Credit Access and College Enrollment*

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Abstract

Does access to credit explain the gap in schooling attainment between children from richer and poorer families? I present new evidence on this important question using two college tuition loans in Chile. Both programs offer loans to students who score above a threshold on the national college admission test, enabling a regression discontinuity design. I find that loan access implies an increase of nearly 20 percentage points in enrollment in the first, second and third year of college, representing relative increases of 100%, 200% and 400%, respectively. More importantly, access to loans effectively eliminates the family income gradient in enrollment.

JEL Codes: I22, I24, I28, O1

Keywords: college enrollment, credit constraints, income gap, college dropout, Chile

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1 Introduction

Students from richer families are more likely to attend, persist at, and graduate from college than students from poorer families. Whether the gap is due entirely to differences in tastes and abilities, or is partially driven by credit constraints faced by lower income families, is a matter of much debate. Some analysts argue that the gap is mainly a reflection of long-run differences in educational investment, both at home and in schools, that affect readiness for college (e.g., Cameron and Heckman (2001); Keane and Wolpin (2001); Carneiro and Heckman (2002); and Cameron and Taber (2004)). Others have argued that liquidity constraints prevent some relatively able but poor students from enrolling in college (e.g., Lang (1993); Kane (1994, 1996); Card (1999); Belley and Lochner (2007); Lochner and Monge-Naranjo (2011a); and Brown, Scholz and Seshadri (2012)).[1,2]

Measuring the effects of credit constraints on college enrollment is a difficult task because determining whether a family has access to credit is difficult or impossible. Moreover, even if access to credit were directly observed, there are many other unobserved variables that affect college enrollment and are likely to be correlated with access to credit, leading to biased estimates.[3] For example, students from high income families may have better access to credit markets, but also may have stronger preferences for college education, better academic preparation, and superior cognitive and non-cognitive skills unobserved by the econometrician. On the supply side, access to loans is sometimes correlated with ability; for example, Van der Klauuw (2002) argues that colleges' grants are increasingly based on academic merit and are used to encourage the best of the admitted students to enroll in a given college, rather than being used to assist students from low income families. In addition, the admission process relies on unobserved and subjective measures, such as recommendation letters, parental alumni status, etc. Recognizing the problem, tests of the credit constraint hypothesis have relied mainly on indirect measures of credit access that lead to mixed - and sometimes inconsistent - findings.

In this paper, I exploit the sharp eligibility rules of two loan programs recently introduced in Chile. These programs give access to college tuition loans for students who score above a certain threshold on the national college admission test. A comparison of students who receive scores just at the eligibility cutoff and just below it provides a direct measure of access to credit that is as good as random assignment, (Lee (2008)), enabling a regression discontinuity design that addresses the problems of unobserved omitted variables and selection. Thus, these loan programs allow for a

[1] See Lochner and Monge-Naranjo (2011b) for a detailed review of the literature.

[2] A different approach is used by Attanasio and Kaufmann (2009) and Kaufmann (2010). They use differences in the expected returns and information sets between students from high and low income families to explain the college enrollment differences in Mexico, concluding that the sensitivity of low income students to changes in direct costs suggests the presence of credit constraints.

[3] This econometric problem has also been documented in the literature that estimates the price elasticity of demand for college education (e.g., Manski and Wise (1983), McPherson and Schapiro (1991), Van der Klaauw (2002), Dynarski (2003) and Nielsen, Sorensen and Taber (2010)).

direct and unbiased estimate of the causal effect of credit access on college enrollment and college progress.[4,5]

A key feature of my analysis is the availability of detailed student-level data that present several advantages over the samples used in earlier studies. First, I observe the entire population of individuals who participate in the national college admission process, including full information on their enrollment in all programs in the country (including their ranking of choices for traditional universities, and their actual admission on those programs and enrollment). Second, I observe the two variables that completely determine college admission: the scores on the national college admission tests[6] and high school GPA, ruling out potential biases from admission processes that weight subjective characteristics. Third, the two loan programs provide access to standardized loans to eligible students, offered by the government and private banks, eliminating potential endogeneity of loan offers designed to attract better students. With this data, the nature of the loan programs allow a reliable evaluation of the causal effects of credit access on college enrollment and college progress. To the best of my knowledge, this is the first paper that uses an exogenous source of access to loans and the entire population of students and institutions that participate in the college admission process.

My analysis shows that access to the loan programs increases the college enrollment probability by 18 percentage points - equivalent to a nearly 100% increase in the enrollment rate of the group with test scores just below the eligibility threshold. Students from the lowest family income quintile benefit the most: for these students, access to the loans causes a 140% increase in the probability of enrollment (on a baseline enrollment rate of 15% for students just below the cutoff).

More importantly, access to the loan programs appears to eliminate the relatively large income gradient in college enrollment. Among those who are just below the eligibility threshold for loans, students from the richest quintiles are twice as likely to enroll as students from the poorest quintile. In contrast, among students who are just at the eligibility threshold, the enrollment gap is statistically zero.

The literature on the importance of liquidity constraints has focused mainly on college enrollment, but programs that promote enrollment would not have any significant effect on educational attainment if they attract students who are unable to graduate. For this reason, a different strand of literature examines the impact of aid on persistence, dropout and graduation rates (e.g., Dynarski (2003); DesJardins, Ahlburg and McCall (2002); Bettinger (2004); Singell (2004); and Stinebrickner and Stinebrickner (2008)), with a similar level of disagreement on the conclusions as the literature

[4] In terms of the methodology, Canton and Blom (2010) and Gurgand, Lorenceau and Melonio (2011) perform an RDD analysis using information on Mexican and South African students.

[5] Rau, Rojas and Urzúa (2013) analyzes enrollment, dropout rates, and earnings for one of the two loans analyzed here, the State Guaranteed Loan program, using a sequential schooling decision model with unobserved heterogeneity.

[6] Language and mathematics tests are mandatory; science and history are optional (students choose at least one of them).

on college enrollment.[7]

The literature on persistence and dropout faces additional econometric problems. Enrolled students constitute a self-selected sample of individuals, and therefore the relationship between credit constraints and persistence and dropout rates cannot be interpreted as a causal relationship. Furthermore, in most cases, the analysis is performed using information from a single institution or restricted group of institutions. That implies two more concerns. First, the analysis depends critically on the characteristics of the analyzed institution. Second, in many cases, transfer students are mistakenly considered dropouts.

The data used in this paper allows me to follow students up to their third year of enrollment. Using the same exogenous variation in access to loans, I estimate the causal effect on college progress, defined as enrollment in the second and third year. Using the entire population of students who participate in the admission process eliminates the selection bias in the analysis of college progress, and using all institutions eliminates the bias associated with transfer students and presents general evidence not contingent on one institution.

In this context, I estimate that, for each student who enrolls in the second year of college without access to credit, three students who have access to loans enroll in the second year. Moreover, for every student who enrolls in the third year of college without access to credit, five do so when they have access to loans.

Additionally, access to the loan programs eliminates the income gradient in second and third year college enrollment. Among those just below the threshold for loans, students from the poorest income quintile enroll at 6% and 3% in the second and third years, respectively, while students from the richest quintile enroll at 20% and 24%, respectively. In comparison, among those just eligible for loans, there is no statistical difference in the enrollment rate in the second and third year between the richest and the poorest students.

Finally, to explore whether these effects are driven by implicit subsidies present in these loan schemes (such as a lower-than-market interest rate and a low enforcement rate), a price effect, or an access effect (because these loans constituted the first source of financing available for these students), I present three tests. The first test uses a second natural experiment that gives exogenous access to the Bicentenario scholarship, which is available to students in the two poorest income quintiles who score above the scholarship cutoff (which is higher than the cutoff for the loan programs). In this context all students have access to the two loan programs (no access effect), but students just above the scholarship cutoff face a reduction of 90% in tuition cost (a pure price effect). I find that students with access to loans have the same enrollment rate as those who benefit from a scholarship that reduces their tuition cost, i.e., the price effect is zero.

The second test directly explores the access effect. I use survey data from a subset of students around the threshold to analyze directly the importance of financial constraints to the enrollment

[7] See Chen (2008) and Hossler et al (2009) for a survey of the literature.

decision. The rate of students who respond that financial problems prevent them from enrolling in college drops between 10 to 12 percentage points at the cutoff (a relative decrease of 30%), indicating that a large portion of students blame liquidity constraints as the main reason not to enroll in college.

Finally, I present a test that combines information on the characteristics of the financial market to determine which income quintiles may be restricted to credit, and I explore the different predicted responses for these quintiles to decompose the enrollment effect into price and access effects. I find that the price effect is small and conclude that the overall effect is driven by loan access.

The paper is organized as follows. Section 2 describes the background and the data. Section 3 discusses the empirical strategy. Section 4 presents the empirical evidence for the effects of credit access on college enrollment and progress, and the enrollment gap by family income. Section 5 decomposes the effects into access and price effects. Section 6 concludes.

2 Background and Data

One key feature of this paper is the possibility of observing every aspect of a partially centralized college admission process and the entire population of students who participate in the admission process nationwide. The admission process is based on the college admission test (Prueba de Selección Universitaria, PSU test hereafter), which is taken by 93% of all students graduating from high school each year.[8] Some students take it even when they do not plan to enroll in tertiary education, because sometimes it is required as a high school graduation certificate. The test is taken simultaneously across the country only once a year, and can be taken as many times as wanted after paying a fee.[9]

The admission process is described in Figure 1. It depicts students decisions and the information available for them. In brief, students need to register for the PSU test before graduating from high school in November. They take the test the second week of December and learn their score the first week of January. With the score in hand, they know if they are eligible for aid or loans (assuming they satisfy the other criteria) when they apply to the different college programs available in the country. Simultaneously, those students who want to receive aid or loans from the Ministry of Education need to complete a socioeconomic verification form (Formulario Único de Acreditación Socioeconómica, FUAS) before high school graduation. This form is sent to the tax authority to classify students into income quintiles. A few days after taking the PSU test, students know into which income quintile they were classified, and whether they are eligible for the two loans analyzed here and for almost all scholarships available from public funds. With all this information, they

[8]Source: Ministry of Education.

[9]The fee is about US $50 or CLP 25,000 (pesos of 2012) and is waived for all students graduating from public and voucher schools who apply for a waiver.

start applying and enrolling to college programs.

2.1 The College Admission Test and Placement.

The PSU test consists of two mandatory tests on language and mathematics and two optional tests. The average score on the mandatory tests is referred to as the PSU score, and is used for college placement and for loan and grant eligibility.[10]

The tests have only multiple choice questions, which are answered on a special sheet that is graded automatically by a photo optical device. Therefore, the scores are not subject to manipulation by students or graders. PSU scores are normalized to a distribution with a mean of 500 and standard deviation of 100 to make them comparable among years. The scores range from 150 to 850 points.[11]

Once students know their PSU scores, they can apply to two types of universities, called "traditional" and "private." The "traditional" universities consist of 25 institutions that were founded before the educational reform of 1981. Some are public and others are privately funded, but all receive direct funding from the government (Aporte Fiscal Directo).

The 33 universities created after the reform of 1981 are called "private" universities. They do not receive direct funding from the government, and, before 2006, their students were excluded from the loan system using public funds. Their growth has been rapid and steady, increasing enrollment from a handful of students in 1991 to nearly half of the student body in 2009. Since 2006, the State Guaranteed Loan program have been available to students attending private universities.

Both types of universities use the PSU test score to select students. Traditional universities use the test as a centralized mechanism to allocate applicants. The allocation process is as follows: After learning their scores, students apply to up to 8 programs in traditional universities. All the students applying to any given program are ranked using the scores on the PSU tests (the two mandatory and one optional test), and high school GPA. Seats are offered to the best scoring students applying to each program; the rest are put on a waiting list. If a student is accepted into more than one program, she is placed in her highest choice and is eliminated from all other rankings. If students do not matriculate by specific dates, spots become available based on the ranking on the waiting list.

Private universities receive applications independently from the centralized allocation system, but they also consider the PSU test score and high school GPA when selecting applicants. They prefer students with higher PSU scores for four reasons. First, institutions that admit students receiving loans through the State Guaranteed Loan program (SGL) are required by law to select

[10]The optional tests are (1) History and Social Sciences and (2) Sciences, which includes modules on biology, chemistry, and physics. They are not considered for loan eligibility, but they are considered for placement ranking in traditional college programs.

[11]The PSU test is implemented by the Council of Chancellors of Chilean Universities (Consejo de Rectores de las Universidades Chilenas: CRUCH), which organizes the traditional universities that are described below.

students based on the PSU score.[12] This loan program has become the main source of financing for private universities and explains their rapid growth since 2006. Second, private universities use PSU scores to distinguish the quality of the students, as it is the best ability measure available. Third, all the universities in the country compete to get indirect governmental funding (Aporte Fiscal Indirecto), which is calculated based on PSU scores from the students enrolled in each institution every year. This funding is the second-largest source of earnings for private universities. Fourth, the PSU scores of the student body are used to publicize the quality of the programs to attract more students. Each year, before the PSU test, universities disclose the PSU score of the last student enrolled in each program (program cutoff score or "puntaje de corte") to signal how much in demand they are.

After the whole enrollment process is finished, universities inform the ministry about the enrollment in all of their programs, and the ministry assigns loans, grants and scholarships.

2.2 Financial Aid

Financial aid from the Education Ministry is assigned according to the information provided by students before the PSU test, on the economic status verification form (the FUAS form). This information is sent by the ministry to the Chilean tax authority (Servicio de Impuestos Internos or SII) to verify the information and classify students in income quintiles. One of the most important characteristics of the Chilean college admission process is that, except for one program, all loans and scholarships managed by the State are assigned depending on PSU scores and income quintiles. Table 1 summarizes all college-related financial aid given or managed by the Ministry of Education.

The only two college tuition loans given using public funds in the country are the SGL and the Traditional University Loan program (Crédito Solidario, TUL hereafter). The same eligibility criteria are used in both programs, namely, students are required to be classified by the tax authority in one of the four poorest income quintiles, and to score at least 475 points on the PSU test. The only difference in terms of eligibility is that TUL is given to students enrolling in one of the 25 traditional universities, while SGL can be used at any of the 44 accredited universities in the country (all the traditional universities and 18 private universities).

Both programs aim to cover tuition costs only, up to the reference tuition. The reference tuition is an amount calculated by the Ministry of Education reflecting how much a program should cost depending on the institutional assets' quality and the labor market prospects after graduation of any program. On average, the reference tuition is slightly less than 90% of the actual tuition cost. Any part of tuition not covered by these loans has to be covered by the student.

On average, annual college tuition is 1.8 million pesos (in 2009, this was US $3,600), while

[12] Law 20,027, title III, article 7. This law created the SGL in June of 2005. All accredited universities receive students with SGL.

the median family income is 4.5 million pesos in nominal terms ($ 9,000).[13] Therefore, even after receiving one of these loans to matriculate in college, the non-covered portion of the tuition and the indirect costs may still be a financial burden for families in the bottom income quintiles, leaving space for liquidity constraints.

2.2.1 The Traditional University Loan (TUL) Program

The TUL program is managed by the traditional universities. Each traditional university determines how much to lend and is in charge of collecting loan repayments.[14]

This loan has special conditions that make it very attractive to students. The real interest rate on this loan is about 2% per year, with a maximum of 15 years of payments - after that, the debt is written off. Repayment starts two years after the student's graduation and the installments correspond to 5% of the borrower's income. Moreover, any portion of tuition not covered by this loan can be covered by the State Guaranteed Loan.

Despite these special characteristics, the loan has a high default rate (about from 52% for the years considered). One possible reason is that universities are in charge of collecting the loan payments in the first stage. If a student defaults, a central organization named Fondo Solidario becomes responsible for collecting the debt. Neither of these institutions are specialists in collecting loans. In recent years, the Chilean government has made some modifications that allow the tax authority to retain tax refunds and publicize the names of defaulting students; this has increased the repayment rate to as much as 80% of loans for which a new payment schedule has been negotiated.[15] The low enforceability and the low interest rate indicate the existence of a subsidy component in this loan scheme.

2.2.2 State Guaranteed Loan (SGL) Program

The SGL program allows private banks to provide college tuition loans to eligible students. These loans are guaranteed by the state and by higher education institutions. To be eligible, students need to fulfill the requirements mentioned above and enroll in one of the 44 accredited universities. Students decide the amount to request to meet their financial needs up to the reference tuition.

Out of the 58 institutions that provide college education in Chile, 77.6% participate in the program. Of the remainder, 19% are not accredited institutions and 3.4% have dropped out of the SGL program. SGL is the most important student loan program in the country in terms of the number of beneficiaries and the amount involved. SGL serves 29% of eligible students (compared

[13] Calculated using the household survey CASEN 2009. Per capita income (PPP) is approximately $14,000 dollars (using conversion rates of 2009). The difference is an indication of the inequality in the income distribution.

[14] TUL was introduced in 1981 as part of an educational reform. However, the eligibility criteria studied in this paper was introduced in 2006.

[15] Source: Fondo Solidario de Crédito Universitario.

to 22% of TUL) and its average loan amount is 1.56 times the amount given by TUL, which make its total value 2.2 times the size of the TUL.

This loan scheme is very similar to loans currently available in the conventional financial market. First, the real interest rate was about 6% per year in the years considered, which corresponds to the government long-run interest rate,[16] and is slightly higher than the mortgage rate for the same period. Anecdotally, this loan and its interest rate led to massive street protests in 2011 and 2012. It was considered too expensive, because some graduates had to pay up to 17% of their income after graduation.

Second, private banks make the loans and are in charge of the repayment process. Private banks can use all available legal mechanisms to recover the debt, including release of information to credit score institutions, asset impoundment, and judicial collection. Releasing information to credit score institutions is important in the labor market in Chile, because usually firms request that potential employees not appear as defaulters in credit score records.

Third, installments do not depend on the borrower's income. The SGL program requires students to start repayment 18 months after graduation in monthly installments for 20 years.

Fourth, to increase the enforceability of the debt, the loan contract has special clauses that involve the tax authority and employers. Employers are mandated to deduct repayments directly from payroll and to make payments directly to banks. The law establishes penalties on employers who do not comply with this process. Additionally, the loan contract allows the tax authority to retain tax refunds in case the former student does not pay the lending bank. This last characteristic has proven to be an efficient measure, increasing repayment for these traditional loans since 2002.

In the event that a student stops paying, after the bank implements all mechanisms used to collect the loans, the guarantors (the state and/or the educational institution) must pay the bank and become responsible for enforcing collection from the student. If a student drops out in the first year, the institution is responsible for repaying the bank up to 90% of the capital and interest accumulated; if the student drops out in the second year, the institution guarantees 70% and the state 20%; and if the student drops out in the third year or later, the institution guarantees 60% and the state 30%. After the student graduates, the state guarantees 90%. Some higher education institutions ask for higher PSU scores to guarantee the loan, but 85% of all programs require that students have the standard 475 PSU score in order to be eligible for the SGL.

Despite these characteristics that make the SGL very similar to a loan from the conventional financial market, the repayment rate has been low, raising issues in this study of separating the credit access effect from a subsidy effect. The World Bank estimates the current default rate at 36% (evaluated in 2011), and predicts that it could increase up to 50% if certain recommendations

[16]Source: International Comparative Higher Education and Finance Project. State University of New York at Buffalo.

are not followed.[17] The World Bank argues that, "By design, CAE's terms of lending should lead to high recovery. With lending rates that exceed the Government's cost of capital by two hundred basis points, the program does not explicitly contain an embedded subsidy."[18] Although SGL does not contain an implicit subsidy, a high default rate may give the wrong incentives to students who may consider it a grant instead of a loan. Because of that, to disentangle the effect of an embedded subsidy from the effect of access to financial markets, I will mainly use alternative methods, which will be described in Section 5.[19]

2.2.3 Other Loans Available

Some colleges offer scholarships or loans to complement the loans described above. The objective of these loans is to attract the best students, and therefore, these scholarships and loans require much higher PSU scores than 475. Hence, the presence of such loans will not confound the effects of the two loan programs that I study.

There are two types of loans given by private banks: the Corfo loans ("crédito Corfo") and private bank loans. To get any of these loans, students need a guarantor, who has to certify a good credit record, be employed, have a regular income source, and have a minimum family income or assets to use as collateral.

Corfo (Corporación de Fomento a la Producción) is a government development office. Corfo loans are offered by private banks, which manage the entire process, using resources from Corfo. These loans have interest rates that vary among banks, ranging from 6.8% to 8.5% (real annual), and require the guarantor to have a minimum monthly income of CLP 600,000 (US $1,225), corresponding to a family income in the bottom part of the fourth income quintile (see Panel B on Table 1 for the definition of the income quintiles).

Secondly, banks also offer loans using their own resources. The most relevant is the one given by BancoEstado.[20] This loan is aimed at lower income families, but the two poorest income quintiles and part of the third are excluded by credit requirements. The minimum family monthly income required to apply for this loan is CLP 350,000 (US $714). The real interest rate lies between 6.6% and 6.8% annually. All other loans from private banks have very similar requirements but ask for higher minimum family income, starting at CLP 600,000 (US $1,225).

Both of these loans depend on family characteristics that exclude students from the poorest families. The income requirement is the main source of exclusion, but some families are excluded

[17] According to the World Bank's report on the SGL program, the high default rate is caused mainly by "suboptimal program administration, rather than excessive debt burden." The main cause of the low collection rate is the lack of effective communication between lenders and students. See World Bank. 2011. "Chile's State Guaranteed Student Loan Program (CAE)".

[18] Op. Cit. p. 30.

[19] This program was designed to give a market alternative to students in private universities and vocational schools, who did not have access to traditional loans.

[20] This is a private bank with partial ownership by the government of Chile.

because they do not have a stable income source or have bad credit records. This is especially important in a country with high levels of labor market informality. According to the national household survey CASEN, in 2006, 36% of all workers were in the informal sector (self-employed or without a contract), and therefore students from those families were excluded from getting college loans in the regular market. Moreover, students need to rely on family altruism to get support when asking for loans.[21] In contrast, the two loan programs analyzed in this paper do not depend in family characteristics for 80% of the population (the four poorest income quintiles).

2.2.4 The Bicentario Scholarship

In addition to loans, some students are eligible for scholarships. This study makes use of the Bicentario scholarship, which is effectively a tuition subsidy, to disentangle credit access effects from price effects. The Bicentenario scholarship is available to students who comply with the following requirements: first, complete the FUAS form and be classified in the two poorest income quintiles; second, score above 550 points on the PSU test; and third, enroll in traditional universities. This scholarship program is the third in importance in the country. It is given to 4.7% of the universe of students and 55% of eligible students. Moreover, it covers in full the reference tuition, hence constitutes a significant drop in the cost of university education.

2.3 Data and Sample

This paper combines several sources of administrative data that allows me to observe in detail the outcome of the college admission process. The first data source in this paper is the registry of students who enroll for the PSU test. It contains individual data on PSU scores and high school GPA, which determine placement in universities, and a rich set of socioeconomic characteristics, such as self-reported family income, parent education, school of graduation, etc., for the years 2007 to 2009.

The PSU data set also contains information on the student's ranking of their first and subsequent choices among the traditional universities and programs of study, as well as placement results from the centralized mechanism.

The second source of data used in this paper is the enrollment in higher education data set from the Ministry of Education. It includes the enrollment outcome of the process described above (for all programs and institutions) for the same period of time.[22]

The enrollment data for 2008 and 2009 also contains information regarding the enrollment status of students initially enrolled in 2007 and 2008. I use this data to measure the effect of credit access on college progress (enrollment in the second and third year of college) and on dropout rates.

[21] Brown, Scholz and Seshadri (2012) have shown that this factor is an important source of credit constraints.
[22] All data sets were merged using the national identification number, RUN (Rol Único Nacional).

The third source of information is the FUAS application data set for the same years. The key element in this data set is the income quintile reported by the tax authority that determines eligibility for the two loan programs and for six scholarship programs. Moreover this data set contains the assignment to financial aid programs and the take-up for the traditional (TUL) loan.

The last set of information used in this paper corresponds to loan take-up for the State Guaranteed Loan Program. The data are from the INGRESA commission, the organization created in 2006 to manage this credit program.[23]

The data present two sources of selection that may be problematic. First, students who do not complete the FUAS socioeconomic form before the PSU test are not eligible, and therefore they are not affected by the cutoff. Second, because students can take the PSU test as many times as desired, a student may try repeatedly until getting a score equal to or greater than 475, self-selecting to be eligible for loans.

I address the first problem by restricting the analysis to students who comply with all the requirements to get the TUL or the SGL loan before the PSU test (pre-selected students, hereafter). For this sample of students, crossing the threshold implies a sharp change in access to tuition loans. To address the second problem (to eliminate the self-selection into treatment), I restrict the sample to students who are first-time test takers. Specifically, the sample is limited to students who graduated from high school the same year they take the PSU test.

3 Empirical Strategy

As described in the previous section, two financing programs in Chile offer college tuition loans to students who satisfy three conditions: first, they complete the socioeconomic FUAS verification form before taking the PSU test; second, they are classified in one of the poorest four income quintiles by the tax authority; and third, they score at least 475 points on the PSU test.

This last requirement enables a sharp regression discontinuity design for those students who comply with the first two conditions. Students receive access to loans "as good as random" assignment around the cutoff (Lee, 2008).Therefore, comparing college enrollment rates for the group at, or just above the cutoff (the "treatment" group) and the group just below (the "control" group) gives the causal effect of credit access on college enrollment.

Hahn, Todd and Van der Klaauw (2001), Van der Klaauw (2008), Lee (2008), and Lee and Lemieux (2010) describe the conditions under which a RDD gives a causal estimation. The intuition is simple. If we assume that each individual's score (the running or assignment variable) has a random component with a continuous density, then the probability of scoring ϵ above the cutoff or

[23]The assignment rule was fulfilled for all years except 2006, the first year of implementation, when the commission managing the SGL program mis-assigned part of the loans. Therefore, I do not consider 2006 in the analysis. In all other years, the assignment rule was fulfilled perfectly.

scoring ϵ below is the same (for a sufficiently small ϵ). That is why, even though the score depends on individual characteristics (selection), eligibility for treatment in the small neighborhood around the cutoff is as good as random assignment. In other words, students barely below the cutoff can be used as a counterfactual to students barely above the cutoff, because the only difference between these two groups is that students above the cutoff receive the treatment.

Ideally, we would compare the average outcome for students in a small neighborhood at the threshold, but usually there is not enough data in this small vicinity, and thus the estimation suffers from small sample bias. Lee and Lemieux (2010) suggest the following equation as an equivalent specification to estimate the RDD.

$$Y_i = \beta_0 + \beta_1 \cdot \mathbf{1}(T_i \geqslant \tau) + f(T_i - \tau) + \xi_i \tag{1}$$

where $\mathbf{1}(T_i \geqslant \tau)$ is an indicator function for whether student i's PSU score T_i is equal to or greater than the eligibility threshold τ; the term $(T_i - \tau)$ accounts for the influence of the running variable on Y_i in a flexible nonlinear function $f(\cdot)$; and ξ_i is, a mean zero error. The parameter β_0 captures the expected value of Y_i for students barely below the cutoff and β_1 captures the increase in the expected value of Y_i for individuals ϵ above the cutoff.

Equation (1) allows the researcher to include students who are not necessarily close to the cutoff. The advantage is the increased statistical power achieved by adding more data to the estimation. The disadvantage is the bias produced by individuals who are farther from the cutoff when f is not correctly specified. Imbens and Kalyanaraman (2012) propose a method to calculate an asymptotically optimal bandwidth to use a local linear regression in equation (1), where they use a squared error loss function to weigh these two biases.[24]

The results shown in this paper are based on a local linear regression using the optimal bandwidth of Imbens and Kalyanaraman (I&K), which in this case gives a bandwidth of 44 PSU points to each side of the cutoff ($w^* = 44$).[25] Nevertheless, the results are highly robust to different bandwidths and functional specifications. In appendix A, I performed a sensitivity analysis, showing that different bandwidths from 2 to 80 points around the cutoff over two functional forms, linear and 4th order polynomial, give statistically the same results, in terms of absolute and relative enrollment change.

Alternatively, to use the whole population of students, the follow specification interacts the condition of being preselected with the indicator of scoring at least at the cutoff.

[24] Additionally, I will use equation (1) to test whether baseline characteristics are balanced around the threshold to test the local continuity assumption implicit in RDD.

[25] The bandwidth is calculated using the Edge Kernel. A uniform Kernel gives a higher bandwidth, but results do not differ significantly.

$$Y_i = \beta_0 + \beta_1 \cdot \mathbf{1}(T_i \geqslant \tau) + \beta_2 \cdot PreSel_i + \beta_3 \cdot \mathbf{1}(T_i \geqslant \tau) \cdot PreSel_i + f(T_i - \tau) + \xi_i \tag{2}$$

In this case, β_1 is the change in the probability of enrollment in college after scoring at least at the cutoff for those ineligible for loans (those who did not complete FUAS or were classified in the richest quintile). This parameter captures whether scoring more than the cutoff plays the role of a signal for the students or college admissions officers. The fact that the government offers financing to eligible students scoring at least at the cutoff may be interpreted by students as a signal that they are suitable for college. Therefore, students' expectations about their own ability are not continuous at the cutoff. On the other hand, admissions officers may discriminate in favor of students scoring at least 475 because they expect that students with financing have a lower probability of dropping out, which translates into an expectation of higher earnings for the institutions.

The variable $PreSel_i$ is an indicator of being classified in one of the poorest four income quintiles after filling out the FUAS form. The coefficient β_2 captures whether there is any difference in the probability of enrollment between those who complete FUAS and those who don't. Those who complete the socioeconomic form may be more interested in the loans, either because they have higher preferences for college, or higher preferences for the terms of the loans.

In this specification, the parameter of interest is β_3, which measures the effect on college enrollment for those students who score at least at the cutoff, implying a change in their access to tuition loans.

3.1 Enrollment in Second and Third year

One concern from the policy maker's perspective is that access to loans may have an effect only on initial enrollment, but not on the graduation rate, if loans are given to students without the proper preparation for a college education. Hence, to reduce the education attainment gap, it is not sufficient to observe only the effect on the first year enrollment rate.

I estimate the causal effects of access to loans on enrollment in the second and third years of college, using the same exogenous variation. In this case, I deal with the problem of selection into treatment in the second or third year of college by using a fuzzy RDD.

In the previous case, eligibility for loans was determined sharply by the score in one PSU attempt. For second (third) year enrollment, students have the chance to retake the PSU test once (twice) (because the test is given once a year). Students with scores lower than the cutoff may enroll in college for the first year, expecting that they can get access to loans for the second (third) year if they score at least 475 in a subsequent attempt, thus self-selecting into treatment. In this case, eligibility is not fully determined by the score of the first attempt (the probability of being eligible for loans for second and third year enrollment is not zero for the control group). Nevertheless, the probability of being eligible still jumps discontinuously at the threshold, because not all students who scored below 475 on their first attempt retake the test, and only a portion of those succeed in scoring 475 or more in subsequent attempts. This allows a fuzzy RDD, where eligibility in the second and third year is instrumented by the status of eligibility in the first, i.e., a dummy for scoring greater than or equal to 475 in the first year.

Specifically, I perform a two stage least square regression as follows:

$$Elig_i = \gamma_0 + \gamma_1 \cdot \mathbf{1}(T_i \geqslant \tau) + f(T_i - \tau) + \eta_i \tag{3}$$

$$Y_i = \beta_0 + \beta_1 \cdot Elig_i + f(T_i - \tau) + \nu_i \tag{4}$$

The term $\mathbf{1}(T_i \geqslant \tau)$, the indicator function for scoring greater than or equal to the cutoff in the first attempt, is used as an instrument for eligibility for loans. $Elig_i$ takes on the value 1 if student i is eligible for college loans in the year of analysis, and zero otherwise. The dependent variable Y_i corresponds to the outcome of interest: enrollment in the second year, or enrollment in the third year (or dropout status, for the analysis in the appendix). All the other variables are defined as in equation (1).

Now, the parameter β_1 measures the effect of having access to college loans on enrollment in the second and third year for those for whom the treatment status does not change in the following years, after taking the PSU test for the first time.

4 Results

This section presents the empirical evidence organized as follows. Section 4.1 tests the conditions for a valid RDD: random loan assignment, absence of manipulation of PSU scores, and balance on baseline characteristics between the eligible and non-eligible students around the cutoff. Section 4.2 shows results for the estimation of the causal effect of loan access on college enrollment. Section 4.3 presents results by income groups and revisits the college enrollment gap. Section 4.4 presents the effects of access to loans on college progress, and the family income gap on enrollment in the second and third years. Section 5 decomposes the price and the access effect.

All the following RD results are restricted to the group that took the PSU test for the first time (see section 2.3 for details), and scored within a window of 44 PSU points to either side of the loan program cutoff, which correspond to the I&K optimal bandwidth that allows me to control linearly for the running variable (see section 3).

4.1 Conditions for a Valid RD Design

4.1.1 Loan Eligibility

Those students who are classified into the four poorest income quintiles after completing the FUAS socioeconomic form are, in effect, pre-selected for loans. Figure 2 shows that the probability of completing the FUAS socioeconomic form and being classified into the four poorest income quintiles does not change at the cutoff, either for all students or for students by year of PSU process. Each dot in every figure represents the average rate of pre-selection for students in bins of 2 PSU points, and the dashed lines correspond to fitted values from a regression that controls for the PSU score using fourth order splines at each side of the threshold and 95% confidence intervals. For pre-selected students, loan eligibility changed sharply from 0 to 1 at 475, and forms the basis for the RD evaluation design.

Figure 3 shows loan take-up among pre-selected students. The upper left graph shows take-up for all students in all years pooled together, while the other graphs show the same by income quintile. As before, each dot represents average take-up among students within 2 PSU points, and dashed lines represent fitted values and 95% confidence intervals. The first vertical line indicates the loan eligibility threshold (at 475) while the second vertical line (at 550) corresponds to the cutoff for the Bicentenario Scholarship, which will be used in section 4.3 to estimate the price effect directly. These graphs show that a third of the students around the threshold took up either of the two loans, while nobody below the cutoff took up one of the loans, as expected. For the discontinuity that occurs at 550, the take-up of the two loans is substituted by the Bicentenario scholarship (more details will be given in section 5.1)

4.1.2 Local Continuity Assumption: Manipulation of the Assignment variable.

Because the eligibility conditions are public knowledge, students may try to self-select into treatment by manipulating their score to be just above the cutoff. This would violate the assumption that the assignment variable density is continuous at the cutoff (McCrary, 2008). I argue that manipulation is not feasible in this context. First, as explained in section 2.2, the PSU test contains only multiple choice questions that are graded by an optical device, and, therefore, it is an objective measure of the test outcome.[26] Second, to verify this formally, Figure 4 shows the empirical density function of PSU scores and the fitted values from an estimation using fourth order splines for the assignment variable at each side of the cutoff, plus 95% confidence intervals. The test shows that the density function is statistically continuous at the cutoff, which confirms that PSU scores are not subject to manipulation around the cutoff.

[26] Moreover students are assigned to random locations (in the same city) with random evaluators for the day of the test

4.1.3 Local Continuity Assumption: Balance of Covariates.

As a second test for the validity of the regression discontinuity design, I show that baseline characteristics are balanced at the cutoff.

First, as mentioned in section 2, no other aid or loan program influences the financial conditions for students in the vicinity of 475 (see Table 1). Secondly, I use equation (1) to show the balance on covariates at the discontinuity, where Y_i is now a covariate.

Table 2 and 3 show the balance of covariates (for a linear f using the optimal bandwidth of $w^* = 44$ PSU points) for the population of students, for the group that is pre-selected for loans, and for pre-selected students by income quintile. The first column in each category shows the level of the covariate at the cutoff (the parameter β_0 in equation 1), the second column shows the change in the covariate for students barely above the threshold (β_1), and the third column the t-value of the difference. Table 2 shows the population, the pre-selected sample and the first two income quintiles, and Table 3 shows the last three income quintiles. Table 2 shows that the covariates are balanced, with a few exceptions. The population is not balanced at the 10% level of significance in number of females and high school GPA. Above the threshold, there are approximately 1% more female students, and, surprisingly, students have a 0.3% lower GPA. For the second poorest income quintile, the number of females and the indicator of whether the student was already working before taking the PSU test are not balanced at 5% of significance. Table 3 reports similar conclusions: students above the cutoff are very similar to those barely below the cutoff, except for two or three characteristics in each quintile.[27] This evidence shows that the differences that appear in the data are in line with errors of type I, i.e., of the 170 t-tests reported in these tables, 13, 6 and 0 reject the null at the significance levels of 10%, 5% and 1% respectively, below the hypothetical levels of 17, 8.5 and 1.7.

Figure 5 shows the balance for 11 of these baseline characteristics presented in Table 2 for the pre-selected group. All variables appear perfectly balanced at the cutoff.

All the conditions for a valid RDD are satisfied. Therefore, the comparison between students barely eligible and barely ineligible will give the causal effects of access to loans on enrollment and progress.

4.2 Effect on College Enrollment

Table 4 shows the main estimations of the paper. Column (1) (our preferred specification) shows the estimation of equation (1) for pre-selected students (those for whom access to loans changes sharply at the cutoff, given that they completed the FUAS form and were classified into the lowest

[27] The unbalance for type of high school is considered as only one characteristic because voucher, public and private high schools are perfectly collinear.

four quintiles), where Y_i is the probability of enrolling in college and f is linear, for the sample of students within the optimal bandwidth of 44 points. Column (1) shows that scoring at least at the cutoff implies a 35.7% probability of enrolling in college, compared to the 18.3% probability of enrollment for the control group. This increment of 17.4 percentage points implies a relative increase in the probability of enrollment of nearly 100%.

Column (2) shows the same estimation for the sample of non-pre-selected students (those who either did not complete the FUAS form or completed it and were classified into the highest income quintile). It shows that the probability of college enrollment does not increase at the cutoff, which is an indication that students do not believe that scoring more than 475 is a signal of students' suitability for college (either to college admissions officers, or to the students themselves). Additionally, non-pre-selected students around the cutoff have a lower enrollment rate than pre-selected students below the cutoff. This indicates that those who self-select to complete FUAS have a higher preference for college.

Column (3) estimates equation (2) for the whole population of students for the optimal bandwidth and replicates the results for Columns (1) and (2). To show that the results are not sensible to the chosen bandwidth and the specification of f, Column (4) estimates equation (2), where f is a different 4th order polynomial spline for each of the four groups of students (preselected and non-pre-selected, below and above the cutoff), and the sample is the whole population of students. The results are basically the same, i.e., the probability of enrolling in college increases roughly 100%, from 18.5% of those who were pre-selected but score just below 475, to 34.7% of those barely above the threshold. Column (5) shows a third specification, f, which is again linear, but the bandwidth is 4 PSU points.[28] The results are even stronger: scoring equal to or greater than 475 implies an increase of 16.2 percentage points in the probability of enrolling, but this time the control group enrolls at 13.6%, and therefore the relative increase is 120%. Moreover, the pre-selected group is now not statistically different than the group that did not complete FUAS. Nevertheless, these results may be affected by small sample bias, despite the fact that the sample is quite large (roughly 14,000 students).

Finally, columns (6) to (8) show regressions for the preferred specification (equation (2) with a linear f, within a bandwidth of 44 points) for each year separately. As a sign of robustness, these columns show that the same conclusions can be inferred every single year, considering that each year is an independent natural experiment.

For a broader perspective about the results presented above, Figure 6 shows the enrollment rate for the whole PSU support for the population of preselected students. The upper figure shows the effect for the three years pooled together and the smaller figures below show the effect for each year separately. These pictures show why the estimation is not sensitive to bandwidth or functional

[28] 4 PSU points is the maximum bandwidth that fails to reject the null hypothesis of no difference in baseline characteristics when simple t-tests are used (not controlling by PSU score)

specification. Appendix B shows a sensitivity analysis: for different bandwidths from two to 80 PSU points, I show estimations of equation (1) using a linear (to the left) and 4th order polynomial (to the right) specification of f to find very similar estimations for the effect (top figures) and the relative change (bottom figures) with respect to the enrollment rate for the control group.

4.3 Enrollment Gap by Family Income

This section addresses whether access to these loans helps reduce the existing enrollment gap between students from high and low income families, by exploiting the income quintile classification given by the tax authority.

I estimate the effect on the probability of enrollment by income quintiles, interacting equation (1) with dummies for the quintiles. The analysis is equivalent to that in section 4.2, comparing individuals with and without access to loans, but within income quintiles. In this case, information on income quintiles is missing for all the students who did not complete the FUAS form, and therefore, the analysis is restricted to those with income quintile information.[29]

Table 5 shows the estimation. The first column presents results for all the years pooled together and the following columns for each year separately. Focusing on all years together, we observe that the effect is stronger for the poorest quintile. Access to these loans caused an increase in the enrollment probability of 20 percentage points for students in the first quintile, whereas the enrollment rate for barely ineligible students is 13.3 percent in this quintile. This implies that having access to tuition loans led to a 151% increase in the enrollment rate.

The effects are slightly smaller but not significantly different for quintiles 2 and 3 (an increase of 17 and 16 percentage points in each case). Because the enrollment rate for the students barely below the threshold are 17% and 15%, respectively, these increments imply relative increases of 103% and 106% in the probability of enrollment for quintiles 2 and 3 respectively. For the fourth quintile, the effects are weaker: the effect is not statistically different from zero in 2008. For all the years pooled together, having access to loans causes an increment in the enrollment probability of 7 percentage points. Figure 7 shows the estimations in graphical form by income quintile.

To see what happened with the enrollment gap by family income, Figure 8 shows these results in perspective for all years pooled together.[30] The graph on the left of panel A reproduces the results of Table 5, showing the jump in enrollment at the discontinuity by quintile, plus 95% confidence intervals, while the graph on the right (of panel A) shows the estimates for the enrollment rate, separated for ineligible and eligible students at the threshold, and 95% confidence intervals.

[29] I performed an analysis for the whole population, estimating the income quintile using observable characteristics from the sample that has this information and performing an out-of-sample prediction. The results are very similar to those presented here, and are available upon request.

[30] Equivalent figures for each year show the same patterns. These results are not shown but are available upon request.

The latter figure shows that the college enrollment rate increases with family income for the group without access to tuition loans. Thus the enrollment gap between students from the poorest income quintile and students from the richest is very similar to the enrollment gap found in the whole population - 15 percentage points - and is statistically different than zero. The enrollment rate for the poorest quintile is 15% percent, while the richest income quintile has an enrollment rate of 30%.[31]

By contrast, among students with access to loans, the enrollment gap by income quintile is statistically zero. The enrollment rate is 35% for the poorest quintile and 33% for the richest.

In conclusion, conditional on being around the cutoff (i.e., graduating from high school, taking the PSU test, and scoring around 475), access to these programs eliminates the college enrollment gap by family income.

4.4 College Progress.

In the previous section, I showed that access to loans has an important effect on first year enrollment and on reducing the enrollment gap by family income. Nevertheless, if the students receiving these loans are not prepared to succeed in college and drop out easily, the effects on first year enrollment may not be enough to increase the educational attainment of the students or to reduce the educational attainment gap. I explore the persistence of the effects of having access to loans, analyzing college progress, defined as enrollment in the second and third year, and showing the effects on the educational gap by family income on enrollment on second and third year. In appendix A, I present evidence that access to loans decreases the dropout rate.

4.4.1 Effect on College Progress

Here, second and third year enrollment are defined as being enrolled continuously since the first year. This ad hoc definition is a consequence of data availability. Because I observe only three years with full information (PSU scores, income quintile, enrollment), it is not possible to determine whether a student drops out or stops studying for a year to work, in order to solve her lack of access to financial markets problems.[32] On the other hand, one could believe that ineligible students are simply delaying enrollment, rather than changing their rate of college enrollment.[33] To rule out this possibility, I show the probability of whether a student will ever enroll in college.

[31]The population enrollment gap (poorest to richest) calculated with this data may present biases if students from the richest income quintile do not apply for benefits, because they may know a priori that they are not eligible. In that case, quintile information would be missing, and therefore those students wouldn't be considered in the calculations of Table 5 and Figure 8. I address that problem by calculating the population enrollment gap using the Chilean household survey CASEN 2006 and 2009, finding similar estimates as those calculated using this data.

[32]I do not observe class performance for these students while in college, therefore this definition is agnostic about students' true advancement in coursework.

[33]Nevertheless, Kane (1994) argues that delaying college entrance is consistent with the hypothesis of binding liquidity constraints.

Panel A in Table 6 presents results using the linear specification previously described for the pre-selected sample in the first three columns and for the whole population in the last three.[34,35]

Column (1) shows the enrollment probability in the second year: having access to college tuition loans increases the probability of reaching the second year of college by 20 percentage points. In relation to the enrollment rate for the control group (10 percent), the relative effect at the discontinuity is equivalent to a 200% increase. Column (2) shows that third year enrollment[36] increases by 19 percentage points for those barely eligible for loans. Relative to the enrollment rate for the control group (4.8 percent), the effect is equivalent to a 400% increase in the probability of reaching the third year in consecutive years. Column (3) shows that just having access to the loans increases the probability of ever being enrolled in college by 15 percentage points which, relative to those just ineligible, corresponds to an increase of 50%.

Columns (4) to (6) repeat these estimations, now including the students who did not apply for financial aid and people classified in the richest quintile. The results are almost identical for the group of pre-selected students (those who completed FUAS and were in the lower four quintiles). Moreover, crossing the cutoff acts as a placebo test for ineligibles and confirms that students scoring at least at the cutoff do not consider loan eligibility an indication of their suitability to succeed in college. Finally, these estimations show that pre-selected students do not react differently than the rest of the population, since the parameter is statistically zero in columns (4) and (5).

The difference in the enrollment rate between eligible and ineligible students continues to be stable from the first to the second to the third year, and increases dramatically in relative terms, indicating that credit access not only matters for initial enrollment, but also helps students stay in college.

4.4.2 College Progress by Income Quintile

Table 7 shows the effect on college progress by income quintile. As before, the dummy for being eligible due to a PSU score at or just above 475 on the first attempt is used as an instrument for being eligible in the second and the third year, using the linear specification described before.[37]

Columns (1) to (3) show enrollment in the second year and column (4) shows enrollment in the third year.

[34] The results are highly robust to different functional specifications and different bandwidths. These results are not shown but are available upon request.

[35] Panel B in Table 6 shows the first stages of the different definitions of eligibility used in the 2SLS setting for enrollment in the second and third year, i.e., the portion of compliers who completed FUAS.

[36] Here, we only observe the behavior of the cohort that took the PSU for the first time in 2007. They are the only ones that can be tracked up to the third year in the data.

[37] The results are also highly robust to different specifications and bandwidths. Those results are available upon request.

These results show that the effects are very similar for the first three income quintiles, but they are stronger in relative terms for the poorest. Column (3) shows that students who have access to the loan programs increase their second year enrollment rate by 22 percentage points compared to the enrollment rates for ineligibles: 6%, 10% and 11% for quintiles 1, 2 and 3, respectively. This represents relative increases of 266%, 120% and 100%, respectively. The fourth income quintile also benefits from the loan programs; eligible students increase their enrollment probability in the second year by 6 percentage points. Students in the fifth income quintile have statistically the same second year enrollment rate around the cutoff.

Similar changes occur for the third year enrollment. The poorest three income quintiles have higher impacts on enrollment in the third year. The first three quintiles increase their enrollment from 21 to 25 percentage points, representing relative increments of 607%, 814% and 382%.

Regarding the enrollment gap by family income, Panel B of Figure 8 shows the enrollment rate separated for students barely eligible and ineligible by income quintile. The left graph shows enrollment in the second year and the right shows enrollment in the third. Those figures show a strong income gradient in college progress for students who have no access to tuition loans, i.e., the second year enrollment rate among students from the richest income quintile is three times the rate for the poorest. This gap increases to eight times (richest to poorest) for enrollment in the third year. By contrast, the gap between the poorest and the richest quintiles is statistically zero when access to the loans is granted. In conclusion, access to loans not only reduces the gap in initial enrollment, but the effects are persistent in later years, allowing students from poor backgrounds to have the same enrollment rate as the richest in the country.

4.5 Validity Check

One potential concern is that other policies may have affected college enrollment at the cutoff. The most important potential confounding factor is that some traditional universities require students to have a minimum PSU score in order to apply, which, in some cases, coincides with the eligibility score cutoff for loans. These minimum score requirements at the threshold may imply that the supply of programs significantly decreases for students who are below the eligibility cutoff. If this decrease in the choice set leads students not to enroll, then the conclusions presented above would be overestimated.

Appendix C shows evidence that the choice set for students below the cutoff does not decrease significantly, for three reasons. First, universities set minimum score requirements for admitting students into specific programs of study, and generally fills vacancies with students whose scores are much higher than PSU 475, not affecting the decisions of those at the loan eligibility cutoff. Second, most programs that do not fill their vacancies above the minimum requirements, do not always enforce their own requirements for program eligibility, i.e., the score for the last enrolled student is usually below the minimum score that is supposedly required for that program. The most conservative measure of the reduction of the choice set indicates that 76 programs (1.4% of the 5,500 programs available to students at the loan eligibility cutoff, offered in the three years considered) restricted the number of accepted students to exclude those below the minimum PSU score required. Finally, the great availability of programs allows students to adjust their behavior by choosing close substitutes to those few programs that enforce their own minimum score requirements. I show that, in term of program characteristics, the programs available for students around the cutoff are the same in term of length (semester to graduation), tuition costs, expected income, and expected employability. As a consequence, the enrollment rate is not affected by these minimum scores.

5 Price Versus Access Effect

A natural question is whether these effects in enrollment are a consequence of access to credit markets (an "access effect"), or are due to a change in the price of higher education (a "price effect"), a consequence of implicit subsidies, such as lower-than-market interest rates or low repayment enforceability, that are present in these tuition loans.[38]

As prima facie evidence, the World Bank report on SGL (World Bank (2011), p. 11) estimates that 68% of SGL beneficiaries "would not have been able to attend without CAE [SGL] assistance." For all graduates with SGL, "Three quarters of these students likely never would have graduated, and one-quarter likely would have graduated but only after undergoing much greater hardship to pay for their studies." These calculations are based on all students receiving SGL, including high achieving students (high PSU scores) who would have received other types of aid from the government and from the institutions in which they enrolled. The World Bank also considers students from the fifth income quintile who mistakenly were awarded loans in 2006, as well as students from the fourth income quintile who are probably not financially constrained, as will be argued in section 5.3 . Nevertheless, their estimations are not causal measures of the effect of credit restrictions; instead, they are based on enrollment trends for the years before the introduction of the SGL program, compared to enrollment and dropout data for the years 2006 to 2010, when the SGL has been fully active.

To decompose the total effect into price and access effects, I present the following three tests.

5.1 Estimating the Price Effect Directly

The first test directly estimates the price effect. Specifically, it compares the enrollment rate of students who must finance the full tuition cost to those who receive a scholarship that covers tuition almost in full, in a context where access to credit is available for everybody (no access effect). As

[38] Dynarski (2003) called these effects the liquidity and subsidy effects respectively.

usual, students who receive scholarships are different from those who do not. To address these endogeneity problems, I use another natural experiment of the same type as exogenous variation in access to scholarships.

Table 1 presented the requirements to qualify for scholarships delivered by the Ministry of Education. Most of them depend on PSU score cutoffs, enabling the use of a regression discontinuity design. As discussed above, the Bicentenario scholarship is available to students who are in the two poorest income quintiles, score above 550 points on the PSU test, and enroll in traditional universities.[39] Because it covers in full the reference tuition,[40] it constitutes a significant drop in the cost of university education.

Because all students scoring 475 PSU points or higher have access to college tuition loans, there is no access effect around the Bicentenario scholarship cutoff. Therefore, the comparison between the college enrollment rates of those who score at or barely above the scholarship cutoff of 550 PSU points, with those slightly below, gives the causal effect of the reduction in tuition cost on the enrollment rate, i.e., the price effect.

The upper-left graph in Figure 9 shows the rate of students receiving the Bicentenario scholarship among students who meet all requirements around the scholarship cutoff point (as before, the sample is restricted to pre-selected students who take the PSU for the first time to avoid selection). By definition, nobody below the threshold received the benefit, while 38% of students barely above the threshold received the scholarship, and therefore their tuition was reduced by approximately 90%.

The bottom graphs on Figure 9 show the effects on enrollment around the scholarship cutoff. The bottom left graph reproduces Figure 6 for the two poorest income quintiles with vertical lines at 475, 500 and 550, while the The bottom-right graph shows a close-up of the previous graph to enlarge the effects around 550.

More formally, Table 8 presents the same outcomes. Column (1) shows the change in the probability of receiving the Bicentenario scholarship and Column (2) shows a linear regression for equation (1) around the cutoff of 550. The reduction in the tuition costs did not affect enrollment, i.e., the estimated price effect is zero.

If this scenario were true for those around 475, we could conclude that the effects for enrollment and progress are mainly due to the difference in access to credit markets. However, there may be differences between the enrollment decisions of students receiving this scholarship and those who get scores around 475. To eliminate this problem in part, I perform the same analysis using another scholarship with a cutoff point closer to 475: the Teachers' Children scholarship (Beca Hijo de Profesor, BHDP), which considers a cutoff of 500 points. The main disadvantage is that this program generates much less variation in the rate of beneficiaries than the previous program (see

[39]The same tests are made to check the validity of RDD: Balance on observed characteristics, bunching at the cutoff, and a discontinuous number of recipients around the cutoff. Those tests are not presented here but are available upon request.

[40]Reference tuition is defined in Section 2.2.

Table 1).

To gain access to this scholarship, students need to satisfy the following requirements: first, complete the FUAS form and be classified in one of the four poorest income quintiles; second, be children of teachers or employees of public and voucher schools; and third, score 500 points or more on the PSU. This scholarship provides a benefit level which is about a third of the reference tuition for college discussed above.

The left graph of Figure 10 shows the change in the rate of beneficiaries of the Teachers' Children scholarship relative to eligible students. The comparison is between these scholarship recipients and the entire pool of students who meet the scholarship criteria except for being children of an eligible teacher. I do not know how many students are in fact the children of a teacher or another employee of an eligible school. Even though the industry in which parents work is observable in the data, I cannot tell whether those working in education are working in schools or other educational institutions that make their families eligible for the scholarship. In addition, many students do not report the industry in which their parents work. The right graph confirms what the previous figures show: that there is no change in college enrollment, despite the significant drop in the price of education. These results are confirmed in Table 8. Column (4) shows the change in the probability of receiving the scholarship and Column (5) shows the change in the enrollment rate at the cutoff. The price effect is again statistically zero.

The price effects measured by both of these scholarships are based on students who have higher PSU scores than 475, and therefore they may not fully reflect the population of interest: the students around the loan threshold. To address that problem, the following two tests shed light on what happens around 475.

5.2 Evidence from a Survey

To shed more light on the importance of liquidity constraints on students college enrollment decisions, this section presents evidence from a survey applied to the same students across the eligibility cutoff. Students who were first time takers and completed the FUAS socioeconomic form between 2007 and 2009 were invited by email to answer a web survey performed in October of 2012. The survey was designed for a broader study on the relationship between education and different outcomes (see Solis, 2013). The survey was administered by the Universidad Católica de Concepción, a traditional university that is part of CRUCH, which sent the emails and merged the responses with administrative data from the PSU process, enrollment in higher education, etc.

The first concern it is how representative of the population is the survey sample. Over the 200,000 emails that were sent, roughly 25,000 were opened (12.5%), and 10,000 responded (5%); thus, the rate of response among those who viewed the invitation was 40%.

There are many reasons that potentially can explain this rate of response. First, these email addresses were self-reported by students between 2007 and 2009, and they may have not been kept by the students after they began study or work. Second, it may be that the invitation email went directly to spam folders, mainly because the invitation was sent through an email address not previously known by the students, and contained words such as "invitation," "survey," "questionnaire," "raffle," "iPad," and "tablet," all of which raise red flags for email servers. Third, students may follow the common recommendation from IT technicians that suggest not opening emails from unknown senders.[41]

To show whether there is selection among the survey respondents, I use equation (1) interacted with a dummy for surveyed students to compare baseline characteristics between survey respondents and the population across the cutoff. Results are reported in Table 9.[42] For each base line characteristic, Column (1) indicates the population level for students at the cutoff (ϵ below the cutoff), Column (2) indicates the jump on the value of that characteristics for students who are (barely) above the cutoff, Column (4) shows the difference for survey respondents (below the cutoff), and Column (6) shows the difference in levels for survey respondents above the cutoff.

This table shows, first, that surveyed students above and below the threshold (Column (6)) are comparable in observables, suggesting that both groups can be considered as a good counterfactual. Second, around the threshold, survey respondents are almost identical to the population, except for two characteristics that are significantly different at the 5% level: type of high school and being married. Moreover, Panel A in Table 10 shows that students who answered the survey show the same increases in college enrollment relative to the population previously presented (this table shows a linear specification with the optimal bandwidth $w^* = 44$ in Column (1), a fourth order polynomial using the whole sample in Column (2), and by income quintile from column (3) to column (7). Together, this evidence suggests that the surveyed sample is a good representation of the population of interest.

Figure 16 shows the questionnaire structure and Panel B of Table 10 shows the results for the main questions. The first four columns in Panel B of Table 10 show the RD regressions where the dependent variable is an indicator of whether a student reported not having enrolled because of financial problems (specifically, the indicator takes the value of 1 if a student marked options "I could not afford it" or "I had to work to get income," in question Q2b of Figure 16). Columns (1) and (2) consider the whole sample of surveyed students across the threshold (for a linear and a 4th order polynomial specification of the control function f in equation (1)). These columns indicate that 30% of all students below the eligibility cutoff report that financial problems prevent them from enrolling in college, whereas eligibility for loans reduces that figure by 10 to 12 percentage points. Columns (3) and (4) show the same regressions but are conditional on the sample of students who never enrolled in college. Among them, 56% report that they never enrolled in college because of

[41] To increase the response rate the survey offered a raffle of 3 tablets and 5 gift cards ($20 each).

[42] Each element of equation (1) is interacted with an indicator for survey respondents

financial problems, while this rate is reduced by 12 to 14 percentage point for those students who are eligible.

These outcomes are difficult to interpret because they are potentially contaminated by response or social desirability bias. It could be simpler for students to blame financial problems when they are not interested in college education, especially when the society sees college education as a social ladder and pressures young individuals to pursue it. On the other hand, it could be that students do not want to reveal their true financial status because of the potential stigma of being poor. Nevertheless, if the proportion of students affected by these biases is balanced across the threshold, the effects would be consistently estimated.

Moreover, these outcomes can also reflect that fact that students were surveyed in 2012, and the outcome analyzed previously is based on enrollment of students who first took the PSU test between 2007 and 2009. Many students who did not enroll after the first attempt at the PSU test enrolled in subsequent years, sometimes after they scored at or above 475 on a later attempt. Therefore, students who enrolled following a PSU test that was not their first attempt were not asked why they did not enroll after the first attempt; this may bias downward the effects.

With these problems in mind, it is interesting to see that the magnitude of the effect across the threshold is not statistically different than the increment in college enrollment presented previously. This evidence is in line with the idea that liquidity constraints constitute the most important cause of the difference in college enrollment across the cutoff.

Columns (5) to (8) show different potential explanations for the difference in college progress. Column (5) on Table 10 shows whether the dropout decisions are affected by access to the loan programs (question Q7 in the survey presented in Figure 16). The reported results are conditional on having enrolled in college once, and therefore this measurement suffers from at least two types of bias: small sample bias and selection bias. The former is because only 13% of respondents have enrolled and then dropped out, and the latter is because those who enroll in college with scores below the cutoff are from families with higher income and more educated backgrounds, which should bias the effects negatively. Contrary to the liquidity constraint hypothesis, the estimated effect is positive, but not significantly different than zero. These results are consistent with those in Stinebrickner and Stinebrickner (2008), who find that credit constraints are not an important factor in determining dropout decisions in the U.S.

Column (6) shows the probability of working during college, while columns (7) and (8) show work intensity during college, measured as the number of months worked during the year and the total earnings. The liquidity constraint hypothesis predicts that access to loans would allow students to avoid working at the intensive and extensive margins, i.e., students who do not have access to loans because their scores are below the cutoff would need to find a job and work more hours to fund their investments in college. Again the analysis presented in this table is conditional on having enrolled in college, and therefore, cannot be interpreted as causal. The first two measures of work are consistent with the liquidity constraint hypothesis, and the third is not, although neither is significantly different than zero.

5.3 Responses for Differentiated Access to Credit Markets

Section 2.2.3 discussed the characteristics of the conventional financial market for college loans in Chile. Such loans require the parents of the student to have a good credit record, a formal source of income, and minimum earnings. The minimum earning requirements exclude the two poorest quintiles and part of the third, while the requirement of a formal source of income could potentially exclude students from all income quintiles, since a third of the employment in Chile is informal (i.e., no contract or independent). Potentially, families from all income quintiles can experience barriers to full access to credit markets; the two poorest income quintiles are definitely excluded, but some students from higher quintiles may also be excluded if their parents do not work in the formal sector.

The SGL was created to imitate loans in the current financial market with similar interest rates, and with special clauses to increase enforceability; see section 2.2.2, and therefore it can be used as a benchmark relative to conventional market loans. If we ignore the formal sector requirement in conventional market loans, we can argue that students from the second-highest income quintile are not credit constrained because, by definition, they meet the minimum income requirements to get access to loans in this conventional market. Therefore, these students will only substitute these conventional market loans in favor of SGL if the latter offers a significant reduction in price, e.g., lower interest rates or low enforceability. The third test uses these facts; it defines students from the fourth income quintile as not restricted and students from the poorest two income quintiles as restricted from access to credit markets, and compares their responses when they have SGL as the only option.

The logic is straightforward: for non-restricted students, the inclusion of the SGL would have no effect on their enrollment unless there is a price effect. The test can be implemented by analyzing students from different quintiles who choose private universities because these students can only opt for SGL.

Table 11 shows that there is no change in enrollment for the fourth income quintile in private universities in 2007, 2009, and for all the sample pooled together, while for 2008 the effect is marginally significant. This indicates that SGL is seen by students as equivalent to the loans in the conventional credit market, i.e., the price effect due to SGL is zero. Additionally, the larger response for the first two quintiles, which do not have access to other loans in the formal market, indicates that these effects are driven by the accessibility of loans rather than by a change in the price of education.[43]

[43] Panel B of Table 11 gives the relative importance of these effects on the change in enrollment relative to the rate of those barely ineligible.

Having access to the SGL implies a 105% increase in the probability of enrollment for the first quintile, while the increment is 61% and 44% for quintiles two and three respectively, indicating that those with fewer financial opportunities are the ones driving the effects.

None of the three tests presented here is a perfect measure of how important the access effect is, but taken together they are evidence that the results in the previous sections are mainly driven by the partial elimination of credit access restrictions for the lowest income quintiles.

6 Conclusions

In this paper, I exploit the sharp eligibility rules of two programs in Chile that give access to tuition loans to students who score above a given threshold on the national college admission test. This enables a regression discontinuity design which, when combined with full information on students' enrollment and financial aid, and an admission system that weights only two observed variables, allows the unbiased estimation of the causal effect of credit access on college enrollment and college progress.

The results around the cutoff show that enrollment increases dramatically for students who have access to the loan programs. For every student who enrolls in college with no access to loans, two students enroll when these loans are available. This enrollment effect is enhanced over time in the second and third years of college. For each student without access to these loans who enrolls in the second year, three students who do have access to loans enroll in the second year; for each student without access who enrolls in the third year, five students who have access enroll in the third year.

Most strikingly, this paper shows that access to the loan programs appears to eliminate the relatively large income gradient in college enrollment and progress. Among those who are just below the test score threshold for loans, students coming from the richest quintile are twice as likely to enroll as students from the poorest income quintile, an enrollment gap very similar to the whole population. In contrast, among students who are just at or above the threshold for loans, the enrollment gap is statistically zero.

The same is true for enrollment in the second and third year. Among students who are just below the loan eligibility threshold, students from the richest income quintile are three and eight times more likely to enroll in the second and third year, respectively, compared to students from the poorest income quintile. In contrast, among students who are just at or above the eligibility cutoff, there is no statistical difference between the enrollment rates of the richest and the poorest students.

Finally, I show evidence from three different tests, to disentangle the effects into the effect of implicit subsidies and the effect of access to loans. All of them point in the same direction, which is that access to loans drives the results. The first test shows that a different set of students facing a substantial exogenous reduction in tuition costs have the same enrollment rate as students who finance tuition costs with loans, meaning that a reduction in educational costs has no effect after students are granted access to loans. In a second test, a sub-sample of students was asked about the main reasons they did not enroll in college. I find two main conclusions. First, the most frequent answer pointed to financial constraints. Second, the number of students prevented from enrolling because of financial problems drops at the loan eligibility cutoff at a rate that is indistinguishable from the effects from enrollment in the first year, i.e., the increase in enrollment is equivalent to the decrease of relief from financial constraints. Finally, a third test uses SGL as a market loan benchmark to show that potentially non-constrained students do not benefit from this loan, indicating that the price effect, for this loan, is zero.

Comparing these results with the previous literature is difficult, mainly because the literature has focused on the U.S. Moreover, the programs analyzed here constitute a shift from a regime with no access to aid or private loans, to one with access to college tuition loans. Most of the literature analyzes the effects of marginal changes in aid or loan programs already in place, and therefore, these studies capture, in part, how successful those programs are in eliminating such constraints. Nevertheless, this paper sheds light on what happens with college enrollment when aid programs fall behind tuition costs increases, as seen in the U.S. in recent years (see for example Belley and Lochner (2007)). It is of special interest in middle to low income economies, where there are fewer programs to alleviate financial constraints. This type of imperfection in financial markets may have substantial consequences in access to college education and the development of highly skilled workers, with the obvious consequences for growth and economic development.

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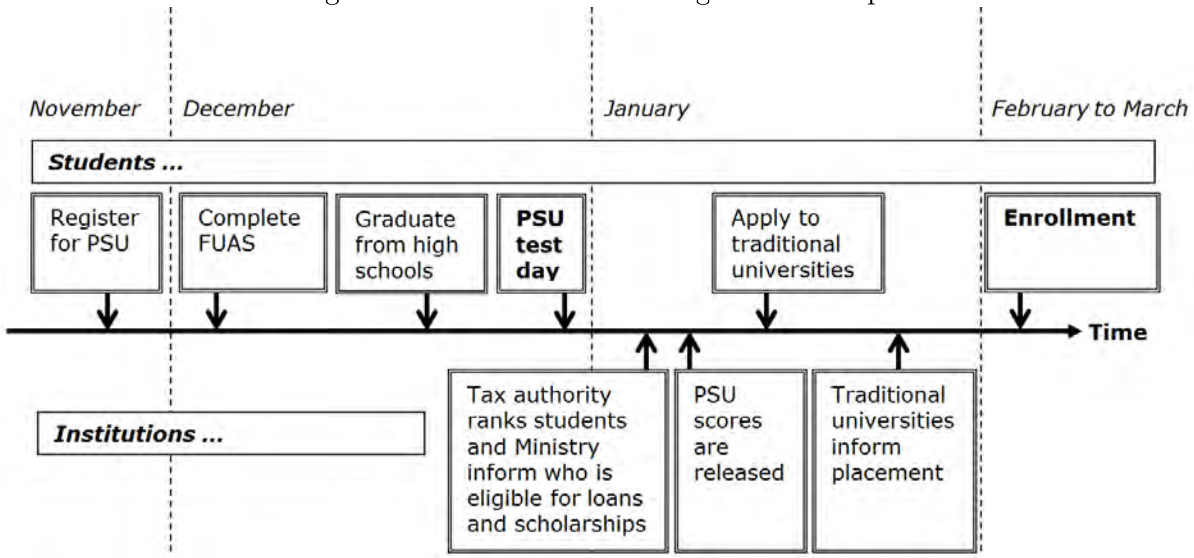
http://documents.worldbank.org/curated/en/2011/03/16406290/chiles-state-guaranteed-student-loan-program-cae

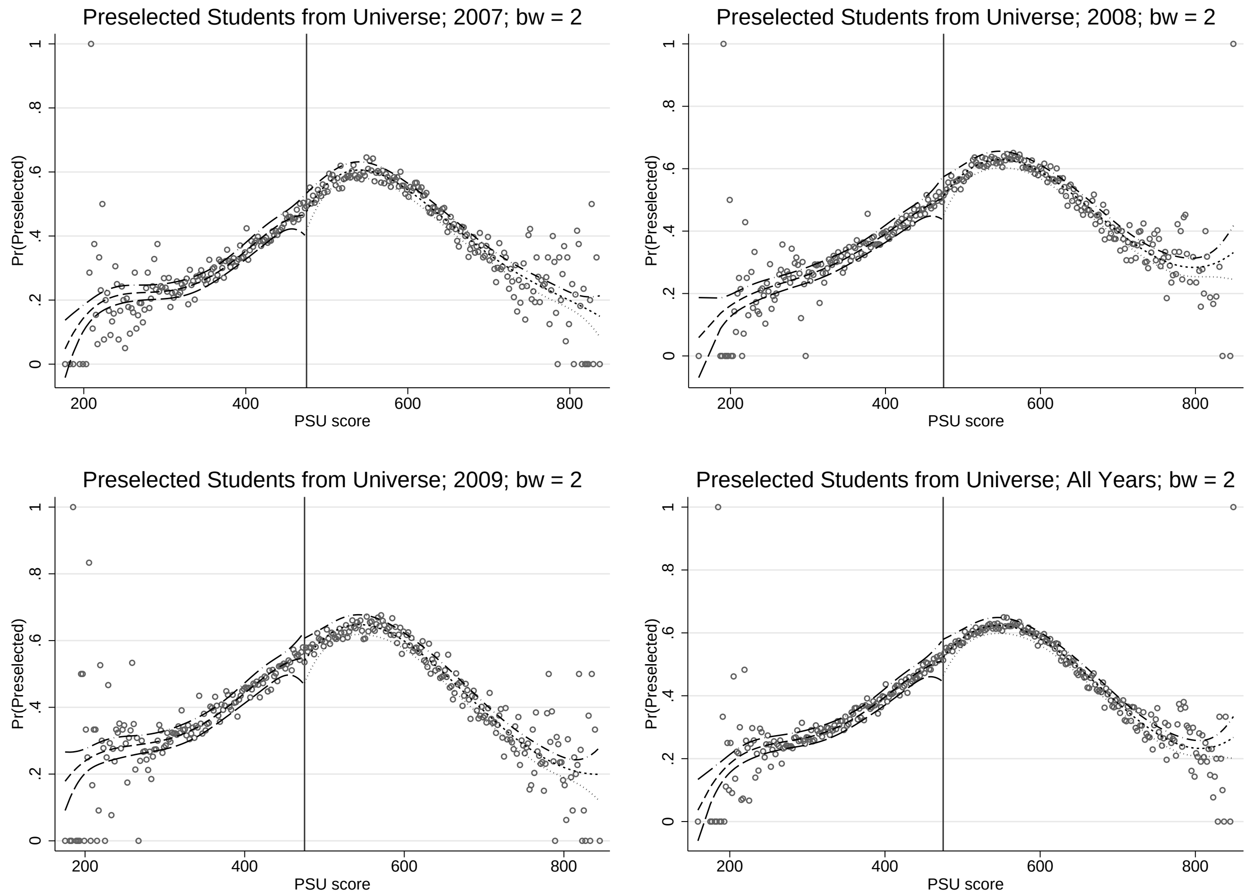
8 Tables and Figures

Figure 1: Time-line of the college admission process



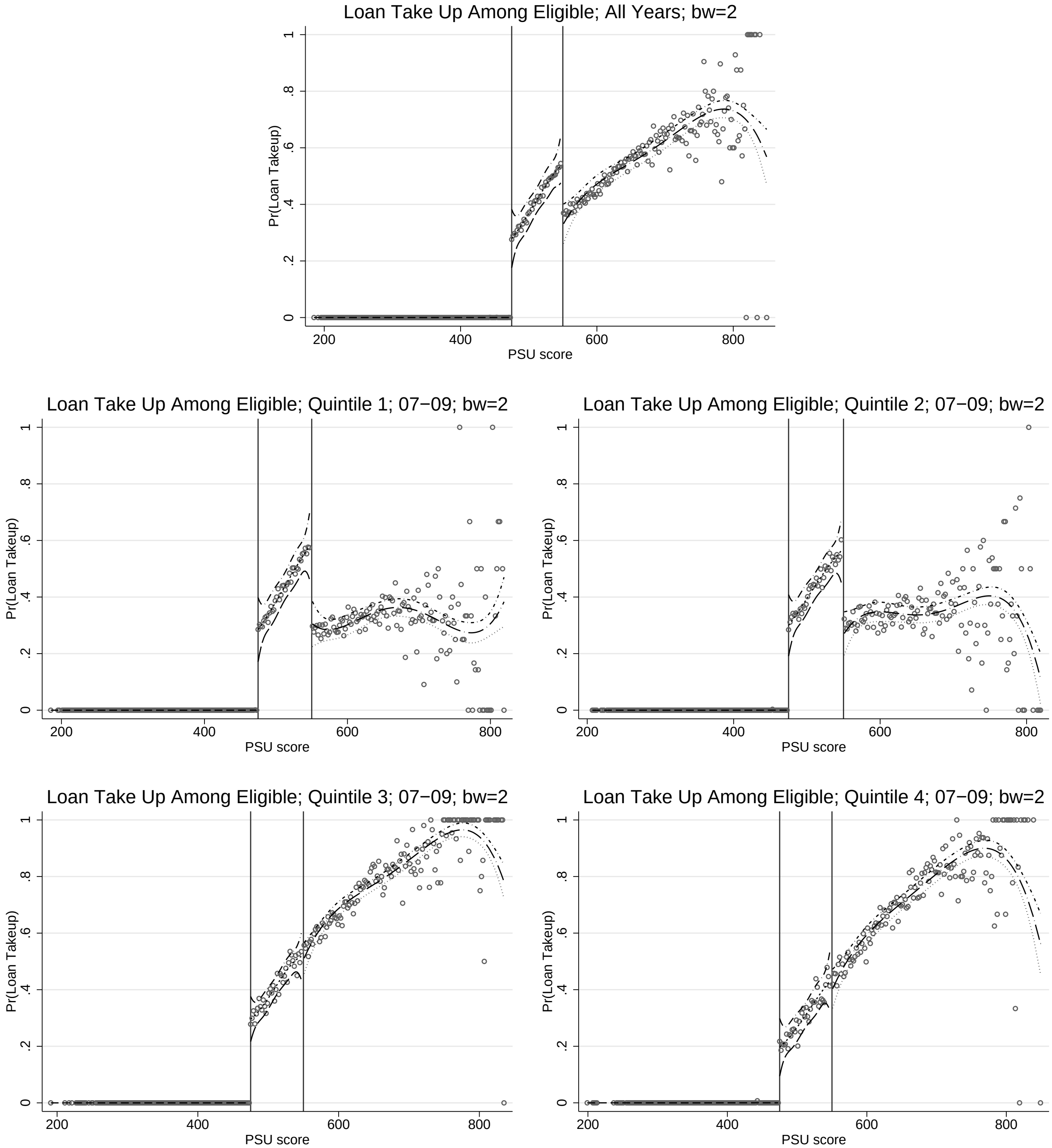
Above the time-line, the decisions taken by students. Below the time-line, the timing of information releases.

Figure 2: Probability of being *Preselected* for loans.



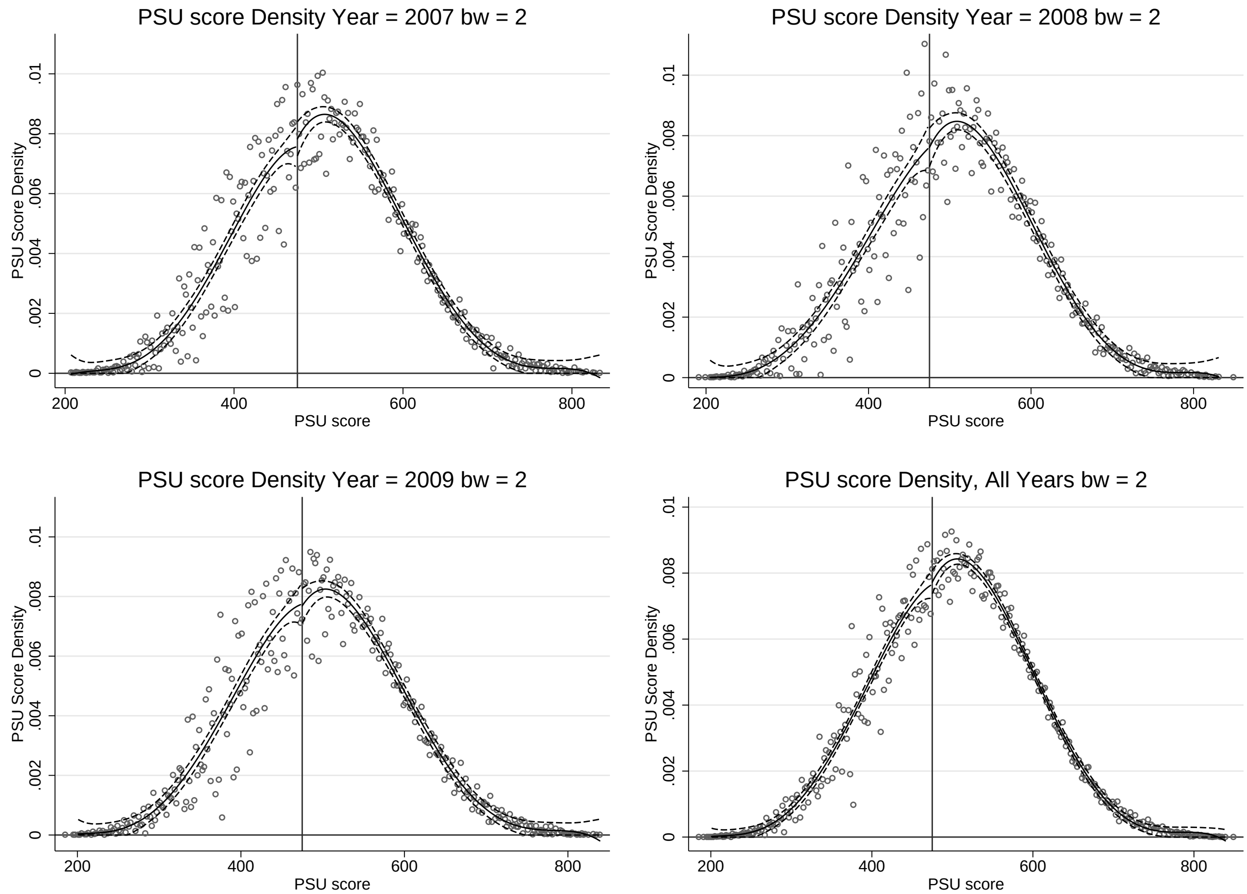
Note: Each dot indicates the preselection rate of students with scores in an interval of 2 PSU points (all students included). On average each dot contains 670 students. The dashed lines represent fitted values from a 4th order polynomial spline and 95% confidence intervals for each side. The vertical line indicates the cutoff (475).

Figure 3: Loan take up. Probability of taking up a college tuition loan among preselected eligible students.



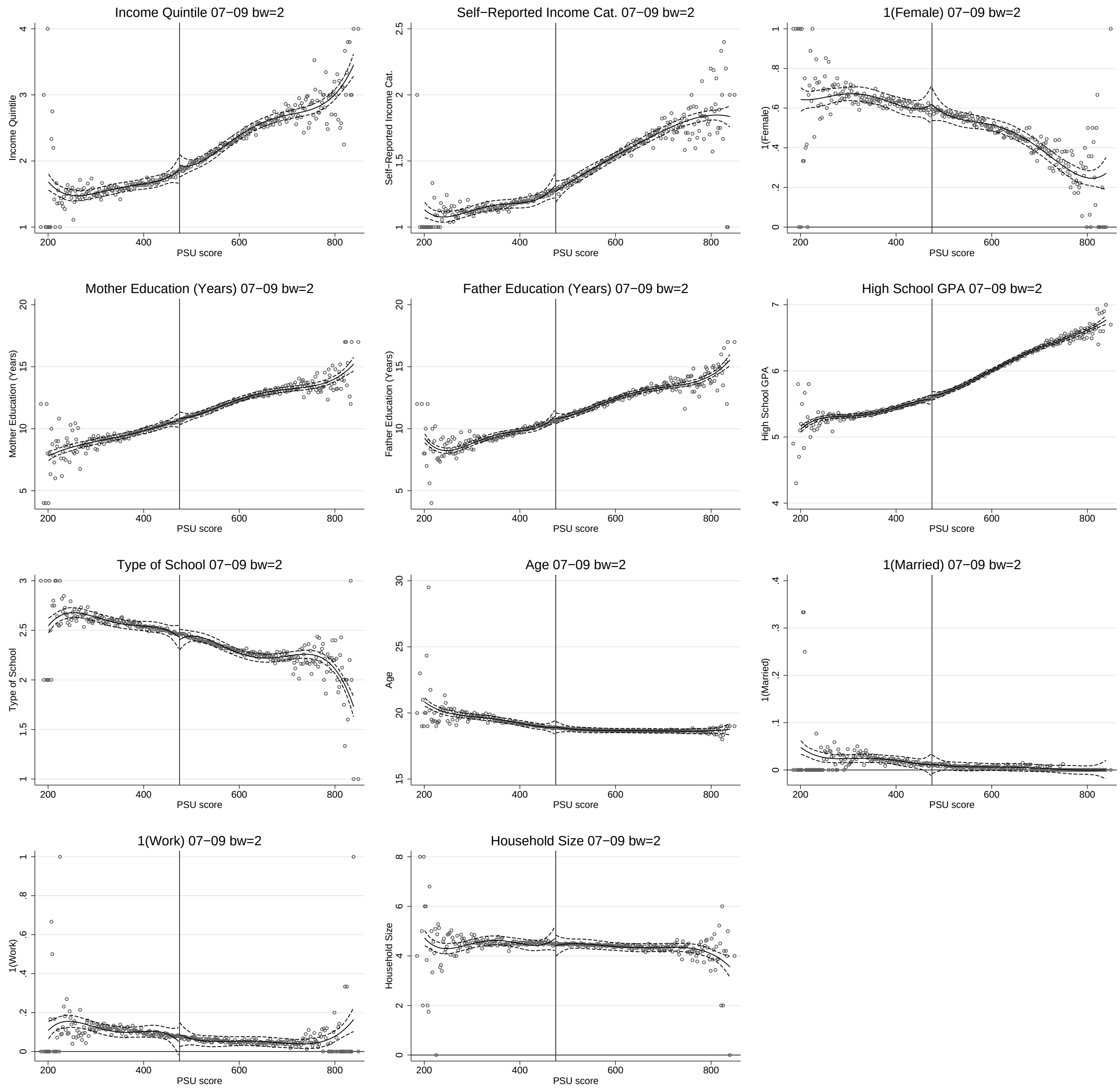
Note: Each dot represents average loan take-up relative to eligible students, in an interval of 2 PSU points. To the right of the cutoff, each dot contains on average roughly 441 students receiving the loans. The dashed lines represent fitted values from a 4th order spline and 95% confidence intervals for each side. The vertical line indicates the cutoff (475).

Figure 4: RD for PSU scores frequency distribution.



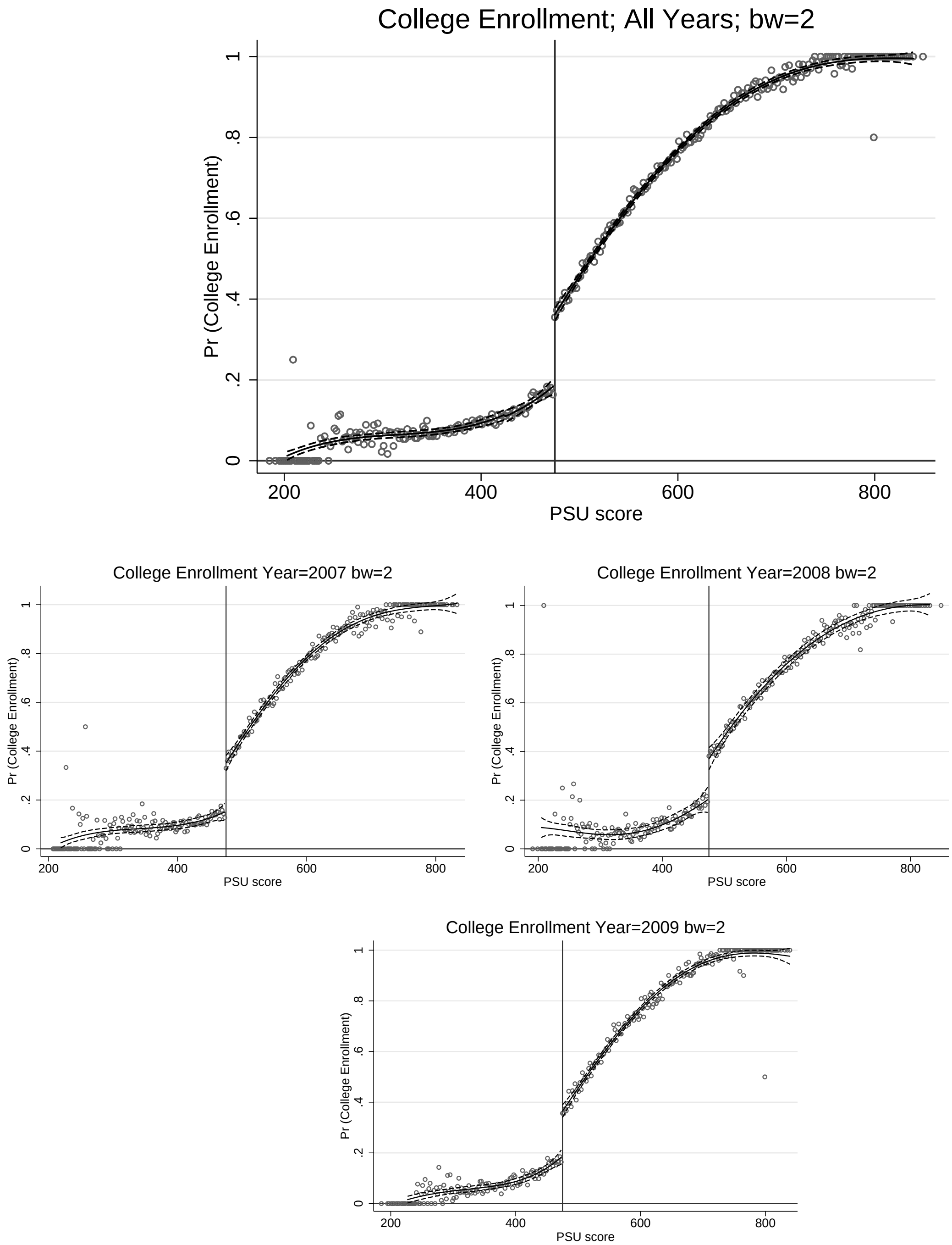
Note: Each dot represents the density of PSU scores in an interval of 2 points. The sample considers only students who satisfy all requirements to be eligible for college loans and take the PSU immediately after graduating from high school.

Figure 5: RD for base line characteristics. Full sample.



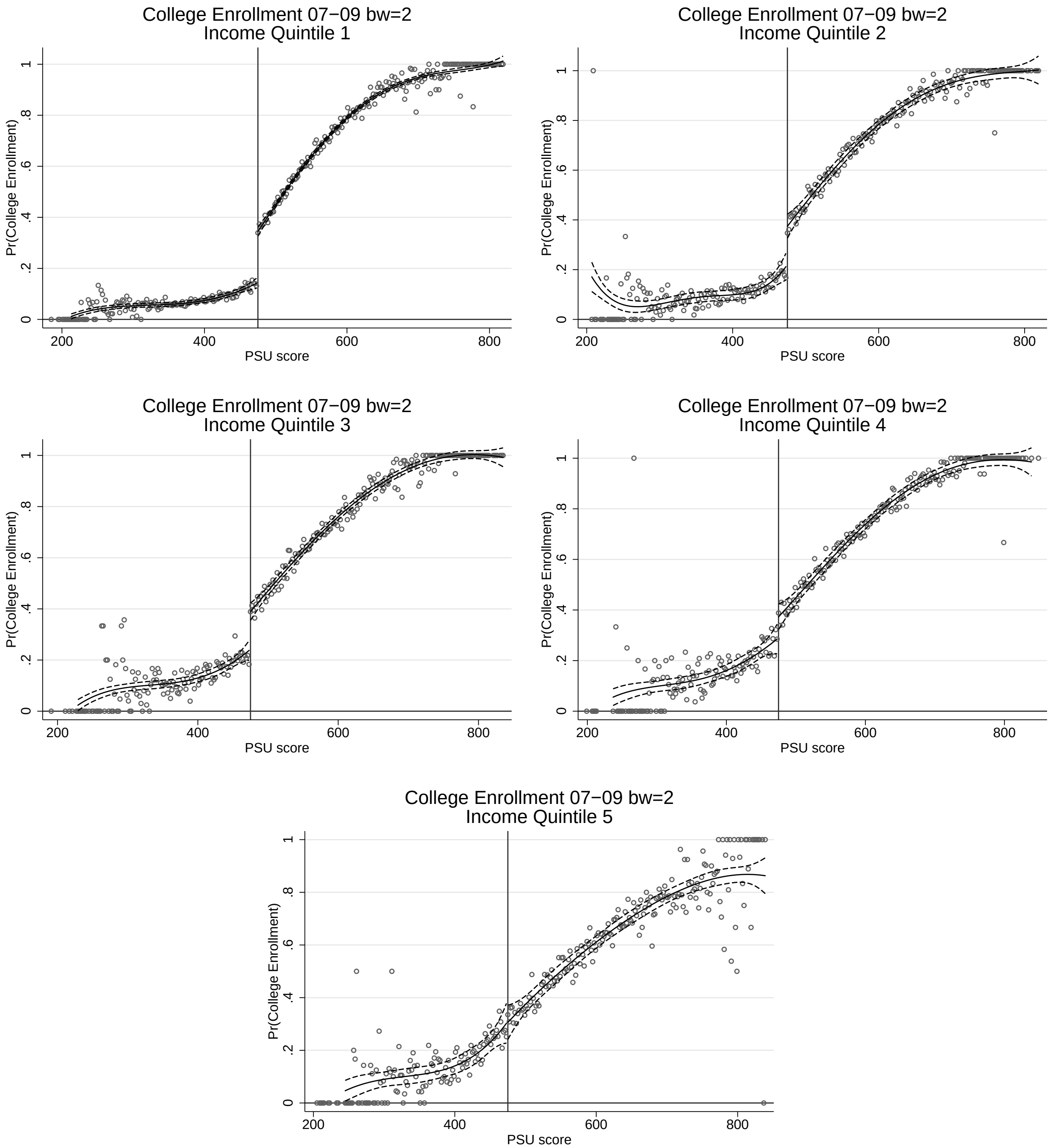
Note: Each dot represents the average of the variable in an interval of 2 PSU points. The dashed lines represent fitted values from a 4th order spline and 95% confidence intervals for each side.
The vertical line indicates the cutoff (475). These graphs show the full sample of preselected first-time takers students.
Self-reported income is classified in three categories, 1 being the lowest. School type is classified in three categories, 1 for private, 2 for voucher, and 3 for public schools.

Figure 6: RD for College enrollment. Full sample.



Note: Each dot represents average college enrollment within bins of 2 PSU points (bw=2).
The dashed lines represent fitted values from a 4th order spline and 95% confidence intervals for each side.
The vertical line indicates the cutoff (475).
These graphs show the full sample of students fulfilling all requirements to be eligible for college loans and taking the PSU immediately after graduating from high school.

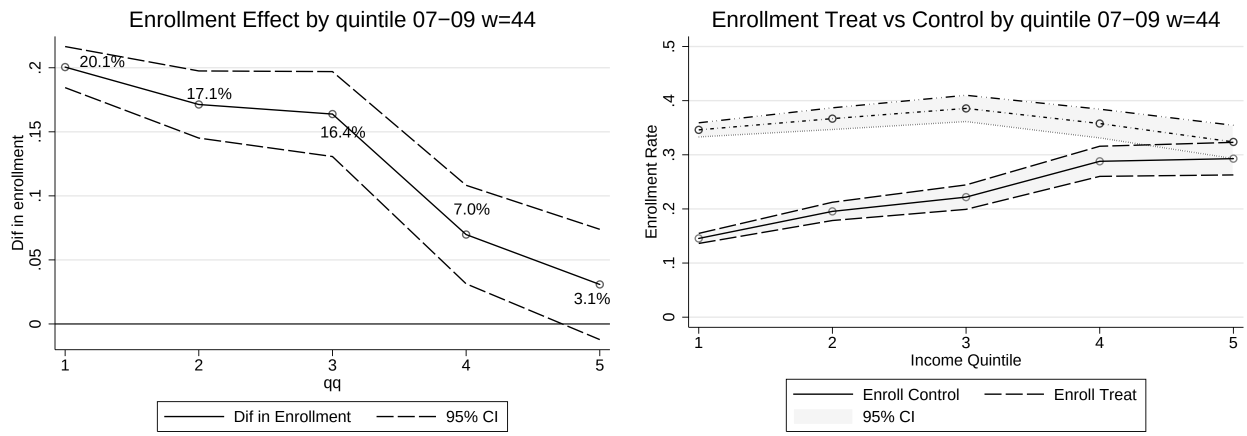
Figure 7: RD for College enrollment by income quintile. Whole PSU support.



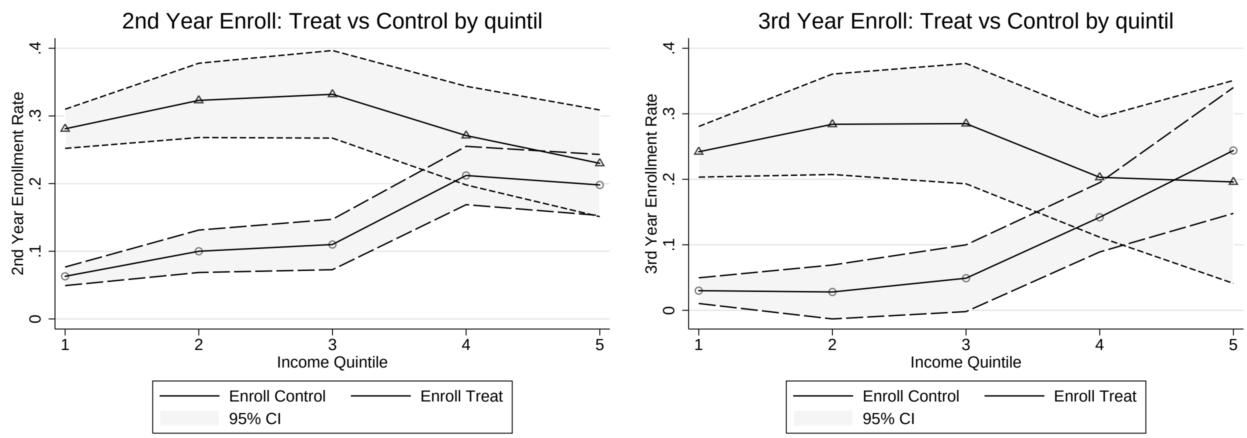
Note: Each dot represents average college enrollment within bins of 2 PSU points (bw=2).
The dashed lines represent fitted values from a 4th order spline and 95% confidence intervals for each side.
The vertical line indicates the cutoff (475).
These graphs show the full sample of students fulfilling all requirements to be eligible for college loans and taking the PSU immediately after graduating from high school.

Figure 8: Enrollment rate by quintile years 2007 to 2009 pooled together.

Panel A: First year enrollment.



Panel B: Second and third year enrollment.



Note: On the upper left figure, each point represents the effect of access to college loans on enrollment by income quintile (and 95% confidence intervals from robust standard errors) for all years of the sample pooled together. The upper right and the bottom figures show the estimation of the enrollment rate (first, second and third year respectively) at each side of the cutoff by income quintile (and 95% confidence interval).

Figure 9: Estimating the price effects using Bicentenario Scholarship.

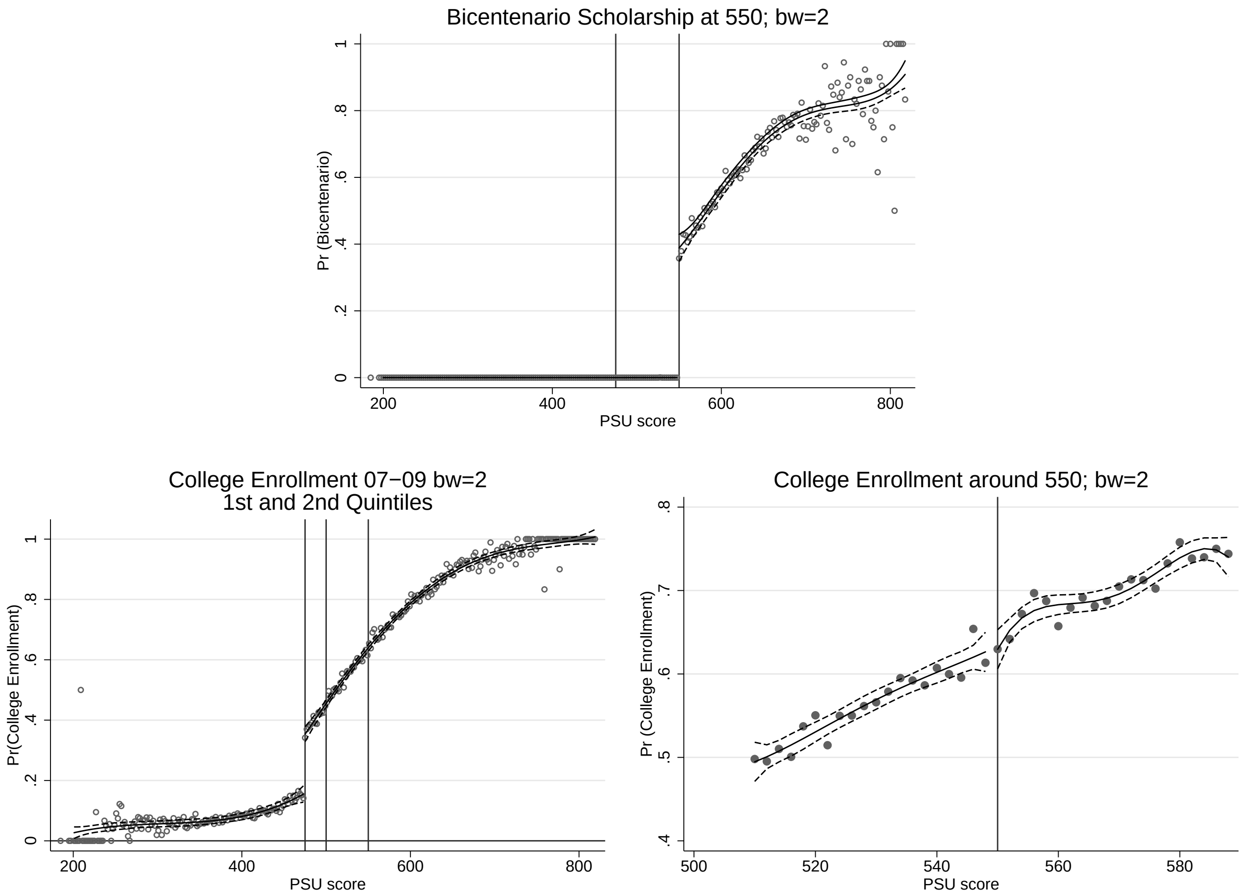


Figure 10: Estimating the price effects using Teacher Children Scholarship

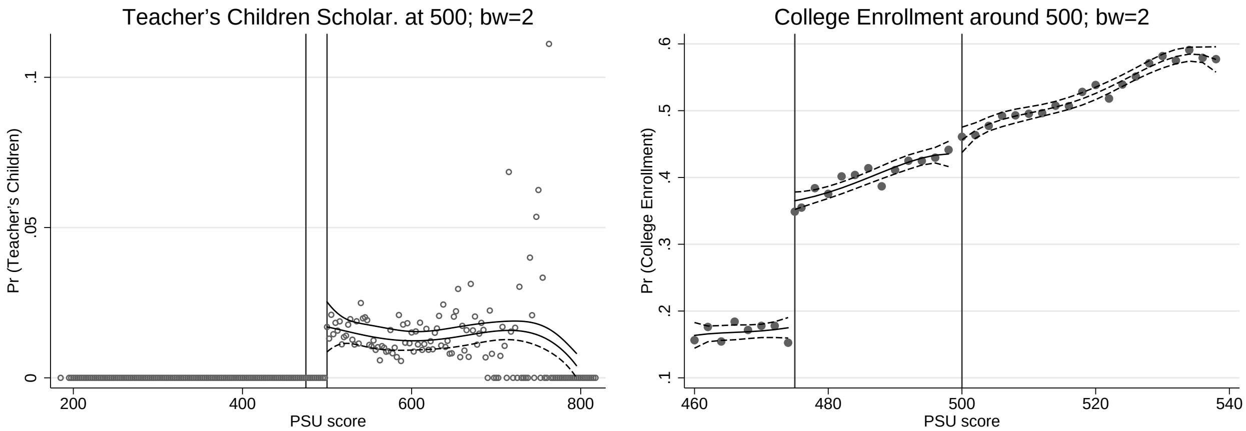


Table 1: Requirement for scholarships

PANEL A: Requirements for loans and scholarships.

	% Recipients[1] with respect to: Population	Eligibles	Requirements: Income quintiles	PSU Cutoff	Institution type	Cover
	(1)	(2)	(3)	(4)	(5)	(6)
Loans						
State Guaranteed	9.46%	27.90%	1 to 4	**475**	Accredited[+]	(a)
Traditional Loan	8.58%	21.92%	1 to 4	**475**	Traditional[++]	(a)
Scholarships and Grants						
Bicentenario	4.70%	55.14%	1 and 2	550	Traditional	(a)
Juan Gomez Millas	0.02%	0.87%	1 and 2	640	Accredited[2]	(a)
PSU Score grant	0.02%	0.05%	1 to 4	-	Accredited[3]	(b)
Exellence	2.32%	4.78%	1 to 4	-	Accredited[2,4]	(a)
Teacher's children: BHDP	1.02%	3.98%	1 to 4	500	All[5,6]	(c)
Pedagogy: BPED	0.07%	0.74%	all	600	Accredited[5]	(b)

PANEL B: Income quintile definitons.[(*)]

Income Quintile	I	II	III	IV
Upper bound Monthly family Income in CLP	178,366	306,000	469,625	777,218
Upper bound Monthly family Income in USD	364	624	958	1,586

(1): Column (1) reports the ratio of recipients over students taking the test for the first time. Column (2) correspond to the ratio of recipients over those that take the PSU test for the first time, have applied to the benefit, belong to eligible quintiles and score more than the respective cutoff.
(2): Only students graduating from voucher and public high schools.
(3): National or regional best PSU score.
(4): Only for students in the top 5% of their graduating high school.
(5): Only student with high school GPA greater than 5.5 are eligible for BHDP, and only GPA greater than 6.0 for BPED. High School GPA goes from 1 to 7 points.
(6): Only for children of teachers and employees of voucher and public schools.
($^{+}$): "Accredited" refers to all accredited colleges (traditional and private) and accredited vocational institutions.
($^{++}$): "Traditional" refers to traditional universities which are all accredited.
(a): Funds up to reference cost.
(b): Funds up to fixed value, about the same magnitude than reference tuition US $2,250 for univ., which corresponds to the average reference tuition, and US $1,000 for vocational programs).
(c): Funds up to US$1,000 which correspond to a quarter of the university average tuition or total vocational school tuition.
(*): Source: CASEN 2009. Calculated using autonomous income per family. Household autonomous income included salaries, rents, subsidies from the governments, pensions, etc. for all members of the family.

Table 2: Balance of Covariates. Population, preselected and by income quintiles

	Population			Preselected			Quintile 1			Quintile 2		
	Level	Dif	abs(t)	Level	Dif	abs(t)	Level	Dif	abs(t)	Level	Dif	abs(t)
Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Self-reported Income	1.38	0.003	(0.58)	1.28	-0.003	(0.405)	1.12	-0.005	(0.764)	1.28	-0.004	(0.279)
Income quintile	2.09	0.014	(0.777)	1.83	0.020	(1.334)	1			2		
Mother years of education	10.96	-0.019	(0.518)	10.66	-0.002	(0.035)	9.86	-0.093	(1.343)	10.92	0.104	(1.039)
Father years of education	11.03	-0.008	(0.19)	10.64	-0.010	(0.174)	9.81	-0.068	(0.875)	10.79	0.031	(0.28)
1(female)	0.541	0.009	(1.729)*	0.593	0.001	(0.191)	0.593	0.015	(1.583)	0.613	-0.037	(2.467)**
High school GPA	53.94	-0.175	(1.751)*	55.13	-0.070	(0.59)	55.59	-0.114	(0.7)	54.92	0.063	(0.249)
Public high school	0.437	0.005	(0.938)	0.476	0.011	(1.501)	0.553	0.003	(0.308)	0.45	0.019	(1.225)
Voucher high school	0.515	-0.004	(0.701)	0.508	-0.009	(1.204)	0.438	-0.003	(0.299)	0.532	-0.013	(0.882)
Private high school	0.043	0.000	(0.216)	0.013	-0.002	(1.585)	0.006	0.000	(0.149)	0.012	-0.004	(1.265)
1(married)	1.02	-0.001	(0.718)	1.02	0.000	(0.089)	1.02	-0.002	(0.625)	1.02	-0.001	(0.282)
1(work)	0.03	0.001	(0.628)	0.028	0.000	(0.033)	0.03	-0.004	(1.151)	0.022	0.010	(2.061)**
HH size	4.47	-0.005	(0.241)	4.49	-0.021	(0.829)	4.59	0.006	(0.172)	4.46	-0.048	(0.899)
Mother has formal work	0.291	0.001	(0.304)	0.279	-0.001	(0.206)	0.216	-0.010	(1.306)	0.315	-0.013	(0.936)
Father has formal work	0.552	0.004	(0.811)	0.515	0.005	(0.771)	0.437	-0.003	(0.265)	0.549	0.018	(1.181)
Will leave HH	0.202	0.000	(0.035)	0.23	-0.003	(0.577)	0.246	-0.004	(0.424)	0.223	-0.010	(0.76)
Both parents live	0.771	0.001	(0.34)	0.77	0.006	(0.979)	0.756	0.004	(0.438)	0.773	0.001	(0.112)
Mother Housewife	0.498	-0.001	(0.156)	0.514	0.002	(0.318)	0.551	0.008	(0.864)	0.481	0.016	(1.046)
Parents do not work	0.11	-0.002	(0.516)	0.118	-0.001	(0.305)	0.136	0.008	(1.126)	0.112	-0.009	(0.995)
Both parents work	0.162	0.001	(0.298)	0.138	-0.001	(0.153)	0.088	-0.007	(1.377)	0.147	-0.003	(0.23)
Mother some higher educ.	0.175	0.000	(0.029)	0.146	0.001	(0.195)	0.081	0.002	(0.298)	0.145	0.008	(0.782)
Father some higher educ.	0.189	-0.001	(0.274)	0.15	0.000	(0.052)	0.095	-0.005	(0.845)	0.137	0.003	(0.322)
Mother dropout high Sch.	0.439	0.000	(0.076)	0.459	-0.002	(0.245)	0.551	0.015	(1.566)	0.419	-0.013	(0.894)
Father dropout high Sch.	0.451	-0.002	(0.346)	0.482	-0.003	(0.424)	0.572	0.014	(1.467)	0.461	-0.024	(1.613)
Mother college graduate	0.059	0.002	(0.87)	0.042	0.001	(0.22)	0.017	0.002	(0.701)	0.033	0.005	(0.875)
Father college graduate	0.074	0.000	(0.057)	0.046	-0.001	(0.259)	0.022	0.003	(0.968)	0.036	0.002	(0.308)
Observations		150356			79352			41303			17249	

Note: Dif refers to the β_1 of equation (1). t-values in parenthesis (in absolute values). (**): p⩽5%, (*): p⩽10%
Self-reported income is classified in three categories, 1 being the lowest.

Table 3: Balance of Covariates. Population, preselected and by income quintiles. Continued..

	Quintile 3			Quintile 4			Quintile 5		
	Level	Dif	abs(t)	Level	Dif	abs(t)	Level	Dif	abs(t)
Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Self-reported Income	1.53	-0.015	(0.752)	1.71	-0.005	(0.209)	1.68	0.066	(2.077)**
Income quintile	3			4			5		
Mother years of education	11.72	0.104	(0.884)	12.65	-0.147	(1.081)	12.52	-0.115	(0.698)
Father years of education	11.72	0.179	(1.404)	12.76	-0.208	(1.462)	12.57	-0.162	(0.907)
1(female)	0.577	0.025	(1.324)	0.578	-0.020	(0.958)	0.564	0.017	(0.723)
High school GPA	54.35	0.182	(0.569)	54.29	-0.262	(0.778)	54.31	-0.348	(0.84)
Public high school	0.359	0.042	(2.28)**	0.3	0.009	(0.482)	0.3	0.038	(1.716)*
Voucher high school	0.615	-0.032	(1.719)*	0.661	-0.012	(0.622)	0.648	-0.042	(1.817)*
Private high school	0.023	-0.010	(1.897)*	0.036	-0.004	(0.535)	0.047	0.002	(0.184)
1(married)	1.02	0.009	(1.309)	1.01	0.003	(0.494)	1.02	0.007	(0.789)
1(work)	0.037	-0.009	(1.417)	0.024	0.007	(1.119)	0.032	-0.011	(1.432)
HH size	4.32	0.018	(0.292)	4.34	-0.132	(1.96)*	4.38	-0.040	(0.498)
Mother has formal work	0.352	0.039	(2.128)**	0.416	0.005	(0.248)	0.392	-0.001	(0.028)
Father has formal work	0.639	0.006	(0.331)	0.675	-0.006	(0.302)	0.645	0.005	(0.199)
Will leave HH	0.213	-0.002	(0.163)	0.185	0.012	(0.718)	0.223	-0.019	(0.962)
Both parents live	0.795	0.012	(0.818)	0.798	0.015	(0.879)	0.8	0.023	(1.217)
Mother Housewife	0.475	-0.018	(0.948)	0.455	-0.028	(1.325)	0.441	0.009	(0.363)
Parents do not work	0.097	-0.014	(1.307)	0.074	-0.007	(0.603)	0.085	0.004	(0.273)
Both parents work	0.209	0.014	(0.919)	0.27	0.005	(0.257)	0.257	-0.010	(0.476)
Mother some higher educ.	0.225	0.013	(0.828)	0.365	-0.044	(2.221)**	0.342	-0.006	(0.261)
Father some higher educ.	0.228	0.020	(1.226)	0.335	-0.023	(1.149)	0.328	-0.001	(0.023)
Mother dropout high Sch.	0.335	-0.017	(0.991)	0.253	-0.014	(0.79)	0.262	0.017	(0.803)
Father dropout high Sch.	0.348	-0.022	(1.225)	0.259	0.006	(0.306)	0.28	0.022	(1.014)
Mother college graduate	0.075	-0.006	(0.585)	0.141	-0.006	(0.447)	0.149	0.010	(0.546)
Father college graduate	0.084	-0.013	(1.322)	0.136	-0.011	(0.791)	0.167	-0.001	(0.034)
Observations		11499			9301			7115	

Note: Dif refers to the β_1 of equation (1). t-values in parenthesis (in absolute values). (**): p$\leqslant$5%, (*): p$\leqslant$10%
Self-reported income is classified in three categories, 1 being the lowest.

Table 4: Effects on College Enrollment. Comparing Pre-selected with non Pre-selected students.

Dependent Variable:	College Enrollment							
	Pre-selected	Not eligible	Population, 07-09 pooled			Population, by year		
			Linear	Poly 4th	Linear	2007	2008	2009
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$1(T \geq \tau)$	.174	.003	.003	.008	.023	-.013	.011	.012
	(.006)***	(.006)	(.006)	(.006)	(.018)	(.009)	(.010)	(.009)
Const.	.183	.158	.158	.159	.136	.153	.178	.143
	(.004)***	(.004)***	(.004)***	(.004)***	(.015)***	(.006)***	(.006)***	(.006)***
Pre-selected			.025	.026	.022	.001	.032	.040
			(.005)***	(.006)***	(.021)	(.009)	(.010)***	(.009)***
Pre-selected$\times 1(T \geqslant \tau)$			.172	.162	.164	.202	.148	.165
			(.008)***	(.008)***	(.027)***	(.014)***	(.015)***	(.014)***
Obs.	79352	71004	150356	485629	13969	47221	49493	53642
R^2	.107	.02	.101	.352	.048	.102	.093	.108
Bandwidth	44	44	44	All	4	44	44	44

Table 5: RD College Enrollment by income quintile. By year and full sample. $w = 44$ PSU points.

	Pooled 07 to 09	2007	2008	2009
	(1)	(2)	(3)	(4)
$\mathbf{1}(T \geqslant \tau) \times q_1$	.201	.210	.186	.203
	(.008)***	(.015)***	(.016)***	(.013)***
$\mathbf{1}(T \geqslant \tau) \times q_2$	.171	.211	.160	.157
	(.013)***	(.026)***	(.022)***	(.022)***
$\mathbf{1}(T \geqslant \tau) \times q_3$	.164	.210	.162	.134
	(.017)***	(.031)***	(.028)***	(.029)***
$\mathbf{1}(T \geqslant \tau) \times q_4$	.070	.064	.033	.110
	(.020)***	(.032)**	(.036)	(.034)***
$\mathbf{1}(T \geqslant \tau) \times q_5$	.031	-.091	.042	.085
	(.022)	(.058)	(.030)	(.044)*
q_1	.133	.164	.142	.146
	(.008)***	(.009)***	(.007)***	(.005)***
q_2	.166	.219	.190	.195
	(.016)***	(.014)***	(.014)***	(.009)***
q_3	.154	.242	.257	.224
	(.020)***	(.019)***	(.020)***	(.011)***
q_4	.232	.345	.290	.287
	(.023)***	(.026)***	(.024)***	(.014)***
q_5	.318	.248	.372	.292
	(.038)***	(.019)***	(.032)***	(.015)***
Obs.	84605	24126	28536	31943
R^2	.378	.377	.379	.384

Robust standard errors in parenthesis. (***): p⩽1%, (**): p⩽5%, (*): p⩽10%

Table 6: Enrollment in Second and third years of college for all students around the cutoff in 2007 and 2008. $w = 44$

PANEL A: 2SLS IV Regression						
	Pre-selected			Population		
Dependent Var.:	Enrollment 2nd year	Enrollment 3rd year	Ever Enrolled	Enrollment 2nd year	Enrollment 3rd year	Ever Enrolled
	(1)	(2)	(3)	(4)	(5)	(6)
Eligible	.197	.190	.154	.199	.201	.146
	(.010)***	(.012)***	(.008)***	(.013)***	(.016)***	(.011)***
Const.	.099	.048	.316	.090	.052	.287
	(.006)***	(.007)***	(.005)***	(.004)***	(.004)***	(.004)***
$1(T \geqslant \tau)$				-.001	-.009	.007
				(.006)	(.008)	(.007)
Pre-selected				.008	-.007	.031
				(.007)	(.008)	(.007)***
Obs.	48044	22819	78072	94234	46153	147638
R^2	.074	.086	.119	.052	.064	.113
PANEL B: First Stage						
Instrumented: Ever been Eligible for loans						
Intrument—>	$1(T \geqslant \tau)$			Pre-selected$\times 1(T \geqslant \tau)$		
Intrument	.782	.790	.867	.768	.773	.858
	(.005)***	(.008)***	(.003)***	(.008)***	(.012)***	(.005)***

Robust standard errors in parenthesis. (***): p⩽1%.

Table 7: Enrollment in Second and third years of college for students around the cutoff by quintile. $w = 44$

2SLS IV Regression				
Dependent Var.:	Enrollment 2nd year in 2008	Enrollment 2nd year in 2009	Enrollment 2nd year pooled	Enrollment 3rd year in 2009
	(1)	(2)	(3)	(4)
$Eligible \times q_1$	.228 (.017)***	.207 (.019)***	.218 (.013)***	.212 (.017)***
$Eligible \times q_2$	.261 (.033)***	.198 (.031)***	.223 (.023)***	.256 (.033)***
$Eligible \times q_3$	.266 (.038)***	.189 (.037)***	.222 (.027)***	.236 (.039)***
$Eligible \times q_4$	.084 (.038)**	.029 (.045)	.059 (.030)**	.061 (.038)
$Eligible \times q_5$	-.054 (.062)	.062 (.039)	.032 (.033)	-.048 (.062)
q_1	.044 (.010)***	.083 (.012)***	.063 (.007)***	.030 (.010)***
q_2	.058 (.021)***	.128 (.021)***	.100 (.016)***	.028 (.021)
q_3	.060 (.026)**	.147 (.026)***	.110 (.019)***	.049 (.026)*
q_4	.152 (.027)***	.278 (.034)***	.212 (.022)***	.142 (.027)***
q_5	.275 (.049)***	.171 (.026)***	.198 (.023)***	.244 (.049)***
Obs.	24172	28583	52755	24172

Robust standard errors in parenthesis. (***): p⩽1%, (**): p⩽5%, (*): p⩽10%

Table 8: Measuring the price effects from exogenous change in college tuition.

	Bicentenario Scholarship			Teacher's children Schol.	
	Recipients Bicentenario scholarship at 550	College Enrollment at 550	Recipients of any benefit at 550	Recipients Teacher's Children at 500	College Enrollment at 500
	(1)	(2)	(3)	(4)	(5)
$\mathbf{1}(\mathrm{T} \geqslant \tau_s)$	.378	.012	.009	.021	-.008
	(.006)***	(.009)	(.009)	(.002)***	(.006)
Const.	.00005	.633	.625	-2.99e-14	.468
	(.004)	(.006)***	(.006)***	(.001)	(.004)***
Obs.	48370	48370	48370	82991	82991
R^2	.327	.03	.015	.013	.109

Robust standard errors in parenthesis. (***): p⩽1%.

All regressions are based on equation (1), using 44 point around the cutoff and a linear specification.

Table 9: Survey Balance of Covariates

	Full sample			Surveyed			
	Level	$1(T \geqslant \tau)$	se	1(survey)	se	1(survey)× $1(T \geqslant \tau)$	se
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Income Quintile	1.83	0.019	(0.015)	0.04	(0.07)	-0.06	(0.09)
Quintile 4	0.11	0.001	(0.005)	0.01	(0.02)	0.01	(0.03)
Quintile 3	0.14	0.006	(0.005)	-0.01	(0.02)	-0.02	(0.03)
Quintile 2	0.21	0.003	(0.006)	0.05	(0.03)*	-0.05	(0.04)
Quintile 1	0.53	-0.010	(0.007)	-0.04	(0.03)	0.06	(0.04)
Self-reported income	1.28	-0.002	(0.007)	0.04	(0.03)	-0.04	(0.04)
Mother years of Educ.	10.66	-0.002	(0.052)	0.15	(0.24)	-0.04	(0.3)
Father years of Educ.	10.64	-0.018	(0.057)	-0.001	(0.28)	0.21	(0.35)
1(female)	0.59	0.002	(0.007)	0.03	(0.03)	-0.02	(0.04)
High School GPA	5.60	0.002	(0.006)	0.01	(0.03)	0.01	(0.04)
Public high shool	0.47	0.013	(0.007)*	0.07	(0.03)**	-0.06	(0.04)
Voucher high school	0.51	-0.011	(0.007)	-0.07	(0.03)**	0.07	(0.04)
Private high school	0.01	-0.002	(0.002)	0.0	(0.01)	0.0	(0.01)
1(married)	0.01	0.000	(0.002)	-0.01	(0.01)**	0.02	(0.01)**
1(work)	0.08	-0.003	(0.004)	-0.002	(0.02)	-0.001	(0.02)
Household size	4.49	-0.023	(0.026)	0.2	(0.12)	0.06	(0.15)
Mother formal work	0.28	-0.002	(0.007)	0.06	(0.03)*	-0.03	(0.04)
Father formal work	0.52	0.008	(0.007)	0.02	(0.03)	-0.05	(0.04)
Will leave HH	0.23	-0.002	(0.006)	-0.03	(0.03)	0.02	(0.03)
Both Parent Live	0.77	0.004	(0.006)	-0.001	(0.03)	0.01	(0.04)
Observations		77,544			2,353		

Table 10: Survey outcomes

PANEL A: College Enrollment for Surveyed

Dependent Var.	College enrollment						
	Linear w=44	4th Pol. All sample	Linear, w=44 q1	q2	q3	q4	q5
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$1(T \geqslant \tau)$	.175	.170	.200	.169	.165	.072	.035
	(.006)***	(.006)***	(.008)***	(.014)***	(.017)***	(.020)***	(.022)
1(survey)	.029	.028	-.010	.024	.104	.115	.085
	(.026)	(.032)	(.032)	(.054)	(.082)	(.092)	(.099)
$1(\text{survey})\times 1(T \geqslant \tau)$	.003	.015	.010	.041	.005	-.067	-.110
	(.038)	(.040)	(.049)	(.078)	(.111)	(.120)	(.137)
Const.	.182	.183	.145	.195	.219	.285	.289
	(.004)***	(.004)***	(.005)***	(.009)***	(.012)***	(.014)***	(.016)***
Obs.	77544	230653	40317	16876	11244	9107	6948
R^2	.108	.336	.132	.109	.077	.047	.021

PANEL B: Survey outcomes

	Did financial problems prevent you from enrolling in College: Full sample		Never enrolled		Dropout due to financial problems	Work on college	Months of Work in college	Earnings in college
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$1(T \geqslant \tau)$	-.102	-.117	-.119	-.143	.013	-.004	-.212	38.62
	(.036)***	(.040)***	(.061)*	(.070)**	(.025)	(.059)	(.543)	(130)
Const.	.301	.301	.562	.571	.060	.630	4.44	577.1
	(.03)***	(.036)***	(.044)***	(.053)***	(.02)***	(.048)***	(.45)***	(108)***
f Specification	Linear	4th pol.	Linear	4th pol.	Linear			
Obs.	2370	8447	1011	2109	1359	1359	1359	1356
R^2	.041	.089	.009	.016	.002	.0004	.001	.002

Table 11: RD Private College Enrollment by income quintile. By year and full sample. $w = 44$ PSU points.

	PANEL A: Regression by quintile			
Dependent Var.:	Private College Enrollment in year			
	Pooled 07 to 09	2007	2008	2009
	(1)	(2)	(3)	(4)
$\mathbf{1}(\text{PSU}\geqslant\tau)$ x q1	.105	.107	.073	.125
	(.007)***	(.011)***	(.013)***	(.011)***
$\mathbf{1}(\text{PSU}\geqslant\tau)$ x q2	.086	.097	.059	.112
	(.011)***	(.020)***	(.019)***	(.020)***
$\mathbf{1}(\text{PSU}\geqslant\tau)$ x q3	.071	.085	.076	.060
	(.015)***	(.025)***	(.025)***	(.027)**
$\mathbf{1}(\text{PSU}\geqslant\tau)$ x q4	.020	-.012	.019	.053
	(.018)	(.026)	(.032)	(.032)*
$\mathbf{1}(\text{PSU}\geqslant\tau)$ x q5	.018	-.056	.048	.019
	(.020)	(.040)	(.028)*	(.042)
q1	.100	.074	.120	.106
	(.004)***	(.007)***	(.008)***	(.007)***
q2	.140	.092	.159	.152
	(.008)***	(.013)***	(.013)***	(.012)***
q3	.173	.109	.175	.219
	(.010)***	(.017)***	(.018)***	(.018)***
q4	.219	.158	.242	.260
	(.013)***	(.020)***	(.024)***	(.023)***
q5	.231	.189	.209	.316
	(.014)***	(.032)***	(.018)***	(.031)***
Obs.	86463	24889	29404	32170
R^2	.206	.167	.204	.243
Quintile	PANEL B: Relative increase			
q1	105%	145%	61%	118%
q2	61%	105%	37%	74%
q3	41%	78%	43%	27%
q4	9%	-8%	8%	20%
q5	8%	-30%	23%	6%

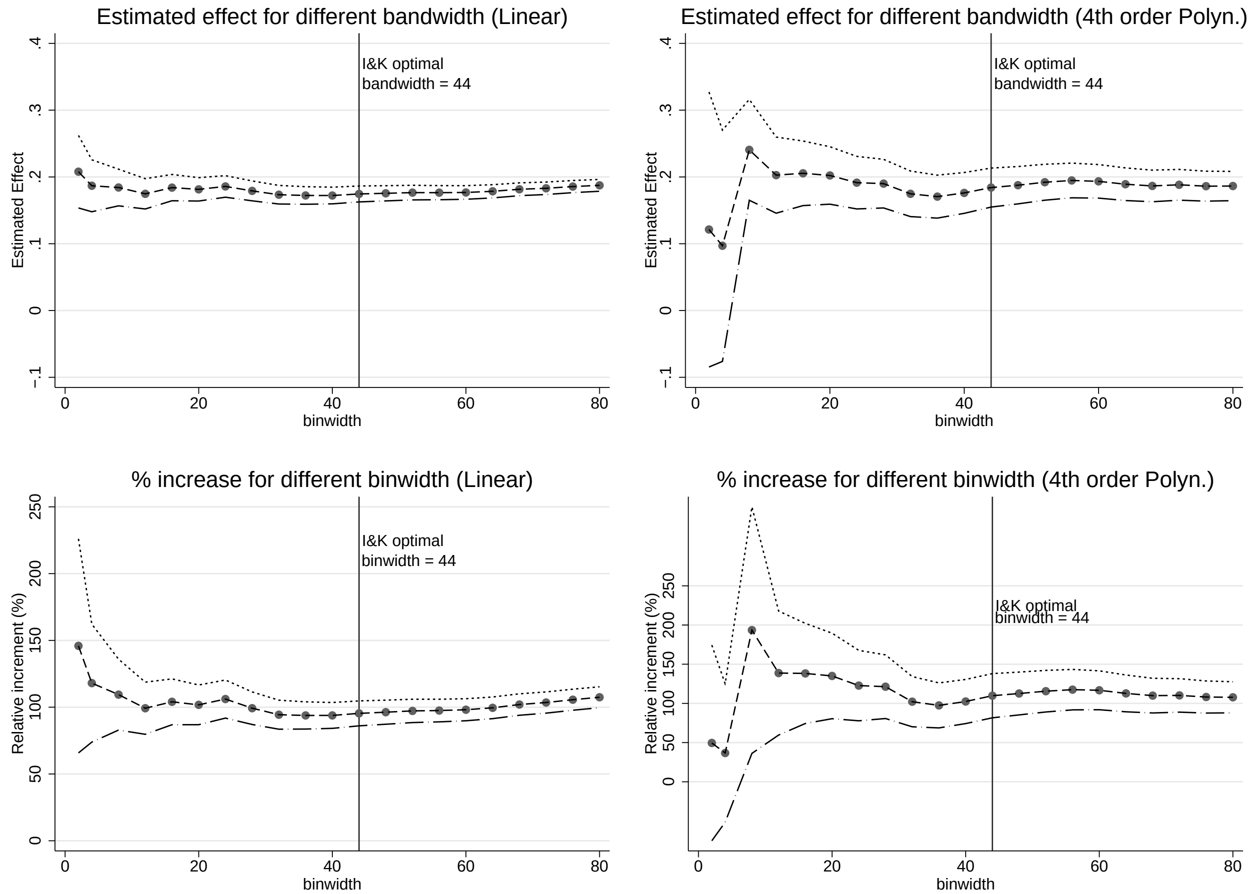
Robust standard errors in parenthesis. (***): p⩽1%, (**): p⩽5%, (*): p⩽10%

A Appendix: Sensitivity Analysis

To give a sense of how insensitive these results are to the chosen bandwidth and specification, Figure 11 presents estimates of β_1 and β_1/β_0 for different bandwidths (from 2 to 80 PSU points), comparing the linear with a fourth order spline specification. The upper left graph shows estimations of β_1 for the linear specification, with a vertical line for the optimal bandwidth used throughout the paper ($w^* = 44$), while the upper right graph shows estimations of β_1 for a fourth order polynomial spline. We can observe that the results are not sensitive to bandwidth and are almost the same for the two specifications, estimating an effect of roughly 18 percentage points.

The graphs on the bottom present the relative increase in the enrollment probability, i.e., the ratio (β_1/β_0), with a 95% confidence interval (standard errors calculated using the delta method). The relative increase is very close to 100% for both specifications and for all bandwidths, except for some small ones.

Figure 11: Comparison of different bandwidth in the estimation of the effect of loan access on college enrollment.



Note: The graphs on the top show the RD estimation of the effect of being eligible for loans on college enrollment using different bandwidths and 95% confidence intervals constructed using robust standard errors. The graph on the bottom show the relative increase in enrollment: $(\underset{T\downarrow\tau}{lim}\Delta Enrollment)/(\underset{T\uparrow\tau}{lim} Enrollment) = \beta_1/\beta_0$, Where β_0 is the enrollment rate for students without access to loans at the cutoff and β_1 the loans access effect (see equation (1)), and 95% confidence interval using delta method standard errors. “I&K optimal bandwidth” refers to the optimal bandwidth $w = 44$, estimated using Imbens and Kalyanaraman (2012).

B Appendix: Dropout Rates

Few papers try to document the causal effects of financial aid on retention conditional on enrollment and dropout rates. Exceptions are Dynarski (2003), Bettinger (2004), Singell (2004) and Stinebrickner and Stinebrickner (2008), with mixed conclusions.

In this section, I study the effects of college loans on the dropout status of the students in this quasi-experiment. The main difference between these results and those in the previous section is that here the sample is restricted to students who enrolled in college after taking the PSU test for the first time, while in the previous analysis the comparison was made with respect to all students around the cutoff. This analysis sheds light on the potential problems faced in the literature.

Because this section compares only students who self-selected into college around the cutoff, the estimates are no longer causal effects, but rather are correlations that can be illustrative in comparison to the previous results. First, I check what types of biases are underlying the correlations by comparing observable characteristics. Table 12 shows the estimation of equation (1) for the same group of covariates for students around the cutoff, with each column corresponding to those who enrolled in 2007 through 2009.

As expected, students who enroll in college despite not being eligible for loans are different than eligible students who enroll in college. The former students come from higher income families, as indicated by the income quintile and the self-reported income, suggesting that these students relied on family resources in order to enroll. Ineligible students who enroll in college also have better educated parents and come from higher quality schools; among all students who enroll in college, there are more students from public schools above the cutoff, and more students from voucher schools below the cutoff. This may indicate a higher preference for college education among highly-educated parents and parents who chose to send their children to voucher schools.

The available data do not provide a definitive measure of dropout status for the students. Some students may not enroll in one year, but go back to finish their programs after some time out. I will therefore, use different definitions of dropout. The first definition, named "dropout after one year," is an indicator function that takes the value 1 if a student enrolls after taking the PSU test for the first time, but is not enrolled the year immediately after. Similarly, "dropout after two years" takes the value 1 if somebody enrolled in 2007, but was not enrolled in 2009. Because these definitions do not capture the possibility of coming back after some years of absence, I define a third measure of attrition. The variable "dropout in 2009" is an indicator variable that takes a value of 1 for any student who enrolled in 2007 or 2008, but was not enrolled in 2009, the last year for which I observe the enrolling behavior of these students. This measure allows those who enroll in 2007 to miss 2008 but come back in 2009, but does not capture those who may come back in later years. Finally, to distinguish between the first two definitions, I define a variable named "dropout in 2nd year" to equal 1 if a student enrolled the first two years but did not show up in the third.

Table 13 reports the estimate of the same linear specification in a two stage least squares setting to control for self-selection on the eligibility condition, adding as covariates all the observable characteristics to control for any selection on observables. Column (1) shows the dropout rate after the first year of college. Students barely eligible for loans drop out 6 percentage points less frequently than ineligibles. The dropout rate for students without access to these loans is 19%; this implies that loan eligibility reduces the probability of dropping out after the first year of college by 31%.

Column (2) shows the estimates for the definition "dropout in 2009," indicating that eligible students drop out 5 percentage points less than constrained ones. Column (3) shows dropout rates over a longer span of time: "dropout rates after two years of college." Eligible students dropped out less frequently, by 11 percentage points. In relative terms, this effect implies a 38% decrease in this dropout rate. Column (4) shows that the dropout rate does not fall significantly for the students enrolled in a second year, but the relative magnitudes confirm the previous result: there is a 26% reduction in the dropout probability.

These correlations help explain the long run enrollment results previously reported, but they also help to reconcile results from the literature. One important issue is the selection process that is evident here. Students who enroll in college are different than the underlying population, and therefore the effects estimated from the sample conditional on enrollment present a bias toward zero. In this case, the dropout results are much smaller than the results from enrollment and progress which are due to family income compensating for access to loans. Nevertheless, they are relatively large and highly significant.

Table 12: Balance among covariates for Students that choose college in their first PSU test. $w = 44$

Year Process ($w = 44$)	2007		2008		2009	
Variable	dif	abs(t)	dif	abs(t)	dif	abs(t)
Self reported income	-0.14	(4.79)***	-0.07	(2.38)**	-0.13	(4.96)***
Quintile	-0.20	(2.91)***	-0.19	(3.31)***	-0.25	(4.71)***
Mother education	-0.22	(1.68)*	-0.35	(2.71)***	-0.17	(1.35)
Father education	-0.51	(3.33)***	-0.30	(2.01)**	-0.12	(0.80)
1(female)	0.08	(2.68)***	-0.03	(1.41)	0.02	(0.90)
High school GPA	0.90	(1.91)*	0.49	(1.10)	0.40	(1.0)
H. school type	0.11	(3.31)***	0.10	(3.82)***	0.06	(2.27)**
1(married)	-0.01	(1.23)	0.02	(1.86)*	0.01	(1.46)
1(work)	0.01	(0.46)	0.01	(0.35)	0.01	(0.58)
HH Size	0.13	(1.16)	0.02	(0.18)	0.12	(1.39)
1(mother works)	-0.04	(0.28)	0.25	(1.99)**	0.15	(1.21)
1(father works)	0.06	(0.52)	0.01	(0.15)	0.11	(1.18)
Will live outside HH	0.02	(0.64)	-0.03	(1.23)	-0.01	(0.60)
Who finance college	0.14	(1.43)	0.04	(0.55)	0.13	(1.72)*
Expect aid to finance	0.01	(0.69)	0.01	(0.87)	-0.01	(0.76)
Both Parents live	0.00	(0.05)	0.01	(0.44)	-0.01	(0.27)
Obs (N)	6,728		8,022		8,980	

Note: Dif refers to the β_1 of equation (1). t-values in parenthesis (in absolute values). (***): p⩽1%, (**): p⩽5%, (*): p⩽10%

Table 13: Dropout rate in 2nd and 3rd years of college around the cutoff. $w = 44$

Dep. Variable :	Dropout after 1 year of college	Dropout in 2009	Dropout after 2 year of college	Dropout in 2nd year of college
	(1)	(2)	(3)	(4)
Eligible	-.058	-.051	-.110	-.010
	(.017)***	(.018)***	(.033)***	(.024)
Const.	.188	.201	.293	.038
	(.099)*	(.105)*	(.155)*	(.124)
Covar	Y	Y	Y	Y
% Decrease	31%	25%	38%	26%
Obs.	14750	14750	6728	6728
R^2	.032	.04	.067	.018

Robust standard errors in parenthesis. (***): p⩽1%, (**): p⩽5%, (*):p⩽10%. All regressions are based on equation (1), using 44 point around the cutoff and a linear specification.

Covariates are "self reported income", income quintile, mother education, father education, age, female dummy, high school GPA, health insurance system, married dummy, work dummy, dummy for public schools, dummy for voucher schools, household size.

C Appendix: Minimum Scores Requirements

One potential concern is that other policies may have affected college enrollment at the cutoff. The most important is the imposition of minimum score requirements to apply to traditional universities, which coincide with the eligibility PSU score cutoff. The existence of these minimum score requirements at the threshold may imply that the supply of programs significantly decreases for students who are below the loan eligibility cutoff. If this decrease in the choice set leads students not to enroll, then the conclusions presented above would be overestimated.

This appendix presents evidence that this is not the case, for two reasons. First, most universities do not comply with their own minimum score requirements, i.e., the score for the last enrolled student is usually below the minimum score requirement. Therefore, in practice, the choice set does not decrease at the eligibility cutoff. Secondly, there is a great availability of programs and students adjust their behavior by choosing close substitutes to those few programs that enforce the minimum score requirements. As a consequence, the enrollment rate is not affected by these minimum scores.

Traditional universities set minimum scores for enrollment using two types of scores: PSU score and "weighted score".[44] The first score, as defined in the beginning, is the average between mandatory math and language tests. The second is a weighted average between these two mandatory tests, the score associated with high school grades, and one optional test (science or history). These weights vary relative to the skills needed in each program. The weighted score is what determines the ranking on the list of accepted students in each program in traditional universities.

Figure 12 shows the number of programs that require minimum scores in traditional universities, for the years 2005 to 2009. The graph to the left shows programs with minimum PSU score requirements and the one to the right, programs with minimum weighted score requirements. The left figure shows that the most common minimum PSU score requirement is 475 (which is worrisome for the conclusions of this paper). However, it shows that the requirement also existed in 2005, long before the creation of SGL and the definition of the 475 PSU score as the eligibility cutoff for both loans.[45] The growth in the number of programs that set this criterion between 2005 and 2009 is mainly due to the creation of new programs in universities that already had this requirement in 2005, as a result of the increased demand for higher education created by the SGL.

If minimum score requirements (PSU and weighted score) had an effect on matriculation, then we should notice a change in enrollment at different score levels, especially at 450, 475 and 500, the most common minimum score requirements. However, as seen in Figure 6, a discontinuity exists only at 475. This shows that a potential reduction in the choice set at 450 and 500 is substituted by students enrolling in similar programs. If substitution is available for these scores, it should also

[44] Private universities typically did not impose such minimum scores requirements. Evidence that this is not a problem for private universities is shown below.

[45] The definition of the eligibility cutoff at 475 was enacted on September 7th, 2005, by Decree 182 of the Ministry of Education, while the requirements for applying to universities in 2005 were released in June 2004.

be available for 475.

To reinforce this idea, the next two arguments present more formal evidence.

C.1 Minimum PSU Scores Are Not Binding

I combined three sources of information to determine how important these requirements are. I combined individual level data on applications to traditional universities, official information on the self-imposed requirements for traditional universities and their enforcement, and actual enrollment data reported by traditional universities to the Ministry of Education. With these three sources of information, I computed the program PSU cutoff (the PSU score of the last enrolled student in each program).

Figure 13 shows the PSU score of the last enrolled student in each program (the lowest PSU score of enrolled students, which I call the program PSU cutoff) relative to the minimum score required in every program in the traditional universities. To the left, I show programs with minimum PSU scores, and to the right, programs with minimum weighted scores.

The figure to the left shows that an important number of programs enroll students with PSU scores lower than their own stated requirements; this is indicated by the points below the 45° line. As the figure shows, this is particularly interesting around the loan eligibility cutoff. Between 2007 and 2009, 25% of the programs with a minimum PSU requirement enrolled students who did not meet that requirement. Among the programs that have PSU cutoffs above the minimum required, many of them fill their vacancies with students who have PSU scores much higher than the minimum required, which in part indicates that programs choose these requirements to restrict the waiting list, and to signal quality. These programs are not available for students around the loan eligibility cutoff. Only 76 of these programs declared that they did not fill all of their vacancies. In this list of 76 programs, some explicitly rule out applications from students who did not meet their program requirements, but some allowed them to enroll anyway, according to the Ministry of Education enrollment data. Moreover, some programs appear to have very few applications, and therefore it is difficult to know whether or not they were complying with their own score requirement. Figure 14 shows the number of programs available for different PSU scores (pooled for 2007 to 2009), for the whole PSU support and a window of 100 points around the eligibility cutoff (left and right figures respectively).[46] For students scoring around the loan eligibility cutoff, there are 5,500 available programs (programs that have the last enrolled student with a PSU score around 475); therefore, 76 programs complying in the three years imply a reduction of 1.4% the choice set.

[46] A program is available to a student if the score of the last enrolled student is lower than the student score.

C.1.1 The weighted Scores are continuous

The minimum weighted score requirement is not a problem for the conclusion of this paper because it affects students on both sides of the cutoff in the same way. This is because weighted scores also consider the scores equivalent to high school GPA and one optional test. A student above (below) the loan eligibility threshold could (not) be restricted by this requirement if she has a low (high) score, either on the high school GPA score or the optional test. Because both scores (high school GPA or the optional test score) are continuous, for any given PSU score, the proportion of students with weighted score epsilon apart is the same. The right graph of Figure 13 shows the PSU score of the last enrolled student in programs that impose minimum weighted scores. In this case, if the PSU score of the last enrolled student is below the 45°, it does not imply a violation of the requirement, but illustrates that students with scores lower than 475 are not restricted in general by this requirement, and, most importantly are not restricted differently from those with a score equal or above the eligibility threshold. Finally, Figure 15 shows the empirical distribution of the weighted scores, calculated with actual scores for the students around 475. Dots indicate the mean of the empirical distribution conditional on the student PSU score and lines indicate a 95% confidence interval. It shows that the density is continuous, as suggested previously.

C.2 Substitutability between programs

The previous section showed that the imposition of minimum scores did not significantly reduce the number of programs available for the student at the cutoff. However, even a small reduction in the choice set could keep students from enrolling if unavailable programs are highly demanded and have no close substitutes.

This part presents a second exercise that shows the level of substitutability of programs at the threshold. Specifically, it shows that the characteristics that are crucial to infer the returns to human capital investments are the same for chosen programs above and below the cutoff.

Table 14 shows regression discontinuities for four characteristics of the chosen programs: program tuition costs, effective duration of programs, expected income after four years of graduation, and employability after one year of graduation. The information comes from the database mifuturo.cl, a website run by the Ministry of Education which is specially designed to provide information to potential students. The information about tuition has always been available to help students choose between college programs; however, information about the other three has only been available since 2012. This is because the Ministry of Education has only been collecting enrollment and graduation data (for all programs offered in the country) since 2006. Therefore, this information was not available at the time students made their enrollment decision. Nevertheless, these results reflect private information that is collected by the students to make their decision.[47]

[47]Previously, information about the same characteristics was grouped based on program similarities (103 groups)

The first two columns show the difference between annual tuition for the programs selected by students. Column 1 shows the results for a linear specification restricting the sample to 44 points around the cutoff. Column 2 shows the results for a polynomial spline of fourth degree for the whole sample.[48] Both specifications indicate that there is no difference in tuition costs for the programs chosen by the students around the threshold. The average cost is 2.1 million CLP (US $4,400), about 50% of the median income in 2012 dollars. Source: CASEN 2009.

Columns 3 and 4 show that the average number of semesters required to graduate is the same for both groups (estimated with a linear and polynomial specification, respectively). Students take 6.25 years to graduate. Columns 5 and 6 (linear and polynomial specification, respectively) indicate the difference in expected income (four years after graduation) for the chosen programs. Expected income is CLP 700,000 (US $1,490), approximately two times the median income reported in CASEN 2009, and is the same at both sides of the cutoff. The last two columns of the table show the probability of being employed one year after graduation. One year after graduation, 75% of the students are employed, and there is no difference for eligible versus ineligibles. This exercise indicates that the small reduction in the choice set does not affect the quality of the human capital investments, because students are able to substitute.

The evidence presented in C.1 and C.2 leads to the conclusion that the imposition of minimum score requirements by traditional universities does not affect the student´s choice set, and therefore should not cause any change in the rate of enrollment, i.e., the conclusions on the effect of loan availability on college enrollment should not be biased.

without distinguishing between universities.

[48] Because the analysis is based on self-selected students who enroll in universities, both specifications include a set of controls: income quintile, category of self-reported income, family size, parental education, type of high school, high school grade point average, age, whether the student worked before taking the PSU, type of health insurance held by the family, and marital status. Results do not vary significantly when these controls are not included.

Figure 12: Programs with Minimum Score Requirements

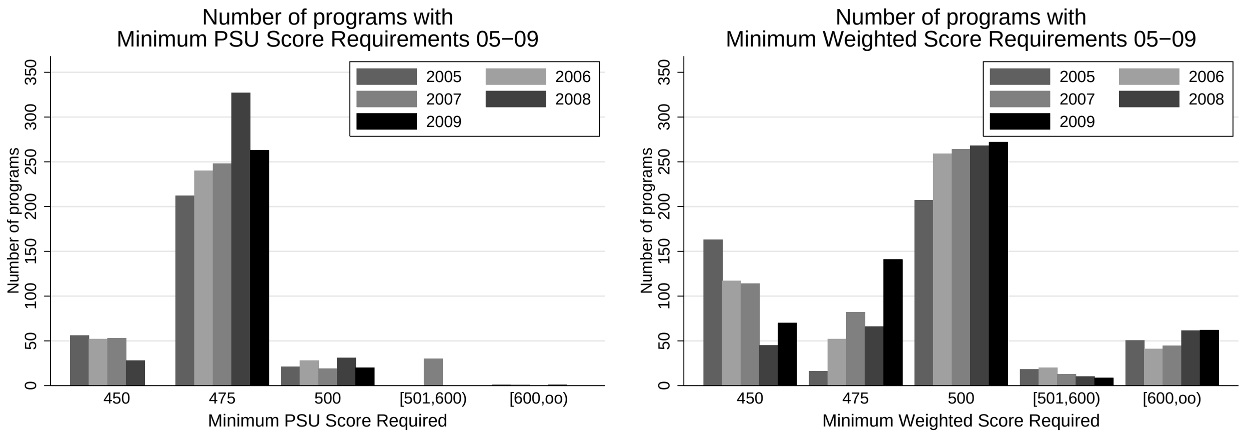


Figure 13: Minimum PSU Score Requirement Compliance by PSU score.

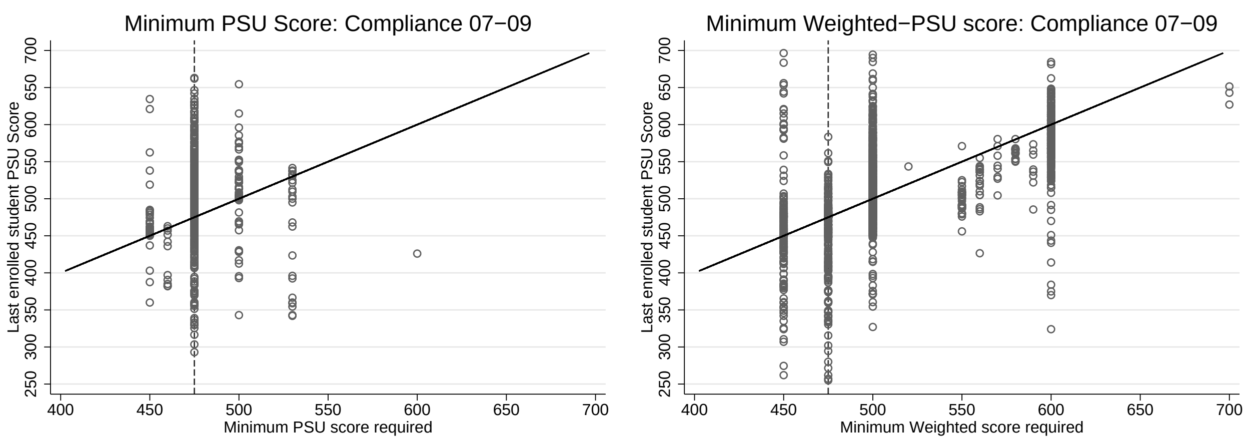


Figure 14: Program availability by PSU score

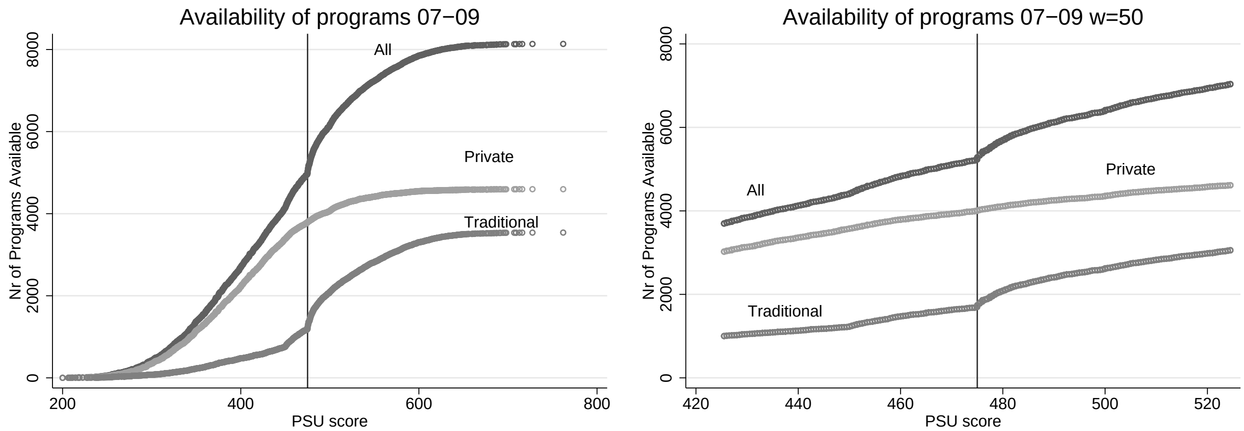


Figure 15: Weighted Score Empirical Distribution.

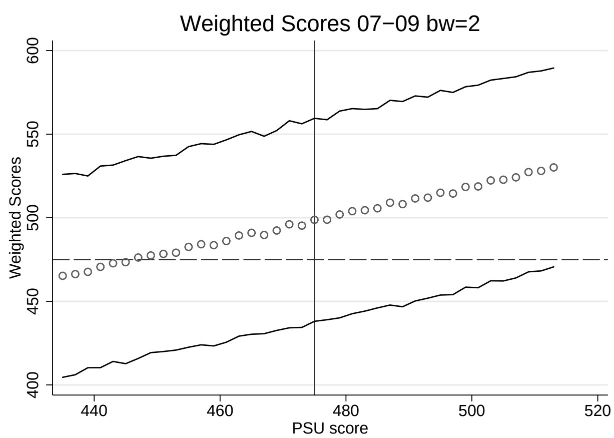


Table 14: Chosen program characteristics.

	Tuition Costs		Semesters to graduate		Expected Income 4 years after graduation		Probability of employment after 1 year of graduation	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$1(T \geqslant \tau)$	-10.202	12.076	-.019	-.092	-4.687	-14.177	-.007	-.010
	(20.884)	(23.938)	(.094)	(.107)	(10.218)	(11.734)	(.005)	(.006)
Const.	2052.9	2115.9	12.1	12.6	697.4	731.8	.726	.757
	(37.214)***	(27.692)***	(.172)***	(.119)***	(19.169)***	(13.317)***	(.009)***	(.007)***
Obs.	17294	74962	16419	71852	10690	52996	17296	74969
R^2	.041	.265	.038	.15	.073	.3	.02	.095
Linear	yes		yes		yes		yes	
4th Poly		yes		yes		yes		yes

D Appendix: Survey

In this appendix, I present the structure of the questionnaire that is analyzed in section 10. The questionnaire is based on an interactive web platform.

Figure 16: Survey Questions Structure