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ASSESSING THE IMPACT OF A STUDENT LOAN PROGRAM ON TIME-TO-DEGREE: THE CASE OF A PROGRAM IN PERU

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RESUMEN

Este documento evalúa el impacto de un programa de crédito educativo sobre el tiempo necesario para concluir los estudios universitarios en una universidad grande en Perú. Los préstamos han sido entregados a estudiantes con bajos ingresos que muestran un desempeño académico satisfactorio. La decisión de aplicar o no por un préstamo depende de cada estudiante, por lo tanto el análisis de regresión simple podría fallar en la estimación de este impacto debido al problema del regresor endógeno. En este estudio se utiliza una aproximación de variables instrumentales, y se encuentra que los estudiantes con préstamos obtienen sus grados más rápidamente que similares estudiantes sin préstamo.

Palabras clave: Préstamos estudiantiles; duración de los estudios.
Códigos JEL: C13, C14, C21, I22

ABSTRACT

This paper evaluates the impact of a student loan program on time-to-degree for undergraduate students at a large university in Peru. The loans have been provided to low-income students who display satisfactory academic performance. The decision whether to apply for a loan depends on each student; therefore, simple regression analysis may fail to estimate the impact due to the problem of endogenous regresor. In this study, an instrumental variable approach is employed, and it is found that students with loans obtain their degrees more rapidly than similar students without loans.

Keywords: student loans; time-to-degree
JEL Classification Codes: C13, C14, C21, I22

ASSESSING THE IMPACT OF A STUDENT LOAN PROGRAM ON TIME-TO-DEGREE: THE CASE OF A PROGRAM IN PERU

Luis García*

1. INTRODUCTION

It is widely known that, for students, one of the most significant barriers to the completion of higher education is the absence of some kind of financial aid. Young students have an increasing opportunity cost of studying, and sometimes—especially in poor and less developed countries—they are also required to contribute funds toward meeting household expenses; therefore, these higher education students are forced to work and study at the same time.

As a consequence of sharing time between studying and working, students opt for a light course load, taking fewer courses per semester and thus extending the time for degree completion.[1] This result becomes a problem for students entering the labor market at an older age as they will receive lower college wage premiums for each additional year (Monks, 1997; Taniguchi, 2005). Furthermore, foregone earnings and additional tuition expenditures create further problems for undergraduate students.

One method of helping these students is to provide some kind of financial support either through loans, grants, or both. In this paper, I analyze a particular experience in Peru, a less developed country in which loans and grants for higher education are virtually nonexistent. Nevertheless, for decades, Pontificia Universidad Católica del Perú (PUCP), a large middle-class university located in Lima, has been providing student loans

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[1] School dropout is another consequence of financial problems. Stinebrickner and Stinebrickner (2003) found that when students choose to work, it affects their academic performance.

to some of its students who display satisfactory academic performance but face economic problems that might hinder their studies. Although this program was created more than 40 years ago, its results have not been rigorously evaluated.

2. RESEARCH QUESTIONS AND HYPOTHESIS

This document attempts to assess the extent to which the program has benefited students and, in particular, its impact on time-to-degree. The main research questions are the following: To what extent can student loans affect the period of time in which a student needs to earn a bachelor degree? Does the number of semesters during which a student receives a loan affect the impact of the loan on time-to-degree?

The main hypothesis of this research is that student loans in higher education can help students to complete their course of study more rapidly than students without loans. In addition, the paper explores whether there is an "intensity-of-treatment effect" because, normally, the number of semesters for which the student receives the loan varies. I would expect that the student who received a loan for many semesters should show a shorter time-to-degree than the student who received the same benefit for only a few semesters.

Voluntary participation in this program caused a "selection problem" with the data; therefore, an empirical strategy had to be taken into account to deal with this problem and to obtain estimates with causal interpretation.

This paper takes advantage of exceptional data that are not normally available to researchers. Student loans are not common in Peruvian society; consequently, discovering the effectiveness of such a program can provide insight into what would happen if student loans were offered to higher education students outside the PUCP and what would be necessary to make them effective.

3. LITERATURE REVIEW: STUDENT LOANS, EDUCATIONAL ATTAINMENT, AND TIME-TO-DEGREE

Since the twentieth century, economic and social research has recognized that education is an essential path to overcoming poverty and social differences (Sen, 1999). In some cases, education can break the poverty trap in which some families are caught for generations.

The question that governments and educational institutions ask themselves is how to improve access to education. The main objective of student loans as a social program is to equalize educational opportunities for individuals who would not otherwise have the opportunity to study, giving those students the opportunity to earn a degree.[2] Although social differences in less developed countries may be vast, student loans may help to reduce these disparities.

In contrast to scholarships, student loans have become a popular means of financial aid in many countries[3] due to their multiple advantages: they relate future earnings to present needs, and they are not restricted to a fixed fund as they are self-financed with the amounts repaid by former students. However, student loan programs also face problems that can make them difficult to implement. In countries in which credit markets are not developed, there are still students who are not eligible for new loans because of the absence of financial products that are sufficiently attractive for borrowers and lenders.

There is some literature on college student loans and their effect on academic success around the world. In the United States, the factors that affect the completion of bachelor's degrees have been studied by Adelman (1999); however, he did not find a significant effect of loans on bachelor degree completion using OLS regressions. King (2002) found that among low-income students, borrowing had a strong and negative

[2] This refers, in particular, to students who come from low-income families or those who come from an environment in which it has been difficult to develop professional skills.

[3] See, for example, Adelman (1999) for the United States, Callender and Kemp (2000) for the United Kingdom experience, Canton and Blom (2010) for the Mexican case, Larrain and Zurita (2008) for Chile, Kotey (1992) for Ghana, and Tilak (1992) for India.

correlation with the likelihood of dropping out and that this effect increased when borrowing was combined with part-time jobs. In addition, low-income students who borrowed and worked part time were more likely to attend school full time compared with students who only worked part time.

However, other studies based on a variety of modern statistical and econometric techniques do not find a clear association between loans and degree attainment. Paulsen and St. John (2002) estimated a model that explains persistence among undergraduate students in the United States. Using logistic regressions, they found that loans had a negative effect on persistence for low-income students. Dinarski (2003) assessed the impact of a financial aid program on college attendance and completion through exogenous changes in the financial aid program in the United States. The author found that aid eligibility had a strong effect on college entry and attendance. In a study using data from the University of Oregon, Singell (2004) estimated a bivariate probit model to assess the effect of different types of financial aid on retention. He found that a $1,000 increment in need- and merit-based grants and subsidized loans increased the retention probability by 1.4% and 4.3%, respectively. However, the effect of unsubsidized loans was close to zero. In a more recent work, using hierarchical generalized linear models, Kim (2007) found that higher student loan debt was associated with a lower probability of degree attainment among low-income students in the United States. Kim's results are contrary to the original intent of financial aid policies, which is to equalize educational opportunities among students. In Mexico, Canton and Blom (2010) studied the impact of a credit program on accessibility to higher education and academic performance. Using a regression discontinuity design, they found that the financial package contributes to an improvement in students' academic performance.

In relation to time-to-degree for undergraduate students, Bound, Lovenheim, and Turner (2010) found that financial aid would help to reduce time-to-degree due to changes in students' labor supply. Using a regression discontinuity design, Scott-Clayton

(2011) also found that receipt of a financial scholarship affected time-to-degree in West Virginia.

Some scholars study the effect of loans and other forms of financial aid on time-to-degree in PhD programs. For example, using a competing risk model, Ehrenberg and Mavros (1995) found that PhD students at Cornell University who received fellowships or research assistantships have higher completion rates and shorter time-to-degree than students who only received teaching assistantships or were self-supporting. De Valero (2001) focused on departmental characteristics and their effect on time-to-degree and found that the type of financial support is important when it comes to explaining this variable. Using hierarchical linear models, Kim and Otts (2010) found that the size of the loan has a different effect on time-to-degree in PhD programs in the United States. According to their paper, students who received large loan amounts obtained their doctoral degrees in less time than non-borrowers in all fields of study, and surprisingly, students with low amounts of loans (below $50,000) completed their degrees at the same pace as non-borrowers did. Using duration analysis, Stock and Siegfried (2006) found that students who received fellowships completed their degrees more quickly than those who received teaching assistant support. In a more recent study, Stock, Siegfried, and Finegan (2011), using the same technique to explain time-to-degree in economics PhD programs, found that students who were awarded no-work fellowships during the first year of their PhD studies and those who were awarded no financial aid both took about four months shorter to complete their degrees than students with teaching assistantships.

In summary, the literature around the world shows that financial aid in the form of student loans and scholarships has a significant impact on time-to-degree, where students with loans obtain their degrees in a shorter time than students without loans. This result is robust for different kinds of data and various methodologies.

4. THE STUDENT LOANS PROGRAM IN PERU

Peru's rate of loans for students in higher education (less than 3% in 2006) is one of the lowest in the region (Universia, 2009). Only one public institution and very few private institutions provide loans to students in higher education. Private banks have minimal participation in these types of credit loans, despite the great expansion of other forms of credit in the Peruvian economy in recent years.

In this context of a significant lack of credit for students in Peru, this research focused on the experience at PUCP as a student loan provider for higher education. Although its scope was limited to PUCP students, we can learn a number of lessons from this experience and perhaps attempt to apply them to other private colleges and universities in urban areas.

The student loan program at PUCP was created in 1967 to assist students who had financial problems that could threaten their status as regular students. To apply for a loan, students must meet the following two requirements: (a) a family income below four times the current minimum wage,[4] and (b) the student's academic performance should be satisfactory, meaning that his or her average grade should be above 60% of the maximum possible score.[5] To evaluate these two conditions, a permanent commission composed of social workers and academic representatives was established. Students who were granted loans would not be required to pay tuition or fees for one year (two academic semesters) and, in special cases, could receive extra funds for lunch and books. Six months after graduation, these students were required to contact the authorities at PUCP and provide a repayment plan. These rules were maintained for about 30 years with minor changes; however, at the beginning of this century, the

[4] The minimum wage in Peru is fixed by the Ministry of Economy and Finance.

[5] Academic grading in Peru employs a scale from 0 to 20 points, where the passing threshold is 11 points. These scores are absolute, not relative to the class. In higher education, a student who gets a score in the 0-10 range in one course must repeat that course. A student who repeats the same course three times is expelled from school. The weighted average score is calculated by semester using the number of credits of each course as weights. The cumulative score is the weighted average score of all courses taken (whether passed or not) from the first semester to the present.

program was revised to include stricter conditions for new applicants as of 2002. These new conditions are not presented here because they were applied outside the period of analysis of this paper.

For many reasons, it was common to observe students receiving a loan without fulfilling these conditions. In some cases, the committee considered that some schools inside the PUCP had different standards for grading their students. In other cases, they took into account reports on applicants' motivation and perception based on information provided by their teachers. It was also understood by the committee that other personal and qualitative factors (the environment in which the students grew up, their relationships with their parents, the development of skills during childhood, and socialization problems) could affect their performance. Another important matter that characterized this program was that students applied voluntarily for the loans, and the committee decided who would be the beneficiaries.

To determine the amounts students must pay for tuition and fees, PUCP has a tiered fee payment structure that takes into account the income distribution in Peruvian society, and it seeks to ensure that all students are able to receive an education regardless of their financial circumstances. There are currently five levels, with Level 1 corresponding to low-income students and Level 5 corresponding to students with the highest income. When students are admitted to PUCP, a thorough socioeconomic study is conducted to determine the classification of each student. It also includes interviews with parents and other relatives.

Students could be reclassified at any time if a change occurred that worsened their financial situation, or they could apply for a loan. In either case, a new socioeconomic study would be conducted. In addition, students who were granted loans were permanently monitored to detect any positive change in their financial status. If this occurred, or if their academic performance was not as good as expected, these students could be expelled from the program.

To provide figures related to the program in the 1990s and the first five years of the twenty-first century, Table 1 shows the number of enrolled students from the second semester of 1998 to the first semester of 2002, with the numbers broken down into fee levels and student borrower status.

Table 1
Number of Students at PUCP by loan status and tiered fee system

	With Loan		Without Loan						Total
Level:	1	2	1	2	3	4	5	6[a]	
1998-2	691	0	3,649	2,556	2,223	1,686	988	1,304	13,097
1999-1	666	0	3,937	2,744	2,332	1,717	970	1,267	13,633
1999-2	729	7	4,086	2,934	2,434	1,671	871	1,194	13,926
2000-1	733	0	4,284	3,241	2,508	1,757	967	1,210	14,700
2000-2	724	2	4,436	3,225	2,531	1,676	896	1,096	14,586
2001-1	665	1	4,298	3,353	2,706	1,813	898	1,104	14,838
2001-2	626	0	4,529	3,475	2,614	1,712	774	1,011	14,741
2002-1	504	1	4,744	3,724	2,791	1,793	1,758	--	15,315
2002-2	434	0	4,871	3,866	2,747	1,676	1,507	--	15,101

[a] Since 2002, levels 5 and 6 were combined.
Source: PUCP data bases

As we can see in this table, out of the total student population, less than 5% applied for and received loans. As expected, the majority of the students who applied for and benefited from this program belonged to Level 1 (the lowest income group), while only a few belonged to Level 2.

I defined one indicator to be evaluated—the number of semesters the student needs to complete the course of study, which is called the time-to-degree variable. A student with financial problems may choose to either apply for a loan or to work and study. This latter option affects the time the student dedicates to his or her studies, which may prolong the time required to pass all courses in the program. Besides, as students can choose the number of courses they take each semester, taking fewer courses could be desirable for working students and would also mean lower fees (which they could

afford). Contrastingly, a student who benefits from a loan can take as many courses as he or she wants (depending only on his or her time and capabilities), and the program forbids the student to work.

5. RESEARCH METHODS

5.1 Econometric issues

The data available for this study came from student records; therefore, the observational data may suffer from different selection biases. In this sense, it is important to consider the selection mechanisms that underlie the observational data. The first mechanism is related to the students who apply and are granted student loans. As we can see in Table 1, the students who obtain the loans correspond to the low-income students, and this selection mechanism is the result of the program rules. One part of the identification strategy suggests that the data for the students (with and without loans) must be restricted to poor students only. A similar argument can be stated on the merit-based component of the program, in which higher grades are expected to be observed for students who received loans. One way to face this problem is to restrict the sample to students who meet at least the basic requirements stipulated in the program rules.

However, the voluntary decision regarding whether or not to apply for a loan and the yearly evaluation of the loan conducted by PUCP create a second selection mechanism, which leads to the problem of selection in observable and unobservable variables. In this scenario, simple linear regression analysis fails because it only controls for observable covariates. To address these problems, I employed instrumental variables, which can, under certain conditions, remove the hidden bias caused by unobservable characteristics.[6]

[6] Some unobservable characteristics are: (a) attitude toward borrowing, (b) preference for "working and studying" or "only studying," (c) student's motivation to regard studies as a personal effort, and (d) other psychological aspects of students' personalities.

I use a parametric approach based on a linear regression model, where the treatment variable d_i is an endogenous regressor,

$$\mathrm{y_i} = \beta_1 + \boldsymbol{\beta}_2' \mathbf{x_i} + \theta \mathrm{d_i} + \mathrm{u_i} \tag{1}$$

where $\mathbf{x}_\mathrm{i}$ is the vector of observable characteristics and $\mathrm{d_i}$ is a dummy variable, which indicates that i-th individual received or did not receive the loan. The instrumental variables method is used to consistently estimate the causal parameter θ. The effectiveness of this technique relies on the validity of the instrument; it is to be correlated to the variable d_i and uncorrelated to the error term u_i.

Based on this approach, d_i in equation (1) is an endogenous dummy variable. Let z_i be a valid instrument, then I specify one additional equation

$$\mathrm{d_i} = 1[\alpha_1 + \alpha_2' \mathrm{x_i} + \alpha_3 \mathrm{z_i} + \varepsilon_\mathrm{i} > 0] \tag{2}$$

where the 1[.] operator takes the value 1 if the expression in brackets is true and 0 otherwise. It is assumed that $\mathrm{u_i}$ and ε_i are independent normal error terms. Equations (1) and (2) are estimated simultaneously by maximum likelihood.

A crucial point here is the counterfactual scenario. The time-to-degree outcome is only observed for students who never quit studying. By definition, an individual who failed or dropped out of college cannot obtain the loan; therefore, I would never know what would have happened if he or she had been offered a loan after quitting school. This fact forced me to limit the scope of my analysis and conclusions to individuals who remained in school—that is, conditional on already being in school.

5.2 The data and variables

From this point onward, the individuals who obtained a loan will be referred to as "treated students" and the remaining students as "untreated." The treated group is disaggregated into two levels of treatment, generating treated groups to be compared with the untreated group.

To find these groups, the first step was to define the target population according to the original rules of the program. As Table 1 suggests, I focused on students who belonged to the lowest socioeconomic level (Level 1) and discarded the other levels from 2 to 5. In addition, because the program also had a merit-based component related to the weighted average score, I focused on students who attained a grade point average (GPA) of at least 12. Although some students who received a loan had a GPA below this level, I preferred to use this threshold to define a "potentially eligible student."[7] These two conditions (belonging to Level 1 and having a historic GPA ≥12) were applied to select the sample.

The second criterion for selecting the data was related to the long-term nature of the student loan program. To assess the impact, I needed to give the students sufficient time to complete their course of study or make the decision to no longer study at PUCP. The data covered up to the middle of 2009; therefore, I ruled out all students who were admitted from 2003 and later, given that Peruvian laws require that the curricula take at least five years. Another restriction was that it was very difficult to find reliable data for the years before 1997.

For these reasons, I was forced to work with students who were admitted to PUCP from the first semester of 1997 to the second semester of 2002. In the end, I obtained a random sample of 1,330 students belonging to the subpopulation described above. Due to the fact that some students' files were missing or incomplete, I obtained a preliminary sample for 1,020 students.[8] From those, 306 students received loans, and the remaining 714 did not. This analysis is conditional on students who completed the

[7] The GPA used here is the weighted average of all the courses a student took during all the semesters he or she was a regular student at PUCP, weighted by the number of credits. The sample was restricted to this condition; however, administrators also provided me with the GPA data for each semester, and I observed that, in some semesters, the GPA could be below 12 points. Because the rule of 12 grade points was not a strict rule, it was normal to see in the sample students with a GPA<12 in one semester getting a loan immediately after that semester. Therefore, the condition "general GPA≥12" selected good students with a high probability of obtaining a loan.

[8] This sample size decreased more during estimations due to missing data on some variables.

course of study (excluding students with incomplete studies); therefore, the final sample was reduced to 765 students—233 with loans and 532 without.

Table 2

Number and Percentage of students in the sample[a], by participation in the program

Type of student	Frequencies	Percentage
Untreated	532	69.5%
Treated	233	30.5%
Received treatment for 1 to 5 semesters	93	12.2%
Received treatment 6 or more semesters	140	18.3%
Total	765	100%

a Only students who got the bachelor degree by mid-2009.

Three arbitrary and distinct levels of treatment were considered, as shown in Table 2. In my notation, S=0 stands for the untreated students, S=1 stands for students who received the loan for one to five semesters, and S=2 refers to students who received the loan for six or more semesters. The dependent variable in this study is time-to-degree, which is defined here as the number of semesters from entry to degree completion.[9] It does not include the semesters that a student spent away from school. The minimum time-to-degree is 10 semesters (five academic years). The mean time-to-degree in the sample was 13.8 semesters, and the median was 14 semesters.

Regarding the covariates, I obtained information from the Household Socioeconomic Form, which all students must fill out at the time they are admitted to PUCP. For all students, the socioeconomic data available correspond to these forms (completed on the day of admission).

[9] In Peru, degree completion for undergraduate students requires passing all courses for the duration of their studies.

The Household Socioeconomic Form provided data on individual, family and dwelling characteristics, and household income (declared and imputed). The latter was the income that was calculated after a social worker visited the student's home and checked the information provided on the socioeconomic form. Social workers checked bills and paychecks and other sources of income. The information on income that was used in this study was the imputed household income. For all untreated students, the data on household income correspond to the imputed income during the admissions process, whereas for all treated students, the data on household income correspond to the imputed income at the time they applied for the loan (an update of the information provided previously).

These data were appended to the academic record of each student. These records included GPA and percentile rank by semester, the school in which the student was enrolled, the semester in which each student received the loan, the date of graduation, etc.

I classified the observed covariates into two groups—student characteristics and household characteristics. The first group includes age (at date of admission) and sex. I also included some dummy variables on the undergraduate school to which the student belonged. The aim of this was to capture the variety in the study plans among the schools at PUCP (the Schools of Law, Social Sciences, and Engineering have longer study plans and/or usually require much more effort than others). A set of dummies for year of admission was also included as covariates because, as I explained previously, the outcome variable was recorded by the middle of 2009, and by that date, students from cohorts 1997, 1998, and 1999 showed larger time-to-degree values than students from cohorts 2000, 2001, and 2002. This was simply because the students from the former groups had more years in which to complete the requirements to graduate, while the students from the latter cohorts had fewer years in which to pass all the courses in the study plan. The next student characteristic is the percentile rank for the first semester in which the student studied at PUCP, which is a measure of his or her ability. The reason for including this variable is related to the process of selection that the program creates,

as the status of students who are granted loans is reviewed once per year. In a dynamic process through the years, this procedure affects the probability of receiving the loan for the following years, because students with poorer performance could be expelled from the program. In a long-term program, a selection problem arises because only the better students will survive this process. In my opinion, this is a kind of "cream skimming"; therefore, it is necessary to control for the students' abilities. The percentile rank was measured in the first semester to ensure that it was a pretreatment variable. The last covariate is the type of high school (private or public), which was included because, in Peru, there are major disparities in the level of education of each type (Banco Internacional de Reconstrucción y Fomento, 2006).

The second group shows four household characteristics: imputed household income, number of floors in dwelling, number of siblings living at home, and number of household members suffering from chronic diseases.[10] The main idea about the last two covariates is that if these variables increase, it is more difficult for poor students to focus on their studies, possibly forcing them to work and ultimately affecting time-to-degree.

Table 3 presents descriptive statistics of those covariates in the sample. At the top of this table, there is evidence of some degree of association between outcome and treatment status. Without controlling for any covariate, the number of semesters at PUCP is smaller for students who received a loan for six or more semesters, which is not a surprising result given the rules of the program. Across these groups, there are also no significant differences in students' age and the number of floors in their dwellings.

The table below shows some important differences between the treated and untreated groups. There is a significant difference in the percentile rank for the first semester (a measurement of student ability), where the performance of treated students was better than that of untreated students, and performance increased with the intensity of the

[10] It includes reports of household members with mental health problems, disabilities, etc. Normally, only serious diseases were reported on the Household Socioeconomic Form.

treatment. The tests show that because the monthly household income is lower for students with loans, the treated students came from a subpopulation with lower economic status in comparison with the untreated students. This result shows that, although I limited the student sample to individuals who belonged to Level 1, there are still income differences within this level, and those treated students seem to be poorer than the untreated ones. In addition, there is a significant difference in the number of siblings living in the household (with a greater number of siblings in households of treated students who received loans for one to five semesters), and there are differences in the number of household members who suffer from chronic diseases (more frequent in treated households).

Table 3
Descriptive statistics for covariates in sample[a]

				Treated	
			Without loan	1 to 5 semesters	6 to more semesters
Outcome variable:					
Median time-to-degree (number of semesters)			14.000	14.000	13.000
Average time-to-degree			13.879	13.957	13.271
				(0.7316)	(0.0011)
Quantitative covariates: (average values)					
Students Age (in years, at the time of admission)			18.011	17.826	18.036
				(0.4384)	(0.9043)
Percentile Rank (at first semester)			64.469	70.451	82.662
				(0.0327)	(0.0000)
Household Income (in constant Peruvian Soles of 1997)			1345.687	1145.111	964.806
				(0.0017)	(0.0000)
Number of siblings living in household			2.241	2.725	2.393
				(0.0001)	(0.1299)
Number of household members who suffer of diseases			0.648	0.989	0.821
				(0.0002)	(0.0288)
Number of floors in dwelling			1.313	1.250	1.243
				(0.3373)	(0.1985)
Qualitative covariates: (percent)					
Sex	Male		49.15	47.83	47.14
	Female		50.85	52.17	52.86
		P-value		(0.815)	(0.657)
Type of high school before PUCP	Private school		66.73	56.52	55.71
	Non-private school		33.27	43.48	44.29
		P-value		(0.058)	(0.016)
Undergraduate school	Administration and accounting		17.65	17.39	6.43
	Architecture and urbanism		0.38	0.00	0.00
	Art		1.52	1.09	0.71
	Sciences and engineering		34.35	45.65	48.57
	Social sciences		4.74	4.35	10.00
	Communications arts and sciences		9.11	10.87	10.71
	Law		21.25	14.13	17.14
	Education		4.55	3.26	2.14
	Administration and executive studies		0.19	0.00	0.00
	Liberal arts and humanities		6.26	3.26	4.29
		P-value		(0.619)	(0.003)

[a] For quantitative variables, p-values of t test of equal means with respect to untreated students. For qualitative variables, p-values from the Pearson Chi2 test with respect to the untreated group.

In sum, receipt of treatment is clearly related to the academic performance of the student, the economic situation of his or her family, the number of siblings he or she has, and the number of sick relatives at home.

The bottom part of Table 3 presents the comparison of treated versus untreated students for qualitative variables in the sample. I do not observe significant differences related to students' gender. Contrastingly, the proportion of students who come from private high schools is lower for treated than for untreated students. Finally, many treated students were enrolled (at the time of evaluation) in the School of Sciences and Engineering (around 50%), while for untreated students, that percentage was lower (34.4%). There is also a difference for students enrolled in the School of Social Sciences.

6. RESULTS

In this section, I present the main results of this research. The impact was calculated using two methods: linear regression analysis and a treatment effect model (instrumental variables).

6.1 OLS results

A linear regression model is estimated by ordinary least squares. Therefore, a simple estimation of equation (1) is conducted, ignoring equation (2). To evaluate the impact by intensity of the treatment, I defined subsamples with respect to the number of semesters for which a student obtained a loan, and I regressed a linear model to each subsample. The first subsample included students for whom S=0 and S=1. The second subsample included S=0 and S=2 only.

According to the OLS estimates in Table 4, the impact was not significantly different from zero when a student received treatment for fewer than six semesters; however, the impact was significant when students received treatment for six or more semesters. This estimated impact, according to the OLS results controlling for covariates, was -0.8 semesters, meaning that benefiting from the student loan program is associated with a lower time-to-degree.

Table 4
OLS estimates

Dep. Var.: Time-to-degree	Subsamples	
Variables	Treated 1 to 5 semesters vs. untreated	Treated 6 or more semesters vs. untreated
Dummy (1=with loan, 0=without loan)	-0.0869	-0.792***
	(0.199)	(0.170)
Sex (1= Male, 0 = Female)	0.145	0.135
	(0.144)	(0.134)
Students Age (at the time of admission)	0.0810**	0.0582*
	(0.0347)	(0.0320)
Type of School (1=Private, 0 = Non private)	-0.135	-0.128
	(0.145)	(0.134)
Log (Percentile Rank)	-0.778***	-0.779***
	(0.119)	(0.117)
Number of household members who suffer from chronic diseases	0.152*	0.153**
	(0.0834)	(0.0765)
Number of children living in household	0.0669	0.0912
	(0.0676)	(0.0638)
Log (Household Income in Peruvian Soles of 1997)	-0.348**	-0.360**
	(0.176)	(0.161)
Number of floors in dwelling	0.0954	0.0722
	(0.119)	(0.111)
School of Science and Engineering	0.841***	0.877***
	(0.171)	(0.163)
School of Social Sciences	0.791**	0.969***
	(0.332)	(0.280)
School of Law	1.652***	1.696***
	(0.186)	(0.174)
Dummy 2000	-0.622***	-0.685***
	(0.192)	(0.183)
Dummy 2001	-1.481***	-1.459***
	(0.187)	(0.174)
Dummy 2002	-1.952***	-2.000***
	(0.197)	(0.179)
Constant	17.78***	18.24***
	(1.544)	(1.436)
Observations	609	658
R-squared	0.341	0.365

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Recalling that the application and reapplication for a loan are voluntary and may depend on student preferences, if these unobserved covariates are relevant variables, the causal interpretation of the estimated parameters in Table 4 is invalidated.

6.2 The treatment effect model

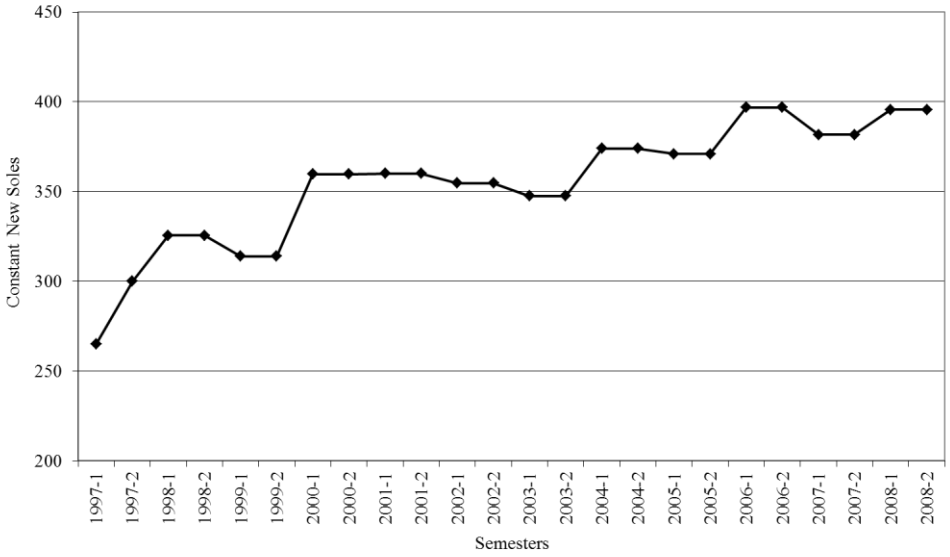
To address the problem of endogenous regressors, I use instrumental variables, where I propose an instrument that, in my opinion, satisfies the requirements of this method. The instrument is related to the legal minimum wage (LMW) in Peru, which is set by that country's Ministry of Economy and Finance. In practice, many Peruvian workers earn salaries lower than the minimum wage; this is due to the high degree of informality in the Peruvian economy. As I explained in section 4, for the student loan program, the legal minimum wage was used to determine if the student's family was sufficiently poor to be eligible for a loan. When family income was lower than four times the minimum wage, the probability of obtaining a loan increased.

During the years a student studied at PUCP, he or she experienced different legal minimum wages. Figure 1 shows the legal minimum wage in constant Peruvian soles in 1997 by each semester in the sample, and we see that this wage increased in real Peruvian soles in 1997 (adjusted according to the annual inflation rate). In the figure, the "jumps" in the time series correspond to the changes in the nominal minimum wage. Those changes occur irregularly and respond to pressure from political parties, election promises, or the ideological reasoning of the authorities. In the scope of PUCP, changes in the LMW are not related to student performance or time-to-degree; therefore, they could be considered as exogenous to the model. Contrastingly, changes in LMW are related to the assignment of loans among students, as stated by the program rules. Therefore, legal minimum wage is a valid instrument.

I propose an instrument that is constructed as follows on the basis of the LMW. The *Average Minimum Wage (AMW)* is defined as the average of the real LMW that a student experienced in the semesters during which he or she was a student. For example, for a student who studied for 12 semesters, from 1997-I to 2002-II, the AMW

is the average of the real LMW from that period, which, in this example, yields 332.7 new soles.

Figure 1
Minimum Wage in Peru
(Constant Peruvian New Soles of 1997)



Sources: Author's calculations from reports of inflation from Banco Central de Reserva del Peru (www.bcrp.gob.pe).

Table 5 summarizes the results of a treatment effect model, where the treatment variable is a binary endogenous regressor, and assuming normal perturbations. This table also shows some tests related to the weakness of the AMW instrument. The F-test of excluded instruments of a linear analog of the first step regression in the treatment effect model is shown, as suggested in Nichols (2007). The F statistic is smaller than 10 (the "rule of thumb") when I compare the groups S=0 and S=1, but it is greater than 10 in the subsample S=0 and S=2, which means that the instrument is valid for the second subsample but not for the first. The table also shows the z-statistic of the first-step probit regression, which essentially confirms the weak association between the AMW instrument and the treatment dummy for subsample S=0 and S=1 and the strong association between the instrument and the treatment dummy for subsample S=0 and S=2. As a result, I can only identify the causal effect of the loans when students received them for six or more semesters.

Table 5
Treatment effect model results

Variables	Treated 1 to 5 semesters vs. untreated		Treated 6 or more semesters vs. untreated	
	Time-to-degree	Treatment Dummy	Time-to-degree	Treatment Dummy
Treatment Dummy (1=with loan, 0=without loan)	-2.067*** (0.373)	--	-2.473*** (0.255)	--
Sex (1= Male, 0 = Female)	0.138 (0.153)	-0.0770 (0.137)	0.0627 (0.143)	-0.317** (0.138)
Students Age (at the time of admission)	0.0662* (0.0371)	-0.0690* (0.0415)	0.0499 (0.0340)	-0.0468 (0.0363)
Type of School (1=Private, 0 = Non private)	-0.239 (0.156)	-0.294** (0.138)	-0.259* (0.143)	-0.401*** (0.134)
Log (Percentile Rank)	-0.716*** (0.127)	0.141 (0.143)	-0.560*** (0.127)	1.179*** (0.223)
Number of household members who suffer from chronic diseases	0.279*** (0.0910)	0.250*** (0.0726)	0.232*** (0.0816)	0.178** (0.0711)
Number of children living in household	0.202*** (0.0751)	0.275*** (0.0613)	0.184*** (0.0684)	0.243*** (0.0620)
Log (Household Income in Peruvian Soles of 1997)	-0.694*** (0.195)	-0.833*** (0.172)	-0.866*** (0.179)	-1.131*** (0.167)
Number of floors in dwelling	0.0442 (0.127)	-0.0654 (0.118)	0.0708 (0.118)	0.00681 (0.113)
School of Science and Engineering	0.936*** (0.183)	0.147 (0.162)	1.081*** (0.174)	0.388** (0.166)
School of Social Sciences	0.822** (0.353)	0.0768 (0.323)	1.245*** (0.299)	0.649** (0.265)
School of Law	1.602*** (0.198)	-0.0235 (0.190)	1.747*** (0.184)	0.293 (0.186)
Dummy 2000	-0.534*** (0.205)	0.877*** (0.237)	-0.832*** (0.195)	0.689*** (0.240)
Dummy 2001	-1.506*** (0.200)	0.838*** (0.271)	-1.606*** (0.185)	0.978*** (0.250)
Dummy 2002	-2.038*** (0.210)	0.977*** (0.326)	-2.092*** (0.190)	1.289*** (0.283)
AMW	-- --	-0.0608*** (0.0121)	-- --	-0.0830*** (0.0105)
Constant	20.26*** (1.690)	26.53*** (4.588)	21.24*** (1.556)	31.95*** (4.022)
athrho		0.754*** (0.145)		0.780*** (0.109)
lnsigma		0.567*** (0.0393)		0.522*** (0.0341)

Wald Chi-sq (15)	300.23		403.37	
Observations	609	609	658	658
F-test of excluded instruments	0.54		18.46	
P-value	0.463		0.000	
First-step Probit |z|-test on excluded instrument	0.79		3.86	
Pvalue	0.430		0.000	
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1				

Estimation using the AMW instrument makes sense because it shows that individuals who obtained treatment for six or more semesters completed their courses of study approximately one year and half a semester earlier than untreated students (without any kind of loan). This number is larger than the estimates I obtained from OLS because the OLS results may be biased due to selection on unobservables.

I can interpret this result as an accumulated effect of the loan. Obtaining a loan for a long time helps students to take and pass courses; however, similar students without any kind of loan are sometimes forced to work or take fewer courses, which prolongs the time-to-degree. In the curricula of all the programs at PUCP, there are many courses that are prerequisites for more advanced ones ("gateway courses"); therefore, after several semesters, if a student does not enroll or does not pass only one such course, this automatically extends the time-to-degree in one semester.

Here, there are comments on the results for covariates in the treatment regression model for the (S=0, S=2) subsample. The gender variable was only significant in the treatment dummy regression (first step), and its sign was negative, which means that male students were less likely to obtain a loan than their female counterparts. Whether the high school was private or not was significant in the first and second steps, meaning that students from private institutions were less likely to receive the loan and the time-to-degree was lower for them. Concerning the percentile rank, it was significant in both steps but with different signs. In the first step, students with a higher percentile rank were more likely to obtain a loan, and in the second step, time-to-degree decreases

with percentile rank, which means that more able students obtained their degrees faster than less skillful students. With respect to the number of household members who suffer from serious diseases, this variable was also significant in both steps with a positive sign. This means that it is more likely for the student to obtain a loan for a long period if he or she has household relatives who have a serious disease, and it also increases the time-to-degree. The number of children living in the student's household is also significant in both steps and has a similar interpretation. The logarithm of household income is significant in both regressions and its effect is negative. I can interpret this result in a similar way to type of school. The dummies for the Schools of Engineering, Social Sciences, and Law are significant and positive in the time-to-degree regression, meaning that it takes more time to graduate from these schools compared with the other schools at PUCP. Finally, the set of dummies for cohorts 2000, 2001, and 2002 are also significant, with a negative sign in the time-to-degree equation. This means that there exists a certain truncation on time-to-degree for recent cohorts (in particular the 2002 cohort) because the outcome was recorded in 2009 for all the cohorts.

7. CONCLUSIONS

Student loan programs for higher education have spread around the world, and this paper entailed an in-depth exploration of a particular experience in a large middle-class university in Peru.

I focused my attention on the impact of this program on time-to-degree, which is the time a student takes to complete all the courses in his or her curriculum. This variable is usually affected by the student's economic and family situations. In this sense, student loans can help to partially overcome such problems and allow recipients to have more time and enthusiasm for their studies. If this is true, students should complete their study plans in a shorter time than similar students who do not benefit from this program.

In this paper, I showed that student loans are effective in the reduction of time-to-degree when the student obtains the loan for several semesters (six or more). This effect was significant when it was calculated by a treatment effect model (which controls for observable and unobservable covariates).

According to the results, the student who receives a student loan for six or more semesters can complete his or her course of study more than one year faster than the student who does not apply for or receive a similar loan. However, for students who obtain the loans for less than six semesters, I was unable to identify a parameter that controls for observable and unobservable characteristics because the proposed instrument was not valid in the treatment effect model.

Regarding external validity—that is, whether the results can be generalized to different populations—I must note that because this is a merit- and need-based program, results are valid for good students who are experiencing financial trouble. I cannot report on the impact of loans on poorer students or non-poor students. Results could also be cautiously generalized to the rest of the Peruvian population, as the PUCP is an urban middle-class university that does not represent the entire society. Even “poor” PUCP students are different from the other poor students in the rest of the country.

REFERENCES

Adelman, C.
1999 *Answers in the Toolbox: Academic Intensity, Attendance Pattern and Bachelor's Degree Attainment.* Washington D.C.: National Institute on Postsecondary Education, Libraries and Lifelong Learning.

Banco Internacional de Reconstrucción y Fomento.
2006 *Por una educación de calidad para el Perú: estándares, rendición de cuentas y fortalecimiento de capacidades.* Lima: Banco Mundial.

Bound, J., Lovenheim, M. F., & Turner, S.
2010 *Increasing time to baccalaureate degree in the united states.* Working Paper N° 15892, National Bureau of Economic Research.

Callender, C., & Kemp, M.
2000 *Changing Student Finances: Income, expenditure and the Take-up of Student Loans Among Full- and Part-time Higher Education Students in 1998/9.* Research Report N°213, Department for Education and Employment, London.

Canton, E., & Blom, A.
2010 Student support and academic performance: experiences at private universities in Mexico. *Education Economics, 18*, 49-65.

De Valero, Y. F.
2001 Departmental factors affecting time-to-degree and completion rates of doctoral students at one land-grand research institution. *The Journal of Higher Education, 72*, 341-367.

Dinarski, S.
2003 Does aid matter? Measuring the effect of student aid on college attendance and completion. *The American Economic Review, 93*, 279-288.

Ehrenberg, R. G., & Mavros, P. G.
1995 Do doctoral students' financial support patterns affect their times-to-degree and completion probabilities? *The Journal of Human Resources, 30*, 581-609.

García, Luis.
2010 "The impact of student loans on educational attainment: the case of a program at the Pontifical Catholic University of Perú." Departamento de Economía PUCP. Documento de Trabajo N° 287.

Kim, D.
2007 The effect of loans on students' degree attainment: differences by student and institutional characteristics. *Harvard Educational Review, 77*, 64-100.

Kim, D., & Otts, C.
2010 The effect of loans on time to doctorate degree: differences by race/ethnicity, field of study, and institutional characteristics. *The Journal of Higher Education, 81*, 1-32.

King, J. E.
2002 *Crucial Choices: How Students' Financial Decisions Affect Their Academic Success.* Washington DC: American Council on Education Center for Policy Analysis.

Kotey, N.
1992 Student loans in Ghana. *Higher Education, 23*(4), 451-459.

Larrain, C., & Zurita, S.
2008 The new student loan system in Chile's higher education. *Higher Education, 55*, 683-702.

Ministerio de Trabajo y Promoción del Empleo.
2005 Revisión de la Remuneración Mínima en el Perú. [online] Available: http://www.mef.gob.pe/contenidos/pol_econ/documentos/REVISION_DE_LA_RM_EN_PERU.pdf (March 3, 2014).

Monks, J.
1997 The impact of college timing on earnings. *Economics of Education Review, 16*, 419-423.

Nichols, A.
2007 Causal Inference with observational data. *Stata Journal, 7*, 507-541.

Paulsen, M. B., & St. John, E. P.
2002 Social class and college costs: Examining the financial nexus between college choice and persistence. *Journal of Higher Education, 73*, 189-236.

Scott-Clayton, J.
2011 On money and motivation: a quasi-experimental analysis of financial incentives for college achievement. *Journal of Human Resources, 46*, 614-646.

Sen, A.
1999 *Development as freedom.* New York: Oxford University Press.

Singell, L. D.
2004 Come and stay a while: does financial aid effect retention conditioned on enrollment at a large public university? *Economics of Education Review, 23*, 459–471.

Stinebrickner, R., & Stinebrickner, T. R.
2003 Working during school and academic performance. *Journal of Labor Economics, 21*, 449-472.

Stock, W. A., & Siegfried, J. J.
2006 Time-to-degree for the economics PhD. class of 2001–2002. *American Economic Review: Papers & Proceedings, 96*, 467-474.

Stock, W. J., Siegfried, J. J., & Finegan, T. A.
2011 Completion rates and time-to-degree in economics PhD programs. *American Economic Review: Papers & Proceedings, 101*, 176–187.

Taniguchi, H.
2005 The influence of age at degree completion on college wage premiums. *Research in Higher Education, 46*, 861-881.

Tilak, J. B.
1992 Student Loans in Financing Higher Education in India. *Higher Education, 23*, 389-404.

Universia (Ed.).
2009 *Crédito Educativo: experiencias internacionales y desafios futuros.* Lima: Universia Perú.

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