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Labor Market Returns to Student Loans*

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Abstract

This paper studies the labor market returns to a state guaranteed loan (SGL) used to finance university degrees. Using administrative data from Chile and a regression discontinuity design, we show that nine years after high school graduation students who enrolled at a university thanks to the SGL attended it for 5 years, foregoing 3 years of vocational education and accumulating additional 14 thousand dollars in student debt. Strikingly, these students do not benefit in terms wages, employment, type of contract, or type of employer. The low quality of institutions attended by loan users may account for these results.

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1 Introduction

In the last decade, several countries have seen a heated debate over the benefits and negative consequences of student loans. The high labor market returns for higher education together with the inability to borrow against future returns from education have encouraged the introduction of different student loan programs intended to democratize access to higher education. However the idea that student loans may impose a heavy burden on students and their families has raised. Indeed, the debate over a potential student debt crisis has motivated calls for a redesign of the student loan system in both developed and developing countries. Unfortunately, most of this discussion has focused only on anecdotal and correlational evidence.

This paper contributes to the debate by providing causal evidence of the labor market return to a state guaranteed loan (SGL) for students who enroll at a university thanks to it. We study this issue in Chile, where a SGL was introduced in 2006 setting sharp eligibility criteria. Chile is an appealing case for study. First, students gain access to the SGL to finance a university degree by applying for financial aid and scoring above a fixed cutoff in the centralized college admissions exam. This institutional feature allow use to implement a fuzzy regression discontinuity design that exploits the quasi-randomness of loan eligibility as an instrument for its use at a university. Second, linked administrative data allows to follow students up to nine years after high school graduation, making it possible to estimate the causal effect of the use of this university loan on both educational and labor market outcomes.

We find that treated students induced to use a university loan due to their initial eligibility increase their total years of schooling by two, substituting vocational programs for university degrees. However, eight years after high school, only 40% of university loan takers have graduated versus a 65% of ineligible compliers. By year nine out of high school, we find that users of a university loan have increased their debt by 14 thousand dollars and have experienced a decrease in their labor market experience of around 1.2 years. Furthermore, we estimate statistically insignificant effects on wages and employment and we do not find any difference between treated and untreated students in their type of contract, public sector participation or on the average wage paid by their employers. We provide suggestive evidence that the low quality of the higher education institutions chosen by university loan users, measured by years of accreditation and graduation rate, contribute to explain their null labor market gains. Regression discontinuity-based estimates show that the university loan induced students to substitute away mostly from top tier vocational institutions into medium tier universities that have on average one fewer year of accreditation and a twenty percentage points lower graduation rate. In line with this finding, a model that interacts institutional characteristics with our quasi-experimental variation shows that proxies of institutional quality are important determinants of labor market returns.

Our focus is on the causal effect of ever using an SGL to attend a university, and our empirical strategy is a fuzzy regression discontinuity design. This strategy uses the sharp university loan eligibility cutoff based on the national college admissions test (Prueba de Selección Universitaria, PSU hereafter) and accounts for the voluntary take-up of the loan and students' ability to retake the PSU and qualify for the university loan over the years. We implement this strategy with an instrumental variables approach that uses students' eligibility status for a university loan on their first attempt taking the test as an instrument for ever using it. Our first stage estimates show that being initially eligible increases take-up by 8 percentage points, a 26% increase relative to the initially ineligible group (with an F-test above 100). Because of the local nature of this quasi-experiment, our estimates are better interpreted as a local average treatment effect (LATE) for compliers (Imbens and Angrist, 1994), or those who without initial access to a loan do not ever enroll at a university using an SGL. We show that compliers to this instrument are poorer than other students, coming disproportionately from the poorest 20% of the population; they also have less-educated parents and rely more heavily on public health insurance. Additionally, compliers have limited alternatives for financing a university degree as none of them are eligible for scholarships.

This paper makes two main contributions. First, we add to a growing literature on the effects of financial aid on educational outcomes (e.g. Abraham and Clark, 2006; Angrist et al., 2014; Avery et al., 2006; Bound and Turner, 2002; Cornwell et al., 2006; Dynarski, 2000; Goodman, 2008; Kane, 2007; Marx and Turner, 2018).[1] In our context, more than 95% of students who took the PSU and applied for financial aid enrolled in some type of higher education by year nine out of high school. Thus, the use of a university loan increasing the years of higher education by just two; motivating students to substitute 3 years of vocational education for 5 years at a university. Despite this educational upgrade, we find that eligible compliers have a 25 percentage points lower graduation rate and attend 30% more institutions. Furthermore, 30% of eligible compliers and 17% of ineligible compliers enroll at both university and vocational institution at some point.[2] Together, these results suggest that the large short-run effects of loan eligibility on university enrollment, previously reported by Solis (2017), may have dissipated over time.

Second, we contribute with direct quasi-experimental evidence to an incipient literature on the effects of student loans on early labor market outcomes (e.g. Rothstein and Rouse, 2011; Rau et al., 2013; Ji, 2018, Weidner, 2016; Montoya et al., 2017). For this analysis, we use administrative data from the Unemployment Insurance that covers all formal dependent labor in the private sector from 2007 to 2017,[3] and we provide robustness to our findings by using Pension System data that include dependent and independent labor in both the public and private sector, but

[1] Deming and Dynarski (2009) survey this literature.

[2] By year nine out of high school, the percentage of compliers enrolled at a university is very close to zero. Therefore, our graduation results are not driven by students enrolling for longer periods.

[3] Other work using similar data include Rau et al. (2013), who also study the role of the SGL but implement

which we can access for a shorter period of time (2013 to 2015). We show that nine years after high school graduation, eligible compliers did not experience any statistically significant gain in wages or their probability of employment. Additionally, we show that the university SGL had no effect on job security measured by the use of fixed term contracts, on the probability of working in the public sector, or working for better paying firms. However, we report that university loan takers experience a decrease of 1.2 years of labor market experience. Finally, administrative data on SGL borrowers shows that the take-up of a university loan increase debt by 14 thousand dollars.

We interpret the previous results in the light of recent evidence on the heterogeneous labor market returns to different higher education alternatives (e.g. Hastings et al., 2013; Rodriguez et al., 2016; Ref para EEUU). We find that compliers attend second- and third-tier universities when eligible for a university loan and high quality vocational institutions otherwise. These universities have 25 percentage points lower graduation rate and one fewer year of institutional accreditation compared to the fallback vocational institutions.[4] Moreover, using a 2SLS model that separately interacts the use of university loan with the graduation rate and years of accreditation of the institutions students attend, we show that on average: i) one standard deviation increase in the graduation rate of the higher education institutions raises the wages of eligible compliers by 538 dollars (0.58 standard deviations), and ii) one standard deviation increase of the years of accreditation implies gains of 357 dollars (0.39 standard deviations) for eligible compliers. These findings suggest that the low return of the loan policy may come from the low quality of the institutions where eligible compliers are admitted, a result related to that of Cohodes and Goodman (2014) who, in a different context, show that financial aid could incentivize students to attend institutions with lower graduation rates.

The rest of this paper is organized as follows. Section 2 discusses some of the institutional features of the SGL program we study. Section 3 presents the data used in this paper while section 4 explains the empirical strategy. Section 5 shows the main results and section 6 offers a discussion focused on the role of institutional quality. Finally, section 7 concludes.

2 Background: The State Guaranteed Loan Program

High school graduates applying for admission at 4-year degrees take a college admission score (Prueba de Seleccion Universitaria, PSU), which includes a Math, Language, Science and His-

a structural approach in a shorter time horizon, and Montoya et al. (2017), who studies the return to university degrees vis a vis vocational degrees using ever eligibility for a university loan as instrument. While Rau et al. (2013) and Montoya et al. (2017) report similar reduced form effects to what we find, our study focuses on loan take-up, looking at a larger set of outcomes and providing direct evidence of the importance of the quality of institutions where loan takers enroll.

[4]We classify universities into four tiers according to their selectivity, following Beyer et al. (2015).

tory. Scores on each section are normalized within a range from 100 and 850, with mean 500 and standard deviation of 110. In 2006, the Chilean government introduced a State Guaranteed Loan program (SGL, hereafter). This policy provides access to loans at any accredited institution to students who fill out a socio-economic information form (Formulario Único de Acreditación Socioeconómica, FUAS hereafter) and score above 475 points on the average Math and Language college admission exam. Students with a high school GPA above 5.27 (GPA ranges 1 to 7) who pursue 2-year degrees are also granted access to a loan. Figure 1 shows that the data conforms to these sharp eligibility requirements. Panel A shows the total first-year student debt at any type of institution, and Panel B restricts to debt at universities. This form helps the government determine family income quintiles. Although the SGL program was initially meant to benefit students in the first four income quintiles, conversations with individuals involved in the implementation of the loan program and our own analysis of the data shows that individuals in the fifth income quintile also became eligible in years when there was enough funding.

Applicants to the loan know about their eligibility status before enrolling in higher education, and the general terms of the loan are publicly available. Because SGL eligibility cutoffs were established in 2006 and have remained the same since then, students considering higher education alternatives can easily learn their eligibility status for an SGL at different types of institutions after their PSU tests are graded. Moreover, the government and higher education institutions advertise students eligibility to receive the guaranteed loan. Some institutions and degrees are allowed to impose different requirements for loan eligibility, above those established by the Law. These institution specific requirements are also available to students at the time of enrollment. During the years of our study, the conditions of the loan were a 6% real interest rate; a fixed payment over a period of 5, 10, or 15 years, depending on the total debt; and a grace period of 18 months before students have to make the first payment following their graduation or drop out date. Additionally, conditional on being in good academic standing, students could finance their degree for up to 3 years in excess of the official duration in the case of university degrees and for 2 years for vocational degrees.

Students can use the SGL at any accredited institution. Accreditation is responsibility of an independent agency (Comisión Nacional de Educación, CNA) which decides whether an institution receives accreditation or not (and by how many years) based on different records from the university and external auditors. Since the introduction of the SGL, the total number of accredited institutions has increased. Table A.1 in the appendix shows that the number of accredited universities raised from 14 in 2004 to 45 in 2016. As of today, 64.3% of all higher education institutions are accredited. However, there is significant heterogeneity in the number of years for which they receive the accreditation, and degrees might not be accredited even when the institution receives accreditation.

After enrolling at the accredited institution of their choice, students can borrow up to a degree-institution specific maximum. The degree-institution cap for borrowers is on average 90% of the tuition, and students, their families, or scholarships would have to cover the difference. Alternative financing options include another university loan available only for students enrolled at a CRUCH university[5] and government-provided scholarships. For the cohorts in our analysis, students among the poorest 40% who scored above an average of 550 points on the Mathematics and Language exams of the PSU have access to scholarships that partially covered tuition at 4-year degrees, while students with a GPA above 5.0 are eligible for scholarships at 2-year degrees. However, most students who did not meet the minimum eligibility requirement for a loan would probably have trouble funding their education with a private loan. According to the nationally representative household survey CASEN, only 7.5% of the loans held by all students in 2015 came from private banks (without State guarantee).

Since its implementation, the total debt held by students has increased at a rate of 70% per year, and the total number of students holding a student loan increased from 15.8 thousand students in the first year of operation to 652 thousand students by 2016. Figure 2 presents the evolution of both the number of students using the SGL and the total debt that they hold. As these figures increased, commentators started arguing about the heavy burden that student debt imposes on borrowers and debating whether the rising outstanding debt should be of public concern. In fact, in April 2018 congress created a commission to reformulate the SGL and investigate whether debt negatively affected students. The Chilean government is currently considering a complete reform of the SGL.

3 Data and Descriptive Statistics

The Chilean government provided the data, which include demographic information, test scores, enrollment, graduation, financial aid, and labor market outcomes from 2007 to 2017. Our analysis sample consists of students who graduated from high school in 2007 or 2008, took the college admission test immediately, and filled their socio-economic information to access financial aid. For these students we observe enrollment in higher education, their loan take-up, their graduation, the characteristics of their degrees, as well as their labor market participation, wages, and employers' characteristics up to nine years after high school graduation.

[5]The Traditional University Loan program, called Fondo Solidario de Crédito Universitario, covers only CRUCH students scoring above 475 points.

Labor market outcomes come from the the Unemployment Insurance (UI) system, which covers all dependent labor in the private sector between January 2007 and October 2017, and the Pension System (PS) dataset, which we access from 2013 to 2015 and includes dependent labor in both the public and private sector and approximately 14% of all independent labor who voluntarely contribute to the pension system. We conduct most of our analysis using UI data, and use the PS dataset to study public sector work and to check the robustness of our results to the inclusion of independent labor that contribute to the pension system.

Financial aid applicants and students in our RD sample are poorer than the general population of test takers. Table 1 reports descriptive statistics for test takers, financial aid applicants, students eligible for a university loan, and students within a bandwidth of 40-points around the cutoff (RD sample).[6] Column (2) shows that financial aid applicants are more likely to have attended a public high school, have public health insurance as opposed to private, and have less-educated parents. In contrast, column (3) shows that students who qualify for a university loan, scoring above 475 points, come from a higher socioeconomic background. Our RD sample, in column (4), has similar characteristics to the rest of financial aid applicants. No student in this sample is eligible for a state-provided scholarship, a byproduct of the test score window of this sample that excludes scholarship-eligible students. Finally, we also see that the labor market outcomes of students in these four samples are similar.

Institutions of different selectivity level differ markedly. Table 2 presents a comparison of universities and vocational institutions at different selectivity tiers. University tiers were constructed following Beyer et al. (2015) so that lower-tier institutions have higher average Math and Language admission scores and a higher share of students taking the admission test. Top vocational institutions have a share of students who took the college admission test above the median. Table 2 shows large heterogeneity in terms of institutional characteristics. Compared to the rest of institutions, more selective universities and top vocational institutions have more students with a scholarship, a higher share of accredited degrees, more years of accreditation, a higher graduation rate, and a higher tuition. For our analysis, we focus on middle-tier universities and top vocational institutions which concentrate most of the students using the SGL.

On the one hand, second-tier universities are better than or similar to top vocational institutions in terms of years of accreditation, graduation rate, and the share of students with scholarship. On the other hand, third-tier universities are worse than top vocational institutions along all these dimensions. It is also worth noting that vocational institutions are significantly cheaper and less selective than second- and third-tier universities. Finally, the two types of institutions that concen-

[6]These 40-points correspond to 0.36 standard deviations of the running variable.

trate the smallest share of students with an SGL (first- and fourth-tier universities) are at opposite extremes in terms of their characteristics and they enroll fewer students using SGL for opposite reasons. Students enrolled at first-tier universities have more access to merit-based scholarships, decreasing their need for loans. Meanwhile, 18% of universities in the fourth-tier are not accredited, which makes their students ineligible to use the SGL.

4 Empirical Framework

The primary relation of interest is

$$Y_i = \beta L_i + f(r_i, Z_i) + e_i \tag{1}$$

where Y are educational and labor market outcomes for student i in year t; L_i is an indicator of treatment equal to one if the student ever used an SGL to enroll at a university; $f(r_i, Z_i)$ is a function of the running variable $r_i = (\text{Average Math and Language}_i - 475)$ where the Math and Language correspond to the score in the first attempt at the college admission exam; and the initial eligibility dummy, $Z_i = 1(r_i > 0)$, equals 1 if the scored above 475 in the first attempt at the college admission exam. Our definition of treatment captures enrollment at a university using the SGL. Thus, untreated students are either those who enroll at a university without an SGL, those who attend vocational institutions, or those who do not enroll at any higher education program.

An obvious threat to identification in this setting is that the decision of taking up a SGL to attend a university may be related to potential earnings and comparative advantage, so an ordinary least squares (OLS) estimation of equation (1) may not recover causal the effects of loan use. Therefore, we use a fuzzy regression-discontinuity design to estimate university loan effects. Specifically, we exploit the quasi-random eligibility for university loans induced by the test score cutoff described in section 2. To implement this, we estimate equation (1) by two-stage least squares (2SLS), with first-stage equation

$$L_i = \pi Z_i + g(r_i, Z_i) + v_i \tag{2}$$

where $g(r_i, Z_i)$ is a function of the running variable r_i and the university-loan initial eligibility indicator Z_i. In our setting, where students cannot manipulate the exact score they get, the first-stage

exploits the quasi-random nature of initial eligibility around the eligibility cutoff. For estimation, we specify $f(r_i, Z_i)$ and $g(r_i, Z_i)$ as a linear function of r_i with a change of slope at each side of the cutoff. Figure 3 plots the university loan take-up among students who initially applied for financial aid and those who did not, confirming the importance of initial eligibility on ever taking up the university loan. Plotted points are conditional means for all students in our analysis sample within a two-points binwidth of the average Math and Language scores obtained by the students at their first PSU attempt. Panel A shows the increase in university loan take-up among students who cross the first-year eligibility cutoff. As previously reported by Solis (2017), immediately after high school graduation, university loan take-up jumps from 0 to 15% for students who applied for financial aid and scored above 475 points. On the other hand, students who did not apply for financial aid in their first attempt have no access to the SGL. The figure also shows that above 550 points, loan take-up starts decreasing due to the increase in scholarship availability at higher test score levels.

Panel B of Figure 3 graphically shows the first stage of our design. Crossing the initial eligibility cutoff increases discontinuously the probability of ever taking up a university loan. In this panel, we see that even students who initially did not cross the cutoff or did not apply for financial aid can access the SGL at some point in the future, highlighting the fuzzy nature of this quasi-experiment. Even without being initially eligible, students have the ability to retake the college admission test or get an SGL as second-year students at their universities. Nonetheless, initial eligibility around the cutoff is an important determinant of its use.

Estimates of equation (2) show that initial eligibility for the university loan, which is deterministic and sharp, significantly increases loan take-up, which remains probabilistic over time. Within a bandwidth of 40 points, initial eligibility increases the probability of ever taking up a university loan by 8 percentage points, a 35% increase with respect to the 23% take-up among initially ineligible students. This effect is precisely estimated with a standard error of 0.008, which implies a strong first-stage with an F-test above 100. Moreover, our design passes the standard test of non-manipulation of the running variable and it exhibits balanced covariates between treated and untreated students.[7]

Visual inspection of the density of the running variable in Figure 4 and overlapping confidence intervals of density estimates at both sides of the cutoff indicate no manipulation on the centrally administered tests used to construct the running variable. Reassuringly, the tests proposed by

[7]We report results using outcome specific bandwidths selected using the robust criteria in Calonico et al. (2014) in tables A.2 to A.5.

Cattaneo et al. (2016, 2017) and McCrary (2008) fail to reject the null hypothesis of equal densities around the cutoff. Students who scored above the cutoff look much like students who scored below it. Table 3 presents a simple comparison of baseline characteristics for students at both sides of the cutoff. These calculations include all students in our analysis sample within a 40-points binwidth of the eligibility cutoff. Column (1) displays the mean characteristics for students who are below the cutoff, while column (2) reports the estimated difference by eligibility status around the cutoff. These coefficients come from regressions of each baseline characteristic on the initial eligibility indicator Z_i, substituting L_i by the corresponding characteristic in equation (2). Mean differences are small as reflected by the 95% confidence intervals in columns (3) and (4) and we do not find any economically or statistically significant difference among students at both sides of the cutoff, indicating that random assignment around the cutoff is a reasonable assumption.

In our context, standard LATE assumptions imply that initial university loan eligibility only influences labor market outcomes through the use of the loan to enroll at university, and that initial loan eligibility weakly increases the take-up for all students. Under these assumptions, the 2SLS estimate of β in equation (1) may be interpreted as a local average treatment effect (LATE). This is an average causal effect of the SGL use for compliers, those students who use the loan at some point to enroll at a university only if they are initially eligible, and who without being initially eligible will never use the loan to enroll at a university (Imbens and Angrist, 1994; Angrist et al., 1996).

In our setting, compliers are likely to be in need of financial aid to access university. Table 4 presents the average demographic characteristics for the whole analysis sample and for eligible compliers whose average characteristics are estimated following Abadie (2002). Panel A shows that eligible compliers, in column (3), are more likely to have parents who did not pursue higher education, are more likely to have public health insurance as opposed to private insurance, and did not attend private high schools. Additionally, Panel B shows that 51% of university loan-eligible compliers come from families among the poorest 20% in the country, compared to 36% for the entire university loan-eligible population. Finally, Panel C shows that take-up of the university loan among the eligible population is 36%, and that nobody in the complier population gained access to a university scholarship.

5 Results

5.1 Effects of the University Loan on Education

Initial eligibility for the university loan did not have an effect on the decision of ever enrolling in some form of higher education; it did, however, encourage students to substitute vocational education in favor of university degrees and increase the total years of schooling. Figure 5 plots conditional means of an indicator for ever enrolling in higher education up to nine years after graduation from high school as a function of the running variable, and it also shows estimated conditional mean functions smoothed using local linear regression. Panel A shows that students above and below the cutoff enrolled in some form of higher education at least once throughout the nine years post high school graduation, with students above the cutoff substituting vocational education for university degrees, as shown in panels B and C. Despite the null extensive margin effect, Figure 6 shows that initial eligibility increased the overall years of higher education. Panel A shows reduced form evidence that students who are initially eligible for the loan increase their overall education in 0.18 years, with students increasing university attainment in 0.43 years and reducing attainment at vocational degrees in 0.25 years as shown in panel B and C.

Table 5 summarizes the previous reduced form effects and presents 2SLS estimates. The first row in this table presents the first stage, with initial university loan eligibility boosting the probability of ever taking up a university student loan by 8 percentage points over a mean take-up below the cutoff of 23 percentage points (35% effect). Column (1) shows the reduced form differences in enrollment between initially eligible students and students who, by a small margin, did not cross the cutoff. These estimates summarize the magnitudes displayed in Figures 5 and 6.

Column (3) in Table 5 presents the 2SLS coefficients, which in our just identified IV model correspond to the reduced form effects scaled by the first stage coefficient. We find that taking up a university loan increases the probability of ever enrolling at a university by 83 percentage points, while decreasing ever enrollment at a vocational degree by 71 percentage points. We also find that taking up the university loan increases the total years of higher education by 2.1, similar to the difference in nominal duration between a university degree and a vocational degree. In fact, those who are induced by initial eligibility to take up the university SGL gain 5.1 years in university while giving up 3 years in vocational institutions. An important caveat when interpreting this last result is that the take-up of the university SGL increases the number of institutions in which students pursue a degree by 30%. Moreover, Table 5 shows that taking the loan at a university decreases graduation by 25 percentage points by year eight out of high school. This suggests that the loan

helped students move from a vocational degree into a university but decreased their chances to finish any degree.

Column (2) presents the complier mean among untreated students, $E[Y_i(0)|L_{i1} > L_{i0}]$ in the potential outcomes notation. These are computed following Abadie (2002).[8] These estimates show that all ineligible compliers attended vocational education, and 17 percentage of them attended both types of education. This implies that 30 percent of all eligible compliers attended both types of education. [9] Column (4) shows the corresponding OLS estimates in our RD sample. OLS estimates generally underestimate the impact of loan take-up on schooling, suggesting significant selection into loan take-up.

These results are not significantly affected by students being enrolled in higher education at the time of our measurement. Figures 7 to 9 plot initially eligible and ineligible complier means of the educational outcomes for each year after high school. These figures show that nine years after high school, the total number of years of schooling and the enrollment status converged between eligible and ineligible compliers. Panel A of Figure 7 presents the fraction of students enrolled at a university between 1 and 9 years after high school, with panel B displaying analog results for vocational degree enrollment. Enrollment rates at both types of institutions decline significantly over the years, and there is convergence between treated and untreated compliers by year 9 out of high school. Moreover, by the end of our sample window, enrollment is less than 10% in both vocational and university institutions. Analogously, Figure 8 shows that 7 years after high school graduation the years of schooling at each type of institution convergence. Additionally, Figure 9 shows that the proportion of students holding a degree increases over the years to reach a 40% among the treated compliers and 65% among untreated compliers. Although the graduation rate from university degrees does not show convergence, the fact that the average number of years is stable and that the enrollment rate declines to zero indicates that a significant graduation increase is unlikely.

5.2 Effects of the University Loan on Debt and Labor Market Outcomes

Students who score above the initial eligibility cutoff have higher debt and similar earnings compared to students who were ineligible by a small margin. Figure 10 shows reduced form evidence

[8] We regress $(1 - L_i)Y_{it} = \rho(1 - L_i) + f(r_i, Z_i) + v_i$ where ρ is an estimate of $E[Y_{it}(0)|L_{i1} > L_{i0}]$.

[9] This comes from adding up the 17 percentage points among ineligible compliers and the 12 percentage points treatment effect in attendance of both types mentioned before.

of the increase in total accumulated student debt at any type of institution nine years after high school graduation. Students just above the cutoff accumulate on average 1.2 thousand dollars higher debt, an unsurprising result given that they also enroll longer and at institutions that are more expensive.[10] More surprising is that students end up with a similar level of earnings regardless of their initial loan eligibility status. Figure 11 shows the average monthly wage of students nine years after high school, where the difference around the cutoff is just -4.5 dollars. We find similar reduced form patterns for the probability of being employed, the probability of having a fixed term contract, the probability of part-time job, and for employers' characteristics such as firm size and wage bill.

Turning to the causal estimate of a university SGL on debt and earnings, Table 6 presents again the first stage results at the top, the reduced form effects in column (1), and 2SLS estimates in column (3). This last column shows that students who are induced to take up a university student loan because of their initial eligibility (the compliers) accumulate 14.3 thousand dollars more debt. In column (2), we see that the mean debt for students who are not initially eligible is 3 thousand dollars, which is explained by their eligibility for a loan at a vocational institution, their posterior eligibility to a loan at a university, and by the ability of students to borrow once they enroll as second-year students in good academic standing.

The estimated causal effect of loan take-up on earnings is not statistically different from zero. Table 6 also shows the effect on the probability of employment, without any significant effect. Both of these results are robust to the inclusion of independent and public sector workers as shown in Panel C of Table 6. Additionally, students around the cutoff work at firms with similar average wage, leaving little room for differential career parts arising from firm effects (e.g. Card et al., 2018). Moreover, and unlike in previous studies (e.g. Rothstein and Rouse, 2011), we do not find any effect of the treatment on the probability of working in the public sector.[11] Finally, the only significant effect we find on labor market outcomes is a reduction of labor market experience of 1.2 years as a result of university loan take-up. In Appendix B, we follow a mincerian approach to show that the negative wage effect that arises from the decrease in experience could only account by the null effect of the SGL on wages if the returns to initial loan take-up at university are low enough compared to enrolling at a vocational institution. In the next section, we show that the low quality of the receiving institutions of compliers helps to explain why the average labor market return to university vis a vis vocational is low.

[10] The reduced form effect of initial university loan eligibility on the cost of the tuition of the first degree is 100 dollars.

[11] This setting is different from Rothstein and Rouse (2011) in the sense that they evaluate the effect of taking or not taking up a loan, while we study the effect of taking up a loan for university in a context where the counterfactual for treated compliers includes the possibility of using loans for vocational studies.

6 Discussion

Given the switch in enrollment towards universities and the increase in the number of years of higher education, the null effect of the university SGL on labor market outcomes might be surprising. In this section, we explore to what extent the quality of destination institutions of compliers can account for this result. In the spirit of Abdulkadiroglu et al. (2014) and Abdulkadiroglu et al. (2018), we start by characterizing the educational fallbacks for untreated compliers and the destination of treated compliers. Then, we evaluate treatment effect heterogeneity by exploiting variation in the characteristics of the universities at which compliers enrolled.

6.1 Destination of Compliers

The destination of treated compliers and the fallback of untreated compliers are important to understand the RD-based estimates presented before. For instance, if students without initial access to the loan attend schools with similar or better performance than the institutions in which loan takers enroll, then the zero labor market effect might emerge naturally as a consequence of the high returns in fallback schools rather than as a consequence of low performance of the universities that treated compliers attend. To explore this hypothesis, we characterize the mix of schools that define the loan complier destinations and fallbacks. Specifically, we implement Abadie (2002)'s methods to estimate the the ineligible compliers fallback options with the equation:

$$C_{s(i)}(1 - L_i) = (1 - L_i)\gamma + ar_i + cr_i L_i + \epsilon_i \tag{3}$$

instrumenting $(1 - L_i)$ with the initial eligibility indicator Z_i. Here, $s(i)$ indicates the first institution attended by student i, and $C_{s(i)}$ is the characteristic of that institution. The 2SLS coefficient γ captures the average of the institution characteristic $C_{s(i)}$ for untreated compliers. Similarly, we can replace $(1 - L_i)$ by L_i at both sides of the equation estimate the mean characteristics of destination institutions of treated compliers.

Table 7 presents the fallbacks and destinations of compliers to the initial eligibility instrument for the SGL. Columns (1) and (2) show mean characteristics for students eligible and ineligible

to take-up a university loan, columns (3) and (4) report eligible and ineligible complier means coming from 2SLS estimates of equation (3), and column (5) reports treatment effects. Column (5) of Panel A shows that loan take-up increases the years of enrollment at second- and third-tier universities, without a meaningfully impact on attendance to first-tier universities. Column (4) of this panel shows that the main fallback for the untreated compliers are top vocational institutions. Indeed, years of enrollment at top vocational institutions decreased by almost 3 years as a consequence of loan take-up. Therefore, the main effect of the loan program was to divert students from high quality vocational programs into low- to medium-quality universities.

Panel B in Table 7 reports the years of accreditation and graduation rates of the institutions at which eligible and ineligible compliers enroll. These results come from estimation of equation (3) setting C_{s(i)} equal to the years of accreditation of institution s(i) and its graduation rate. This panel shows that compliers move to institutions with one fewer year of accreditation and with 25 percentage points lower graduation rate. These findings, together with recent research showing that the labor market returns of different higher education alternatives can be heterogeneous in Chile (Hastings et al., 2013; Rodriguez et al., 2016), suggest that the zero effect of university loan take-up could be related to the better quality of fallback vocational institutions relative to destination universities.

6.2 The Role of Institutional Quality

The characteristics of fallback and destination institutions presented in Table 7, together with the descriptive statistics in Table 2 suggest that the university loan pushed students to enroll at worse institutions. To investigate whether these characteristics can explain the null labor market effect of the university loan, Table 8 reports relationships between loan take-up and institutional quality measured by years of accreditation and graduation. The results from this section come from a just-identified model and rely on a constant effects assumption. Specifically, we extend the 2SLS model presented before to include an interaction between loan take-up and characteristics of the institutions,

$$Y_i = \beta_0 L_i + \beta_1 L_i(X_i - \bar{X}) + f(r_i, Z_i) + e_i \tag{4}$$

where $(X_i - \bar{X})$ is the demeaned characteristic of the institution attended by student i. In this case, we use the interaction between initial eligibility and the corresponding demeaned institutional characteristic as an additional instrument for L_i and $L_i(X_i - \bar{X})$. The first stage F-test on these

interacted models is above 90.

Columns (1) and (2) of Table 8 show estimates from 2SLS models interacting loan take-up with the demeaned number of years of accreditation of the attended institution. The interaction coefficients for years of accreditation show that institutions with above average years of accreditation are more expensive and drive higher levels of debt, but they also improve labor market outcomes. An increase in one standard deviation in the years of accreditation (1.6 years) increases wages by 357 dollars, the probability of employment by 18 percentage points, and the average wage of the firm by 588 dollars. Estimates of these interactions are reasonably precise and imply that treated compliers' earnings are being affected by the fewer years of accreditation of some of the institutions they are induced to attend as a result of the SGL.

Columns (3) and (4) of Table 8 report results from models that interact university loan take-up with the demeaned graduation rate of the institutions. The estimates of panel A show that institutions with above average graduation rates lead students to accumulate slightly lower levels of debt, reduces the number of institutions attended, and increases their chances of graduation. Consistently, Panel B shows that better graduation rates lowers the probability of part-time or temporary work, while also providing higher earnings, increasing the probability of employment, and raising the likelihood of getting a job at a better paying firm. From panel B, we observe that a one standard deviation increase in graduation rate (0.5) increases wages by 538 dollars, probability of employment by 21 percentage points, and the average wage paid by the employer by 388 dollars.

Finally, panel C shows the robustness of these interaction effects to the inclusion of independent workers and interestingly, it also suggests that students attending better institutions have a lower probability to hold a job in the public sector.

7 Conclusion

We find that the take-up of a university state guaranteed loan induces eligibility-marginal students to move away from high quality vocational institutions into medium quality universities (as measured by years of accreditation and graduation rates). Nine years after high school graduation, students who took-up the university loan hold 14,000 more dollars in debt and have 1.2 fewer years of labor market experience. However, their wages, employability, job security and firm characteristics are no different from those of untreated students. Overall, our findings depict a concerning

picture for the average student who decided to enroll at a university using the SGL.

We provide suggestive evidence that the quality of higher education institutions has a key role in determining whether students can complete their degrees and benefit in the labor market. Our results also highlight the importance of improving postsecondary institutions whose years of accreditation and completion rates are low. Alternatively, our results should call the attention of policy makers on the need to redefine the set of institutions that are eligible for this loan. Although the estimates presented here are only valid for compliers at the margin of eligibility, we believe that these results are informative for a relevant group of students who would not have attended university without a loan. Most of these students come from families at the bottom of the the income distribution, but despite their socioeconomic background, they decided to take the college admissions exam and applied for financial aid, a signal of their willingness to pursue higher education.

Finally, we have shown that most students are out of higher education at the time we measure their labor market outcomes. However, our paper is silent about longer-run effects of this policy. Short-run and long-run effects might differ, for instance, if experience profiles were significantly steeper for university loan takers. Nonetheless, our results speak to the current debate about the labor market performance of the first generations of students who the SGL intended to help. How these students fare in the long-run is an important task for future work.

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Tables and Figures

Table 1: Descriptive statistics for students

	Test takers	Analysis sample	University loan eligible	RD sample
	(1)	(2)	(3)	(4)
Panel A. Demographics at the time of high school graduation				
Female	0.54	0.57	0.53	0.59
Public high school	0.36	0.40	0.34	0.42
Voucher high school	0.52	0.56	0.60	0.57
Private high school	0.11	0.04	0.06	0.01
Average Math and Language college admission score	496.6	509.6	566.3	477.0
High school GPA (from 1 to 7)	5.60	5.70	5.86	5.57
Public health insurance	0.67	0.72	0.67	0.77
Mother with more than high school	0.28	0.25	0.33	0.18
Father with more than high school	0.33	0.30	0.38	0.22
Father monthly wage (dollars)	518.9	474.2	515.9	429.3
Have information on father wage	0.39	0.41	0.42	0.41
Panel B. Financial aid				
Ever taking up a university loan	0.21	0.28	0.36	0.31
University scholarship eligibility	0.09	0.16	0.25	0.00
Observations	298,859	177,470	113,059	53,416

Notes: This table reports descriptive statistics for different samples of high school students. Column (1) considers students graduating from high school in 2007 and 2008 who took the college admission test (PSU) right after high school graduation. This corresponds to 72% of all high school graduates. Column (2) further restricts the sample to students who filled a financial aid application; this is our analysis sample. Column (3) further restricts the sample to students who scored above 475 points on average on the Mathematics and Language sections of the PSU. Finally, column (4) includes students in the analysis sample with an average Mathematics and Language score around the eligibility cutoff in a 40-point bandwidth. Admission scores presented in panel A have a mean of 500 and a standard deviation of 110 points, and GPA ranges between 1 and 7 with a mean of 5.56 and standard deviation of 0.55.

Table 2: Descriptive statistics for higher education institutions

	University				Vocational	
	Tier 1	Tier 2	Tier 3	Tier 4	Top	Bottom
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. First year student characteristics in 2008						
Took admission test	0.65	0.52	0.38	0.24	0.31	0.17
Average Math and Language score	640.5	557.6	492.8	452.8	445.3	418.6
Students with a state guaranteed loan	0.07	0.18	0.16	0.02	0.21	0.05
Students with a scholarship	0.28	0.19	0.04	0.01	0.20	0.14
Panel B. Institutional characteristics weighted by first year enrollment in 2008						
Number of institutions	10	26	15	8	55	60
Average number of degrees	299.8	127.5	103.6	46.0	76.2	33.2
Total enrollment	29,629	50,279	23,268	4,652	63,290	13,663
Accredited degree	0.49	0.26	0.08	0.06	0.03	0.00
Accredited institution	1.00	1.00	0.97	0.82	0.96	0.62
Years of accreditation	5.98	4.44	2.81	1.74	4.99	1.86
Graduation rate	0.60	0.50	0.40	0.31	0.42	0.31
Tuition (thousand dollars)	5.12	4.20	3.28	2.99	2.11	1.29

Notes: This table reports characteristics of all higher education institutions. Universities are categorized in selectivity tiers following Beyer et al. (2015). Tiers are defined using the average Math and Language score of enrolled students. First-tier are in the range 600-850; second-tier in the range 525-600; third-tier in the range 450-525; and fourth-tier includes institutions with an average below 450 and with more than half students without a score. Vocational institutions are classified using the fraction of students who took the college admission exam. Top vocational have a fraction above the median (23%). All characteristics are weighted by the total level of first-year enrollment in 2008. Graduation rate is constructed at the institution level based on all students who enrolled in their first year in 2007, and it corresponds to the ratio of all students who ever graduate between 2008-2015 and all first-year students at the institution.

Table 3: Covariate balance

			95% confidence interval	
	Ineligible mean	Eligibility differential	Lower interval	Upper Interval
	(1)	(2)	(3)	(4)
Female	0.556	-0.002	-0.019	0.015
Father monthly wage in t=0	430.2	-7.6	-33.6	18.4
Mother has more than high school	0.164	0.004	-0.009	0.018
Father has more than high school	0.210	0.000	-0.015	0.015
Public health insurance	0.764	0.005	-0.009	0.020
Public high school	0.405	0.006	-0.010	0.023
Voucher high school	0.573	-0.006	-0.023	0.011
Private high school	0.023	0.000	-0.003	0.003

Notes: This table compares characteristics of eligible and ineligible students to the university state guaranteed loan. We compute these characteristics for the analysis sample (test takers who applied for financial aid) in a 40-point bandwidth around the eligibility cutoff. Column (1) reports mean characteristics for students ineligible for a university loan immediately after high school graduation, while column (2) reports the difference with respect to the eligible students' mean. This difference comes from a regression of each covariate on an eligibility dummy and a linear term of the running variable with a different slope at each side of the cutoff. Columns (3) and (4) present the confidence interval of differences in column (2).

Table 4: Complier characteristics

	Analysis sample (1)	University loan eligible (2)	Eligible compliers (3)
Panel A. Demographics			
Female	0.57	0.53	0.64
Mother has more than high school	0.25	0.33	0.20
Father has more than high school	0.30	0.38	0.23
Public health insurance	0.72	0.67	0.81
Public high school	0.40	0.34	0.41
Voucher high school	0.56	0.60	0.59
Private high school	0.04	0.06	0.00
Panel B. Family income quintile			
1st	0.44	0.36	0.51
2nd	0.19	0.19	0.17
3rd	0.14	0.16	0.20
4th	0.12	0.16	0.10
5th	0.11	0.14	0.02
Panel C. Financial aid			
University loan eligible	0.65	1.00	1.00
University loan ever take up	0.28	0.36	1.00
University scholarship eligibility	0.17	0.25	0.00
GPA>5.27	0.82	0.91	0.73

Notes: This table presents the average characteristics for our analysis sample in column (1). These are high school graduates who took the college admission test and applied for financial aid in their last year of high school. Column (2) shows average characteristics of students in the analysis sample who qualified for a university loan, and column (3) shows the estimated average characteristics of the eligible complier population computed following Abadie (2002).

Table 5: University loan take-up effect on educational outcomes

	Reduced form	Ineligible complier mean	2SLS	OLS
	(1)	(2)	(3)	(4)
First stage		0.083***		
		(0.008)		
Panel A. Ever enrolled and number of institutions attended				
Any institution	0.004	0.95	0.047	0.046***
	(0.004)		(0.043)	(0.001)
University	0.069***	0.17	0.831***	0.347***
	(0.008)		(0.089)	(0.002)
Vocational	-0.058***	1.00	-0.705***	-0.222***
	(0.008)		(0.102)	(0.002)
Number of institutions	0.035***	1.21	0.408***	0.055***
the student attended	(0.009)		(0.106)	(0.002)
Panel B. Years of enrollment and graduation				
Any institution	0.177**	3.48	2.141**	1.125***
	(0.036)		(0.411)	(0.010)
University	0.426***	0.00	5.140***	2.151***
	(0.048)		(0.530)	(0.012)
Vocational	-0.249***	3.65	-3.000***	-1.026***
	(0.036)		(0.432)	(0.010)
Graduation	-0.021***	0.65	-0.248***	-0.043***
	(0.009)		(0.106)	(0.003)
Observations		53,416		177,470

Notes: This table presents university loan take-up effects on ever enrollment and years of education in different types of institutions. The first row reports first-stage effects of initial university loan eligibility on university loan take-up (F-test of 107.64). Column (1) shows the reduced form effect, column (2) shows the complier mean for ineligible students computed following Abadie (2002), column (3) presents the treatment effect estimated by 2SLS, and column (4) shows OLS estimates. Estimates in columns (1) to (3) are computed in our RD sample, restricting to observations in a 40-point bandwidth of the eligibility cutoff. Column (4) uses the whole analysis sample. Standard errors are in parentheses.

*significant at 10%; **significant at 5%; ***significant at 1%

Table 6: Effect of loan take-up on total debt and labor market outcomes

	Reduced form (1)	Ineligible complier mean (2)	2SLS (3)	OLS (4)
First stage		0.083***		
		(0.008)		
Panel A. Total debt and cost of degree (thousand dollars)				
Total debt all institutions	1.2***	3.00	14.3***	13.8***
	(0.13)		(1.16)	(0.03)
Debt university loan	1.4***	0.00	17.0***	14.7***
	(0.13)		(0.95)	(0.03)
Debt at vocational loan	-0.2***	3.00	-2.7***	-1.0***
	(0.07)		(0.81)	(0.02)
Tuition	0.1**	2.0	1.4**	0.8**
	(0.02)		(0.20)	(0.01)
Panel B. Labor market outcomes from UI data				
Monthly wage (dollars)	-4.5	924.50	-54.8	-35.1***
	(13.76)		(167.60)	(5.05)
Probability of employment	0.0	0.56	-0.1	-0.1***
	(0.01)		(0.09)	(0.00)
Probability of fixed-term job	0.0	0.41	-0.1	0.1***
	(0.01)		(0.12)	(0.00)
Probability of part-time job	0.0	0.10	0.0	0.0***
	(0.00)		(0.05)	(0.00)
Years of experience	-0.1**	3.91	-1.2**	-0.6***
	(0.04)		(0.49)	(0.01)
Average firm wage	10.3	1012.77	125.7	-67.9***
	(15.38)		(188.75)	(5.33)
Panel C. Labor market outcomes from pension system data				
Monthly wage (dollars)	-10.4	840.71	-121.8	-54.2***
	(11.50)		(134.67)	(4.45)
Probability of employment	0.0	0.51	-0.1	-0.1***
	(0.01)		(0.10)	(0.00)
Public sector worker	0.0	0.34	0.0	0.1***
	(0.01)		(0.10)	(0.00)
Observations		53,416		177,470

Notes: This table presents university loan take-up effects on debt and labor market outcomes. The first row reports first-stage effects of initial university loan eligibility on university loan take-up (F-test of 107.64) . Column (1) shows the reduced form effect, column (2) shows the complier mean for ineligible students computed following Abadie (2002), column (3) presents the treatment effect estimated by 2SLS, and column (4) shows OLS estimates. Estimates in columns (1) to (3) are computed in our RD sample, restricting to observations in a 40-point (0.36 standard deviations) bandwidth of the eligibility cutoff. Column (4) uses the whole analysis sample. The total number of observations for monthly wage (excluding zeros) in panel B is 33,484 in columns (1)-(3) and 104,279 in column (4). Standard errors are in parentheses.

*significant at 10%; **significant at 5%; ***significant at 1%

Table 7: Average years of higher education and institutional characteristics by eligibility status

	All applicants		Compliers		
	Eligible	Ineligible	Eligible	Ineligible	Difference
	(1)	(2)	(3)	(4)	(5)
Panel A. Years of education					
University					
Tier 1	1.6	0.1	-0.2	-0.1	-0.02
					(0.21)
Tier 2	2.7	0.6	2.2	-0.7	2.9***
					(0.52)
Tier 3	0.8	0.8	3.0	0.3	2.7***
					(0.42)
Tier 4	0.1	0.2	0.0	0.5	-0.5***
					(0.17)
Vocational					
Top	0.8	2.3	0.5	3.3	-2.8***
					(0.42)
Bottom	0.1	0.5	0.2	0.6	-0.4**
					(0.19)
Panel B. Institution characteristics					
Years accredited	4.8	4.1	3.3	4.3	-1.0***
					(0.34)
Graduation rate	0.5	0.4	0.4	0.6	-0.25**
					(0.11)

Notes: This table presents average years of schooling by university tier and vocational institution and shows average characteristics of the first institution attended by students. These are shown by eligibility status in the full sample in columns (1) and (2) and among compliers in columns (3) and (4). Complier characteristics are computed following Abadie (2002). Column (5) reports the difference in means between columns (3) and (4), which corresponds to 2SLS estimates. Characteristics in Panel B correspond to the first institution where the student enrolled. Graduation rate is constructed at the institution level based on all students who enrolled in their first year in 2007 and corresponds to the ratio of all students who ever graduate between 2008-2015 and all first-year students at the institution. Standard errors are in parentheses.

*significant at 10%; **significant at 5%; ***significant at 1%

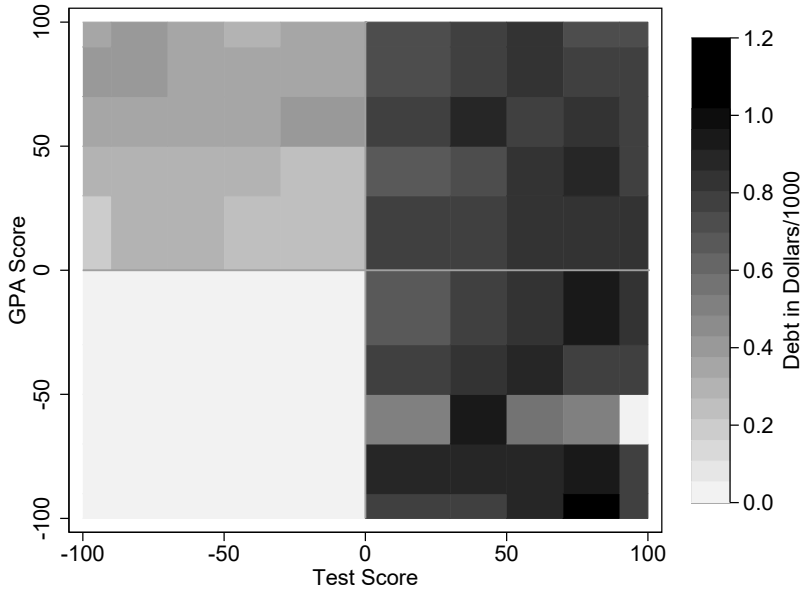
Table 8: University loan effects on debt and labor market outcomes by measures of quality

	By years of accreditation		By graduation rate	
	Main effect	Interaction	Main effect	Interaction
	(1)	(2)	(3)	(4)
Panel A. Debt, tuition (thousand dollars), and number of institutions				
Any institution	18.8***	3.9***	14.2***	-0.9***
	(1.99)	(0.53)	(1.16)	(0.23)
University	17.4***	0.2	16.9***	-2.0***
	(1.43)	(0.38)	(0.94)	(0.18)
Vocational	1.5	3.7***	-2.6***	1.2***
	(1.36)	(0.36)	(0.82)	(0.16)
Tuition	1.9***	0.4***	1.4***	-0.9***
	(0.31)	(0.09)	(0.20)	(0.05)
Number of institutions	0.4**	-0.03	0.4***	-0.4***
the student attended	(0.15)	(0.04)	(0.11)	(0.03)
Graduation	-0.2	0.03	0.0	2.6***
	(0.15)	(0.04)	(0.13)	(0.03)
Panel B. Labor market outcomes from UI data				
Monthly wage (dollars)	255.6	223.1**	63.3	1,076.3***
	(306.06)	(96.00)	(172.98)	(31.63)
Probability of employment	0.1	0.1***	0.0	0.4***
	(0.14)	(0.04)	(0.10)	(0.02)
Probability of fixed-term job	-0.2	-0.1**	-0.1	-0.2***
	(0.21)	(0.07)	(0.12)	(0.02)
Probability of part-time job	-0.1	0.0	0.0	-0.1***
	(0.08)	(0.02)	(0.05)	(0.01)
Years of experience	-0.8	0.2	-1.1**	0.5***
	(0.70)	(0.19)	(0.49)	(0.10)
Average firm wage	651.3*	367.3***	250.5	775.8***
	(365.81)	(114.74)	(197.03)	(36.03)
Panel C. Labor market outcomes from pension system data				
Monthly wage (dollars)	115.4	153.8**	-39.7	862.4***
	(240.36)	(72.90)	(137.32)	(27.19)
Probability of employment	0.1	0.1**	0.0	0.5***
	(0.14)	(0.04)	(0.10)	(0.02)
Public sector worker	-0.2	-0.1***	0.0	-0.4***
	(0.15)	(0.04)	(0.10)	(0.02)
First-stage F	685.5	4427.0	92.3	8801.5
Standard deviation of interaction variable	1.6		0.5	

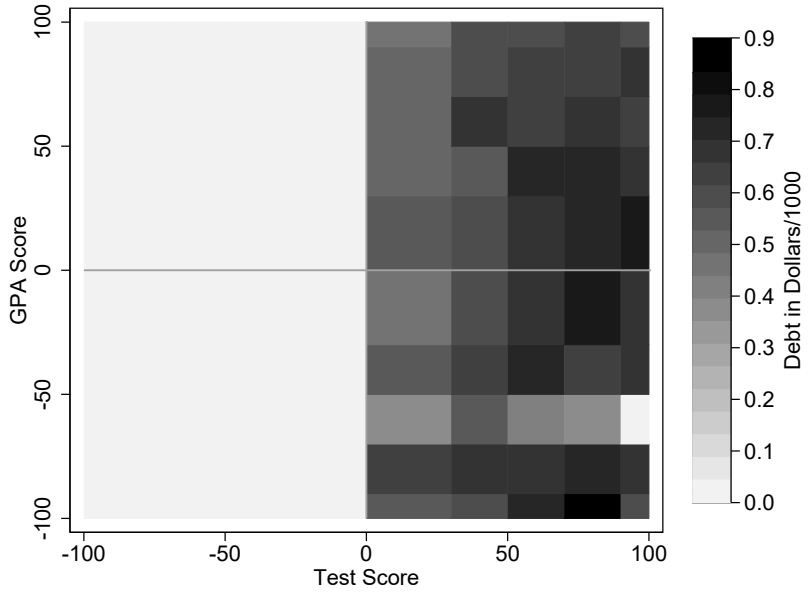
Notes: This table presents 2SLS estimates of models including university loan ever take-up and its interaction with years of accreditation in columns (1) and (2), and graduation rate in columns (3) and (4). The main effect and its interactions are instrumented with initial university loan eligibility and its interaction with the corresponding variable. Years of accreditation and graduation rate correspond to the characteristic of the first institution where the individual enrolls. Graduation rate is constructed at the institution level based on all students who enrolled in their first year in 2007 and corresponds to the ratio of all students who ever graduate between 2008-2015 and all first-year students at the institution. Standard errors are in parentheses.

*significant at 10%; **significant at 5%; ***significant at 1%

Figure 1: First-year amount borrowed using the SGL by type of institution



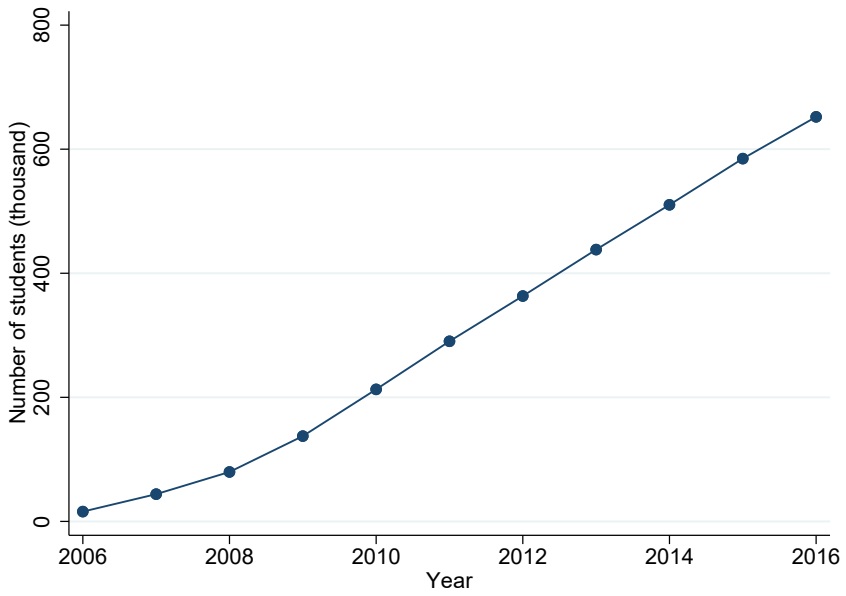
Panel A: Amount borrowed at any institution



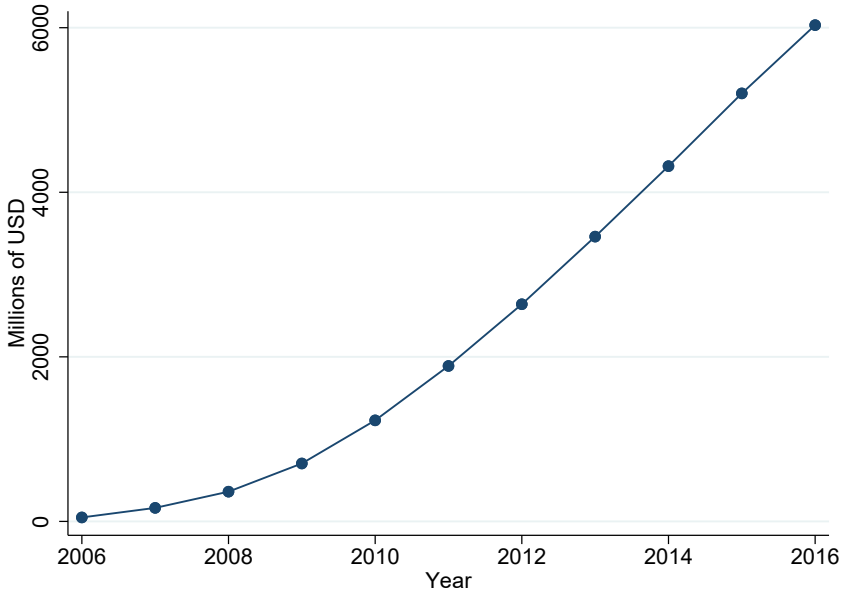
Panel B: Amount borrowed at university

Notes: These figures present the first-year total amount borrowed by students with different average Math and Language test scores centered on the eligibility cutoff (475) on the x-axis, and with different GPA scores also centered on the eligibility cutoff. Panel A shows the total first-year debt at any institution and Panel B restricts this debt to universities.

Figure 2: Total number of students with a student loan and total accumulated debt



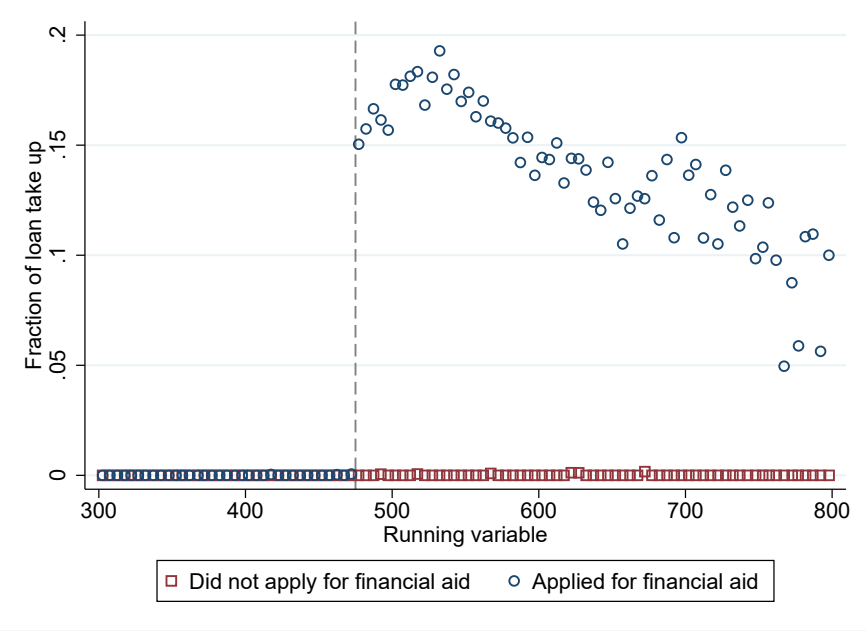
Panel A: Number of students who ever held an SGL



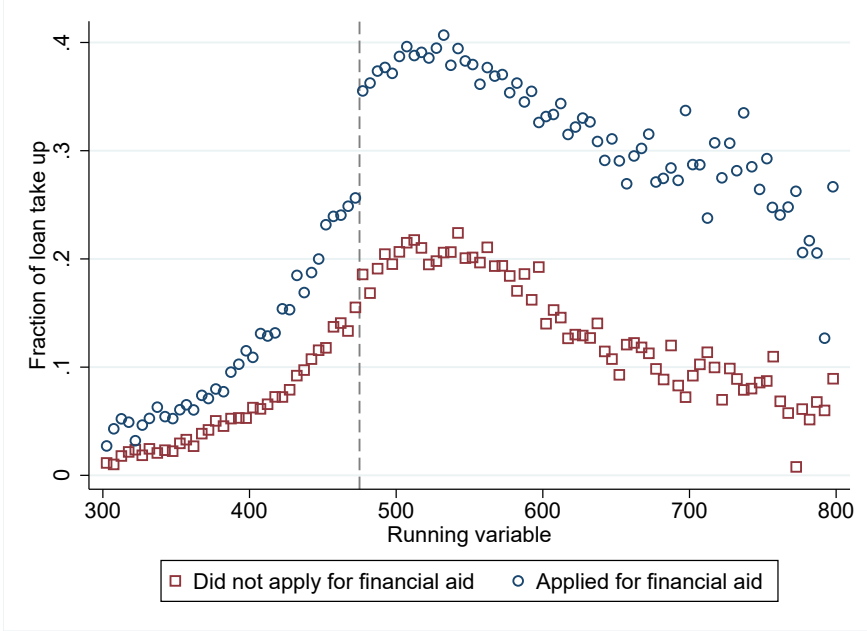
Panel B: Accumulated debt in the SGL

Notes: These figures show the total number of students who ever took-up a State Guaranteed Loan (SGL) in Panel A and the accumulated student debt in the SGL in Panel B, by year.

Figure 3: University loan take-up



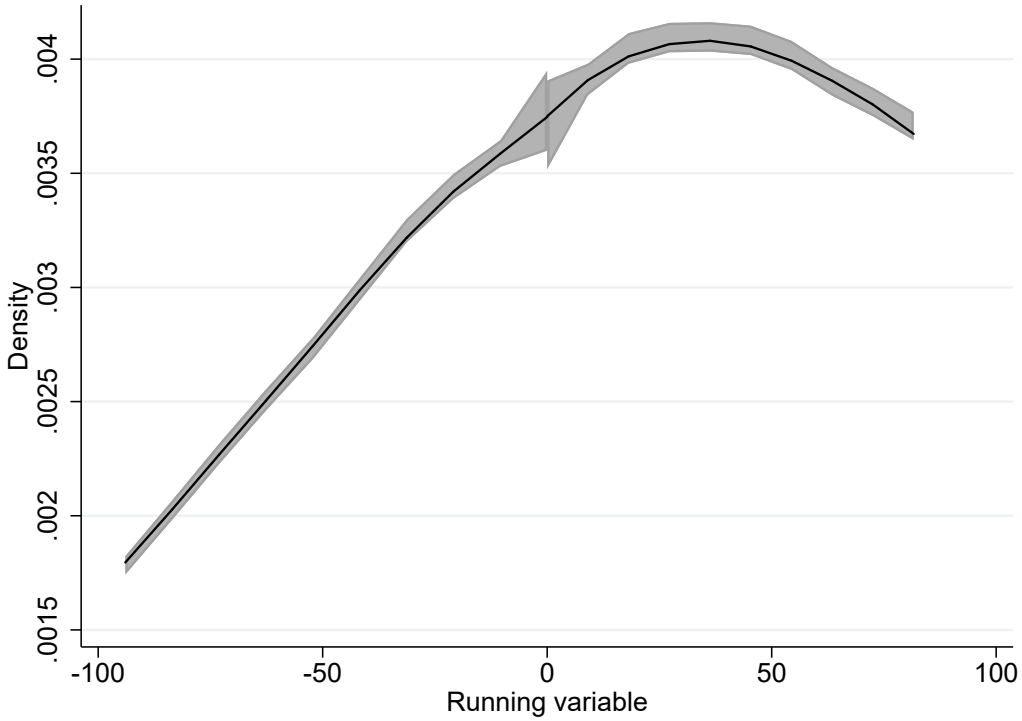
Panel A: Take-up of university loans in the year after high school graduation



Panel B: Ever taking up university loan up to 9 years after high school graduation

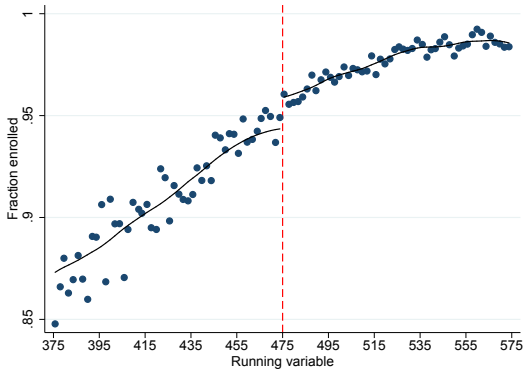
Notes: These figures plot the fraction of students who take-up a university loan as a function of the running variable by initial financial aid application status. Each dot shows a conditional mean in a 10-points bandwidth of the running variable. Panel A shows take-up in the year just after high school graduation and panel B shows take-up at any point up to nine years after high school graduation.

Figure 4: Density of running variable

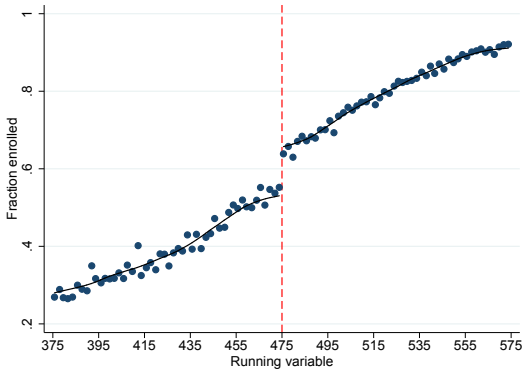


Notes: This figure presents estimates of the density of the running variable on both sides of the eligibility cutoff with their confidence interval in grey. This plot was produced using the rddensity command of Cattaneo et al. (2016).

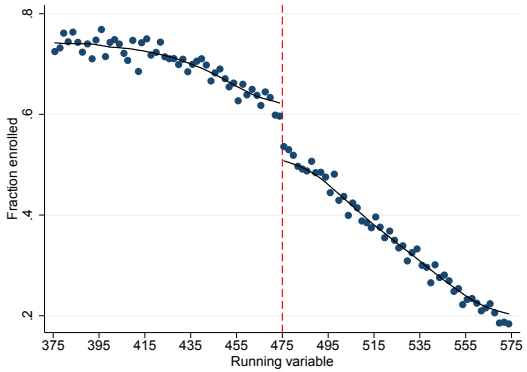
Figure 5: Ever enrollment rates by type of institution



Panel A: Any type of institution



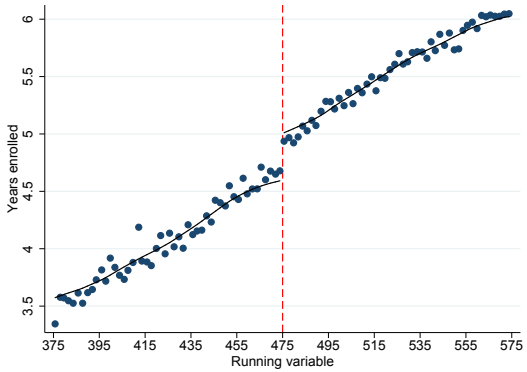
Panel B: University



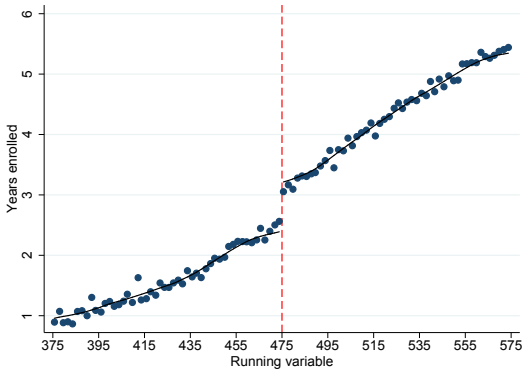
Panel C: Vocational institution

Notes: These figures show the average fraction of students enrolled in a 2-points bandwidth of the running variable at different types of institutions. The dotted vertical line shows the eligibility cutoff for a first-year university loan, and the solid lines are local linear fits using a rule-of-thumb bandwidth and an Epanechnikov kernel. The bandwidth is the plugin estimator of the asymptotically optimal constant bandwidth (Fan and Gijbels, 1996).

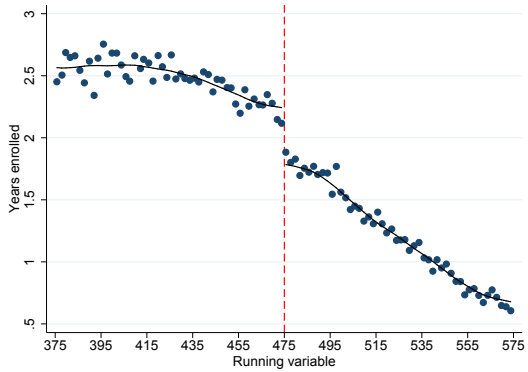
Figure 6: Years of enrollment by type of institution



Panel A: Any type of institution



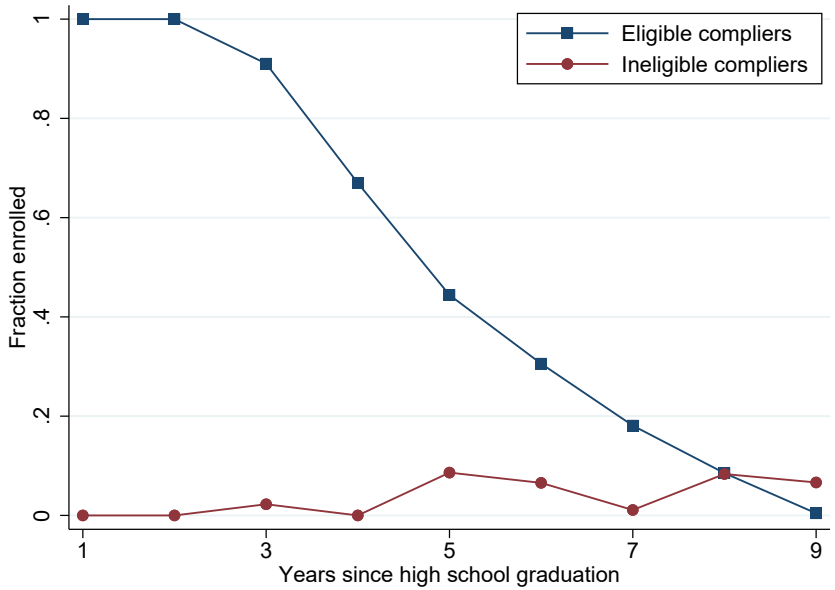
Panel B: University



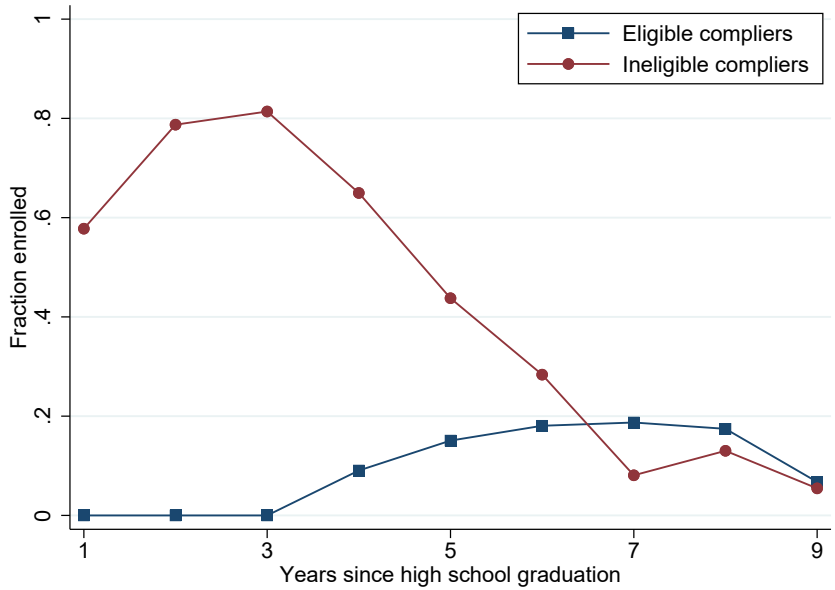
Panel C: Vocational institutions

Notes: These figures show the average years of education in a 2-points bandwidth of the running variable at different types of institutions. The dotted vertical line shows the eligibility cutoff for a first-year university loan, and the solid lines are local linear fits using a rule-of-thumb bandwidth and an Epanechnikov kernel. The bandwidth is the plugin estimator of the asymptotically optimal constant bandwidth (Fan and Gijbels, 1996).

Figure 7: Fraction of compliers enrolled by year and initial eligibility status



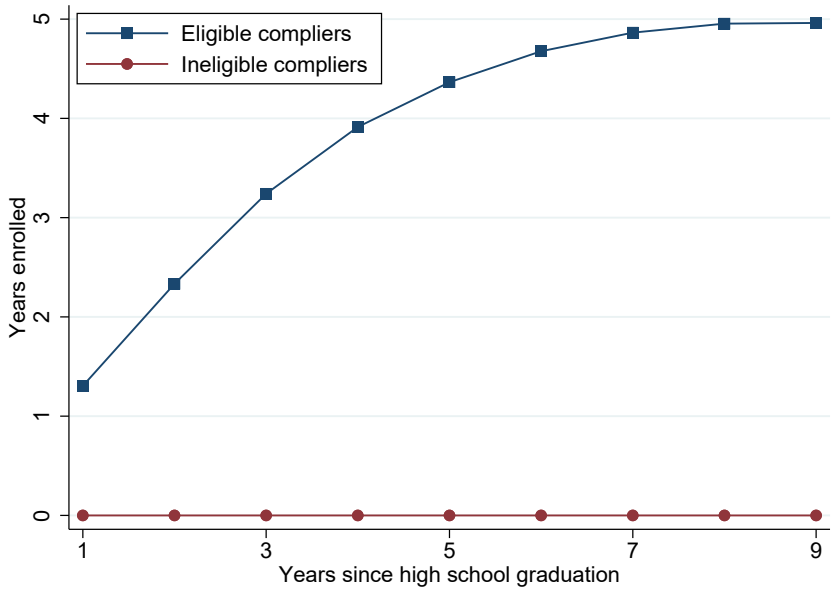
Panel A: University



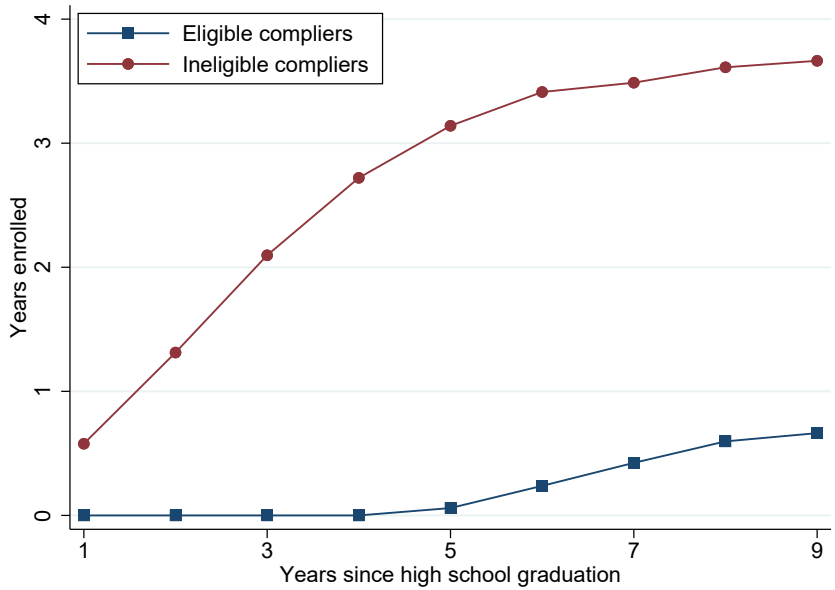
Panel B: Vocational institutions

Notes: These figures present the fraction of complier students enrolled by year (after high school graduation) and by initial university loan eligibility. Panel A shows the enrollment at universities and Panel B shows enrollment at vocational institutions. Each dot is the complier mean obtained using the method in Abadie (2002). We replace the values by 0 or 1 when they are out of bound.

Figure 8: Years of enrollment among complier students, by year and initial eligibility



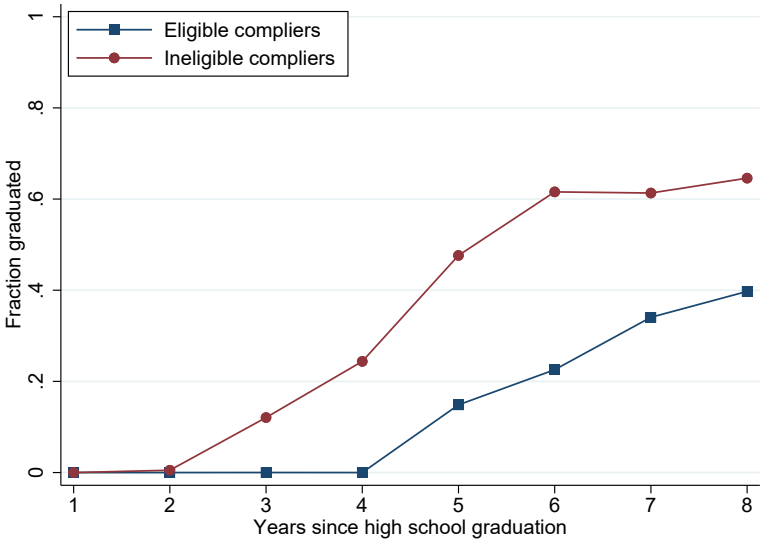
Panel A: University



Panel B: Vocational institutions

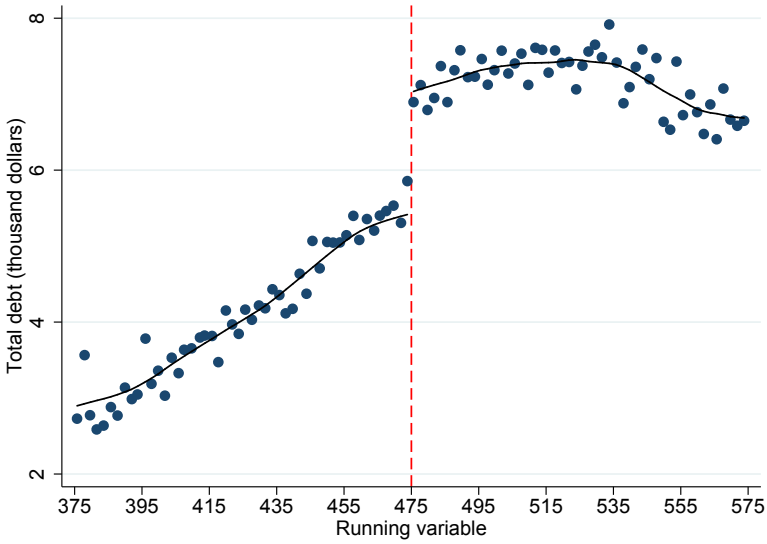
Notes: These figures present the total number of years of enrollment among complier students by year (after high school graduation) and by initial university loan eligibility. Panel A shows results for enrollment at universities and Panel B at vocational institutions. Each dot is the complier mean obtained using the method in Abadie (2002). We replace the values by 0 or 1 when they are out of bound.

Figure 9: Fraction of students graduated with a degree at any type of institution by year and initial eligibility



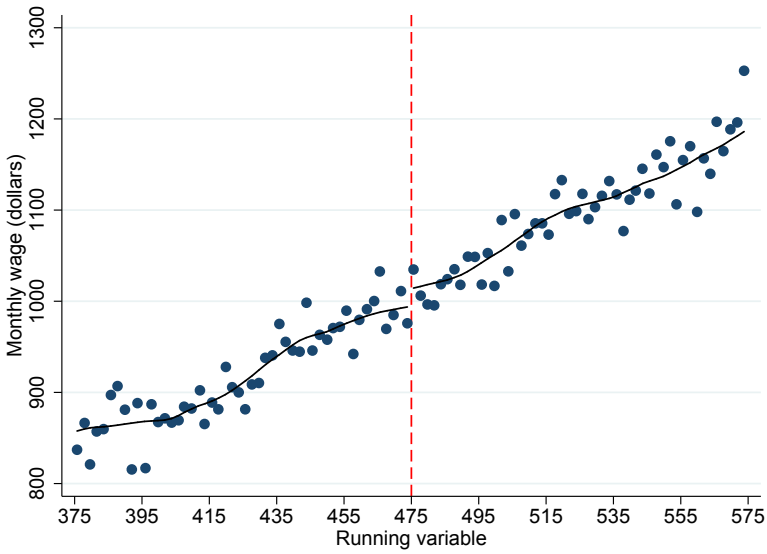
Notes: This figure presents the average fraction graduated from any type of institution among complier students by year (after high school graduation) and by initial university loan eligibility. Each dot is the complier mean obtained using the method in Abadie (2002). We replace the values by 0 or 1 when they are out of bound.

Figure 10: Total debt at any institution



Notes: This figure presents the total average student debt in State Guaranteed Loans accumulated over 9 years. Each dot is the average debt in a 2-point bandwidth of the running variable. The dotted vertical line shows the eligibility cutoff for a first-year university loan, and the solid lines are local linear fits using a rule-of-thumb bandwidth and an Epanechnikov kernel. The bandwidth is the plugin estimator of the asymptotically optimal constant bandwidth (Fan and Gijbels, 1996).

Figure 11: Average wage (excluding 0s) by year 9 out of high school



Notes: This figure presents the average monthly wage in dollars in 2-points binwidth of the running variable. The dotted red line shows the eligibility cutoff for a first-year university loan, and the solid black lines are local linear fits using a rule-of-thumb bandwidth and an Epanechnikov kernel. The bandwidth is the plugin estimator of the asymptotically optimal constant bandwidth (Fan and Gijbels, 1996).

Appendix A: Additional tables

Table A.1: Number of accredited institutions over time

Year	University	Vocational institutions
2004	14	2
2005	30	11
2006	38	16
2007	43	21
2008	45	21
2009	45	21
2010	47	25
2011	51	27
2012	50	28
2013	48	36
2014	45	37
2015	44	38
2016	45	36

Notes: The total numbers between 2004 and 2006 come from World Bank (2011), and between 2007 and 2016 are constructed by us using data from SIES MINEDUC.

Table A.2: University loan take up effect on educational outcomes. Robust bandwidth

		Ineligible			Bandwidth	
	Reduced form	complier mean	2SLS	OLS	Reduced form	Fuzzy RD
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Ever enrolled						
Any institution	0.005	0.963	0.075	0.046***	71.0	46.7
	(0.004)		(0.050)	(0.001)		
University	0.072***	0.159	0.832***	0.347***	39.7	51.7
	(0.010)		(0.097)	(0.002)		
Vocational	-0.063***	1.015	-0.749***	-0.222***	42.0	44.0
	(0.010)		(0.122)	(0.002)		
Panel B. Years of enrollment and graduation						
Any institution	0.173***	3.582	2.124***	1.125***	48.9	47.9
	(0.041)		(0.464)	(0.010)		
University	0.462***	0.000	5.343***	2.151***	41.6	56.9
	(0.056)		(0.542)	(0.012)		
Vocational	-0.278***	3.713	-3.385***	-1.026***	45.9	44.6
	(0.041)		(0.525)	(0.010)		
Graduation	-0.016*	0.642	-0.171	-0.043***	69.6	46.7
	(0.009)		(0.119)	(0.003)		
First Stage			0.083***			
			(0.008)			

Notes: This table presents university loan take up effects on ever enrollment and years of education in different types of institutions. Column (1) shows the reduced form effect, column (2) shows the complier mean for ineligible students computed following Abadie (2002), column (3) presents the treatment effect estimated by fuzzy regression discontinuity, and column (4) shows OLS estimates. Estimates in columns (1) to (3) are computed using the optimal bandwidth in Calonico et al. (2014) presented in columns (5) and (6). Standard errors are in parentheses.

*significant at 10%; **significant at 5%; ***significant at 1%

Table A.3: Effect of loan take up on total debt and labor market outcomes. Robust bandwidth

		Untreated			Bandwidth	
	Reduced form	complier mean	2SLS	OLS	Reduced form	Fuzzy RD
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Total debt (thousand dollars)						
Total debt all institutions	1.2***	2.9	14.0***	13.8***	42.4	45.9
	(0.16)		(1.33)	(0.03)		
Debt university loan	1.5***	0.0	17.3***	14.7***	40.5	41.9
	(0.16)		(1.10)	(0.03)		
Debt at vocational loan	-0.3***	3.0	-3.2***	-1.0***	56.4	48.3
	(0.07)		(0.90)	(0.02)		
Tuition	0.1***	1.7	1.5***	0.7***	43.8	51.8
	(0.02)		(0.21)	(0.01)		
Panel B. Labor market outcomes from UI data						
Monthly wage (dollars)	0.5	1,056.9	3.4	-35.1***	54.9	52.7
	(15.26)		(173.98)	(5.05)		
Probability of employment	0.0*	0.6	-0.2	-0.1***	62.6	47.1
	(0.01)		(0.11)	(0.00)		
Probability of fixed-term job	0.0	0.3	-0.1	0.1***	37.2	45.6
	(0.01)		(0.13)	(0.00)		
Probability of part-time job	0.0	0.1	0.0	0.0***	66.2	46.8
	(0.00)		(0.06)	(0.00)		
Years of experience	-0.1***	4.0	-1.6***	-0.6***	53.9	47.2
	(0.05)		(0.57)	(0.01)		
Average firm wage	31.9*	1,168.1	301.1	-67.9***	43.3	51.0
	(18.76)		(203.65)	(5.33)		
Panel C. Labor market outcomes from pension system data						
Monthly wage (dollars)	-4.8	856.3	-56.7	-54.2***	58.4	52.4
	(12.56)		(145.64)	(4.45)		
Probability of employment	0.0	0.6	0.0	-0.1***	64.1	45.6
	(0.01)		(0.11)	(0.00)		
Public sector worker	0.0	0.3	0.1	0.1***	64.3	59.1
	(0.01)		(0.18)	(0.00)		
First stage		0.1***				
		(0.01)				
Observations		53,416				

Notes: This table presents university loan take up effects on debt and labor market outcomes. Column (1) shows the reduced form effect, column (2) shows the complier mean for ineligible students computed following Abadie (2002), column (3) presents the treatment effect estimated by 2SLS, and column (4) shows OLS estimates. Estimates in columns (1) to (3) are estimated by fuzzy regression discontinuity, and column (4) shows OLS estimates. Estimates in columns (1) to (3) are computed using the optimal bandwidth in Calonico et al. (2014) presented in columns (5) and (6). Column (4) is using the whole analysis sample. Standard errors are in parentheses.

*significant at 10%; **significant at 5%; ***significant at 1%

Table A.4: Average years of higher education and institutional characteristics by eligibility status. Robust bandwidth

	All applicants		Compliers			
	Treated	Untreated	Eligible	Ineligible	Difference	Bandwidth
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Years of education						
Tier 1	1.00	1.09	-0.15	-0.13	-0.02	41.20
					(0.20)	
Tier 2	2.84	1.58	2.22	-0.86	3.1***	47.97
					(0.46)	
Tier 3	1.76	0.41	2.90	0.48	2.4***	53.75
					(0.33)	
Tier 4	0.14	0.10	0.01	0.44	-0.4***	49.69
					(0.14)	
Top vocational	0.48	1.64	0.47	3.27	-2.8***	42.64
					(0.40)	
Bottom vocational	0.06	0.29	0.17	0.60	-0.4***	52.24
					(0.15)	
Panel B. Institution characteristics						
Years accredited	4.31	4.62	3.33	4.20	-0.9***	49.97
					(0.28)	
Graduation rate	0.46	0.48	0.41	0.64	-0.2**	46.73
					(0.09)	

Notes: This table presents average years of schooling by university tier and vocational institution, and average characteristics of the first institution attended by students. These are shown by eligibility status in the full sample in columns (1) and (2) and among compliers in columns (3) and (4). Column (5) shows the difference in means between columns (3) and (4). Column (5) presents the bandwidth within which estimates are computed. The bandwidth is selected using Calonico et al. (2014). Characteristics in panel B correspond to the first institution where the student enrolled. Graduation rate is constructed at the institution level based on all students who enrolled in first year in 2007 and corresponds to the ratio of all students who ever graduate between 2008 and 2015 and all first year students at the institution. Standard errors are in parentheses.

*significant at 10%; **significant at 5%; ***significant at 1%

Table A.5: University loan effects on debt and labor market outcomes by measures of quality. Robust bandwidth

	By years of accreditation		By graduation rate		
	Main effect	Interaction	Main effect	Interaction	Bandwidth
	(1)	(2)	(3)	(4)	(5)
Panel A. Total debt (thousand dollars)					
Any institution	1.8***	3.7***	14.0***	-1.0***	45.9
	(0.55)	(0.47)	(1.02)	(0.21)	
University	16.4***	0.1	16.7***	-2.0***	41.9
	(0.42)	(0.35)	(0.87)	(0.18)	
Vocational	-14.5***	3.5***	-2.6***	1.1***	48.3
	(0.37)	(0.31)	(0.70)	(0.15)	
Tuition	0.2**	0.4***	1.5***	-0.8***	51.7
	(0.10)	(0.08)	(0.17)	(0.04)	
Number of institutions	0.5***	-0.1	0.3***	-0.4***	46.9
the student attended	(0.04)	(0.04)	(0.09)	(0.02)	
Graduation	-0.4***	0.0	-0.1	2.6***	46.7
	(0.04)	(0.04)	(0.11)	(0.02)	
Panel B. Labor market outcomes from UI data					
Monthly wage (dollars)	-652.9***	146.3*	-120.4	1,096.5***	52.7
	(108.22)	(75.79)	(143.24)	(29.22)	
Probability of employment	-0.4***	0.1**	-0.1	0.4***	47.1
	(0.04)	(0.03)	(0.08)	(0.02)	
Probability of fixed-term job	0.3***	-0.1	0.0	-0.2***	46.0
	(0.08)	(0.06)	(0.10)	(0.02)	
Probability of part-time job	0.1***	0.0	0.0	-0.1***	46.8
	(0.02)	(0.02)	(0.05)	(0.01)	
Years of experience	-1.3***	0.0	-1.3***	0.5***	47.2
	(0.19)	(0.16)	(0.42)	(0.09)	
Average firm wage	-872.5***	266.3***	22.5	776.4***	50.8
	(132.86)	(91.82)	(165.89)	(33.17)	
Panel C. Labor market outcomes from pension system data					
Monthly wage (dollars)	-600.4***	151.1***	-72.2	896.0***	52.4
	(83.35)	(58.28)	(115.87)	(25.19)	
Probability of employment	-0.3***	0.1*	-0.1	0.5***	45.6
	(0.04)	(0.03)	(0.09)	(0.02)	
Public sector worker	0.4***	-0.1***	0.0	-0.4***	47.5
	(0.04)	(0.03)	(0.09)	(0.02)	

Notes: This table presents 2SLS estimates of models including university loan ever take-up and its interaction with years of accreditation in column (1) and (2), and interacted with graduation rate in columns (3) and (4). The main effect and its interaction are instrumented with initial university loan eligibility and its interaction with the corresponding variable. Column (5) shows the bandwidth within which we estimate these effects. The bandwidth is computed from the uninteracted version using Calonico et al. (2014). Years of accreditation and graduation rate correspond to the characteristic of the first institution where the individual ever enrolls. Graduation rate is constructed at the institution level based on all students who enrolled in first year in 2007 and corresponds to the ratio of all students who ever graduate between 2008 and 2015 and all first year students at the institution. Standard errors are in parentheses.

*significant at 10%; **significant at 5%; ***significant at 1%

Appendix B

B.1 The role of labor market experience

Loan take-up reduces the labor market experience of students, as expected from the classical models on the effects of education on earnings (i.e. Ben-Porath (1967)'s model).[12] Thus, the null effect of loan take-up on labor market outcomes may respond in part to the cost of lost labor market experience offsetting the benefits of education. In an effort to address this issue, we use our RD sample to estimate the following variant of the classical mincer model

$$W_i = \beta_0 + \rho_{uni}\text{Years university}_i + \rho_{voc}\text{Years vocational}_i + \beta_1 X_i + \beta_2 X_i^2 + u_i \tag{5}$$

where W_i is the annual average of monthly wages, Years university$_i$ and Years vocational$_i$ are the number of years of enrollment at a university and vocational institutions respectively, and X_i stands for the labor market experience observed in our UI administrative data. All these variables are measured by year nine out of high school.

Mincer estimates in Table B.1 show statistically significant returns on experience and education. On the one hand, the linear term on experience in column (1) shows a return of 94 dollars to an extra year of experience. This implies a wage increase of 9% per year over a base of 1,011 dollars per month (average wage in our sample). On the other hand, the return to higher education on wages differ between types of institution, with a return of 48 dollars per year of university education (a 4.1% rate of return) and 30 dollars per year of enrollment at a vocational institution (a 2.5% rate of return per year).

Consistent with our main findings, a back-of-the-envelope calculation based on the estimates from this model suggests that nine years after high school graduation, there is a zero net return to taking up a university loan. To arrive to this conclusion, we plugged in our quasi-experimental estimates[13] from the previous section and estimate $\frac{dW_i}{d\text{Years university}_i} - \frac{dW_i}{d\text{Years vocational}_i}$, the differential effect of university education on wages relative to the effect of vocational on wages (see B.2 for details). We arrive at a point estimate of minus 6.8 dollars which is not statistically different from zero (standard error of 6.7, computed by delta method).

This exercise highlights that the effect on wages for eligible compliers is a composite of the returns and experience cost of attending university versus vocational institutions. In this case, the experience lost completely offsets the extra gains from attending a university, leading to a null effect

[12] See Card (1999) for a review of models for the effects of education on earnings.

[13] University loan take-up induced compliers to attend 5.1 years of university schooling while giving up 3 years of vocational education. It also decreased labor market experience by 1.2 years.

on wages. A result that seem to be drive with the low relative returns that we have estimated. Finally, from the fact that that nine years after high school graduation the educational outcomes are stable, one might be tempted to conjecture long-run effects. Such an exercise, however, would be futile without observing how the experience profiles of these groups evolve over time.

Table B.1: Schooling and experience effects on monthly wages

	(1)	(2)	(3)
Years of university	41.7***	43.4***	45.7***
	(1.9)	(1.9)	(2.7)
Years of vocational	25.5***	24.8***	25.3***
	(2.2)	(2.2)	(3.1)
Experience	94.4***	191.4***	182.9***
	(1.7)	5.8	8.3
Experience^2		-11.3***	-10.4***
		(0.6)	(0.9)
Observations	33,484	33,484	16,698
Mean of monthly wage	1,012	1,012	1,007
Std. dev. of monthly wage	(633)	(633)	(631)
Sample	RD sample	RD sample	Analysis sample

Notes: This table reports estimates of a Mincer-type equation described in the main text. We measure wages as the annual average monthly wage (if employed) in the 9th year out of high school. Years of schooling reflects years of enrollment at a given institution, and experience is constructed as the number of years the individual is observed in the UI administrative data. RD sample corresponds to all students in the analysis sample in a 40-point bandwidth around the PSU eligibility cutoff. All regressions control by PSU test-score and high school GPA, as well as sex, family income quintile, and type of high school dummies. Standard errors are in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%

B.2 Additional Details

For simplicity, we re-write the variables Years university$_i$ and Years vocational$_i$ presented in equation 5 as Uni$_i$ and Voc$_i$.

We are interested in the differential effect of university education (relative to the effect of vocational) on wages. Thus, we need to evaluate the following object that accounts for both the experience cost and the returns to higher education:

$$\frac{\Delta W_i}{\Delta Uni_i} - \frac{\Delta W_i}{\Delta Voc_i} = \rho_U \times \Delta Uni_i - \rho_V \times \Delta Voc_i + (\beta_1 + 2\beta_2 X_i) \times \left(\frac{\Delta X_i}{\Delta Uni_i} - \frac{\Delta X_i}{\Delta Voc_i} \right)$$

For simplicity lets re-write experience as follows: $X_i = X_{0i} - \delta \times I(Uni_i > 0)$. Then:

$$\frac{\Delta W_i}{\Delta Uni_i} - \frac{\Delta W_i}{\Delta Voc_i} = \rho_U \times \Delta Uni_i - \rho_V \times \Delta Voc_i - (\beta_1 + 2\beta_2 X_i) \times \delta$$

Then, plugging-in causal estimates of ΔUni_i and ΔVoc_i from section 5, and using the average years of labor market experience in our sample (2.8 years) we obtain:

$$\frac{\Delta W_i}{\Delta Uni_i} - \frac{\Delta W_i}{\Delta Voc_i} = g(\rho_U, \rho_V, \beta_1, \beta_2) = \rho_U \times 5.1 - \rho_V \times 3 - (\beta_1 + 5.6\beta_2) \times 1.2$$

$$g'() = (5.1, -3, -1.2, -6.7)$$

Finally, using estimates from the mincer equation and given that $g'() = (5.1, -3, -1.2, -6.7)$, we can compute the $E\left[g()\right]$ and $V\left[g()\right]$:

$$E\left[\frac{\Delta W_i}{\Delta Uni_i} - \frac{\Delta W_i}{\Delta Voc_i}\right] = -6.8$$

$$V\left[\frac{\Delta W_i}{\Delta Uni_i} - \frac{\Delta W_i}{\Delta Voc_i}\right] = 45.11$$

where the variance is obtained using delta method (i.e. $V\left[g()\right] = g()'^T V g'()$) with

$$V = \begin{pmatrix} 3.75 & & & \\ 3.02 & 4.85 & & \\ 1.96 & 0.70 & 33.61 & \\ -0.06 & 0.03 & -3.57 & 0.42 \end{pmatrix}$$