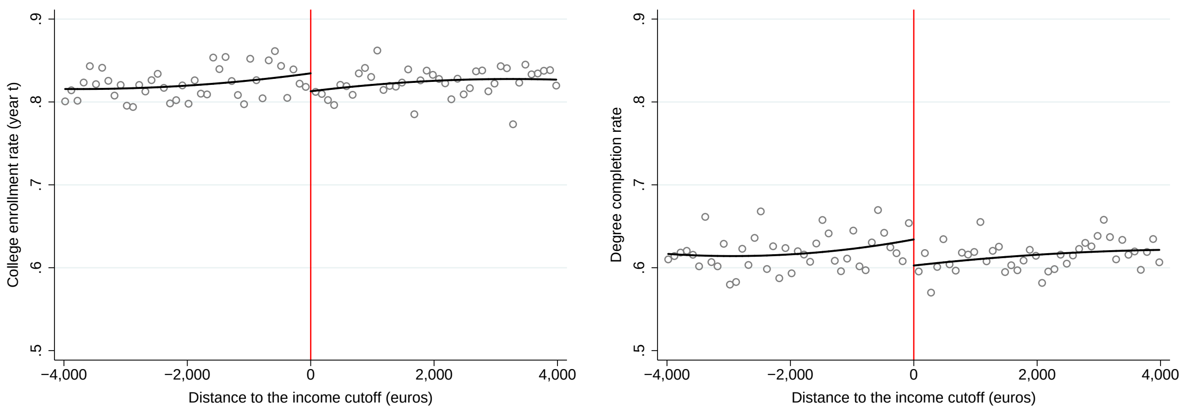
(a) College enrollment rate in current year (b) College enrollment rate in following year



Notes: The circles represent the mean college enrollment in the year of application (left-hand side) and the following year (right-hand side) of first-year undergraduate or graduate applicants, i.e. students applying for the first year of a 3-year bachelor's degree or the first year of a Master's degree. The solid line are the fitted values from a second-order polynomial approximation which is estimated separately on both sides of the cutoff. The vertical lines identify the grant level cutoffs.

Figure 9: College Enrollment and Degree Completion of Final Year Undergraduate or Graduate Applicants, at the L1/L0 Grant Level Cutoff.

(a) College enrollment rate (b) Degree completion rate



Notes: The circles represent the mean college enrollment (left-hand side) and the degree completion rate (right-hand side) of final year undergraduate or graduate applicants, i.e. students applying for a one-year undergraduate degree, the second year of a two-year undergraduate degree, the third year of a three-year undergraduate degree or the second year of a Master's degree. The solid line are the fitted values from a second-order polynomial approximation which is estimated separately on both sides of the cutoff. The vertical lines identify the grant level cutoffs.

Table 1: Average Expenses of University Students not Living with their Family, by Level of Grant, Academic Year 2009-2010.

Level of Grant	Tuition Fees and Social Security	Living Expenses	Amount of Grant	Average Share of living expenses covered by the grant (%)
No grant	391	6,814	0	-
Level 0	0 (exemption)	5,360	0	0
Level 1	0 (exemption)	5,434	1,476	34
Level 2	0 (exemption)	5,376	2,223	52
Level 3	0 (exemption)	5,615	2,849	62
Level 4	0 (exemption)	5,567	3,473	77
Level 5	0 (exemption)	5,491	3,988	88
Level 6	0 (exemption)	5,513	4,228	94

Notes: Data on students' expenses come from the *Enquête Conditions de vie* survey which was conducted by the *Observatoire de la Vie Etudiante* (OVE) during the academic year 2009-2010. The amounts are calculated by the authors over of the length if the academic year (9 months). Data on social security contributions, grant levels and fees come from administrative records. The sample is restricted to undergraduate and graduate students who live outside of their parents' home, either in a student residence or in a flat (13,164 observations). All amounts are expressed in 2011 euros.

Table 2: Descriptive Statistics for Means-Tested Grant Applicants around the Income Eligibility Cutoffs, Years 2008 to 2010.

Sample:	L6/L5 to L2/L1 (1)	L1/L0 (2)	L0/No grant (3)
Applicants:			
% female	.62	.60	.60
Age	20.9	20.7	20.5
	(2.3)	(2.1)	(2.4)
Number of pre-registration choices	1.9	1.9	2.0
	(1.1)	(1.1)	(1.2)
Applications (first choice):			
Parental income (2011 euros)	19,658	30,737	41,926
	(6,322)	(6,374)	(8,572)
Score	3.3	3.0	2.4
	(2.7)	(2.3)	(2.1)
Distance to university (km)	110	114	109
	(184)	(181)	(174)
% applied for student housing	.33	.32	.38
% successful housing application	.16	.13	.11
Level of studies:			
% Year 1	.29	.27	.31
% Year 2	.24	.25	.23
% Year 3	.23	.23	.22
% Year 4	.14	.14	.14
% Year 5	.10	.11	.11
Conditional grant:			
% awarded conditional grant	.92	.92	.62
Amount of conditional grant awarded (2011 euros)	2,800	809	1
	(1,196)	(747)	(57)
Final grant:			
% receive grant	.76	.75	.50
Amount of grant received (2011 euros)	2,319	698	15
	(1,503)	(766)	(219)
College enrollment:			
% enrolled	.82	.81	.82
Number of observations	297,673	191,171	72,965

Notes: Source: The statistics are computed from the AGLAE administrative dataset covering the 2008 to 2010 rounds of application.

Table 3: Descriptive Statistics for Students Enrolled in University, Years 2008 to 2010.

Sample:	All students	Grant recipients	Non recipients
Socio-demographic characteristics:			
% Male	0.43	0.40	0.44
Age	22.4	20.6	23.3
	(5.8)	(2.1)	(6.6)
Parental background:			
% farmers	0.02	0.03	0.01
% craftsmen, tradesmen	0.07	0.06	0.08
% managers	0.29	0.13	0.37
% middle-level professions	0.13	0.14	0.12
% clerical and service staff	0.12	0.19	0.09
% manual workers	0.10	0.19	0.06
% economically inactive	0.13	0.18	0.11
% unknown	0.14	0.07	0.16
% means-tested grant recipients	0.30	1.00	0.00
Level of Study:			
Undergraduate Year 1	0.32	0.37	0.30
Undergraduate Year 2	0.18	0.21	0.17
Undergraduate Year 3	0.20	0.20	0.21
Graduate Year 1	0.15	0.13	0.16
Graduate Year 5	0.14	0.09	0.16
Degree completion (in graduation year):			
% complete degree (undergraduate)	0.77	0.82	0.75
% complete degree (graduate)	0.74	0.83	0.72
Number of observations	3,782,098	1,147,570	2,634,528

Notes: Source: The statistics are computed from the SISE administrative dataset covering academic years 2008-2009 to 2010-2011.

Table 4: McCrary (2008) Test for Manipulation of the Assignment Variable at the Grant Level Cutoffs.

Year of application:	2008-2010 (1)	2008 (2)	2009 (3)	2010 (4)
Panel A. Pooled L6/L5 to L2/L1 Cutoffs				
Log difference in frequency bins	-.001	-.015	.009	.001
(s.e.)	(.012)	(.022)	(.022)	(.020)
T-test	.08	.68	.43	.04
Bin size	2.1	3.8	3.7	3.6
Bandwidth	435	444	415	467
Number of observations	297,673	93,415	98,963	105,295
Panel B. L1/L0 Cutoff				
Log difference in frequency bins	-.012	.007	-.019	-.025
(s.e.)	(.018)	(.034)	(.029)	(.029)
T-test	.66	.19	.65	.85
Bandwidth	1,317	1,275	1,443	1,394
Bin size	10.4	19.1	17.9	17.3
Number of observations	191,171	56,725	64,354	70,092
Panel C. L0/No grant Cutoff				
Log difference in frequency bins	-0.007	-0.024	0.007	-0.017
(s.e.)	(0.030)	(0.066)	(0.055)	(0.045)
T-test	0.24	0.36	0.13	0.38
Bin size	23.6	52.0	39.4	35.6
Bandwidth	2,251	1,894	1,886	2,412
Number of observations	72,965	16,373	25,860	30,735

Notes: The McCrary test is run separately for each group of grant level cutoffs: pooled L6/L5 to L2/L1 cutoffs (Panel A); L1/L0 cutoff (Panel B); L0/No grant cutoff (Panel C). In column (1), the test is performed using all available years (2008 to 2010). Columns (2) to (4) show the results obtained when the test is run separately by year. For each test, the table reports the estimated discontinuity in the density function of the assignment variable at the threshold (θ), its standard error, the t-test, the estimated optimal bandwidth and bin size and the number of observations. The optimal bandwidth and binsize are obtained using the automatic selection procedure proposed by McCrary (2008). T-test values lower than 1.96 suggest no statistical evidence of a discontinuity in the density of the assignment variable at the grant level cutoffs.

Table 5: Balancing Properties for the Baseline Covariates, Applicants' first choice, Years 2008 to 2010.

Estimation Method:	Mean of Dependent Variable	Split Polynomial (order=p)			Local Linear Regression (bandwidth=h)		
		$p=2$	$p=3$	$p=4$	$h=2h^*$	$h=h^*$	$h=0.5h^*$
		(1)	(3)	(4)	(5)	(6)	(7)
Panel A. Pooled L6/L5 to L2/L1 Cutoffs							
Male	.384	.001	.002	-.002	0.004	-.001	.001
		(.005)	(.007)	(.009)	(0.005)	(.007)	(.010)
Age	20.9	.016	.000	.006	0.014	.001	.086*
		(.026)	(.034)	(.043)	(0.024)	(.034)	(.049)
Number of choices	1.9	.009	.023	.039**	0.010	.017	.040 *
		(.013)	(.017)	(.021)	(0.012)	(.017)	(.024)
Parents' taxable income (euros)	19,658	73	2	-118	64	-46	-68
		(70)	(93)	(116)	(65)	(92))	(130)
Family needs assessment score	3.3	.048	.029	.017	0.045	.021	.038
		(.030)	(.040)	(.049)	(0.028)	(.039)	(.055)
Successful student housing application	.164	.001	.001	.000	-0.001	.002	-.005
		(.004)	(.005)	(.007)	(0.004)	(.005)	(.008)
Applied for grant in previous year	.732	.000	-.003	.000	-0.003	.003	.001
		(.005)	(.007)	(.008)	(0.005)	(.007)	(.009)
Parents' income in previous year's application	19,698	17	-50	-170	39	-66	-203
		(104)	(138)	(173)	(98)	(137)	(188)
Amount of grant received in previous year (euros)	1,968	6	1	29	-6	20	21
		(18)	(24)	(30)	(17)	(24)	(34)
Enrolled in college in previous year	.683	-.001	.001	.004	-0.002	.004	.005
		(.005)	(.007)	(.009)	(0.005)	(.007)	(.010)
Number of observations	297,673	297,673	297,673	297,673	147,680	73,507	36,691
Panel B. L1/L0 Cutoff							
Male	.401	-.007	- .003	.000	-.006	-.005	-.003
		(.007)	(.009)	(.011)	(.006)	(.009)	(.013)
Age	20.7	.022	.069*	.020	.046	.003	.022
		(.030)	(.040)	(.050)	(.028)	(.039)	(.057)
Number of choices	1.9	.024	.013	.037	.018	.019	.027
		(.016)	(.021)	(.027)	(.015)	(.021)	(.030)
Parents' taxable income (euros)	30,737	66	91	106	72	115	232
		(84)	(112)	(140)	(79)	(112)	(159)
Family needs assessment score	3.0	.028	.037	.040	.031	.044	.089
		(.032)	(.043)	(.054)	(.030)	(.043)	(.061)
Successful student housing application	.126	.005	.004	.011	.006	.005	.004
		(.005)	(.006)	(.008)	(.004)	(.006)	(.009)
Applied for grant in previous year	.685	.004	.006	.001	.003	.000	.020*
		(.006)	(.009)	(.001)	(.003)	(.009)	(.012)
Parents' income in previous year's application	29,363	116	192	328	52	291	161
		(138)	(185)	(231)	(128)	(180)	(257)
Amount of grant received in previous year	794	25*	28	3	40***	12	49*
		(14)	(19)	(23)	(13)	(18)	(26)
Enrolled in college in previous year	.681	-.001	.005	.010	.001	.009	.012
		(.007)	(.009)	(.011)	(.006)	(.009)	(.012)
Number of observations	191,171	191,171	191,171	191,171	94,879	46,748	22,790
Panel C. L0/No Grant Cutoff							
Male	.403	-.004	-.010	-.001	-.004	.005	-.001
		(.012)	(.016)	(.020)	(.011)	(.016)	(.023)
Age	20.5	.025	.063	.010	.043	.064	-.066
		(.057)	(.077)	(.096)	(.054)	(.077)	(.108)
Number of choices	2.0	-.067**	-.098**	-.046	-.086***	-.061	-.067
		(.029)	(.039)	(.048)	(.027)	(.039)	(.055)
Parents' taxable income (euros)	41,926	240	-112	189	65	-38	463
		(195)	(262)	(329)	(183)	(258)	(365)
Family needs assessment score	2.4	.064	-.029	.046	.020	-.011	.117
		(.051)	(.069)	(.086)	(.048)	(.067)	(.095)
Successful student housing application	.111	.006	-.004	-.002	.007	-.003	.002
		(.008)	(.010)	(.013)	(.007)	(.010)	(.015)
Applied for grant in previous year	.492	-.011	-.007	-.016	-.006	-.011	-.02
		(.012)	(.016)	(.020)	(.011)	(.016)	(.023)
Parents' income in previous year's application	37,496	-394	-42	466	-399	-449	397
		(456)	(612)	(769)	(509)	(647)	(873)
Amount of grant received in previous year	165	5	-8	-33	1	-15	-32
		(15)	(20)	(25)	(13)	(19)	(27)
Enrolled in college in previous year	.647	.000	.011	-.003	.009	.012	-.012
		(.012)	(.016)	(.020)	(.011)	(.016)	(.022)
Number of observations	72,965	72,965	72,965	72,965	33,471	15,928	7,482

Notes: The table shows regression discontinuity estimates to assess the difference in the value of covariates at the income eligibility thresholds between different levels of grants. Each coefficient comes from a separate regression. Column (1) reports the mean value of the covariate. The coefficients in columns (2) to (4) are obtained using split polynomial approximations of order 2, 3 and 4, respectively. The coefficients in columns (5) to (7) are obtained using local linear regressions with different bandwidths: the optimal bandwidth h^*, which is estimated using the cross-validation method proposed by Ludwig and Miller (2007), half the value of h^* and twice its value. Linear probability models are fitted when the outcome is binary. Robust standard errors are in parentheses. *: p<0.10; **: p<0.05; ***: p<0.01.

Table 6: Discontinuities in Conditional Grants Awarded to Applicants, Years 2008 to 2010.

Estimation Method	Mean of dependent variable above cutoff	Split Polynomial Approximation (order=p)			Local Linear Regression (bandwidth=h)		
		$p=2$	$p=3$	$p=4$	$h=2h^*$	$h=h^*$	$h=0.5h^*$
		(2)	(3)	(4)	(5)	(6)	(7)
Panel A. Pooled L6/L5 to L2/L1 Cutoffs							
Awarded a conditional grant	.917	.001	-.003	-.003	-.002	.000	-.003
		(.003)	(.004)	(.005)	(.003)	(.004)	(.006)
Predicted amount of conditional grant (euros)	2,790	569***	575***	592***	571***	577***	588***
		(9)	(12)	(15)	(8)	(12)	(17)
Actual amount of conditional grant (euros)	2,553	518***	519***	535***	515***	528***	521***
		(13)	(17)	(21)	(12)	(17)	(24)
Number of observations	297,673	297,673	297,673	297,673	147,680	73,507	36,691
Panel B. L1/L0 Cutoff							
Awarded a conditional grant	.918	.005	.001	-.006	.003	-.001	.006
Predicted amount of conditional grant (euros)	0	1,494***	1,494***	1,493***	1,494***	1,494***	1,494***
		(0)	(0))	(0)	(0)	(0)	(0)
Actual amount of conditional grant (euros)	7.3	1,361***	1,344***	1,336***	1,362***	1,343***	1,346***
		(4)	(6)	(7)	(9)	(6)	(4)
Number of observations	191,171	191,171	191,171	191,171	94,879	46,748	22,790
Panel C. L0/No Grant Cutoff							
Awarded a conditional grant (fee exemption)	.001	.832***	.818***	.806***	.832***	.817***	.794***
		(.007)	(.009)	(0.012)	(0.006)	(0.009)	(0.013)
Predicted amount of conditional grant (euros)	0	0	0	0	0	0	0
		(0)	(0)	(0)	(0)	(0)	(0)
Actual amount of conditional grant (euros)	0.6	1	2	3	1	2	3
		(1)	(2)	(2)	(1)	(2)	(3)
Number of observations	72,965	72,965	72,965	72,965	33,471	15,928	7,482

Notes: The table reports the estimated discontinuities in the grants awarded to applicants at the different cutoffs, along three dimensions: the proportion of applicants who are awarded a conditional grant, the predicted amount of conditional grant and the actual amount awarded. Each coefficient comes from a separate regression. Column (1) reports the mean value of the dependent variables for observations to the right of the threshold. The coefficients in columns (2) to (4) are obtained using split polynomial approximations of order 2, 3 and 4, respectively. The coefficients in columns (5) to (7) are obtained using local linear regressions with different bandwidths: the optimal bandwidth h^*, which is estimated using the cross-validation method proposed by Ludwig and Miller (2007), half the value of h^* and twice its value. Linear probability models are fitted when the outcome is binary. Robust standard errors are in parentheses. *: p<0.10; **: p<0.05; ***: p<0.01.

Table 7: Discontinuities in College Enrollment Rates, Years 2008 to 2010.

Estimation Method	Mean of dependent variable above cutoff	Split Polynomial Approximation (order=p)			Local Linear Regression (bandwidth=h)		
		$p=2$	$p=3$	$p=4$	$h=2h^*$	$h=h^*$	$h=0.5h^*$
		(2)	(3)	(4)	(5)	(6)	(7)
Panel A. Pooled L6/L5 to L2/L1 Cutoffs							
Enrolled in College in current year	.820	.006	.008	.004	.004	.004	.004
		(.004)	(.006)	(.007)	(.004)	(.006)	(.008)
Number of observations	297,673	297,673	297,673	297,673	147,680	73,507	36,691
Panel B. L1/L0 Cutoff							
Enrolled in College in current year	.804	.026***	.025***	.023**	.029***	.028***	.024**
		(.005)	(.007)	(.009)	(.005)	(.007)	(.010)
Number of observations	191,171	191,171	191,171	191,171	94,879	46,748	22,790
Panel C. L0/No Grant Cutoff							
Enrolled in College in current year	.819	.006	.001	-.005	.005	.001	.008
		(.009)	(.013)	(.016)	(.009)	(.013)	(.018)
Number of observations	72,965	72,965	72,965	72,965	33,471	15,928	7,482

Notes: The table reports the estimated discontinuities in the college enrollment of applicants to means-tested grants at the different cutoffs. Each coefficient comes from a separate regression. Column (1) reports the mean value of the dependent variables for observations to the right of the threshold. The coefficients in columns (2) to (4) are obtained using split polynomial approximations of order 2, 3 and 4, respectively. The coefficients in columns (5) to (7) are obtained using local linear regressions with different bandwidths: the optimal bandwidth h^*, which is estimated using the cross-validation method proposed by Ludwig and Miller (2007), half the value of h^* and twice its value. Linear probability models are fitted when the outcome is binary. Robust standard errors are in parentheses. *: p<0.10; **: p<0.05; ***: p<0.01.

Table 8: Discontinuities in College Enrollment Rates for Different Subgroups of Applicants, Years 2008 to 2010.

Sample:	All	Year of application			Gender		Level of study				
		2008	2009	2010	Females	Males	1	2	3	4	5
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A. Pooled L6/L5 to L2/L1 Cutoffs (eligibility to a 600 euros increase in annual allowance)											
Mean enrollment above the income cutoff	.819	.821	.817	.819	.816	.823	.776	.883	.801	.838	.805
Split polynomial approximation	.006	.003	.009	.006	.008	.003	.009	.005	.000	.016	.000
		(.008)	(.007)	(.007)	(.005)	(.007)	(.009)	(.007)	(.009)	(.011)	(.013)
Number of observations	297,673	93,415	98,963	105,295	183,271	114,402	85,209	71,200	68,627	40,913	31,724
Local linear regression	.004	-.005	.012*	.005	.005	.003	.003	.008	-.003	.014	.000
		(.007)	(.007)	(.007)	(.005)	(.006)	(.008)	(.007)	(.009)	(.010)	(.013)
Number of observations	73,507	46,272	49,106	52,302	56,800	90,880	42,496	35,205	33,737	20,391	31,724
Panel B. L1/L0 Cutoff (eligibility to a 1,500 euros increase in annual allowance)											
Mean enrollment above the income cutoff	.804	.805	.801	.807	.805	.803	.749	.847	.811	.818	.815
Split polynomial approximation	.025***	.028***	.029***	.018**	.021***	.034***	.040***	.018*	.019*	.040***	.014
	(.007)	(.010)	(.009)	(.009)	(.007)	(.009)	(.011)	(.010)	(.011)	(.014)	(.017)
Number of observations	191,171	56,725	64,354	70,092	114,419	76,752	52,260	46,997	44,608	26,529	20,777
Local linear regression	.028***	.032***	.032***	.024***	.025***	.036***	.041***	.025***	.022**	.036***	.018
	(.007)	(.009)	(.009)	(.009)	(.007)	(.008)	(.011)	(.009)	(.011)	(.014)	(.016)
Number of observations	46,748	28,093	32,062	34,724	56,887	37,992	25,903	23,449	22,002	13,090	10,435
Panel C. L0/No Grant Cutoff (eligibility to fee exemption)											
Mean enrollment above the income cutoff	.820	.815	.820	.824	.821	.820	.792	.870	.801	.818	.834
Split polynomial approximation	.004	.000	.008	.003	.007	.000	.008	.009	-.003	-.001	.015
	(.009)	(.020)	(.016)	(.014)	(.012)	(.014)	(.018)	(.016)	(.021)	(.024)	(.029)
Number of observations	72,965	16,373	25,860	30,732	43,550	29,415	22,337	16,953	15,597	10,223	7,855
Local linear regression	-.001	.008	.008	.001	.009	-.001	.002	.005	.005	.008	.006
	(.013)	(.019)	(.015)	(.013)	(.011)	(.014)	(.016)	(.016)	(.019)	(.024)	(.027)
Number of observations	15,928	7,473	11,960	14,038	20,007	13,464	10,421	7,719	7,094	4,709	3,528

Notes: The table reports the estimated discontinuities in the college enrollment of different subgroups of applicants to means-tested grants. Each coefficient comes from a separate regression. We report the results obtained using a split polynomial approximation of order 2 and a local linear regression where the optimal bandwidth is selected based on the cross-validation method proposed by Ludwig and Miller (2007). Robust standard errors are in parentheses. *: p<0.10; **: p<0.05; ***: p<0.01.

Table 9: Discontinuities in Student Persistence at the L1/L0 Cutoff, First Year Undergraduates, Years 2008 and 2009.

Year:	Year of Application	Year of Application + 1			Year of Application + 2	
Outcomes:	Enrolled in college	Enrolled in college	Enrolled in Bachelor's level 2	Earned 120 ECTS Credits	Enrolled in college	Enrolled in Bachelor's level 3
	(1)	(2)	(3)	(4)	(5)	(6)
Mean value above cutoff	0.739	0.614	0.373	0.234	.551	.301
Split polynomial approximation	.049***	.042**	.026	.016	.029	.018
	(.017)	(.019)	(.019)	(.024)	(.028)	(.026)
Number of observations	24,740	24,740	24,740	11,488	11,488	11,488
Local linear regression	.045***	.042**	.028*	.019	.031	.021
	(.016)	(.018)	(.017)	(.022)	(.027)	(.024)
Number of observations	12,381	12,381	12,381	5,733	5,733	5,733
Years	2008-2009	2008-2009	2008-2009	2009	2009	2009

Notes: The table reports the estimated discontinuities in the college enrollment and persistence of applicants to the first year of an undergraduate degree program. Each coefficient comes from a separate regression. We report the results obtained using a split polynomial approximation of order 2 and a local linear regression where the optimal bandwidth is selected based on the cross-validation method proposed by Ludwig and Miller (2007). Robust standard errors are in parentheses. *: p<0.10; **: p<0.05; ***: p<0.01.

Table 10: Discontinuities in Student Persistence at the L1/L0 Cutoff, First Year Graduates, Years 2008 and 2009.

Year:	Year of Application		Year of Application + 1		
Outcomes:	Enrolled in college	Earned 60 ECTS Credits	Enrolled in college	Enrolled in Master's level 2	Obtained Master's Degree
	(1)	(2)	(3)	(4)	(5)
Mean value above cutoff	.817	.511	.697	.473	.043
Split polynomial approximation	.039**	.048**	.037*	.045*	.053
	(.018)	(.024)	(.022)	(.024)	(.034)
Number of observations	16,814	16,814	16,814	16,814	7,964
Local linear regression	.034**	.047**	.042**	.047**	.056*
	(.017)	(.022)	(.020)	(.022)	(.032)
Number of observations	8,210	8,210	8,210	8,210	3,826
Years	2008-2009	2008-2009	2008-2009	2008-2009	2009

Notes: The table reports the estimated discontinuities in the college enrollment and persistence of applicants to the first year of a graduate degree program. Each coefficient comes from a separate regression. We report the results obtained using a split polynomial approximation of order 2 and a local linear regression where the optimal bandwidth is selected based on the cross-validation method proposed by Ludwig and Miller (2007). Robust standard errors are in parentheses. *: p<0.10; **: p<0.05; ***: p<0.01.

Table 11: Discontinuities in College Enrollment and Degree Completion at the L1/L0 Cutoff for Final Year Undergraduate or Graduate Applicants, Years 2008 and 2009.

Sample:	Final Year Applicants (1)	Final Year Undergraduate Applicants (2)	Final Year Graduate Applicants (3)
College Enrollment in Year of Application			
Mean value above cutoff	.827	.832	.817
Split polynomial approximation	.022**	.025**	.013
	(.010)	(.012)	(.022)
Number of observations	51,997	39,292	12,905
Local linear regression	.022**	.025**	.015
	(.010)	(.011)	(.020)
Number of observations	25,522	19,021	6,501
Years	2008-2009	2008-2009	2008-2009
Degree Completion in Year of Application			
Mean value above cutoff	.614	.614	.613
Split polynomial approximation	.031**	.034**	.024
	(.013)	(.015)	(.026)
Number of observations	51,997	39,292	12,905
Local linear regression	.030**	.031**	.028
	(.012)	(.014)	(.025)
Number of observations	25,522	19,021	6,501
Years	2008-2009	2008-2009	2008-2009

Notes: The table reports the estimated discontinuities in the college enrollment and degree completion rates of final year undergraduate or graduate applicants, at the L1/L0 grant level cutoff. Each coefficient comes from a separate regression. We report the results obtained using a split polynomial approximation of order 2 and a local linear regression where the optimal bandwidth is selected based on the cross-validation method proposed by Ludwig and Miller (2007). Robust standard errors are in parentheses. *: p<0.10; **: p<0.05; ***: p<0.01.

Appendix

Bandwidth selection To identify the causal impact of being eligible for a grant of level k in a given year t, we need to compare the outcomes of applicants above and below the relevant income thresholds, in a narrow interval $I_{k,t}(s)$ around them:

$$I_{k,t}(s) = \left[\overline{z}_{k,t}(s) - h^l_{k,t}(s); \overline{z}_{k,t}(s) - h^r_{k,t}(s)\right]$$

where $h^l_{k,t}(s)$ and $h^r_{k,t}(s)$ are the chosen bandwidths to the left and to the right of income eligibility cutoff $\overline{z}_{k,t}(s)$, respectively.

The bandwidths around each income cutoff are chosen so as to meet the following three conditions:

1. They should be symmetric around the cutoff:

$$h^l_{k,t}(s) = h^r_{k,t}(s) = h_{k,t}(s) \quad \forall\, k, s, t \tag{A1}$$

2. They should be identical for all income cutoffs that separate the same two consecutive levels of grants[33]:

$$h_{k,t}(s) = h_k \quad \forall\, k, s, t \tag{A2}$$

3. The interval around income cutoffs should not include the previous or next income cutoffs:

$$\overline{z}_{k-1,t}(s) \notin \left[\overline{z}_{k,t}(s) - h_k\right] \text{ and } \overline{z}_{k+1,t}(s) \notin \left[\overline{z}_{k,t}(s) + h_k\right] \quad \forall\, k, s, t \tag{A3}$$

For each grant level cutoff, the selected bandwidth is set equal to the widest bandwidth that satisfies the three conditions above. Denoting $h_{[\text{L0/No grant}]}$ and $h_{[\text{L1/L0}]}$ the bandwidths that we use to select observations around the L0/No grant cutoff and the L1/L0 cutoff,

[33] This restriction ensures that the density of applicants on either side of the pooled income cutoffs is continuous. In general, the widest possible bandwidth $h_{k,t}(s)$ around the income cutoff $\overline{z}_{k,t}(s)$ is larger than the widest possible bandwidth $h_{k,t}(s')$ around the income cutoff $\overline{z}_{k,t}(s')$, where $s' > s$. Using the largest bandwidth would result in a drop in the number of observations when applicants' parental income falls outside of the interval $I_{k,t}(s')$.

we have:

$$h_{[\text{L0/No grant}]} = \max\Big(h_{0,t}(s)\big|\text{A1, A2, A3}\Big)$$
$$h_{[\text{L1/L0}]} = \max\Big(h_{1,t}(s)\big|\text{A1, A2, A3}\Big)$$

To construct the bandwidth that is used to select the observations around the pooled L6/L5 to L2/L1 income cutoffs, we make the additional restriction that in a given year and for a given FNA score, the intervals around the income cutoffs should not overlap, to avoid applicants appearing simultaneously on both sides of the discontinuity, i.e.:

$$\bigcap_{k=2}^{6} I_{k,t}(s) = \emptyset \quad \forall\, s, t \tag{A4}$$

This bandwidth, which we denote $h_{[\text{L6/L5-L2/L1}]}$, is constructed as follows:

$$h_{[\text{L6/L5-L2/L1}]} = \max\Big(h_{k,t}(s)\big|\text{A1, A2, A3, A4, } k \in \{2, ..., 6\}\Big)$$

Table 12: Income Eligibility Thresholds to the Different Levels of Grants in 2009, for each Value of the Family Needs Assessment Score.

Level of Grant: Amount of Grant	Level 0 Fee exemption	Level 1 1476 euros	Level 2 2223 euros	Level 3 2849 euros	Level 4 3473 euros	Level 5 3988 euros	Level 6 4228 euros
FNA Score:							
0	34,611	23,537	19,023	16,804	14,628	12,494	7,855
1	38,452	26,150	21,136	18,671	16,249	13,881	8,760
2	42,304	28,764	23,248	20,538	17,882	15,268	9,634
3	46,145	31,378	25,361	22,406	19,504	16,655	10,509
4	49,996	33,992	27,473	24,723	21,125	18,042	11,384
5	53,837	36,617	29,597	26,140	22,758	19,439	12,270
6	57,689	39,231	31,709	28,007	24,379	20,826	13,145
7	61,530	41,845	33,822	29,874	26,001	22,214	14,019
8	65,382	44,459	35,934	31,741	27,634	23,601	14,894
9	69,222	47,073	38,047	33,608	29,255	24,988	15,769
10	73,063	49,687	40,159	35,475	30,877	26,375	16,644
11	76,915	52,301	42,272	37,343	32,509	27,762	17,519
12	80,756	54,915	44,384	39,210	34,131	29,149	18,934
13	84,608	57,529	46,497	41,077	35,753	30,536	19,269
14	88,449	60,154	48,620	42,944	37,385	31,933	20,154
15	92,300	62,768	50,733	44,811	39,007	33,320	21,029
16	96,141	65,382	52,845	46,678	40,629	34,707	21,904
17	99,993	67,996	54,958	48,545	42,261	36,094	22,779

Notes: Income eligibility thresholds refer to taxable parental income two years before the application. Source: *Circulaire 2009-1018 du 2-7-2009, Bulletin officiel de l'Education Nationale no 30 du 23 juillet 2009.* All amounts are converted in 2011 euros.