Labor Market Returns to Student Loans for University: Evidence from Chile

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We study the labor market returns to a state-guaranteed loan used to finance university degrees in Chile. Using a regression discontinuity design, we show that marginally eligible students forgo vocational education in favor of university education but reduce their probability of graduation. Even though university loan takers accumulate more student debt, their labor market outcomes are not different from those of ineligible students. We find suggestive evidence that the lower quality of the receiving institutions accounts for these results. Finally, we extrapolate the effects away from the eligibility cutoff and show that supramarginal students benefit from this policy.

I. Introduction

State-guaranteed loans (SGLs) are an integral part of many higher education systems, and they have been shown to be key in making college

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education more attainable.[1] Government intervention is based on the idea that the banking system is not structured for students to borrow against their future income, but because higher education offers a promising return on investment, a student's university education is worth funding. However, multiple countries have seen a rise in the default rates of student loans, paired with protests over the high cost of higher education and policy proposals to overwrite or forgive student loans. According to Hasting, Neilson, and Zimmerman (2013), there was an increase in default rates on federal student loans in the United States throughout the 2000s, and a large protest in early 2010 over high student debt emerged. Similar movements have recently been observed in other countries, such as England and Chile. This suggests that, at least to some extent, not all students benefit from taking out loans. Indeed, it is often argued that student indebtedness may decrease home ownership, delay saving for retirement, and affect family planning decisions (e.g., Cheatham et al. 2013; Mezza et al. 2016). Political analysts have also pointed out that the current level of student debt may become problematic for the economy as a whole if students are not able to repay their loans (Foroohar 2017; Shell 2018).

Why do students have trouble repaying their student loans? There are many possible explanations: students face income shocks that make them miss some payments, students are mismatched to their chosen degrees, students use loans to finance low return degrees, or students acquire loans for high-return degrees but with low graduation rates. All of these alternative explanations have quite different policy implications. For example, negative income shocks call for the use of income-contingent loans, while students who are mismatched could benefit from being more informed. Furthermore, students using the loans to enroll in low-return degree programs or in programs with high dropout rates may suggest regulating "where" loans

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[1] In the United States, attendance increased by 52% between 1990 and 2010 (Snyder and Dillow 2012). During the same time period, student loans rose by 250%. In Chile and in other Latin American countries there has been a similar increase (Ferreyra et al. 2017).

can be used. Despite the fact that student loans are a controversial and policy-relevant topic, causal evidence on their effects is still sparse.

In this paper, we evaluate educational paths and labor market outcomes for periods of up to 9 years after high school graduation. We use rich administrative data and a score-based cutoff for student loan eligibility to contribute to the literature, with causal estimates of the educational and earnings gains associated with taking out a student loan. In doing so, we explore the mechanisms behind our results and offer new evidence to better inform the debate surrounding student loans. We study the case of Chile, a middle-income Organization for Economic Cooperation and Development member country in which an SGL with sharp eligibility criteria was introduced in 2006. Like the United States, Chile has experienced a large expansion of higher education attainment based on means-tested financial aid policies. Unlike the United States, it is possible to systematically link records of all financial aid applicants to higher education enrollment, along with graduation and labor market outcomes in Chile. We believe that the Chilean experience is appealing for several reasons. First, 41% of students use loans to finance their higher education, and 69% of those loans correspond to the referenced SGL. Second, students gain access to the SGL to finance university degrees by applying for financial aid and scoring above a fixed minimum cutoff in a centralized college entrance exam, an institutional feature that allows us to leverage quasi-random variation in loan eligibility in order to study its effects and to instrument take-up of the SGL. Finally, like many countries, Chile has experienced intense policy debate around high indebtedness and poor labor market outcomes of loan takers.

Our analysis focuses on the causal effect of ever using an SGL on educational and labor market outcomes when the SGL is used to finance university attendance. Our main empirical strategy is a fuzzy regression discontinuity (RD) design that uses initial loan qualification as an instrument for ever taking out a university SGL. First-stage estimates show that being eligible increases take-up by 35%, with an F-statistic above 100. Manipulation and balance checks support the internal validity of our design. Regarding its external validity, we follow Abadie (2002) to show that SGL compliers constitute a relevant population to evaluate the effects of financial aid policy. Compliers in our setting disproportionately come from the poorest 20% of the population, have less educated parents, and rely more heavily on public health insurance.[2] Furthermore, most of them are eligible for an SGL at a vocational institution, where the requirement is to have a minimum grade

[2] Similar strategies have been used before in the context of student loans (e.g., Gurgand, Lorenceau, and Melonio 2011; Melguiso, Sanchez, and Velasco 2016; Solis 2017). Score-based cutoffs have been used in multiple contexts in higher education studies (e.g., Hoekstra 2009; Saavedra 2009; Hasting, Neilson, and Zimmerman 2013).

point average (GPA), making this type of higher education a natural alternative for them. Therefore, while this population is not necessarily constrained to finance a vocational degree, they are less likely to have the opportunity to finance a university degree.

In line with findings in the financial aid literature (e.g., Angrist et al. 2014), our main results show that students who take out university loans because of their initial eligibility substitute alternative vocational options for university degrees. Thus, relative to their counterfactual, they increase their total years of higher education only by 2 years. Eight years after high school, only 40% of university loan takers will have graduated, compared with 65% of the students who did not take out a university loan because of not being eligible initially. Moreover, by year 9 out of high school, university loan takers will have increased their student debt by 14,000 dollars, and they will have lost 1.2 years of labor market experience without obtaining any significant gain on wages, employment, type of contract, or type of firm. Together, these results suggest that subsidized loans can be an effective way to get students into college but ineffective in helping them graduate and improve their labor market prospects.[3]

We interpret these null labor market effects for marginal students in light of recent evidence of the heterogeneous labor market returns to higher education alternatives (e.g., Hoekstra 2009; Saavedra 2009; Hasting, Neilson, and Zimmerman 2013; Zimmerman 2014; Kierkeboen, Leuven, and Mogstad 2016; Rodríguez, Urzúa, and Reyes 2016). We find that marginally eligible loan takers opt out of high-selectivity vocational institutions in favor of mid-selectivity universities, which are of lower quality, as evidenced by both the number of years of institutional accreditation and an observational wage value-added measure. Moreover, leveraging geographical variation of the predetermined supply of higher education institutions found around each student's high school, we show that students who enroll at universities that are in the predicted top quartile of years of accreditation will secure work at higher-paying firms and are more likely to work in the public sector; graduation and wages also seem to improve for them, relative to those of other loan takers who enroll at institutions of lower predicted quality. Mismatch or a parental response could also account for the null labor market effects. However, we find no evidence in favor of these alternative hypotheses. We show that the inframarginal loan taker who enrolls at a university has a GPA similar to that of the average student enrolled at the receiving program. Moreover, we do not find differential labor market responses by the parents of the students at the margin of loan eligibility.

[3] This problem has also been documented in the United States, where only about 30% of Pell Grant recipients had completed college by year 6 (Baum and Scott-Clayton 2013).

Finally, we study the effects of the SGL away from the cutoff using the extrapolation methodology proposed by Angrist and Rokkanen (2015). We find that, similar to the results of students around the cutoff, inframarginal students do not benefit from the use of a university loan. However, university loan takers who score 0.5 standard deviations above the loan eligibility cutoff and who are able to use loans to attend better institutions graduate from university at rates similar to those they would have had they graduated from vocational institutions, and they also experience a wage increase of 426 dollars per month. Together, these findings suggest that the null returns of the SGL may come from lower graduation rates among marginal students, a result related to that of Cohodes and Goodman (2014), who show that financial aid could incentivize students to attend poorer-quality institutions.

A. Related Literature

This paper is related to a large body of literature that estimates the causal effect of schooling and the role of credit constraints (Card 1999, 2001; Carneiro and Heckman 2002). Specifically, it contributes new evidence to a growing literature on the effects of financial aid on educational outcomes. While most of the literature has focused on the effects of scholarships or grants for higher education (Dynarski 2000; Bound and Turner 2002; Abraham and Clark 2006; Avery et al. 2006; Cornwell, Mustard, and Sridhar 2006; Kane 2007; Goodman 2008; Angrist et al. 2014), our focus is on the effects of student loans on educational outcomes (e.g., Marx and Turner 2018). Indirectly, our paper also relates to previous evidence on the heterogeneous returns to degrees (e.g., Hoekstra 2009; Dale and Krueger 2002, 2014; Armona, Chakrabarti, and Lovenheim 2018), among others in the United States.

Our work directly contributes to an incipient literature on the effects of student loans on early labor market outcomes (e.g., Rothstein and Rouse 2011; Weidner 2016; Ji 2018). The scarcity of evidence for the medium- or long-term impact of financial aid on labor market outcomes reflects the challenge of following students from high school graduation through to their adulthood in the labor market. Works that do provide causal estimates, at the state-specific level, in the United States are Scott-Clayton and Zafar (2016), Bettinger et al. (2019), and Denning, Marx, and Turner (2018); their results suggest a positive effect of merit-based scholarships on labor market outcomes. With respect to them, our work informs the debate and contributes evidence on the effect of a different, nationwide, financial aid policy: SGLs.

In the Chilean context, a prominent work is Solis (2017), which reports large effects of SGL on college enrollment. While we replicate some of the short-run results documented in this paper, our analysis suggests that accounting for the counterfactual alternative of marginal students is important.

We show, in section 1 of the online appendix, that in contrast to Solis (2017), the university enrollment gap between rich and poor students with access to the loan is very similar to the rich versus poor enrollment rate of students who do not have access to the loan (the difference is only 5 percentage points). Moreover, we show that accounting for enrollment at vocational institutions is important, as students who are not eligible for the university SGL eventually enroll in some type of higher education without it.

Furthermore, in the Chilean context, Rau, Rojas, and Urzúa (2013), first studied the effect of loan take-up on labor market outcomes 5 years after high school graduation using a structural model. While they also report a null effect of the SGL on earnings, our paper exhibits several differences with their work. First, Rau, Rojas, and Urzúa suggest that institutions enrolling SGL takers decrease their quality in order to keep enrollment up and retain funding. In contrast, our results indicate that SGL takers have low graduation rates and end up attending multiple institutions. Second, Rau, Rojas, and Urzúa analyze earnings 5 years after high school graduation, which does not allow enough time for university students to graduate. Indeed, we show that by year 5 after high school, there is still a significant share of students enrolled in higher education, limiting the interpretation of the findings of Rau, Rojas, and Urzúa in the labor market. Finally, as in Solis (2017), the RD analysis by Rau, Rojas, and Urzúa does not account for the significant trade-off between enrollment at universities and vocational institutions. A contemporaneous study, developed in parallel to ours, is Montoya, Noton, and Solis (2018), which supports our finding of a zero effect on earnings, using the same time horizon. Our work differs, however, in the way in which theirs assesses the presence of debt aversion as a potential mechanism behind the null labor market effect, while we show the importance of institutional quality in explaining this result.

The rest of this paper is organized as follows. Section II discusses institutional features of the SGL program. Section III presents the data, and section IV explains the empirical strategy used in this paper. Section V shows the effects of university loan take-up, and section VI presents suggestive evidence on the role of higher education institutions. Finally, section VII presents the extrapolation methodology and its results. Section VIII concludes.

II. Background

High school graduates applying for admission at 4-year institutions take a centralized college admission test (Prueba de Seleccion Universitaria [PSU]), which includes sections on math, language, science, and history. Scores on each section are normalized within a range of 150 to 850, with a mean of 500 and a standard deviation of 110. In 2006, the Chilean government introduced an SGL program. This policy provides access to loans at any accredited higher education institution to students who complete a

socioeconomic information form (Formulario Único de Acreditación Socioeconómica)[4] and score above 475 points on average between the math and language sections of the college admission exam. Students who do not meet the cutoff minimum but who have a high school GPA above 5.27 (GPA range: 1–7) are also eligible for an SGL at an accredited vocational institution but are not eligible for a university SGL. Figure 1 shows that the data conform to these sharp eligibility criteria. Figure 1*A* and 1*B* show the total first-year student debt at any institution and the university debt, respectively.

Loan applicants know their eligibility status before enrolling in higher education, and the general terms of the loan are publicly available. Students considering higher education alternatives can easily determine their eligibility status for an SGL at different types of institutions after their PSUs are graded because the same SGL eligibility cutoffs have been in place since 2006. Moreover, both the government and higher education institutions inform the students of their eligibility to receive the SGL and provide information on other forms of financial aid.

Some institutions and degree programs are allowed to impose requirements for loan eligibility above those established by legislation. These institution-specific requirements are also available to students at the time of enrollment. During the years of this study, the terms of the loan were as follows: 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 after their graduation or 1 month after a student drops out. Additionally, conditional on being in good academic standing, students could finance their degree for up to 3 years in excess of the official duration if it is for a university degree and for two additional years if it is for a vocational degree.

Students can use the SGL at any accredited institution. Accreditation is the responsibility of the Comisión Nacional de Acreditación, an independent agency that decides whether an institution receives accreditation and determines the number of years of accreditation based on different records from the university and external auditors. After the introduction of the SGL, the total number of accredited institutions rapidly increased, from 14 in 2004 to 45 in 2016 (see table A1 for more details). As of 2018, 64.3% of all higher education institutions are accredited, but there is significant heterogeneity in the number of years for which they receive the accreditation (from one

[4] 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, we have learned through conversations with policy makers involved in the implementation of the loan program and through our own analysis of the data that individuals in the fifth income quintile also became eligible in years when there was enough funding.

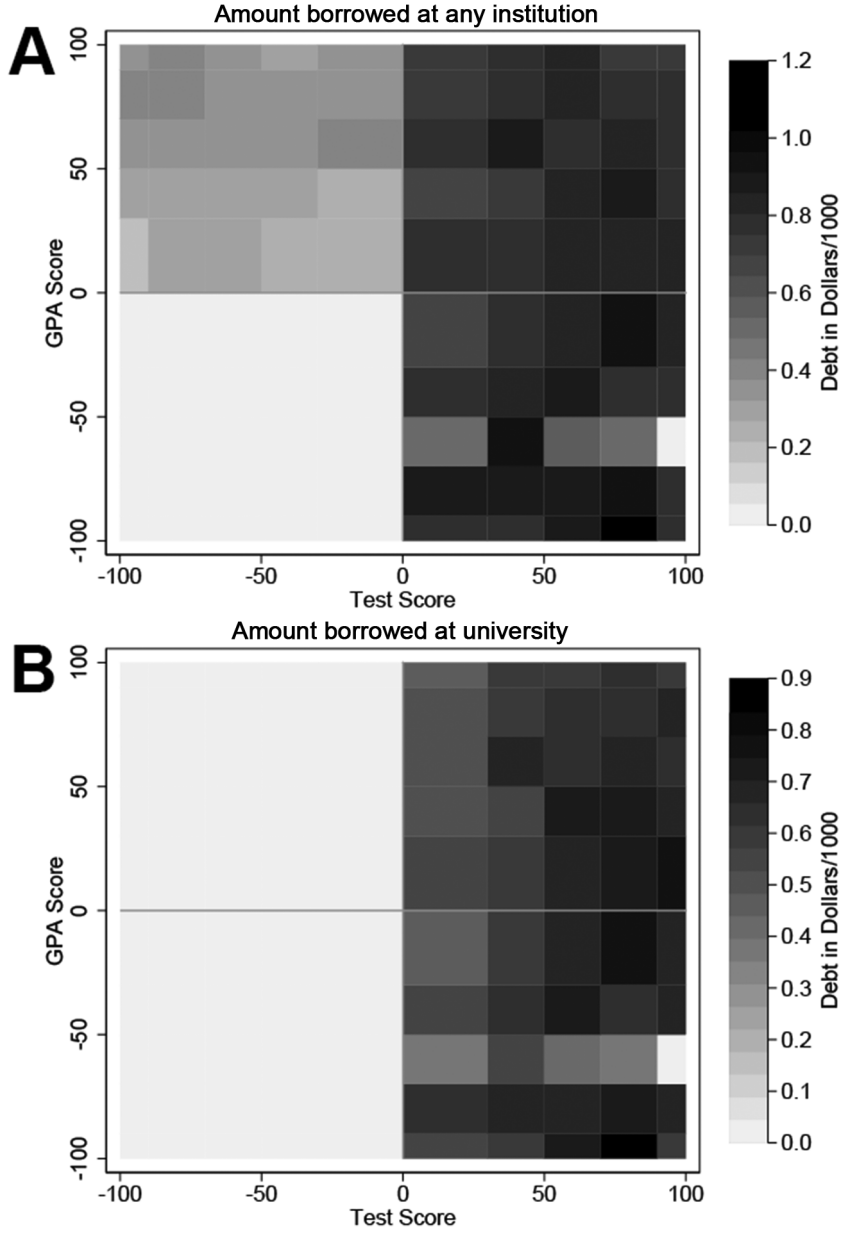

FIG. 1.—First-year amount borrowed using a state-guaranteed loan, by type of institution. These graphs present the first-year total amount borrowed by students with different average math and language test scores centered on the eligibility cutoff (475) on the *X*-axis and with different grade point average (GPA) scores also centered on the eligibility cutoff. *A* shows the total first-year debt at any institution, and *B* restricts this debt to universities.

to seven). After enrolling at an 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, so the difference would have to be covered by students, their families, or scholarships. Alternative financing options include another university loan, available only for students enrolled at universities belonging to the "council of rectors" (Consejo de Rectores de Universidades Chilenas) and government-provided scholarships.

For the cohorts in our analysis, students who are among the poorest 40% of the population and who scored above an average of 550 points on the mathematics and language exams of the PSU have access to scholarships that partially cover tuition for 4-year degrees, while students with a GPA above 5.0 are eligible for scholarships in 2-year degree programs. Therefore, students who qualified by a small margin for an SGL at a university do not have access to government-provided scholarships. Indeed, most students who did not meet the minimum eligibility requirements for a loan would probably have had trouble securing a private loan to fund their education. According to the nationally representative household survey CASEN (Caracterización Socioeconómica Nacional), only 7.5% of the loans held by all students in 2015 came from private banks (without state guarantee).

Since the implementation of SGLs, 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 15,8000 students in the first year of operation to 652,000 students by 2016. Figure 2 presents the evolution of both the number of students using SGLs and the total debt they incurred. As these figures began to increase, commentators started arguing about the burden that student debt can impose on borrowers and whether the rising outstanding debt should be of public concern. In fact, in April 2018, congress created a commission to reformulate the SGL program and investigate whether debt negatively affected students. The Chilean government is currently considering a complete reform of the SGL program.

III. Data and Descriptive Statistics

Our data set includes demographic information, test scores, enrollment, graduation, financial aid, and labor market outcomes for the totality of high school graduates from 2007 to 2017. In our analysis, we focus on a sample of students who graduated from high school in 2007 or 2008, took the college admission test immediately afterward, and provided their socioeconomic information to apply for financial aid. For these students, we observed enrollment in higher education, their loan take-up, whether they graduated and when, and the characteristics of their degrees as well as their labor market participation, wages, and employer characteristics for up to 9 years after high school graduation.

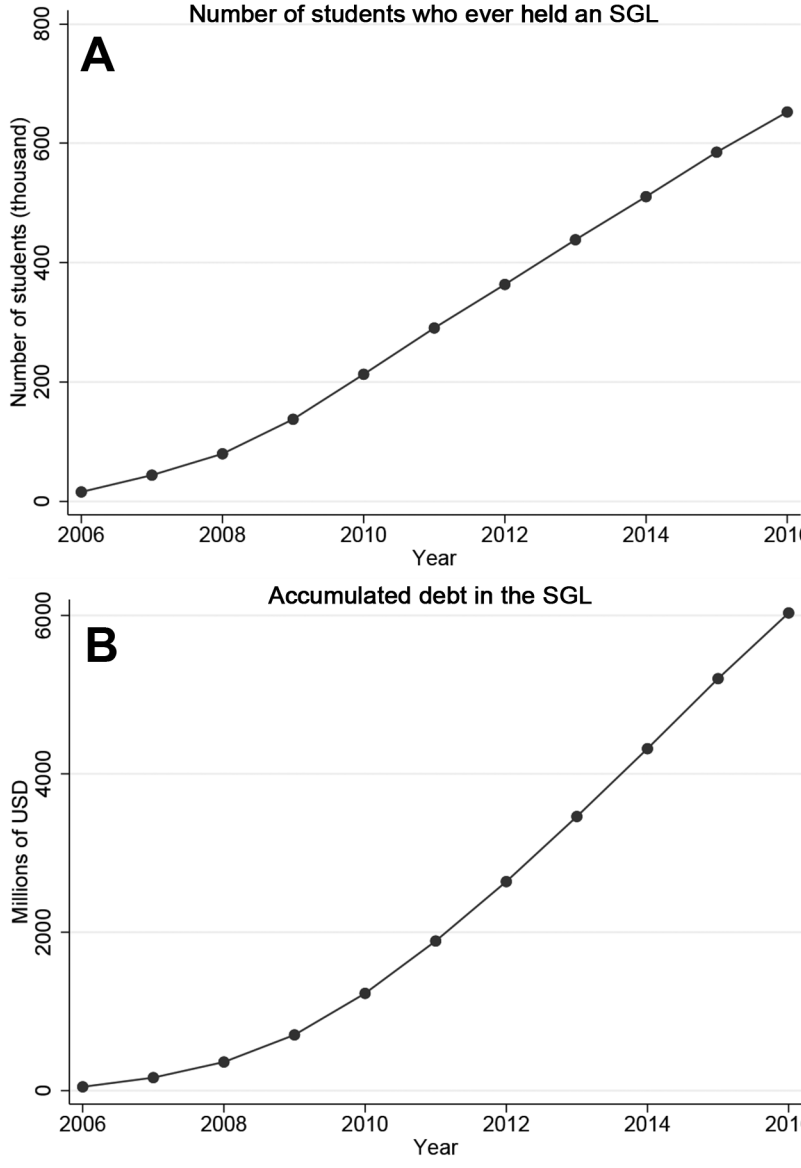

FIG. 2.—Total number of students with a student loan and total accumulated debt. These graphs show the total number of students who ever took-up a state-guaranteed loan (SGL; *A*) and the accumulated student debt in the SGL (*B*), by year.

Labor market outcomes come from the Chilean unemployment insurance (UI) data set, which covers all dependent labor in the private sector between January 2007 and October 2017, and the pension system (PS) data set, which includes dependent and independent labor in both the public sector and the private sector but which we can access only from 2013 to 2015. Thus, while we conduct most of our analysis using UI data, we also use the PS data to study public sector work and to check the robustness of our results to the inclusion of independent workers. Section 9 of the online appendix provides further details on data processing and sample construction.

Financial aid applicants and students in our analysis sample have lower incomes 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

Table 1
Descriptive Statistics for Students

	Test Takers (1)	Analysis Sample (2)	University Loan Eligible (3)	RD Sample (4)
	A. Demographics at the Time of High School Graduation			
Female	.54	.57	.53	.59
Public high school	.36	.40	.34	.42
Voucher high school	.52	.56	.60	.57
Private high school	.11	.04	.06	.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	.67	.72	.67	.77
Mother with more than high school	.28	.25	.33	.18
Father with more than high school	.33	.30	.38	.22
Father monthly wage (dollars)	518.9	474.2	515.9	429.3
Have information on father wage	.39	.41	.42	.41
	B. Financial Aid			
Ever taking up a university loan	.21	.28	.36	.31
University scholarship eligibility	.09	.16	.25	.00
Observations	298,859	177,470	113,059	53,416

NOTE.—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 (Prueba de Seleccion Universitaria [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 out a financial aid application form; 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, col. 4 includes students in the analysis sample with an average mathematics and language score around the eligibility cutoff, specifically in a 40-point bandwidth. Admission scores presented in panel A have a mean of 500 and a standard deviation of 110 points, and grade point average (GPA) ranges between 1 and 7, with a mean of 5.56 and a standard deviation of 0.55. RD = regression discontinuity.

Table 2
Descriptive Statistics for Higher Education Institutions

	University				Vocational	
	Tier 1 (1)	Tier 2 (2)	Tier 3 (3)	Tier 4 (4)	Top (5)	Bottom (6)
	A. First-Year Student Characteristics in 2008					
Took admission test	.65	.52	.38	.24	.31	.17
Average math and language score	640.5	557.6	493.0	446.7	445.3	418.6
Students with an SGL	.07	.18	.16	.00	.21	.05
Students with a scholarship	.28	.19	.04	.00	.20	.14
	B. Institutional Characteristics Weighted by First-Year Enrollment In 2008					
Number of institutions	10	26	16	7	55	60
Average number of degrees	299.8	127.5	103.3	38.4	76.2	33.2
Total enrollment	29,629	50,279	23,713	4,207	63,290	13,663
Accredited degree	.49	.26	.08	.06	.03	.00
Accredited institution	1.00	1.00	.97	.80	.96	.62
Years of accreditation	5.98	4.44	2.82	1.60	4.99	1.86
Graduation rate	.48	.39	.33	.23	.37	.31
Tuition (thousand dollars)	5.10	4.25	3.29	2.95	2.11	1.29

NOTE.—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 institutions are in the 600–850 range, second-tier institutions are in the 525–599 range, third-tier institutions are in the 450–524 range, and fourth-tier institutions includes those with an average below 450 and with more than half of students without a score. Vocational institutions are classified using the fraction of students who took the college admission exam. Top vocational institutions 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 and corresponds to the share of students who are enrolled in their first year in 2008 and ever graduate (between 2008 and 2015) from the institution. Tuition corresponds to the annual tuition. SGL = state-guaranteed loan.

(RD sample).[5] Column 2 shows that financial aid applicants are more likely to have attended a public high school, to have public health insurance, and to have less educated parents. In contrast, column 3 shows that students who qualify for a university loan by scoring above 475 points come from a higher socioeconomic background. Our RD sample, in column 4, has characteristics similar to those of the rest of financial aid applicants. No student in the RD sample is eligible for a state-provided scholarship, a by-product of the test score bandwidth that excludes scholarship-eligible students. Finally, the labor market outcomes of students in these four samples are similar.

The characteristics of the higher education institution where the loan is used are important. 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 would have higher average math and language admission scores and a higher share of students taking the admission test. Top vocational institutions have a

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

greater share of students who took the college admission test and are above the median within these types of institutions. We see that middle-tier universities have the highest concentration of students using an SGL. On the one hand, the more selective second-tier universities are better than or similar to top vocational institutions in terms of years of accreditation, graduation rates, and share of students with scholarships. On the other hand, less selective third-tier universities are worse than top vocational institutions considering all of these dimensions. Moreover, vocational institutions are significantly cheaper than these middle-tier universities. Finally, the two types of institutions that concentrate 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 an SGL for distinct 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 universities are not accredited, which makes their students ineligible to obtain an SGL. We validated this measure of quality with an observational value-added model at the institution level. We come back to this in section V.

IV. Empirical Framework

The first causal relationship of interest is the effect of being eligible for a university SGL (right after graduating from high school) on labor market outcomes. This is identified directly by the sharp RD design of SGL eligibility. We estimate the following specification:

$$Y_i = \gamma Z_i + h(r_i) + e_i, \tag{1}$$

where γ identifies the causal effect of interest, $Z_i = 1(r_i > 0)$ is an initial eligibility dummy that equals 1 if the student scored above 475 in her first attempt at the college admission exam, and $h(r_i)$ is a function of the running variable r_i = (average math and language − 475), where math and language correspond to the score on the first attempt at the college admission exam. Specifically, we use a linear polynomial of r_i on both sides of the threshold.

A second relationship of interest is the effect of taking up an SGL at a university in educational and labor market outcomes. We model this relationship with

$$Y_i = \beta L_i + f(r_i) + e_i, \tag{2}$$

where Y_i is an outcome for student i, L_i is an indicator of treatment equal to 1 if the student ever used an SGL to enroll at a university, and $f(r_i)$ is a function of the running variable modeled similarly to $h(r_i)$.

A potential threat to identification in this setting is that the decision of taking up an SGL to attend university may be related to students' comparative advantage. If that is the case, ordinary least squares (OLS) estimates of

equation (2) will not recover the causal effect of loan take-up. To address this concern, we estimate equation (2) with two-stage least squares (2SLS), using the following first-stage equation:

$$L_i = \pi Z_i + g(r_i) + v_i, \tag{3}$$

where $g(r_i)$ is a linear function of the running variable r_i with a different slope at each side of the cutoff and Z_i is the initial eligibility indicator defined before. In our setting, where students cannot manipulate the score they get, the first-stage exploits the quasi-random nature of initial eligibility around the eligibility cutoff. Figure 3 plots university loan take-up among students who initially applied for financial aid and those who did not. Plotted points are conditional means for all students in our analysis sample within a 2-point bin width of the average math and language scores obtained by the students on their first PSU attempt. Figure 3*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 eligible students. On the other hand, students who did not apply for financial aid do not have access to an SGL. This validates the sharp nature of initial eligibility exploited in equations (1) and (3). The figure also shows that loan take-up starts decreasing above the cutoff of 550 points needed to access government scholarships. Figure 3*B* graphically shows the first-stage equation (3), where crossing the initial eligibility cutoff discontinuously increases the probability of ever taking up a university loan. This also highlights the fuzzy nature of this quasi experiment. Even without being initially eligible, prospective students are able to retake the college admission test or get an SGL as second-year university students.

Estimates of equation (3) confirm the graphical representation of the first stage. 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 relative to the 23% take-up among initially ineligible students.[6] 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 tests of nonmanipulation of the running variable, and covariates are balanced between treated and untreated students. Visual inspection of the density of the running variable in figure 4, and the overlapping confidence intervals of density estimates on both sides of the cutoff indicate no manipulation on the centrally administered tests used to construct the running variable. Corroborating our conclusions, the tests proposed by Cattaneo, Jansson, and Ma (2016, 2019) and by McCrary (2008) fail to reject the

[6] We use a 40-point bandwidth for our analysis. We report results using outcome-specific bandwidths, using the method in Calonico, Cattaneo, and Titiunik (2014).

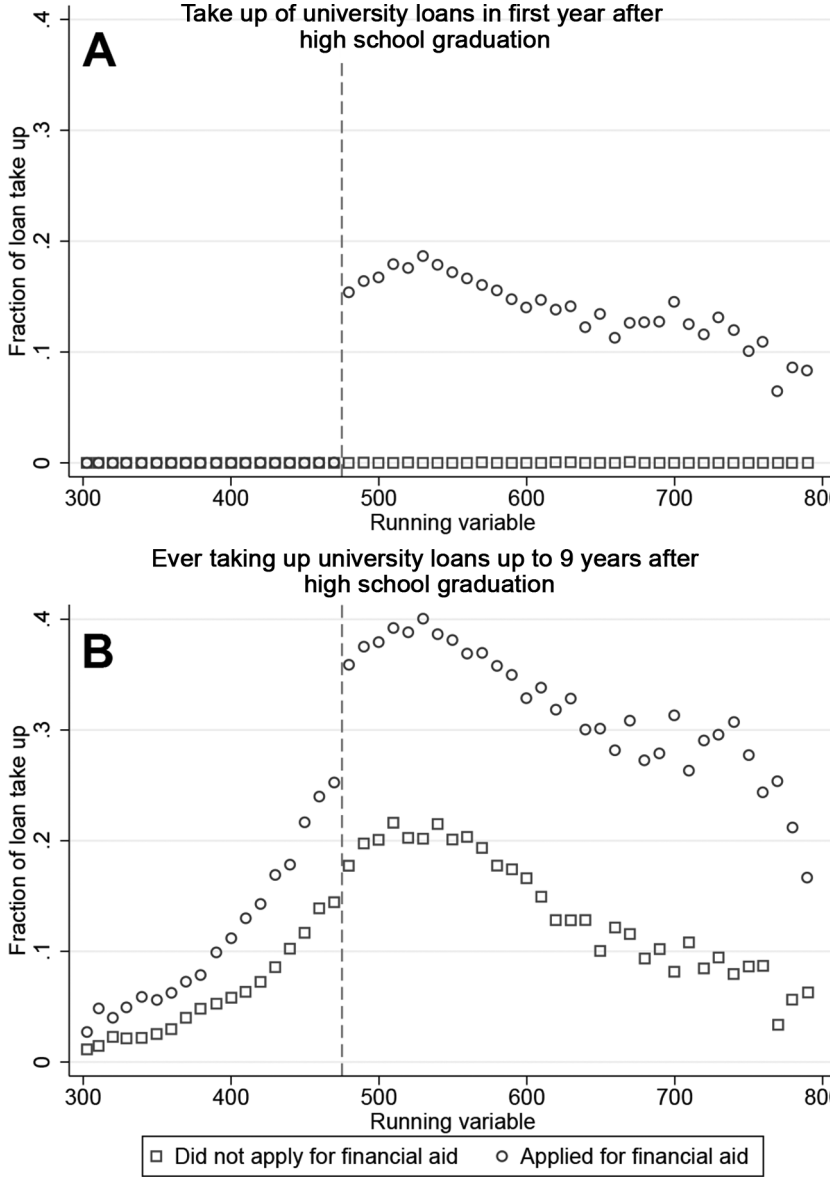

FIG. 3.—University loan take-up. These graphs plot the fraction of students who take up a university loan as a function of the running variable, by initial financial aid application status. Each point shows a conditional mean in a 10-point bin width of the running variable. *A* shows take-up in the year just after high school graduation, and *B* shows take-up at any point up to 9 years after high school graduation. A color version of this figure is available online.

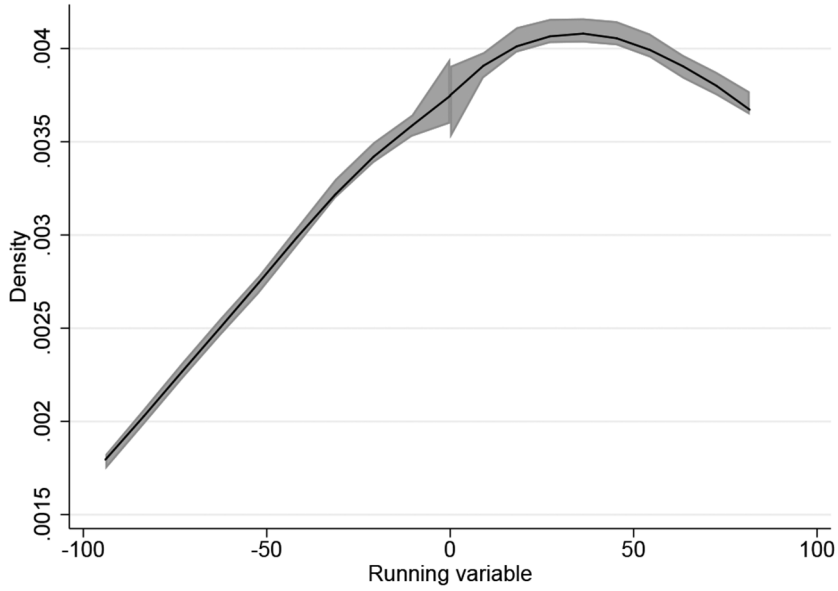

FIG. 4.—Density of running variable. This graph presents estimates of the density of the running variable on both sides of the eligibility cutoff with their confidence intervals in gray. This plot was produced using the rddensity command of Cattaneo, Jansson, and Ma (2016).

null hypothesis of equal densities around the cutoff. Additionally, 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 on both sides of the cutoff. The coefficients come from regressions of each baseline characteristic on the initial eligibility indicator Z_i, substituting L_i by the corresponding characteristic in equation (3). We consider different samples: column 1 uses all test takers, and column 2 only uses test takers who applied for financial aid. Finally, column 3 includes test takers who completed the financial aid application and scored within a 40-point bandwidth of the eligibility cutoff (i.e., our RD sample). As reflected by the coefficients in column 3, mean differences are small and statistically insignificant in the RD sample, indicating that random assignment of initial eligibility for a university loan is a reasonable assumption around the cutoff.

Under standard assumptions, the 2SLS estimate of β in equation (2) may be interpreted as a local average treatment effect (LATE).[7] This is an average causal effect of SGL use for compliers (i.e., those students who use the loan

[7] Standard LATE assumptions in this case would imply that initial university loan eligibility only influences educational and labor market outcomes through the use of the loan to enroll at a university and that initial loan eligibility weakly increases the take-up for all students.

Table 3
Covariate Balance

	Test Takers (1)	Analysis Sample (2)	RD Sample (3)
Female	.023***	.017***	−.002
	(.003)	(.004)	(.008)
Father monthly wage in $t = 0$	−11.092	−11.509	−7.577
	(6.781)	(7.571)	(13.271)
Have information on father wage	.016***	.013***	.013
	(.003)	(.004)	(.008)
Mother has more than high school	.009***	.003	.004
	(.003)	(.004)	(.007)
Father has more than high school	.014***	−.001	.000
	(.003)	(.004)	(.007)
Public health insurance	−.002	.005	.005
	(.003)	(.004)	(.007)
Public high school	−.031***	−.040***	.006
	(.003)	(.004)	(.008)
Voucher high school	.085***	.070***	−.006
	(.003)	(.004)	(.009)
Private high school	−.054***	−.030***	.000
	(.002)	(.002)	(.002)
High school GPA	.004	.002	.009
	(.004)	(.004)	(.010)
Observations	298,859	177,470	53,416

NOTE.—This table compares characteristics of eligible and ineligible students to the university state-guaranteed loan in three different samples. Column 1 reports differences among all test takers, col. 2 presents a comparison between test takers who also applied for financial aid, and col. 3 restricts the comparison to a sample of students within 40 points around the eligibility cutoff. Coefficients come from regressions of each baseline characteristic on the initial eligibility indicator Z_i, controlling by the test score with a different slope at each side of the cutoff. Robust standard errors are in parentheses. GPA = grade point average; RD = regression discontinuity.
*** Significant at 1%.

at some point to enroll at a university should they be initially eligible) and thus would never use the loan to enroll at a university otherwise (Imbens and Angrist 1994; Angrist, Imbens, and Rubin 1996). While the nature of our approach restricts the group for which we can identify the causal effect of the university SGL, this strategy deals with a potential threat arising from the test-retaking behavior of students.[8] In our context, compliers are likely to be in need of financial aid to access a university education. Table 4 presents average demographic characteristics for different groups: all students in the analysis sample, university-loan-eligible students, and university-loan-eligible compliers. Average characteristics for the latter group are estimated

[8] In sec. 4.2 of the online appendix, we present results from our analysis of retaking behavior. Nevertheless, an alternative strategy where the endogenous variable is defined as loan take-up on the first attempt and that leads to compliers who might retake the admissions exam and thus later qualify and take the SGL leads to similar results.

Table 4
Complier Characteristics

	Analysis Sample (1)	University Loan Eligible (2)	Eligible Compliers (3)
	A. Demographics		
Female	.57	.53	.64
Mother has more than high school	.25	.33	.20
Father has more than high school	.30	.38	.23
Public health insurance	.72	.67	.81
Public high school	.40	.34	.41
Voucher high school	.56	.60	.59
Private high school	.04	.06	.00
	B. Family Income Quintile		
First	.44	.36	.51
Second	.19	.19	.17
Third	.14	.16	.20
Fourth	.12	.16	.10
Fifth	.11	.14	.02
	C. Financial Aid		
University loan eligible	.63	1.00	1.00
University loan ever take-up	.28	.36	1.00
University scholarship eligibility	.16	.25	.00
Vocational loan eligible	.81	.91	.74

NOTE.—This table presents the average characteristics for our analysis sample in col. 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 col. 3 shows the estimated average characteristics of the eligible complier population computed following Abadie (2002). A grade point average of more than 5.27 implies that the student is eligible for a state-guaranteed loan at vocational institutions.

following Abadie (2002). Panel A shows that eligible compliers are more likely to have parents who did not pursue higher education, are more likely to have public health insurance, and are more likely to have attended public high school. Additionally, panel B shows that 51% of eligible compliers are part of the poorest 20% of the population, while 36% of students who are eligible for the university loan come from this group. Finally, panel C shows that only 36% of the eligible population take up the university loan and no one in the complier population gained access to a university scholarship, but 74% of compliers are eligible for an SGL at a vocational institution.

V. Results

This section presents the effects of the university loan on education and labor market outcomes. We comment on both the reduced-form effects of loan eligibility and the 2SLS estimates of university SGL take-up. The first estimates are the key input for ex ante analysis of policies that give broader

access to student loans, while the second estimates are the key input from the students' perspective or an ex post evaluation. Reduced-form effects are more precisely estimated and are emphasized throughout.

A. 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 increased their total years of schooling. Figure 5 provides a graphical representation of the reduced form in equation (1), showing conditional means of an indicator for ever enrolling in higher education against the running variable. Figure 5*A* shows that students above and below the cutoff enrolled in some form of higher education at least once throughout the 9 years after high school graduation, with students above the cutoff substituting vocational education for university degrees, as shown by figure 5*B* and 5*C*. Despite the null extensive margin effect, figure 6 shows that initial

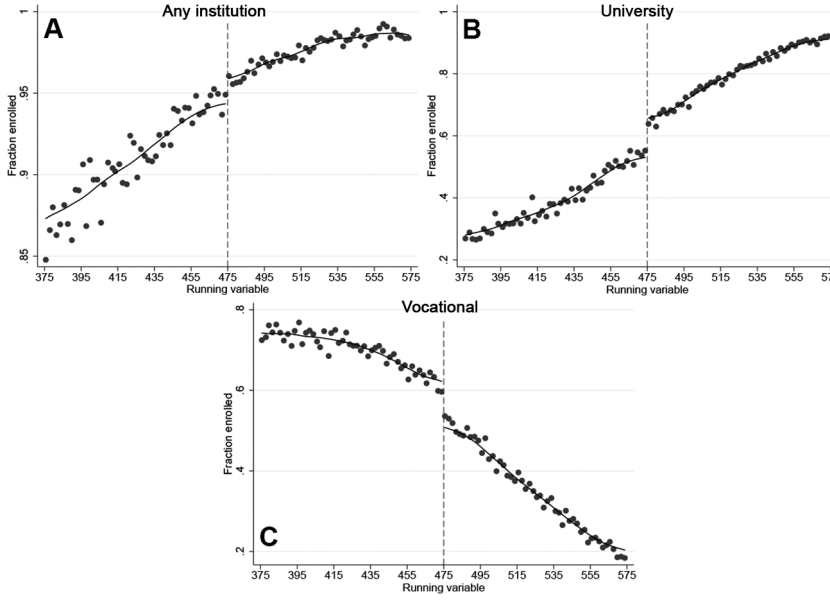

FIG. 5.—Ever enrollment rates, by type of institution. *A*, Any type of institution. *B*, University. *C*, Vocational. These graphs show the average fraction of students enrolled in a 2-point bandwidth of the running variable at different types of institutions. The dashed vertical line shows the eligibility 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 plug-in estimator of the asymptotically optimal constant bandwidth (Fan and Gijbels 1996). A color version of this figure is available online.

eligibility increased the overall years of higher education. Figure 6*A* shows reduced-form evidence that students who are initially eligible for the loan increase their overall education, with students increasing university attainment and reducing attainment at vocational degrees, as shown in figure 6*B* and 6*C*.

Table 5 summarizes the previous reduced-form effects and presents 2SLS estimates. The first row in this table shows 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 (a 35% effect with a *F*-statistic above 100). 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. Initial SGL eligibility at a university increased the years of education by 0.18 years, with an increase in university attainment of 0.43 years and decrease in vocational degrees of 0.25 years. Column 3 in table 5 presents

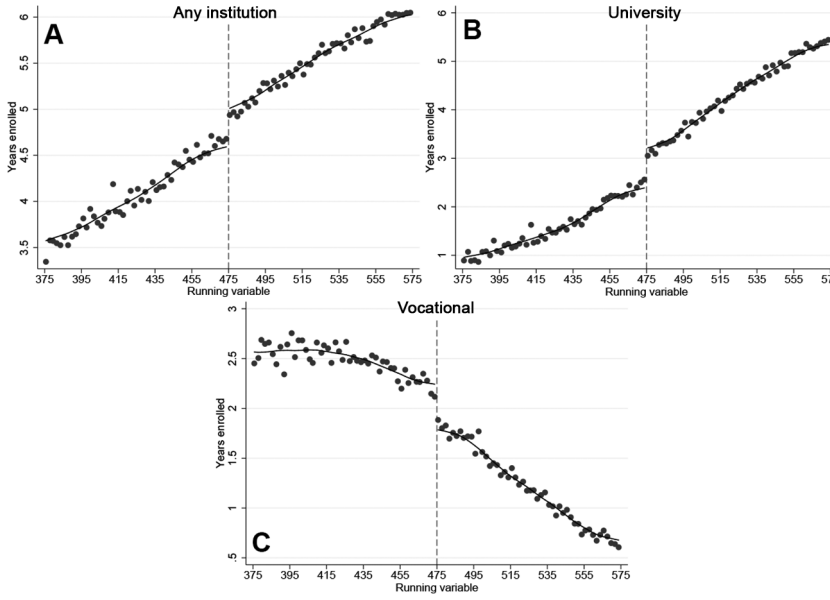

FIG. 6.—Years of enrollment, by type of institution. *A*, Any type of institution. *B*, University. *C*, Vocational. These graphs show the average years of education in a 2-point bandwidth of the running variable at different types of institutions. The dashed vertical line shows the eligibility cutoff 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 plug-in estimator of the asymptotically optimal constant bandwidth (Fan and Gijbels 1996). A color version of this figure is available online.

Table 5
Effect of Loan Take-Up on Educational Outcomes

	Reduced Form (1)	Ineligible Complier Mean (2)	2SLS (3)	OLS (4)
First stage			.083***	
			(.008)	
	A. Ever Enrollment			
Any institution	.004	.953	.047	.046***
	(.00)		(.04)	(.00)
University	.068***	.175	.823***	.347***
	(.01)		(.09)	(.00)
Vocational	−.058***	.999	−.705***	−.222***
	(.01)		(.10)	(.00)
	B. Years of Enrollment			
Any institution	.177***	3.484	2.141***	1.125***
	(.04)		(.41)	(.01)
University	.426***	.000	5.140***	2.151***
	(.05)		(.52)	(.01)
Vocational	−.249***	3.650	−3.000***	−1.026***
	(.04)		(.43)	(.01)
	C. Graduation and Number of Institutions			
Overall graduation	−.021**	.646	−.248**	−.043***
	(.01)		(.11)	(.00)
Graduation university	.033***	.004	.396***	.118***
	(.01)		(.08)	(.00)
Graduation vocational	−.053***	.642	−.645***	−.161***
	(.01)		(.10)	(.00)
Number of institutions attended	.038***	1.158	.460***	.110***
	(.01)		(.12)	(.00)
Observations	53,416	53,416	53,416	177,470

NOTE.—This table presents university loan take-up effects on ever enrollment, years of education, and graduation from 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, col. 2 shows the complier mean for ineligible students computed following Abadie (2002), col. 3 presents the treatment effect estimated by two-stage least squares (2SLS), and col. 4 shows ordinary least squares (OLS) estimates. Estimates in cols. 1–3 are computed in our regression discontinuity sample, restricted to observations in a 40-point bandwidth of the eligibility cutoff. Column 4 uses the whole-analysis sample. Out-of-range complier means are replaced with bound values (0 or 1). Robust standard errors are in parentheses.

** Significant at 5%.

*** Significant at 1%.

the 2SLS coefficients, which in our just-identified instrumental variable (IV) model correspond to the reduced-form effects scaled by the first stage coefficient. Panel A shows that taking up a university loan increases the probability of ever enrolling at a university by 83 percentage points while decreasing the probability of ever enrolling at a vocational institution by 71 percentage points. In panel B, 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 compliers pursue a degree by 40%.[9] Moreover, panel C shows that taking the loan at a university decreases overall graduation by 25 percentage points, which results from a reduction in vocational graduation of 65 percentage points and an increase in university graduation of only 40 percentage points. Thus, while the loan helped students to move from a vocational degree into a university, by year 8 out of high school it did not help them finish their degrees.

Column 2 presents the complier mean among untreated students, $E[Y_{i0}|L_{i1} > L_{i0}]$, in the potential outcomes notation.[10] These estimates show that almost all ineligible compliers attended vocational education, and 17% of them also attended a university. Moreover, from the fact that $E[Y_{i1}|L_{i1} > L_{i0}] = E[Y_{i1} - Y_{i0}|L_{i1} > L_{i0}] + E[Y_{i0}|L_{i1} > L_{i0}]$, we conclude that 30% of all eligible compliers also attended vocational institutions.

Previous results are not significantly affected by students being enrolled in higher education at the time of our measurement. Figures 7–9 plot mean educational outcomes for every year after high school. By year 9, both the years of schooling and the enrollment rates have converged between eligible and ineligible compliers. Figure 7*A* presents the fraction of students enrolled at a university between 1 and 9 years after high school, with figure 7*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 eligible and ineligible compliers by year 9 out of high school. Moreover, by the end of our sample window, enrollment is less than 10% in vocational and university degrees. Similarly, figure 8 shows that 7 years after high school graduation, the years of schooling at each type of institution have converged. Finally, figure 9 shows that the proportion of students holding a degree increases over the years to reach 40% among eligible compliers and 65% among ineligible compliers. Although the graduation rate from university does not show convergence, the fact that the average number of years of schooling is stable while the enrollment rate declines to zero indicates that a significant graduation increase is unlikely.

[9] The increase in the number of institutions in which a student enroll may arise from students switching either within 2- or 4-year institutions or between 2- and 4-year institutions. We have excluded advanced degrees from our analysis.

[10] These are computed following Abadie (2002). Basically, we regress $(1 - L_i)Y_i = \rho(1 - L_i) + f(r_i, Z_i) + v_i$ using initial eligibility as an instrument. In this context, ρ is an estimate of $E[Y_{0i}|L_{i1} > L_{i0}]$.

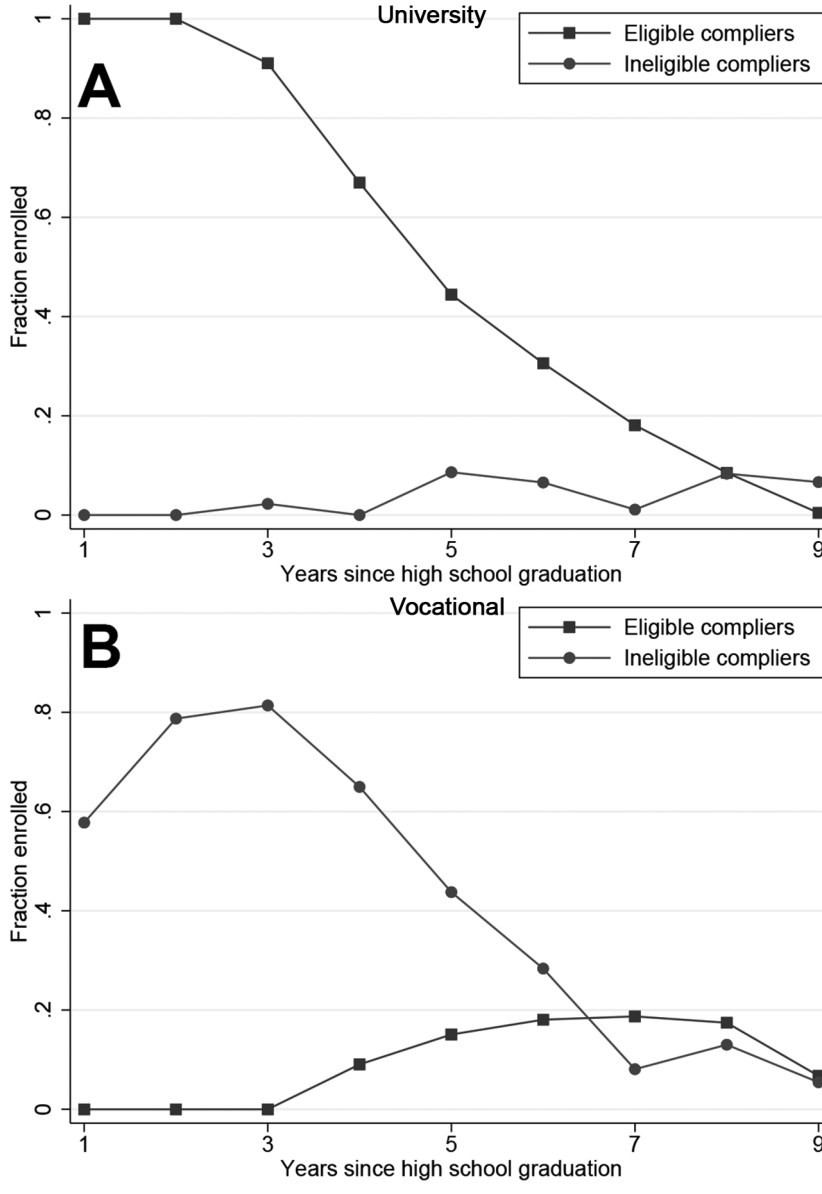

FIG. 7.—Fraction of compliers enrolled, by year and initial eligibility status. These graphs present the fraction of complier students enrolled by year (after high school graduation) and by initial university loan eligibility. *A* shows enrollment at universities, and *B* shows enrollment at vocational institutions. Each point is the complier mean obtained using the method in Abadie (2002). We replace the values with 0 or 1 when they are out of range. A color version of this figure is available online.

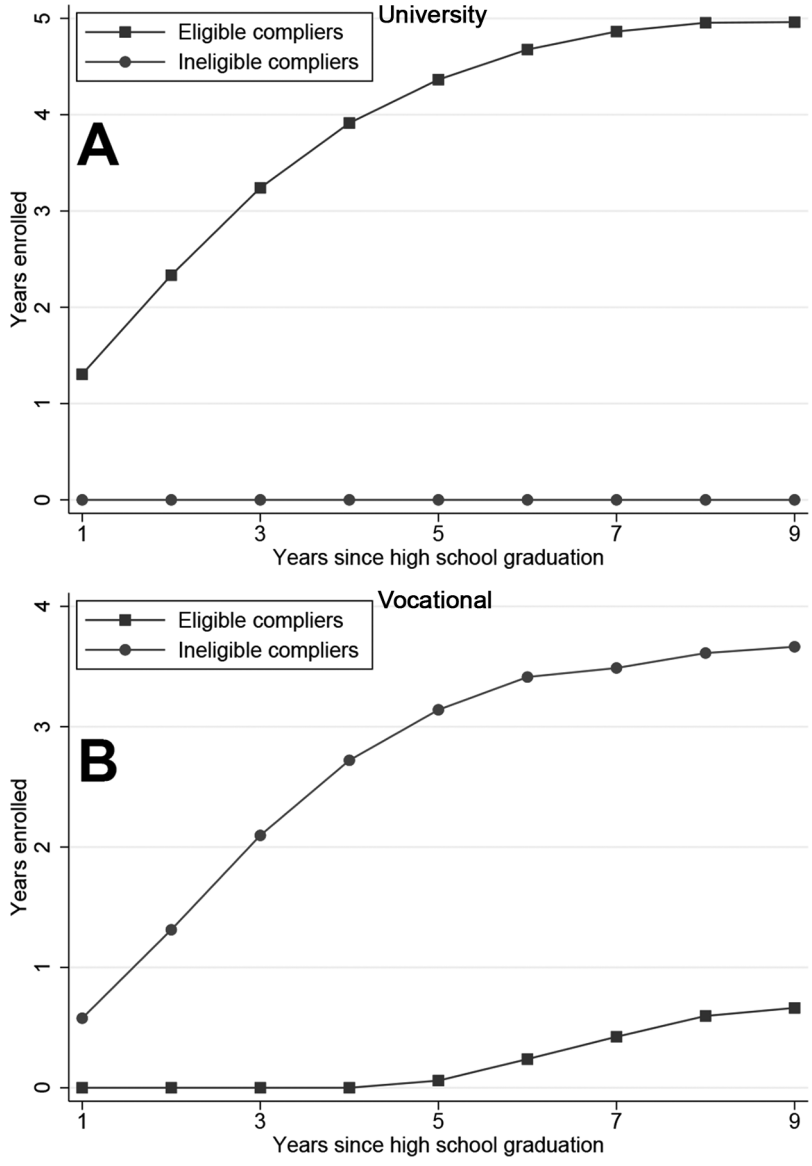

FIG. 8.—Years of enrollment among complier students, by year and initial eligibility. These graphs present the total number of years of enrollment among complier students by year (after high school graduation) and by initial university loan eligibility. *A* shows results for enrollment at universities, and *B* shows results for enrollment at vocational institutions. Each point is the complier mean obtained using the method in Abadie (2002). We replace the values with 0 or 1 when they are out of range. A color version of this figure is available online.

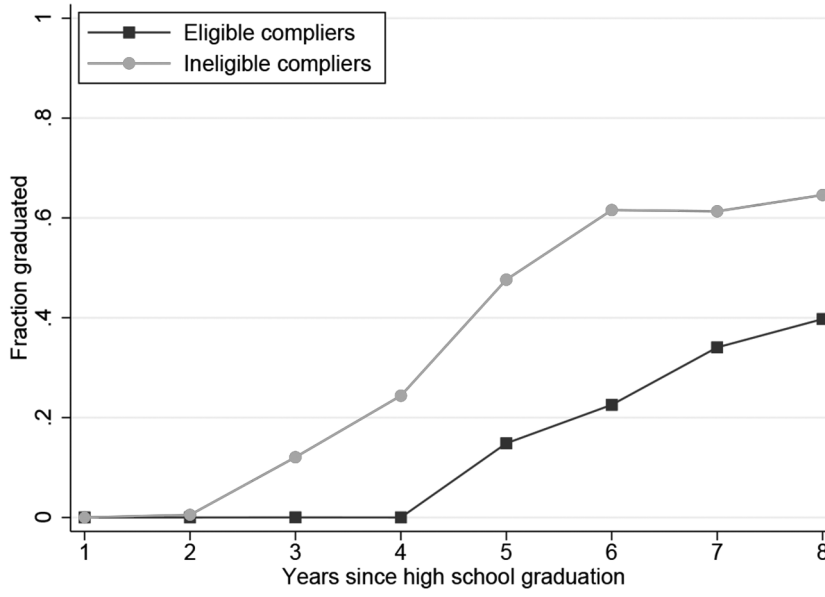

FIG. 9.—Fraction of students graduated with a degree at any type of institution, by year and initial eligibility. This graph presents the average fraction graduated from any type of institution among complier students by year (after high school graduation) and by initial university loan eligibility. Each point is the complier mean obtained using the method in Abadie (2002). We replace the values with 0 or 1 when they are out of range. A color version of this figure is available online.

B. Effects on Debt and Labor Market Outcomes

Students who initially scored above the eligibility cutoff have higher debt and similar earnings than students who were ineligible by a small margin. Figure 10 shows graphical evidence of the reduced-form effects of the increase in total accumulated SGL debt at any type of institution 9 years after high school graduation. Students just above the cutoff accumulate more debt, an unsurprising result given that they also enroll longer and at institutions that are more expensive. More surprising is that students end up with a similar level of earnings regardless of their initial university loan eligibility status. Figure 11 shows the average monthly wage of students 9 years after high school, where we see that students above and below the cutoff have almost indistinguishable average income. We find similar reduced-form patterns for the probability of being employed, the probability of having a fixed-term contract, the probability of having a part-time job, and the average wage paid at the firm.

Table 6 presents again the first-stage results at the top, the reduced-form effects in column 1, the ineligible complier mean in column 2, the 2SLS

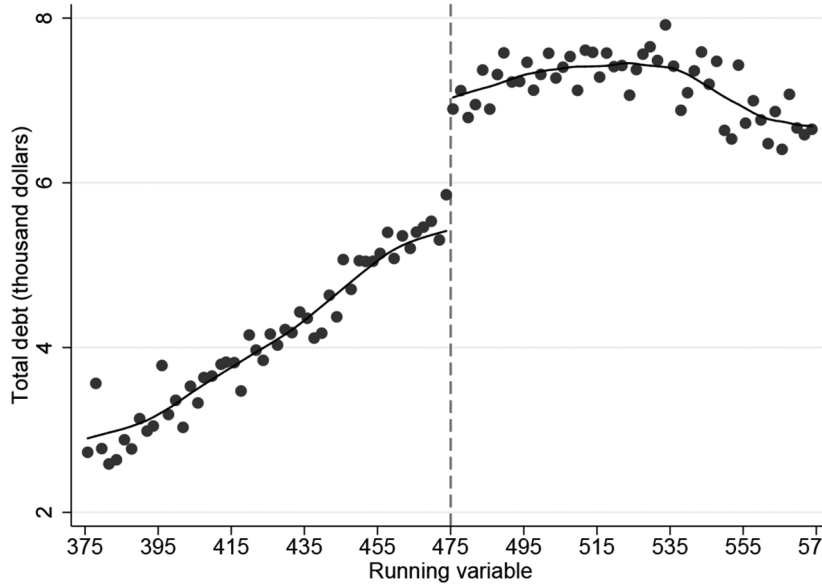

FIG. 10.—Total state-guaranteed loan (SGL) debt at any institution. This graph presents the total average student debt in SGLs accumulated over 9 years. Each point is the average debt in a 2-point bandwidth of the running variable. The dashed vertical line shows the eligibility cutoff for a first-year university loan, and the solid lines are local linear fits using a rule-of-thumb bandwidth and an Epanechnikov kernel. The bandwidth is the plug-in estimator of the asymptotically optimal constant bandwidth (Fan and Gijbels 1996). A color version of this figure is available online.

estimates in column 3, and the OLS estimates in column 4. The reduced form in panel A shows that students initially eligible for a university SGL increase their overall debt by 1,200 dollars of total debt, substituting debt at vocational institutions for university debt, while panels B and C show an insignificant effect on labor market outcomes, with eligible students earning between −4.5 and −10.4 dollars per month less than ineligible students, being able to reject effects larger than 22 dollars. Turning to the causal estimates of taking up a university SGL, we find that students who are induced to take up a university student loan because of their initial eligibility (i.e., the compliers) accumulate 14,300 more dollars in student debt. In column 2, we see that the mean debt for students who are not initially eligible is 3,000 dollars, which is explained by their eligibility for a loan at a vocational institution, by 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. Panel B shows statistically insignificant effects of loan take-up on wages (ranging from USD −381 to 273) and probability of employment (ranging from −0.27 to 0.07 percentage points). As shown in panel C, these estimates

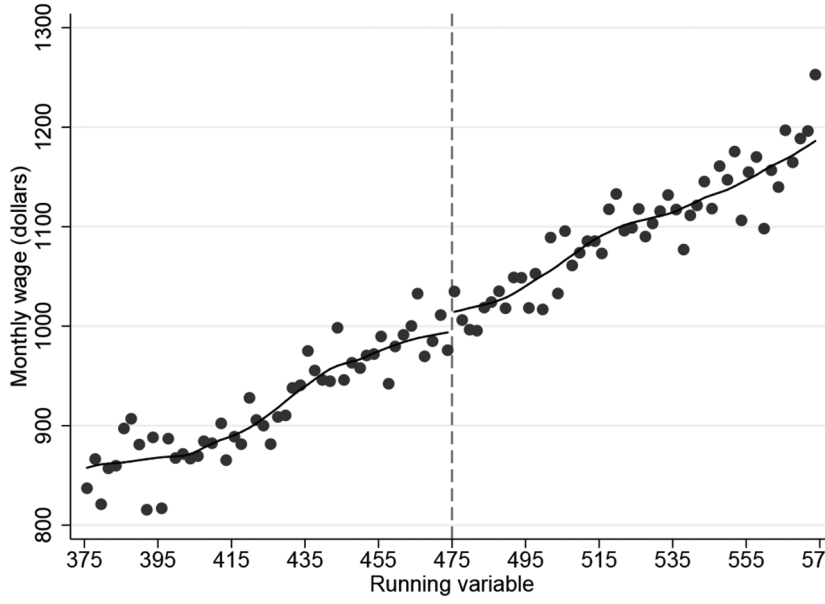

FIG. 11.—Average wage (excluding zeros) by year 9 out of high school. This graph presents the average monthly wage in dollars in a 2-point bin width of the running variable. The dashed vertical line shows the eligibility cutoff for a first-year university loan, and the solid black lines are local linear fits using a rule-of-thumb bandwidth and an Epanechnikov kernel. The bandwidth is the plug-in estimator of the asymptotically optimal constant bandwidth (Fan and Gijbels 1996). A color version of this figure is available online.

are robust to the inclusion of independent and public sector workers. Students around the cutoff also work at firms that pay similar average wages, leaving little room for differential career paths that may arise as a consequence of the initial employer-employee match. 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] While the 2SLS estimates are noisy, the direct effect of eligibility tightly estimates a zero effect. In addition, we also examined differential effects by gender. The evidence indicates that women participate less in the labor market, but the effects of loan take-up on educational and labor market outcomes are similar for men and women.[12]

[11] This setting is different from Rothstein and Rouse (2011) in the sense that we study the effect of taking up a loan for university in a context where the counterfactual for ineligible compliers includes the possibility of using loans for vocational studies.

[12] Section 5 of the online appendix provides details of this analysis.

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			.083***	
			(.008)	
	A. Total Debt and Cost of Degree (Thousand Dollars)			
Total debt all institutions	1.2***	3.00	14.3***	13.8***
	(.13)		(1.16)	(.04)
Debt university loan	1.4***	.00	17.0***	14.7***
	(.13)		(.94)	(.04)
Debt at vocational loan	−.2***	3.00	−2.7***	−1.0***
	(.07)		(.82)	(.01)
Tuition	.1**	2.0	1.4**	.8**
	(.02)		(.20)	(.01)
	B. Labor Market Outcomes from UI Data			
Monthly wage (dollars)	−4.5	924.50	−54.8	−35.1***
	(13.72)		(167.08)	(5.36)
Probability of employment	.0	.56	−.1	−.1***
	(.01)		(.09)	(.00)
Probability of fixed-term job	.0	.41	−.1	.1***
	(.01)		(.12)	(.00)
Probability of part-time job	.0	.10	.0	.0***
	(.00)		(.05)	(.00)
Years of experience	−.1**	3.91	−1.2**	−.6***
	(.04)		(.49)	(.01)
Average firm wage	10.3	1012.77	125.7	−67.9***
	(15.47)		(189.88)	(5.31)
	C. Labor Market Outcomes from Pension System Data			
Monthly wage (dollars)	−10.4	840.71	−121.8	−54.2***
	(11.52)		(134.78)	(4.74)
Probability of employment	.0	.51	−.1	−.1***
	(.01)		(.10)	(.00)
Public sector worker	.0	.34	.0	.1***
	(.01)		(.10)	(.00)
Observations	53,416	53,416	53,416	177,470

NOTE.—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, col. 2 shows the complier mean for ineligible students computed following Abadie (2002), col. 3 presents the treatment effect estimated by two-stage least squares (2SLS), and col. 4 shows ordinary least squares (OLS) estimates. Estimates in cols. 1–3 are computed in our regression discontinuity sample, restricted 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 are 33,484 in cols. 1–3 and 104,279 in col. 4. Out-of-range complier means are replaced with bound values (0 or 1). Tuition corresponds to the annual tuition. Average firm wages correspond to the average of the monthly wages paid by the firm. Robust standard errors are in parentheses. UI = unemployment insurance.

** Significant at 5%.

*** Significant at 1%.

Finally, students who take out the university loan lost 1.2 years of labor market experience. From this last result, one might conjecture that the null effect on wages is partly a result of the lost return to experience. In section 2 of the online appendix, we discuss this hypothesis using correlational evidence from a Mincer-type model that we estimate using the same time horizon and analysis sample used here. There we show that the zero effect on wages comes from both the cost of losing experience and the small return to university, relative to vocational, degrees. We conclude that the cost of lost experience is modest but enough to completely offset the economic returns to more years of education at a university relative to a vocational education institution, especially when these returns are small. However, the evolution of the return to experience vis-à-vis the relative return to university degrees is uncertain to us as researchers. Short-run and long-run effects might differ, for instance, if experience profiles were significantly steeper for university loan takers.

The negative effect on graduation and the null labor market gains associated with the take-up of university loans might be surprising. In the next section, we explore how the quality of destination institutions relative to fallback institutions could account for these results. In the spirit of Abdulkadiroglu, Angrist, and Pathak (2014) and of Abdulkadiroglu, Pathak, and Walters (2018), we start by characterizing the educational fallbacks for ineligible compliers and the destination institutions of eligible compliers. Then we show how the results from the 2SLS approach used here differs for students facing a supply of high- or low-quality universities in the geographic location of their high school. We also discuss the plausibility of other hypotheses that could account for our main results.

VI. Fallbacks, Destinations, and the Role of Institutional Quality

The destination of eligible compliers and the fallback of ineligible compliers are important to understand the previous results. 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 the low performance of the universities that eligible compliers attend. To explore this hypothesis, we characterize the mix of schools that define the loan complier destinations and fallbacks. Following Abadie (2002), we estimate the ineligible compliers' fallback options with the following equation:

$$C_{s(i)}(1 - L_i) = (1 - L_i)\gamma + f(r_i) + e_i, \tag{4}$$

where $s(i)$ indicates either the first university where student i uses the SGL or the first institution she attended (when the student did not take up a university loan) and $C_{s(i)}$ is the characteristic of that institution. Instrumenting

$(1 - L_i)$ with the initial eligibility indicator Z_i, the 2SLS coefficient γ captures the average of the institution characteristic $C_{s(i)}$ for ineligible compliers. Similarly, we can replace $(1 - L_i)$ with L_i on both sides of the equation to estimate the mean characteristics of destination institutions for eligible compliers.

Columns 1 and 2 of table 7 show the mean characteristics for all students, both eligible and ineligible to take up a university loan. Columns 3 and 4 report the same means for students within the 40-point bandwidth only. Finally, columns 5 and 6 show these means for eligible and ineligible compliers, and column 7 reports the difference among compliers (i.e., the local average treatment effects). On the one hand, panel A shows that loan take-up increases the years of enrollment at second- and third-tier universities but has no meaningful impact on attendance at first-tier universities. On the other hand, the main fallback for the eligible compliers are top vocational institutions. Indeed, years of enrollment at top vocational institutions

Table 7
Fallback and Destination Institutions

	All Applicants		Applicants in Bandwidth		Compliers		
	Eligible (1)	Ineligible (2)	Eligible (3)	Ineligible (4)	Eligible (5)	Ineligible (6)	Difference (7)
	A. Years of Education						
University:							
Tier 1	1.6	.1	.3	.1	−.2	−.1	−.02
							(.21)
Tier 2	2.7	.6	2.0	.9	2.2	−.7	2.87***
							(.51)
Tier 3	.8	.8	1.3	1.1	3.0	.3	2.64***
							(.43)
Tier 4	.1	.2	.1	.2	.0	.4	−.42***
							(.15)
Vocational:							
Top	.8	2.3	1.5	2.1	.5	3.3	−2.79***
							(.42)
Bottom	.1	.5	.2	.3	.2	.5	−.36*
							(.19)
	B. Institution Characteristic						
Years accredited	.2	−.3	−.2	−.2	−.8	−.2	−.61***
							(.20)

NOTE.—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 cols. 1 and 2 and among compliers in cols. 3 and 4. Complier characteristics are computed following Abadie (2002). Column 5 reports the difference in means between cols. 3 and 4, which corresponds to two-stage least squares estimates. Accreditation in panel B corresponds to the first institution where the student enrolled and is normalized with respect to the mean accreditation of the corresponding program (i.e., university or vocational). Robust standard errors are in parentheses.

* Significant at 10%.

*** Significant at 1%.

decreases by almost 3 years as a consequence of the university loan take-up, an economically significant effect closely associated with the average duration on vocational programs. Thus, a direct effect of the university loan was to divert marginal students from selective vocational programs into less selective medium-tier universities. Consistent with this, panel B reports the years of accreditation of the institutions at which eligible and ineligible compliers enroll. Since the accreditation process for vocational and university programs may differ in criteria, we normalize the years of accreditation within the corresponding type of program at which students enroll for the first time. Columns 3–5 show that while all compliers attend institutions with accreditation below the sample mean, eligible compliers attend institutions with 0.6 standard deviation fewer years of accreditation than the average institution attended by ineligible compliers. We interpret this as a drop in the quality of the institution attended by students with a university SGL. This is corroborated by a positive relationship between institutions' accreditation and an observational measure of institutions' value added. Reassuringly, we also find a drop in wage value added among compliers, in line with our interpretation of the drop in accreditation as a drop in quality.[13]

We interpret the previous findings as evidence that the null effect of university loan take-up on wages could be related to the lower quality of destination universities attended by marginally eligible students (relative to their fallback alternatives). To further investigate this hypothesis, we estimate differential effects of using the university SGL at institutions of different quality. Specifically, we estimate

$$Y_i = \alpha + \beta_0 L_i + \beta_1 \widehat{Q_i} + \beta_2 \widehat{Q_i} \times L_i + f(r_i, \widehat{Q_i} \times r_i) + \nu_i, \qquad (5)$$

where $\hat{Q}_i$ is a dummy variable that equals 1 if the institution in which student i enrolls belongs to the top quartile of predicted accreditation and L_i is an indicator for university loan take-up. Since enrollment at institutions of higher quality is a decision made by the student and consequently is an endogenous variable, we leverage variation in the predetermined accreditation of institutions around each student's high school. Specifically, we consider all students within a 40-point bandwidth around the eligibility threshold, and we use the average accreditation of the universities around a student's high school (within a 15-km radius) as an instrument that predicts the accreditation of the institution in which the student uses the university SGL. Then we classify the institutions into quartiles of predicted "quality," considering only the institutions attended by students around the eligibility cutoff. It is worth noting that since the eligibility threshold is rather low, these students do not access very selective institutions. In this regard, our

[13] Estimating institutions' value added is outside the scope of this paper, but we provide details and report results in sec. 7 of the online appendix.

estimates speak to the role of relative institutional quality among students who can access only medium- to low-quality universities.[14]

To estimate this model, we instrument $\hat{Q}_i \times L_i$ and L_i with the initial eligibility of the student for a university loan and its interaction with $\hat{Q}_i$. The coefficient of interest is β_2, the differential effect of taking out the loan to attend a university with higher accreditation. In addition to the assumptions used in our fuzzy RD, here we also assume that the supply of higher education only affects student outcomes through their choice of institution. As before, we run this regression within a 40-point bandwidth around the eligibility threshold, and we include a linear polynomial of the running variable for each group on both sides of the threshold.

Table 8 presents the 2SLS effects of university loan take-up on students who enroll at highly accredited universities vis-à-vis the effects on other university loan takers. Columns 1 and 2 show the results obtained from estimating a fully saturated model, which allows us to compute the effects of university loan take-up for each group. In general, these results replicate the main findings presented in section V. The differential effects of interest are presented in column 3. Panel A shows the effects on educational outcomes. Students at top-quartile universities seem to pay more tuition, and they also consistently accumulate more debt. Importantly, they also have a better probability of graduating from university and attend fewer institutions. Panels B and C show the differential effects on labor market outcomes. We see that students enrolling at top-quartile universities are matched with better-paying firms, suggesting better career prospects, and they have a higher probability of working in the public sector. In summary, we believe that these results are suggestive evidence in favor of our hypothesis about the role of institutional quality on labor market outcomes.[15]

We conclude this section by briefly discussing two alternative hypotheses that could explain the null effect of the university SGL on wages: (1) mismatch of students to institutions and (2) family response to loan access. Under the first alternative, loan takers are mismatched in their ability at universities and consequently fail to graduate. The second hypothesis suggests that parents compensate for loan ineligibility by changing their behavior

[14] Figure A1 shows the relationship between the average accreditation of universities in a student's geographical zone and the actual accreditation of the receiving institutions in which they use the university loan. Both variables are strongly associated with a *t*-statistic of 25.

[15] These results are robust whether using the accreditation of the first institution in which a student enrolls or using the accreditation of the first institution in which a student uses the university loan. Moreover, while our prediction of actual accreditation using local supply of universities is noisy, most of our results are also robust to including the local supply of universities directly in a pseudo intention-to-treatment approach.

Table 8
Heterogeneous Effects of Loan Take-Up

	Predicted Accreditation at Top Quartile		
	Yes (1)	No (2)	Interaction Coefficient (3)
	A. Debt, Tuition, Graduation, and Institutions Attended		
Total debt all institutions	16.5***	14.2***	2.4
	(3.16)	(1.31)	(3.42)
Debt university loan	18.6***	15.9***	2.7
	(2.62)	(1.02)	(2.81)
Debt vocational loan	−2.1	−1.7*	−.4
	(2.06)	(.94)	(2.27)
Tuition	1.7***	1.3***	.4
	(.48)	(.22)	(.53)
Overall graduation	−.2	−.3**	.0
	(.26)	(.12)	(.29)
Graduation university	.5**	.3***	.2
	(.22)	(.09)	(.24)
Graduation vocational	−.8***	−.6***	−.2
	(.25)	(.11)	(.27)
Number of institutions attended	−.2	.5***	−.7**
	(.26)	(.13)	(.29)
	B. Labor Market Outcomes from UI Data		
Monthly wage (dollars)	243.5	−142.0	385.6
	(354.07)	(190.31)	(401.97)
Probability of employment	−.2	.0	−.2
	(.23)	(.11)	(.25)
Probability of fixed-term job	.1	.0	.1
	(.23)	(.13)	(.26)
Probability of part-time job	−.2	.0	−.2
	(.14)	(.06)	(.15)
Years of experience	−1.2	−1.1**	−.1
	(1.22)	(.56)	(1.34)
Average firm wage	984.9**	−132.9	1,117.8**
	(453.55)	(216.81)	(502.71)
	C. Labor Market Outcomes from Pension System Data		
Monthly wage (dollars)	892.2	−282.4**	1,174.7
	(972.13)	(133.44)	(981.25)
Probability of employment	.0	−.1	.1
	(.24)	(.11)	(.26)
Public sector worker	.5*	−.1	.5*
	(.26)	(.12)	(.28)

NOTE.—This table presents university loan take-up effects for students taking up the loan to enroll at top-quartile universities vs. the rest of university loan takers. Column 1 presents quasi-experimental estimates for students in top-quartile universities in terms of accreditation. Column 2 presents the results for students enrolling in universities with accreditation below the 75 percentile. Column 3 shows the differential effect between these groups. For the quartile classification, we consider the predicted ex ante accreditation of the receiving institution, using the predetermined average accreditation of universities around a student high school (15-km radius) as a predictor. We restrict the sample to students for whom there is at least one university in the 15-km radius around their high school. Given this sample restriction, the regression includes 42,961 observations within the 40-point bandwidth. Finally, 35% of the 10,261 students in the top quartile actually take up the university loan. Tuition corresponds to the annual tuition. Average firm wages correspond to the average of the monthly wages paid by the firm. Robust standard errors are in parentheses. UI = unemployment insurance.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

(e.g., Pop-Eleches and Urquiola 2013), and this in turn affects the outcomes of students. As shown in section 8 of the online appendix, we find no empirical evidence in support of these hypotheses. First, we show that the inframarginal loan taker has a GPA similar to that of the median student enrolled in the receiving program. If the student loan causes academic mismatch, then we would expect loan takers to have lower ability than the median (e.g., typical) student at the receiving program. To study this, we compute the standardized GPA for the median first-year student for each college-major-year combination. We then compute how far each student is from the median GPA of the first college major where they enroll. Then we estimate whether loan take-up pushes students below the median of their college major. We find that this is not the case (see table 13 in the online appendix). Second, while we have no information on parent investment, we have access to the labor market outcomes of parents at the same time that students in our sample are graduating from high school. We do not observe differential labor market behavior of the parents for the marginal loan taker (see table 14 in the online appendix). While these tests cannot completely eliminate the scope for these alternative hypotheses, we believe that they reassure the role of institutional quality in explaining our main findings.

VII. Effects Away from the Cutoff

We showed that, on average, the marginal students do not benefit from university SGLs in the labor market. However, we also showed that students who attend better institutions seem to perform better. Likewise, it is possible that students who qualify more easily for a loan will benefit more. To study this hypothesis, we extrapolate the effect of the university SGL for students away from the eligibility cutoff following the method introduced by Angrist and Rokkanen (2015). Their method is built on the following conditional independence assumption (CIA), similar to the unconfoundedness assumption used for matching. The intuition is that conditional on a set of observable characteristics, we can break the link between running variable and treatment; therefore, we can explore the effect of the treatment for different values of the running variable. Formally, the assumption is

$$E[Y_{ij}|r_i, x_i] = E[Y_{ij}|x_i], \quad j = 0, 1,$$

where j indexes the treatment status and outcomes are assumed to be mean independent of the running variable conditional on x_i. In an RD design this has a testable implication,

$$E[Y_{i1}|r_i, x_i, r_i \geq 0] = E[Y_{i1}|x_i] = E[Y_{i1}|x_i, r_i \geq 0],$$

so we should expect that covariates that satisfy the CIA obey

$$E[Y_i|r_i, x_i, Z_i = 1] = E[Y_i|x_i, Z_i = 1], \tag{6}$$

with a similar expression for $Z_i = 0$. In our case, we exploit the fact that the average of math and language scores determines the initial eligibility for a university loan, $Z_i = 1(r_i \geq 0)$, but this is not the only measure that predicts achievement. We also observe a student's high school GPA and test scores in science, history, and math, all of which are used in the college admission process and can be included in x_i. To validate our exercise, we first test the CIA graphically. As noted by Angrist and Rokkanen (2015, 8), the CIA implies the graphical pattern mentioned by Lee and Lemieux (2010): "In a randomized trial using a uniformly distributed random number to determine treatment assignment, the randomizer becomes the running variable for the RD design. The relationship between outcomes and this running variable should be flat, except possibly for a jump at the quantile cutoff that determines treatment assignment." Figure 12 plots wage residuals from a regression of wages on x_i against the running variable. Figure 12*A* shows unconditional wages in a 3-point bin width against the running variable, along with a fitted linear function at each side of the cutoff. As expected, we observe a positive relationship between the running variable and wages. From figure 12*B*, we see that once we control for x_i (e.g., other available scores), the relationship between outcome residuals and the running variable becomes essentially flat, a fact that supports the CIA needed for extrapolation. For completeness, we also follow Angrist and Rokkanen (2015) in using a regression of outcomes on x_i and r_i on either side of the cutoff as a simple test of the CIA assumption in equation (6) and its analog for $Z_i = 0$. Table A4 shows the extent to which conditioning on covariates can eliminate the relationship between the running variable and several outcomes at specific intervals of the running variable. Given the evidence in favor of the CIA for wages and the existence of a common support (see fig. 2), we move to estimate the causal effects of the loan away from the cutoff. Additionally, because the running variable has a negligible effect over graduation after conditioning by x_i, we also extrapolate this outcome in order to provide a more detailed picture of the mechanisms that underlie our findings.

At specific intervals of the running variable, the CIA and a common support assumption lead to the following matching-style estimand for the reduced form (with an analog expression for the first stage):

$$E[Y_{i1} - Y_{i0}|c_0 < r_i < c_1] = E[E[y_i|x_i, Z_i = 1] - E[y_i|x_i, Z_i = 0]|c_0 < r_i < c_1].$$

Let $\lambda(x_i) \equiv E[Z_i|x_i]$ denote the propensity score. We use the propensity score weighting estimator, which begins with the observation that the CIA implies:

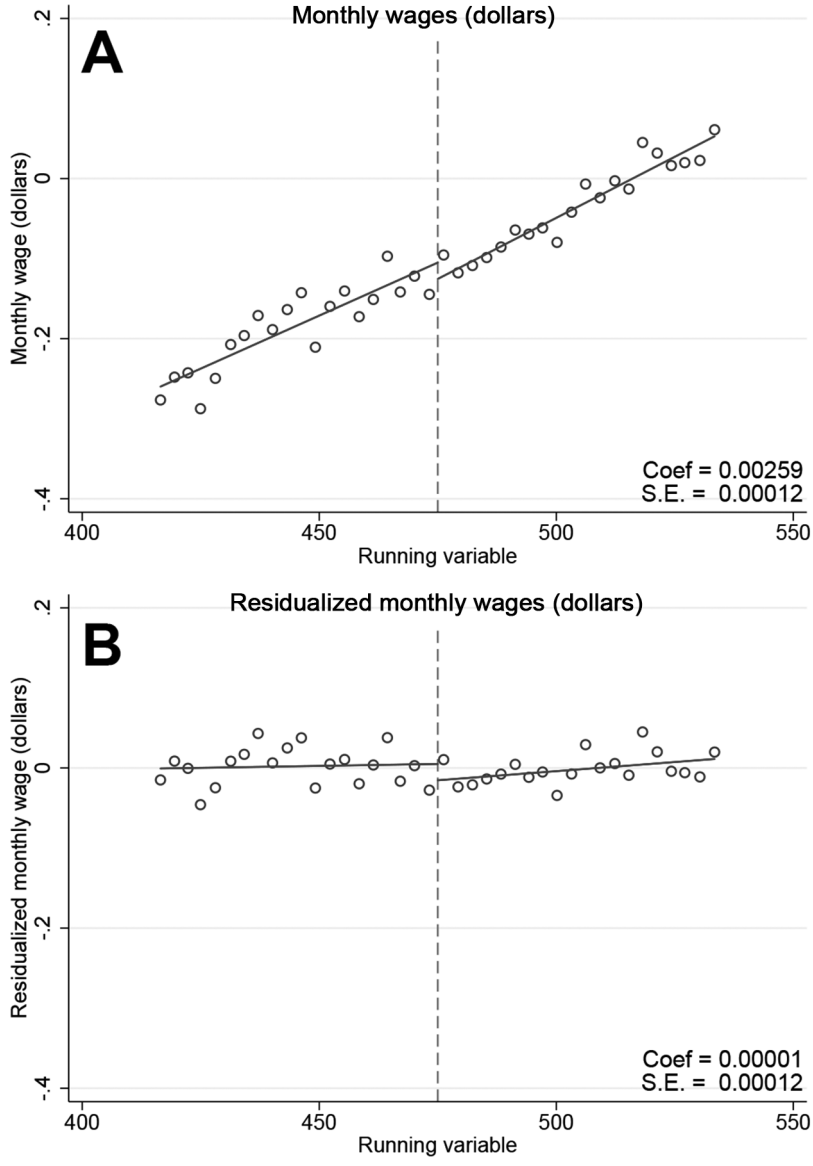

FIG. 12.—Visual test of the conditional independence assumption (CIA). These graphs present mean wages in a 3-unit bin width of the running variable. *A* shows mean wages against the running variable, and *B* shows means of wage residuals (obtained from a regression of wages on other test scores, grade point average, and controls) against the running variable. A color version of this figure is available online.

$$E\left[\frac{y_i(1 - Z_i)}{1 - \lambda(x_i)}\middle| x_i\right] = E[Y_{i0}|x_i],$$

$$E\left[\frac{y_i Z_i}{\lambda(x_i)}\middle| x_i\right] = E[Y_{i1}|x_i].$$

Bringing these expressions together, the reduced-form effect on students in any interval $r_i \in (c_0, c_1)$ is given by

$$E[Y_{i1} - Y_{i0}|c_0 < r_i < c_1] = E\left[\frac{y_i[Z_i - \lambda(x_i)]}{\lambda(x_i)[1 - \lambda(x_i)]} \times \frac{P[c_0 < r_i < c_1|x_i]}{P[c_0 < r_i < c_1]}\right], \quad (7)$$

where a propensity score weighting estimator for the reduced form is given by the sample analog of equation (7). This estimator requires a model for the probability $P[c_0 < r_i < c_1|x_i]$ as well as for $\lambda(x_i)$. For simplicity, we parameterize both in the same way with a logit model.

Figure 13 reports the reduced-form estimates of university loan take-up on wages for different values of the running variable, calculated following

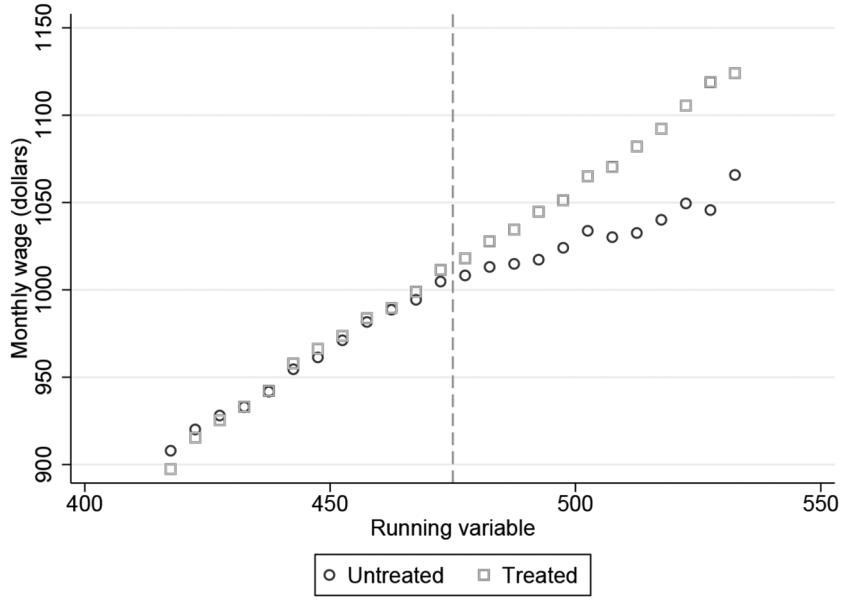

FIG. 13.—Conditional independence assumption (CIA)–based estimates of $E[Y_{1i}|r_i = c]$ and $E[Y_{0i}|r_i = c]$ for c's in the window $[-60, 60]$. This graph presents CIA-based estimates of the potential outcomes at different 5-unit bin widths of the running variable, for a window of 60 points around the eligibility cutoff. Each point is computed using the propensity score weighted estimator presented in section VII. A color version of this figure is available online.

expression (7). Consistent with our RD-based results, we see that students at the margin do not benefit from the use of a university loan, and neither do inframarginal students. Moreover, the point estimate using our RD design bandwidth is close to the estimates presented in the previous section, another reassuring fact supporting the extrapolation exercise for wages. However, we see that stronger applicants who scored above the loan eligibility cutoff experience gains in terms of wages, and these gains increase for higher values of the running variable.

Finally, Angrist and Rokkanen (2015) derive a Wald-type IV estimand with a generalized version of the CIA that we present in section 3 of the online appendix. The LATE estimand is given by

$$\begin{aligned} &E[Y_{i1} - Y_{i0}|L_{i1} > L_{i0}, c_0 < r_i < c_1] \\ &= \frac{E[E[y_i|x_i, Z_i = 1] - E[y_i|x_i, Z_i = 0]|c_0 < r_i < c_1]}{E[E[L_i|x_i, Z_i = 1] - E[L_i|x_i, Z_i = 0]|c_0 < r_i < c_1].} \end{aligned} \tag{8}$$

Wald estimates for wages and graduation at different intervals of the running variable are presented in table 9. Consistent with the reduced-form results, the estimated coefficients for wages in column 2 show small and insignificant effects below the eligibility cutoff and evidence of large and increasing effects above it. In particular, we find that the effect of the SGL for those who scored 0.5 standard deviations above the eligibility cutoff is around 430 dollars per month, an economically significant effect considering that the standard deviation of wages in our analysis sample is USD 633. Columns 3 and 4 confirm the substitution pattern triggered by the university SGL. Interestingly, for students below the cutoff the increase in graduation from university less than compensates for the drop in graduation from vocational institutions. However, students above the cutoff seem to graduate from university at similar or higher rates than they graduate from vocational institutions. This result offers an explanation for the positive wage effect for students with higher scores, and it also suggests that marginal students have a hard time translating a university SGL into labor market returns because of the low graduation rate.

VIII. Summary and Conclusions

Nine years after high school graduation, marginal students who took out university loans hold an extra 14,000 dollars in student debt, have lost 1.2 years of labor market experience, have a lower graduation rate, and are more likely to have attended two or more institutions. Furthermore, their wages, employability, job security, and employers' characteristics are no different from those of students who did not enroll using a university SGL (but who would have if they had been initially eligible). Overall, these findings depict a concerning picture for the average students at the margin of eligibility, who, despite a

Table 9
Extrapolation Estimates

		Wald-Type IV Estimates		
Distance from Cutoff	First Stage (1)	Wage (2)	Vocational Graduation (3)	University Graduation (4)
Below: 415–424	.199***	−1.212	−.687**	.333***
	(.05)	(363.13)	(.33)	(.12)
Below: 425–434	.196***	11.453	−.654***	.381***
	(.04)	(254.43)	(.20)	(.10)
Below: 435–444	.191***	21.146	−.624***	.424***
	(.03)	(183.76)	(.15)	(.08)
Below: 445–454	.187***	29.257	−.613***	.470***
	(.02)	(138.49)	(.10)	(.06)
Below: 455–464	.182***	16.871	−.612***	.510***
	(.02)	(109.90)	(.07)	(.05)
Above: 485–494	.171***	151.020**	−.694***	.725***
	(.01)	(74.70)	(.05)	(.05)
Above: 495–504	.164***	180.551**	−.741***	.813***
	(.01)	(91.14)	(.06)	(.06)
Above: 505–514	.166***	255.243**	−.802***	.870***
	(.01)	(100.17)	(.07)	(.07)
Above: 515–524	.161***	304.375**	−.874***	.951***
	(.01)	(135.96)	(.09)	(.10)
Above: 525–534	.152***	426.495**	−.962***	1.064***
	(.01)	(173.58)	(.12)	(.12)

NOTE.—This table presents first-stage and Wald-type instrumental variable (IV) estimates following Angrist and Rokkanen (2015). Each row shows estimates for the 10-unit bin width indicated in the first column. Wages correspond to the monthly wage. Standard errors (shown in parentheses) were computed using a nonparametric bootstrap with 500 replications.
** Significant at 5%.
*** Significant at 1%.

low socioeconomic background, decided to take the university selection exams and apply for financial aid, signaling their willingness to pursue higher education.

Nevertheless, our analysis also offers suggestive evidence that university loans could help students to finance their education and to benefit from it in the labor market. We show that marginal students who substitute vocational education for better-quality university programs seem to perform better in terms of educational and labor market outcomes. Furthermore, extrapolation away from the cutoff shows that students with higher test scores can also profit from taking up this loan, a result related to having a better opportunity to complete university.

On a final note, we have shown that most students are out of higher education by 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 whom the SGL intended to help. How these students fare in the long run is an important task for future work.

Appendix

Additional Tables and Figures

Table A1
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

NOTE.—The total numbers between 2004 and 2006 come from the World Bank (2011). Numbers between 2007 and 2016 are constructed using data from Servicio de Información de Educación Superior (SIES) Ministerio de Educación (MINEDUC).

Table A2
Effect of Loan Take-Up on Educational Outcomes (Robust Bandwidth)

					Bandwidth	
	Reduced Form (1)	Ineligible Complier Mean (2)	2SLS (3)	OLS (4)	Reduced Form (5)	2SLS (6)
First stage			.083***			
			(.008)			
	A. Ever Enrollment					
Any institution	.005	.963	.075	.046***	71.0	46.7
	(.00)		(.05)	(.00)		
University	.071***	.159	.829***	.347***	39.7	52.3
	(.01)		(.10)	(.00)		
Vocational	−.063***	1.016	−.751***	−.222***	42.1	44.0
	(.01)		(.12)	(.00)		
	B. Years of Enrollment					
Any institution	.173***	3.582	2.124***	1.125***	48.9	47.9
	(.04)		(.46)	(.01)		
University	.463***	.000	5.345***	2.151***	41.6	57.2
	(.06)		(.54)	(.01)		
Vocational	−.279***	3.705	−3.394***	−1.026***	46.0	44.5
	(.04)		(.53)	(.01)		
	C. Graduation and Number of Institutions					
Overall graduation	−.016*	.642	−.171	−.043***	69.6	46.7
	(.01)		(.12)	(.00)		
Graduation university	.036***	.009	.444***	.118***	49.9	50.4
	(.01)		(.09)	(.00)		
Graduation vocational	−.052***	.651	−.615***	−.161***	48.9	44.6
	(.01)		(.11)	(.00)		
Number of institutions attended	.037***	1.179	.476***	.110***	53.2	45.4
	(.01)		(.13)	(.00)		
Observations	53,416	53,416	53,416	177,470		

NOTE.—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, col. 2 shows the complier mean for ineligible students computed following Abadie (2002), col. 3 presents the treatment effect estimated by two-stage least squares (2SLS), and col. 4 shows ordinary least squares (OLS) estimates. Estimates in cols. 1–3 are computed using the optimal bandwidth in Calonico, Cattaneo, and Titiunik (2014) presented in cols. 5 and 6. Out-of-range complier means are replaced with bound values (0 or 1). Tuition corresponds to the annual tuition. Average firm wages corresponds to the average of the monthly wages paid by the firm. Robust standard errors are in parentheses.

* Significant at 10%.

*** Significant at 1%.

Table A3
Effect of Loan Take-Up on Debt and Labor Market Outcomes (Robust Bandwidth)

	Untreated				Bandwidth	
	Reduced Form (1)	Complier Mean (2)	2SLS (3)	OLS (4)	Reduced Form (5)	Fuzzy RD (6)
First stage			.083***			
			(.008)			
	A. Total Debt (Thousand Dollars)					
Total debt all institutions	1.2***	2.9	14.0***	13.8***	42.4	45.9
	(.16)		(1.33)	(.04)		
Debt university loan	1.5***	.0	17.3***	14.7***	40.5	41.9
	(.16)		(1.10)	(.04)		
Debt at vocational loan	−.3***	3.0	−3.2***	−1.0***	56.4	48.3
	(.07)		(.90)	(.01)		
Tuition	.1***	2.0	1.5***	.8***	44.5	53.1
	(.02)		(.21)	(.01)		
	B. Labor Market Outcomes from UI Data					
Monthly wage (dollars)	.5	1,056.9	3.4	−35.1***	54.9	52.7
	(15.26)		(173.98)	(5.36)		
Probability of employment	.0*	.6	−.2	−.1***	62.6	47.1
	(.01)		(.11)	(.00)		
Probability of fixed-term job	.0	.3	−.1	.1***	37.2	45.6
	(.01)		(.13)	(.00)		
Probability of part-time job	.0	.1	.0	.0***	66.2	46.8
	(.00)		(.06)	(.00)		
Years of experience	−.1***	4.0	−1.6***	−.6***	53.9	47.2
	(.05)		(.57)	(.01)		
Average firm wage	31.9*	1,168.1	301.1	−67.9***	43.3	51.0
	(18.76)		(203.65)	(5.31)		
	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)	(4.74)		
Probability of employment	.0	.6	.0	−.1***	64.1	45.6
	(.01)		(.11)	(.00)		
Public sector worker	.0	.3	.1	.1***	56.4	47.5
	(.01)		(.11)	(.00)		
Observations	53,416	53,416	53,416	177,470		

NOTE.—This table presents university loan take-up effects on debt and labor market outcomes. Column 1 shows the reduced-form effect, col. 2 shows the complier mean for ineligible students computed following Abadie (2002), col. 3 presents the treatment effect estimated by two-stage least squares (2SLS), and col. 4 shows ordinary least squares (OLS) estimates. Estimates in cols. 1–3 are estimated by fuzzy regression discontinuity (RD), and col. 4 shows OLS estimates. Estimates in cols. 1–3 are computed using the optimal bandwidth in Calonico, Cattaneo, and Titiunik (2014) presented in cols. 5 and 6. Column 4 uses the whole-analysis sample. Out-of-range complier means are replaced with bound values (0 or 1). Tuition corresponds to the annual tuition. Average firm wages correspond to the average of the monthly wages paid by the firm. Robust standard errors are in parentheses. UI = unemployment insurance.

* Significant at 10%.

*** Significant at 1%.

Table A4
Testing the Conditional Independence Assumption (CIA)

	±10 Points		±20 Points		±30 Points		±40 Points		±50 Points		±60 Points		±70 Points		±80 Points		±90 Points	
	Below	Above	Below	Above	Below	Above	Below	Above	Below	Above	Below	Above	Below	Above	Below	Above	Below	Above
Years enrolled	.002	.005	.007**	.011***	.006***	.009***	.010***	.007***	.011***	.006***	.010***	.006***	.010***	.006***	.010***	.005***	.010***	.005***
	(.011)	(.009)	(.004)	(.003)	(.002)	(.002)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.000)	(.001)	(.000)
Graduation university	.000	.000	.001	.001*	.001***	.002***	.001***	.002***	.001***	.002***	.001***	.001***	.001***	.001***	.001***	.001***	.001***	.001***
	(.002)	(.002)	(.001)	(.001)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Graduation vocational	.000	−.003*	−.001	−.001	−.001***	−.002***	−.001***	−.002***	−.001***	−.001***	−.001***	−.001***	−.001***	−.001***	−.001***	−.001***	−.001***	−.001***
	(.002)	(.002)	(.001)	(.001)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Monthly wage (dollars)	−2.571	−2.778	−.600	.382	−.309	−.134	−.517	.296	−.066	.379	.280	.053	.497**	−.246	.487**	−.337	.256	−.489**
	(3.728)	(3.509)	(1.278)	(1.179)	(.696)	(.678)	(.461)	(.473)	(.348)	(.359)	(.276)	(.287)	(.228)	(.245)	(.198)	(.217)	(.178)	(.196)
Probability of employment	−.001	−.002	−.001	.001	.000	.000	−.001***	−.001**	.000*	−.001***	.000***	−.001***	.000***	−.001***	.000***	−.001***	−.001***	−.001***
	(.002)	(.002)	(.001)	(.001)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)

NOTE.—This table presents the regression-based CIA test proposed by Angrist and Rokkanen (2015). Each row presents a test for a different dependent variable, and the columns indicate the window below and above the university loan eligibility cutoff used for the test. Each cell entry corresponds to the coefficient on the running variable in a regression of the respective dependent variable against math, the maximum between history and science, grade point average, and the running variable. Each regression uses data below or above the cutoff, according to the description of the column, up to the number of points reported in the column title. Robust standard errors are reported in parentheses.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

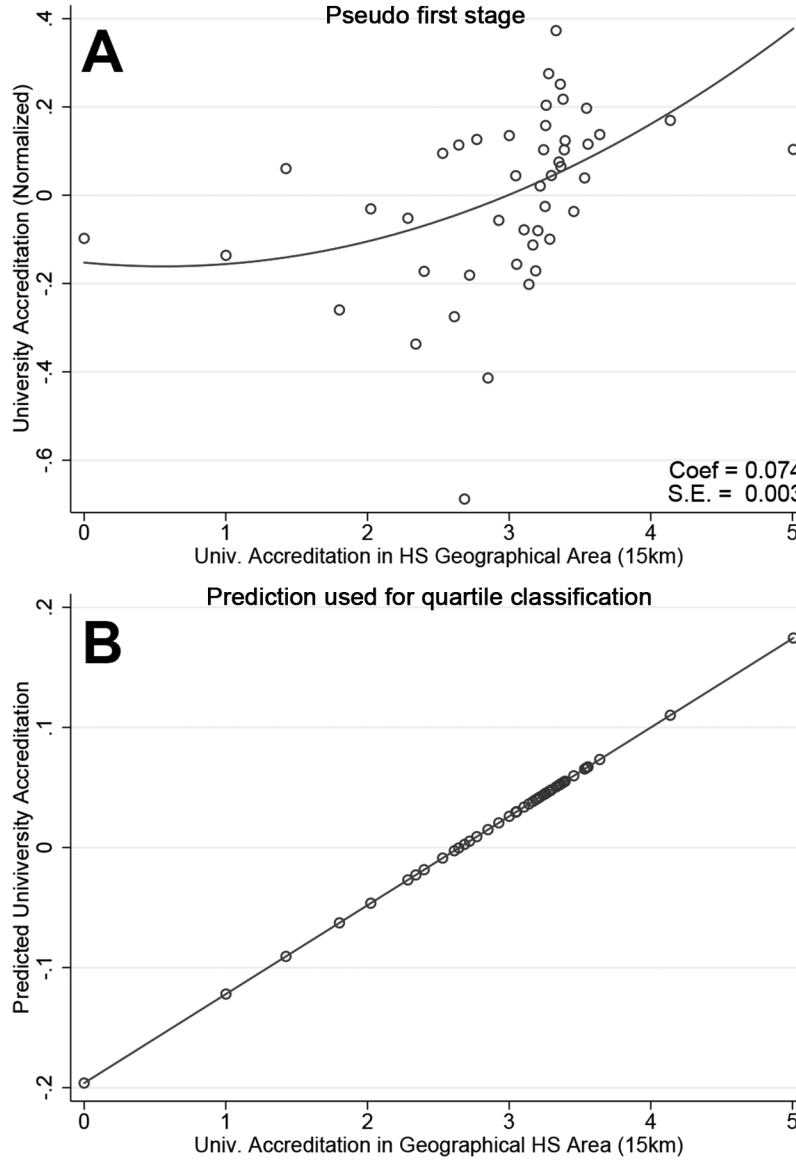

FIG. A1.—Predicted ex ante accreditation of the receiving institution. *A* presents the relationship between the average accreditation of universities around a student's high school and the accreditation of the actual receiving university. *B* shows the prediction fit used to classify an institution into the top quartile. A color version of this figure is available online.

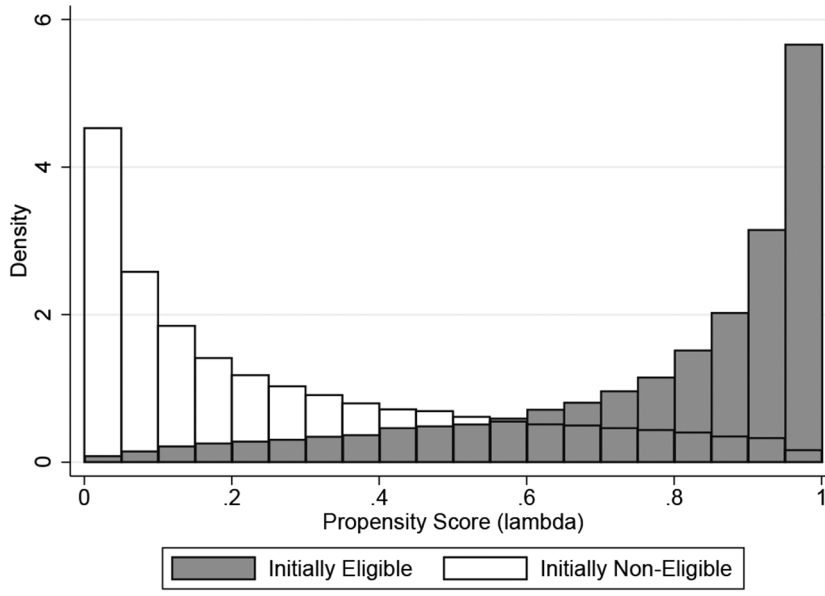

FIG. A2.—Common support. This graph presents the overlap between the propensity score distribution for initially eligible and initially noneligible students.

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