



IDB WORKING PAPER SERIES No. IDB-WP-587

Returns to Higher Education in Chile and Colombia

Carolina González-Velosa
Graciana Rucci
Miguel Sarzosa
Sergio Urzúa

March 2015

Inter-American Development Bank
Labor Markets and Social Security Unit

Returns to Higher Education in Chile and Colombia

Carolina González-Velosa
Graciana Rucci
Miguel Sarzosa
Sergio Urzúa



Inter-American Development Bank

2015

Cataloging-in-Publication data provided by the
Inter-American Development Bank

Felipe Herrera Library

Returns to higher education in Chile and Colombia / Carolina González-Velosa, Graciana Rucci, Miguel Sarzosa, Sergio Urzúa.

p. cm. — (IDB Working Paper Series ; 587)

Includes bibliographic references.

1. Education, Higher—Chile. 2. Education, Higher—Colombia. I. González-Velosa, Carolina. II. Rucci, Graciana. III. Sarzosa, Miguel Alonso. IV. Urzua, Sergio, 1977-. V. Inter-American Development Bank. Labor Markets Unit. VI. Series.

IDB-WP-587

<http://www.iadb.org>

Copyright © 2015 Inter-American Development Bank. This work is licensed under a Creative Commons IGO 3.0 Attribution-NonCommercial-NoDerivatives (CC-IGO BY-NC-ND 3.0 IGO) license (<http://creativecommons.org/licenses/by-nc-nd/3.0/igo/legalcode>) and may be reproduced with attribution to the IDB and for any non-commercial purpose. No derivative work is allowed.

Any dispute related to the use of the works of the IDB that cannot be settled amicably shall be submitted to arbitration pursuant to the UNCITRAL rules. The use of the IDB's name for any purpose other than for attribution, and the use of IDB's logo shall be subject to a separate written license agreement between the IDB and the user and is not authorized as part of this CC-IGO license.

Following a peer review process, and with previous written consent by the Inter-American Development Bank (IDB), a revised version of this work may also be reproduced in any academic journal, including those indexed by the American Economic Association's EconLit, provided that the IDB is credited and that the author(s) receive no income from the publication. Therefore, the restriction to receive income from such publication shall only extend to the publication's author(s). With regard to such restriction, in case of any inconsistency between the Creative Commons IGO 3.0 Attribution-NonCommercial-NoDerivatives license and these statements, the latter shall prevail.

Note that link provided above includes additional terms and conditions of the license.

The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the Inter-American Development Bank, its Board of Directors, or the countries they represent.



1300 New York Ave. NW
Washington, DC 20577
Carolina González-Velosa: cagonzalez@iadb.org

Returns to Higher Education in Chile and Colombia

Carolina González-Velosa

Graciana Rucci

IDB*

Miguel Sarzosa

Sergio Urzúa

University of Maryland

Abstract*

In the last decades, countries in Latin America and the Caribbean have experienced a dramatic increase in the levels of higher education enrollment. Using administrative data from Chile and Colombia, we find that this phenomenon is not always associated with higher private individual returns. In both countries, there is a significant dispersion in the net returns to higher education and a significant proportion of graduates could be facing negative returns. This means that, for many higher education graduates, net earnings might have been higher if they had not earned a higher education degree. We hypothesize that while there have been major policy efforts to increase coverage, institutional arrangements that encourage quality and relevance has been insufficient. Corrective measures in this direction are urgent. Sustainable growth requires a labor force with relevant skills and capabilities. In light of our results, it is not clear that the higher education systems in these countries are delivering these outcomes.

Keywords: Higher education, returns to higher education, heterogeneity, inequality, skills, productivity

* The opinions expressed in this document are those of the authors and do not necessarily reflect the official view of the Inter-American Development Bank. The authors are grateful for the valuable comments and suggestions of Juan Diego Bonilla, Julián Mariño, Carmen Pagés, and participants at LACEA/LAMES 2014 (São Paulo), the IDB conference "Challenges of Education in Latin America," and a research seminar organized by the IDB's Labor Markets and Social Security Unit. They also thank Cristián Sánchez for his contribution as a research assistant.

1. Introduction

The substantial expansion in higher education coverage is one of the most important transformations in the education systems of Latin America and the Caribbean (LAC). In 1992, the region's gross enrollment rate in higher education (ISCED 5 and 6) was 17 percent, and by 2012 it reached 43 percent.¹ Chile and Colombia provide two emblematic examples; in the same period, higher education enrollment rates in these countries increased by 238 percent and 221 percent respectively, growing at a much faster pace than the coverage in secondary education.

This dramatic increase in higher education coverage was received with great optimism in both countries. It not only reflected greater private investments in education, but it was also the result of public policies designed to facilitate access to the system, through, for example, greater financial support for students in Chile and a geographical expansion of higher education institutions (HEI) in Colombia. Increased access to higher education was expected to bring significant economic and equity gains.

This optimistic view, however, is now being tested. There is growing concern that the expansion in coverage has been accompanied by a deterioration in quality. The student protests in Chile (2010-) revealed dissatisfaction with a system of questionable quality and high levels of indebtedness in which, for many students, investing has not been profitable. The general university strike in Colombia (2011) revealed both strong discontent and the high political costs of structural reforms that may affect the quality and financing of higher education.

Concerns about the decline in the quality of higher education are not limited to Chile and Colombia, but extend to the rest of the region as well.² There is a well-documented decrease in the economic returns to higher education in LAC, which could be explained, to some extent, by a worsening in the quality of the system (e.g., Aedo and Walker 2012; Lustig, Lopez-Calva, and

¹ These figures show gross enrollment rates in tertiary education defined as levels 5 and 6 of the International Standard Classification of Education (ISCED). Gross enrollment rates show the percentage of enrollment out of the total population in the five-year age group following the secondary schooling leaving age.

² The Government of Ecuador—through the Council of Evaluation, Accreditation, and Quality Assurance of Higher Education—recently shut down 14 universities that did not meet minimum quality standards.

Ortiz-Juarez, 2013).³ With increased access, it is possible that institutions and students of lower-than marginal quality have entered the system. This would explain why, in spite of the dramatic increases in education coverage, labor productivity in the region has grown at an exceedingly slow pace.

This study contributes to the literature on the quality of higher education by assessing the private returns to technical and university degrees in Chile and Colombia. A related work by Reyes, Rodríguez and Urzúa (2013) estimates the returns to higher education in Chile using administrative data and a structural model that incorporates heterogeneity in unobserved skills. We depart from this study by using a simpler and intuitive methodology aimed at replicating the economic calculation that well-informed households could have performed using publicly available information. Moreover, we derive our data from Internet portals that the governments in Chile and Colombia have recently developed to inform students and their families about the labor outcomes of post-secondary degrees. In the case of Chile, we use the information published by the Ministry of Education on their web portal (see <http://www.mifuturo.cl/>) regarding the costs and length of degree programs and earnings of graduates by institution and degree. For Colombia, we use the administrative databases of the Labor Market Observatory, which is used by its Ministry of Education to construct and publish electronic reports (see <http://www.graduadoscolombia.edu.co/html/1732/w3-channel.html>). We use incomes of individuals who only completed secondary education to construct a counterfactual. Unlike previous studies (e.g., Hernández, 2010), our calculations take into account both the monetary and opportunity costs of higher education.

In line with the results from Reyes, Rodríguez and Urzúa (2013), we find evidence of substantial heterogeneity in the net returns to higher education. Our results show that for a significant proportion of graduates in Chile and Colombia, higher education yields negative economic returns. In both countries this problem is particularly severe for higher technical degrees which typically are accessed by more disadvantaged students. We also find evidence of a dramatic dispersion in returns, not only between degrees but also between institutions offering the same degree.

³ The observed decline in the returns of higher education could also be linked to demand factors, such as technological changes that reduce the relative demand for skills (Aedo and Walker 2012; Lustig, Lopez-Calva, and Ortiz-Juarez, 2013).

Given the large dispersion in the returns of each education program, it is important to analyze what kind of information the prospective students can use to assess the relative profitability of each alternative. To do so, first we analyze tuition costs, which, in theory, should signal the returns to investing in each education program. The evidence suggests, however, that HEIs that charge a higher tuition are not always the most profitable. Quality accreditation does not appear to be a clean signal of economic profitability either. Our results show that attending an accredited HEI in Chile or Colombia does not always lead to higher returns.

Taken together, these results have clear implications for public policy. A first point that emerges is the importance of further efforts to construct and disseminate information on the performance of higher education graduates in the labor market. In both Chile and Colombia and in the rest of the region, households are faced with complex decisions when investing in post-secondary education. Given the multiplicity of HEIs, degrees, qualifications, and the substantial differences in returns obtained in each of these options, it is crucial to guide the decisions of potential students by clear information on the job prospects after graduation. This would not only bring private benefits for those who make better informed decisions; it would also result in more social benefits since wider dissemination of information should reduce the supply of degrees with a lower rate of return. The web portals mentioned above are an important first step in this direction, but further efforts are needed to increase their coverage and dissemination of information.

Additionally, our results highlight the importance of using information on labor market outcomes to assess the education system. In both Chile and Colombia, quality assurance systems primarily use information on education inputs (e.g., teachers' educational attainment, infrastructure, consistency of the project, improvement plans, financial solvency, etc.) to evaluate the quality of the HEIs. Colombia has recently developed useful tools that help monitor the quality of learning consisting of compulsory standardized tests for higher education graduates, which, sometimes, may also be used to guide the accreditation system. However, information on graduate job performance has been absent from the evaluation and quality assurance processes. Thus, the government often designs policies and allocates public funds without taking into account the labor market relevance of the education projects or their private and social economic returns. This weakness is particularly costly in the case of technical degrees, whose primary

objective is to train for work, and which should therefore be evaluated on their relevance and capacity to generate good quality jobs.

Finally, this new evidence calls into question the benefits of the education policies implemented in and Chile which aim at expanding coverage of higher education without assuring the quality and relevance of the educational programs. There has been a dramatic increase in the access to a system that pledged to improve the economic conditions of those who decided to invest in higher education. Results in this study suggest that, way too often, this promise has not been fulfilled.

2. Higher Education in Chile and Colombia

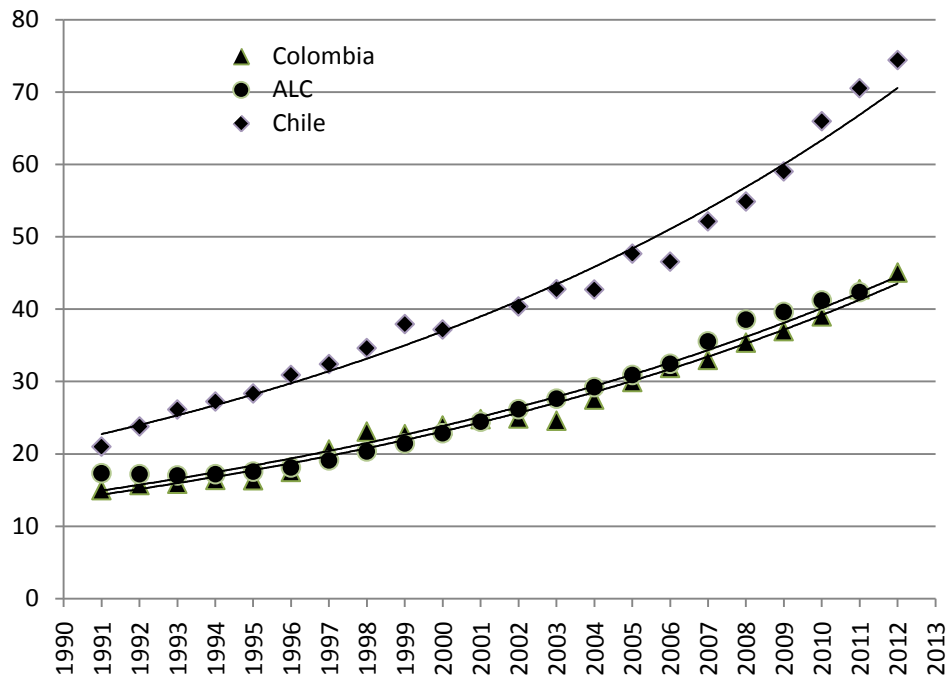
There has been a dramatic expansion in the access to higher education in LAC over the past two decades. From 1991 to 2012, the gross enrollment ratio for the entire region increased from 17 to 43 percent (Figure 1).⁴ In Colombia, tertiary education enrollment grew from 14 percent in 1991 to 45 percent in 2012, a rate similar to the rest of the region. In Chile there was an even more rapid expansion: the gross enrollment rate in Chile increased from 21% (1991) to 71 (2012) and is now at a similar level as those in industrialized countries such as Austria, Holland and Ireland.

Greater access to higher education is consistent with the economic progress experienced by Chile and Colombia during the last two decades. For comparison, Figure 2 shows the association between gross domestic product (GDP) per capita and the enrollment in higher education in both countries and in Mexico. Each point in the scatterplot corresponds to a different year in the period 1991–2012. Clearly, both Chile and Colombia have experienced an expansion in coverage at the same time as they increased their per capita income levels. In fact, given per capita income, Colombia has followed a similar path to Chile. If Colombia sustains its pace of economic growth and coverage expansion, it could achieve a comparable or even higher enrollment rate than Chile by the end of the next decade. In contrast, in Mexico, even though

⁴ The Gross Enrollment Ratio indicator was obtained from the World Bank Education Statistics (EdStats) database. It measures total enrollment in tertiary education (ISCED 5 and 6), regardless of age, expressed as a percentage of the total population of the five-year age group following on from secondary school leaving

higher education enrollment has also grown, the levels are relatively low given its economic development.

Figure 1. Gross Enrollment Ratio in Tertiary Education, 1990–2013 (in percent)



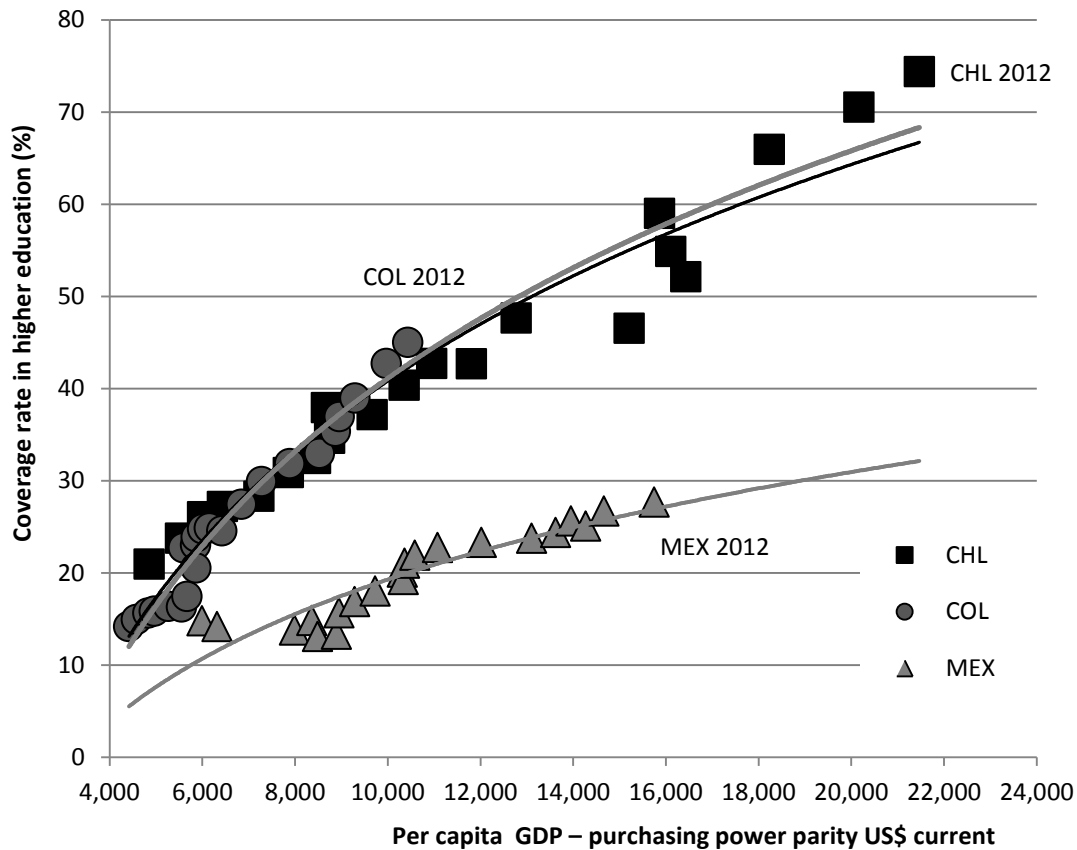
Source: Authors' preparation based on World Bank education statistics-EdStats.

Notes: The figure shows the evolution of the Gross Enrollment Rate in the 1991-2013 period. The lines show the trends predicted by a regression that assumes exponential growth rates in higher education enrollment.

In Chile, the increase in access to higher education has led to a diversification in programs and institutions. Before the 1980s, higher education in Chile consisted mainly of five-year programs provided by public universities. An education reform in 1981 led to a diversification of the system: private institutions entered to compete and began to provide shorter high-level technical programs (Reyes, Rodríguez and Urzúa, 2012). Currently, Chile has three types of HEIs: universities, center of technical training (CTTs), and professional institutes (PIs), which are classified based on the qualification offered: academic degrees (undergraduate programs usually lasting five years and master's and doctorate programs), professional qualifications (technical programs typically lasting four years), and high-level technical degrees

(technical programs usually lasting two years).⁵ Although universities can offer the three types of programs, higher level technical degrees are mainly offered by the TIs and PIs. The importance of this type of institutions has grown progressively. In 2011, approximately one million students were enrolled in the Chilean higher education system: 38 percent in programs offered by PIs and CTTs.

Figure 2. Higher Education Enrollment Ratio and Per Capita GDP (1991–2012)



Source: Authors' preparation based on World Bank education statistics-EdStats and World Development Indicators.

The supply of higher education in Colombia has also diversified. There are currently four types of HEIs regulated by the Ministry of Education: universities, university institutes, technological institutes, and technical professional institutes. As in the case of Chile, they differ based on qualification they grant: university degrees (four to five years), technological

⁵ Universities can grant all types of technical qualifications and degrees. IPs can only grant higher technical and professional qualifications (except for some, which can only be conferred by universities). CTTs are only authorized to grant high-level technical qualifications.

qualifications (three years), and professional technical qualifications (two years)⁶. Additionally, the National Service of Learning (Servicio Nacional de Aprendizaje, or SENA), which is Colombia's public training institution, also offers post-secondary technological and technical degrees, which tend to be shorter than those offered by HEIs. In 2011, approximately 1.9 million students were enrolled in the education system, of which 32 percent were in a program leading to technological or professional technical qualifications. Of all the individuals enrolled in these two types of programs, 46 percent were studying in HEIs and the remaining 54 percent in SENA.

2.1 The Role of the State in Financing Higher Education

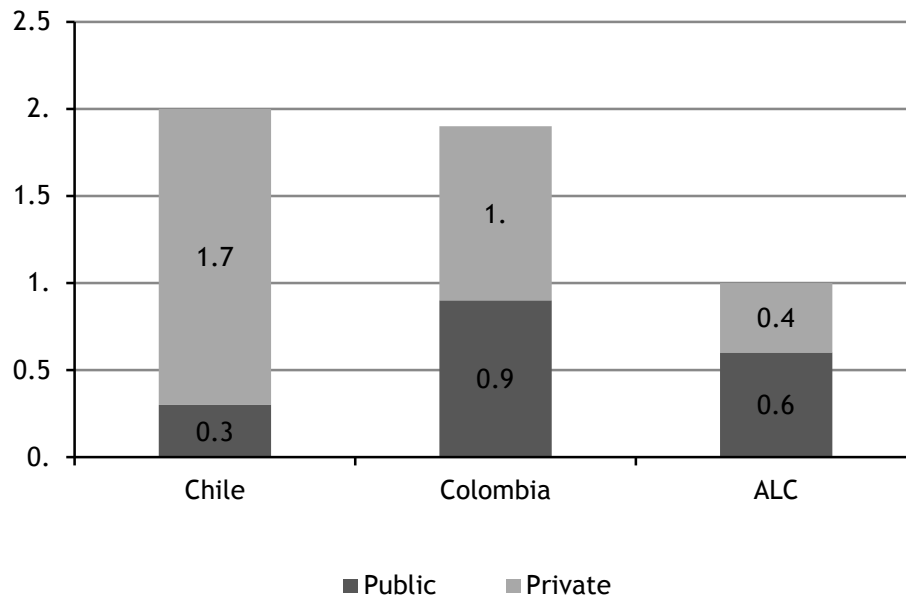
The technical modality is increasingly important in the post-secondary education programs of both Chile and Colombia. There are, however, important differences in the higher education systems in these countries, especially with respect to their financing.

In Colombia, public funding plays a much more important role than in Chile. As shown in Figure 3, total expenditure on higher education is close to 2 percent of GDP in both countries, which places them well above the regional average. The distribution between public and private sources in each country differs. In Chile, for example, private funding (1.7 percent of GDP) is significantly larger than public funding (0.3 percent of GDP), whereas in Colombia expenditures on higher education are evenly distributed between private and public sources.

There are also important differences in the mechanisms that the State uses to finance higher education. In Chile, the State mainly transfers funds to the higher education system in the form of scholarships and student loans. This form of funding exceeds all others in terms of amount and number of beneficiaries, including direct financing to public universities and competitive performance-based institutional grants (Chilean Ministry of Education, 2011).

⁶ Universities are authorized to grant any type of technical or academic qualification, including at the graduate level, whereas university institutes can only offer undergraduate academic or technical programs. Technological institutes can only grant technological or technical professional qualifications, and technical professional institutes can only confer technical qualifications.

Figure 3. Expenditures on Higher Education as Percentage of GDP by Type of Funding, 2008 (public versus private)



Source: OECD, IBRD, and World Bank (2012).

For higher technical degrees, public funding is a relatively recent phenomenon and comes almost exclusively in the form of scholarships and subsidized student loans. Historically, public funds in Chile were exclusively directed to universities. In 2001, however, the State introduced the New Millennium Scholarship (NMS or *Beca Nuevo Milenio*) and in 2005, the State Guaranteed Loan (SGL or *Crédito con Aval del Estado*) (Chilean Ministry of Education, 2011). The NMS is a scholarship targeted to students enrolled in technical programs while the SGL is a student loan for technical or academic higher education targeted at low-income individuals who can demonstrate academic merit. As discussed by Rau, Rojas and Urzúa (2013), the creation of the SGL filled an important void in the loan market, given that previously private banks had been reluctant to provide loans to economically disadvantaged students. Since its inception, the use of SGL has rapidly expanded, especially among students in higher technical education. As Bassi and Urzúa (2010) show, in the three years after its introduction, the number of beneficiaries grew by more than 250 percent, with even greater increases among PIs (566 percent) and TIs (589 percent). In 2010, 42 percent of the students with student aid had an SGL (Rau, Rojas and Urzúa, 2013).

Unlike traditional student loans, the SGL is not based on a family's borrowing capacity. If the student successfully completes his or her studies, the government acts as a guarantor. If the student drops out, a "guarantee for academic drop out" is triggered, and the HEI has to cover a significant portion of the loan. The Chilean government pursued two objectives with the design of the SGL: (i) to expand the coverage of the education system and (ii) to reduce dropout rates, which in Chile, are very high.⁷ These new loans, however, may also have led to undesirable behavior by the HEIs, which have an incentive to maximize the number of students enrolled and impose lower academic standards to reduce dropouts. Rau, Rojas and Urzúa (2013) provide evidence consistent with this hypothesis. Using administrative data and a structural model that incorporates heterogeneity in unobserved skills, the authors find that SGL beneficiaries have lower earnings than non-beneficiaries.

In Colombia, public funding for higher education consists mostly of direct subsidies from national and local governments to public HEIs. Of the 208 HEIs in the country in 2011, 80 were public institutions, which accounted for 54 percent of enrollment. About 50 percent of the students in technical education programs were enrolled in public institutions. Public HEIs are not completely free, but they charge a subsidized, lower value for enrollment. The allocation of these subsidies is based almost entirely on historical appropriations, using the university budget in 1993 as a reference and adjusting for inflation. Neither unit costs nor performance measures are taken into account (OECD, IBRD, and World Bank, 2012). As a result, the allocation system does not create incentives for efficiency or quality. It does not even incorporate cost adjustments when there is an increase in the number of students enrolled.

The Colombian government facilitates access to the system via a system of subsidized student loans. The Colombian Institute for Educational Credit and Studies Abroad (ICETEX, for its Spanish acronym) is in charge of the subsidized loans system, which funds medium-term loans to students of all income levels with good academic records. One of the instruments, known as the ACCESS credit, has had a particularly fast penetration among low-income students. ACCESS combines scholarships with long-term subsidized loans which can be used for university, technological, or technical studies. A co-debtor backs the debt. In the case of technical and technological studies, borrowers enjoy lower interest rates. Following the

⁷ Nearly 50 percent of university students in Chile do not complete their studies, which is similar to the figure reported in the United States (Rau, Rojas, and Urzúa, 2013)

introduction of ACCESS in 2002, the number of loans tripled, and in 2011, 20 percent of students benefitted from education loans.. Colombia thus reached what is perhaps the highest level of penetration of higher education loans in Latin America (OECD, IBRD, and World Bank, 2012).

2.2 Quality Assurance Systems and Information

Chile and Colombia have quality assurance systems based on licensing, registration, and accreditation processes. In both countries, a collegiate body first evaluates if the HEIs and education programs meet the minimum standards for their operation. This initial review is compulsory and takes into account aspects such as compliance with the regulations of the Ministry of Education, the program's social goals, the curriculum's characteristics, infrastructure provision, student welfare, and financial solvency.

Both countries also have a peer review based accreditation process, to which HEIs can submit voluntarily. Specialized councils can grant accreditation to programs or institutions after a self-evaluation process and the evaluation by external committees and peers. In this process, the councils consider aspects such as teachers' educational attainment, the curricula of the academic programs, and the quality of the infrastructure. Colombia has recently made significant progress in the design and implementation of compulsory standardized tests to secondary and tertiary graduates that will provide information to evaluate the quality of learning and the value added of higher education.⁸ In some cases, the councils use the results from these tests as inputs in the accreditation process.

The process of institutional accreditation is much more widespread in Chile than in Colombia. In Chile in 2012, more than half of HEIs were accredited (82 percent of universities, 44 percent of IPs, and 22 percent of CTTs). In contrast, in January 2014 only 30 HEIs were

⁸ Since 2009, all higher education graduates in Colombia are required to take the standardized SABER PRO test, which evaluates generic skills necessary for professional performance, regardless of the program, and specific core skills, which vary according to the program completed. SABER 11, mandatory since 1980, is a compulsory test for high school graduates. It is possible to use the results of SABER 11 and SABER-PRO to construct quality and value added indicators, which are an extremely useful input in the effort to evaluate and compare the quality of programs and institutions and their progress over time.

accredited in Colombia, and all of them were universities.⁹ To date, in none of these countries the accreditation process explicitly incorporates an assessment of the labor market outcomes of the graduates or takes into account any other dimension associated with the relevance of skills in the productive sector in either country.

Nonetheless, both countries have recently made important efforts to collect and disseminate information on job market performance of graduates. In Chile, the collection of information on the labor destination of graduate students is now a condition for accreditation. Moreover, Chile's web portal (<http://www.mifuturo.cl/>) provides important information such as the tuition fees, dropout rates, and employment level and earnings of graduates to prospective students and their parents at the institution and degree level. These data, however, are not yet comprehensive, as HEIs do not report information for about 40 percent of the degrees.

Colombia's web portal (<http://www.graduadoscolombia.edu.co/html/1732/w3-channel.html>) provides similar information. Users can see the average income and the formality rate of graduates for each type of qualification, field of expertise, and institution. As a result, in both Chile and Colombia, a young person who is, for example, interested in the field of accounting can compare the wages of accounting graduates in different HEIs. The information in these web portals is the main input of the analysis developed in this study.

3. Estimating the Returns to Higher Education

The methodology for calculating the returns to higher education by institution and degree follows a simple economic logic. Following Urzlo (2012), its objective is to replicate the economic analysis that potential students and their families could make in Chile and Colombia using the information that governments in these countries has recently made available for this purpose. We start by defining the return to degree i in institution j with the following expression:

$$r_p(i, j) = \frac{VPN(i, j) - VPN_p}{VPN_p}$$

⁹ The information on institutional accreditation for Chile comes from the National Council of Education (CNED, for its Spanish acronym), and for Colombia from the National System of Information on Higher Education (SNIES, for its Spanish acronym).

where the net present value (VPN) is defined as:

$$VPN_{i,j} = \sum_{t=d_{i,j}+1}^{65} \frac{Y_{i,j}(t)}{(1+r)^t} - \sum_{t=18}^{d_{i,j}} \frac{C_{i,j}(t)}{(1+r)^t}$$

$$VPN_p = \sum_{t=18}^{65} \frac{Y_p(t)}{(1+r)^t}$$

and $Y_{i,j}(t)$ is the average income of graduates of institution j in degree i at age t , $C_{i,j}(t)$ is the effective tuition fee of institution j in degree i at age t , r is the discount rate and $d_{i,j}$ represents the effective duration of degree i in institution j . $Y_p(t)$ denotes the income received by individuals who have at most completed secondary education (and not higher education) and are in the percentile p of the income distribution.

In both countries, we use administrative data from the Ministry of Education to obtain information for $d_{i,j}$ and $C_{i,j}(t)$. We also have information on average earnings by degree and institution made public by the government in the web portals *mifuturo.cl* and *graduadoscolombia.com*. For Chile, we have data on earnings at the fourth year after graduation, while for Colombia, we have data on the first year after graduation. From these earnings, we can extrapolate and estimate a series of labor earnings until the expected age of retirement (65). To do this, we proceed as follows:

1. With the information from household surveys (the National Socio-Economic Characterization Survey, or CASEN, in Chile and the Integrated Household Survey, or GEIH, in Colombia) and taking data on university graduates aged 24 to 65, we estimate the following regression:

$$\ln Y_i = \alpha + \beta Edad_i + \gamma Edad_i^2 + \varepsilon_i \quad (1)$$

2. The previous exercise is repeated using data on higher technical education graduates.
3. Using the results of the parameters of the estimates in the two previous steps, we construct for both higher education graduates and technical education graduate the following:

$$Y_{i,j,t} = Y_{i,j,t-1} * \exp(\beta + 2\gamma(t - 1)) \quad (2)$$

where t represents age. Thus, with equation (2), we can estimate the earnings of higher education graduates until age 65.

4. Using a similar procedure, we calculate the series of earnings for individuals with secondary education who have not obtained a higher education degree (counterfactual). We start by using the 75th percentile of the distribution of earnings of individuals with no higher education as the reference value (i.e., the initial value used to construct the earnings profile of this group). Thus, we are assuming that, if the graduates who obtained higher education degrees had chosen not to enter the higher education system, their earnings would have been equivalent to those in the 75th percentile.¹⁰ Based on this reference value, we project earnings from the parameters obtained from running regression (1) with data on individuals aged 18 and 65 with secondary education who are not studying. Additionally, as an alternative, we analyze the sensitivity of the results by using the 50th percentile of the income distribution of individuals who have completed secondary education but do not have a higher education degree.¹¹
5. Finally, given a value for the discount factor, we calculate the present value of the stream of income for graduates of degree i in college j and the present value of the stream of income for individuals who did not complete higher education. We choose 6 percent based on the cost of higher education loans in Chile and Colombia.¹² Using this information and the cost of tuition fees, we obtain the net average returns to each degree and HEI.

Table A1 of the Appendix presents the parameters and sources of information used in this methodology.

3.1 Data

To estimate the net returns to higher education in Chile, we use the information published on the *mifuturo.cl* web portal. For all the degrees for which data are available, we collect information on the length of the program, tuition fees, and earnings in the fourth year after graduation. With this information, we can estimate the returns for 960 degrees offered in 99 HEIs. This is

¹⁰ This assumption is supported by the literature, which shows that the skills, social capital, and network of those who have earned a tertiary degree are higher than those of the “median” individual who have only completed high school (e.g., Espinosa, Sarzosa y Urzúa, forthcoming; Heckman, Stixrud, and Urzúa, 2006; Prada and Urzúa, 2013).

¹¹ Table A2 of the Appendix summarizes these comparisons.

¹² In Chile, the SGL interest rate is 6 percent. In Colombia, the access credit is CPI plus 6 percent or CPI plus 10 percent, according to the loan term and the applicant’s socioeconomic level. Table A2 of the Appendix examines sensitivity to different discount rates, 6 and 9 percent.

approximately 60 percent of the total number of degrees offered in the country. From the web portal, we also obtain data on the number of students enrolled in each program. With this information, we can calculate average returns weighting by the number of students enrolled in each type of program.¹³

To estimate the net returns to higher education in Colombia, we use data from the Economic Labor Market Observatory of the Ministry of Education (OEML, for its acronym in Spanish). This is an individual level database with information on graduates of the higher education system which includes, among other variables, the program completed, the name and type of HEI attended, the type of degree obtained, a dichotomous variable indicating whether or not the individual contributed to social security, and the base income used for contribution for employees in the formal sector.¹⁴ Using the OEML data, the Colombian Ministry of Education constructs the information on income and formal employment disaggregated by degree and institution which is published on its web portal. For Colombia, unlike Chile, we do not have information on the cost of enrollment (tuition fee) disaggregated by degree and institution. Instead, we use the table of average tuition in 2013 for 16 different types of HEI (see Table A3 in the Appendix), which is published by the Colombian Ministry of Education in their "Higher Education Statistics" report.

We are able to compile information for 514,180 individuals who graduated in 2008, 2009, and 2010 and represent 80 percent of the graduates of the higher education system in the period. Since SENA does not report information on its graduates to OEML, we only have information on graduates from technical and technological degrees in HEIs, which make up 46% of higher level technical enrollment in the country. Using this information, we estimate returns for 3,883 educational programs offered in 311 HEIs.¹⁵

¹³ Chile's web portal does not always specify if the program leads to a technical or academic degree. We use two criteria to define a technical degree: (1) the name of the program must include the terms "technician," "university technician," "higher level technician," or "technologist"; (2) the program must be offered by a TI or an IP, even if it is not explicitly defined as a "technician" or "technologist" level degree.

¹⁴ OEML data are obtained from merging two administrative databases with individual level information: the graduate database of the higher education system of the Ministry of Education (SNIES) and the records of contributors to the social security system (PILA).

¹⁵ To estimate the returns, we use the information on the labor income of graduates working as wage earners. We exclude self-employed from the analysis because, under Colombian labor legislation, these workers are not required to report total labor income received as contribution base. As a result, self-employed workers consistently report lower earnings in the social security administrative records than they actually receive. The information reported by the Colombian Ministry of Education in their web portal also excludes the earnings of the self-employed.

4. Results

The first set of results indicates that in both Chile and Colombia, university degrees have, on average, positive rates of return of 62 and 26 percent, respectively (see Table 1). In contrast, technical education is, on average, not profitable in either country, with expected net returns equal or close to zero. These averages, however, are not a good estimate of the rates of return perceived by many individuals, given the significant dispersion. In both countries, there is a substantial variation in the net return to investing in higher education, both university and technical (Table 1). For example, a university degree in Chile in the 90th percentile of the distribution has a net rate of return of 167 percent, while a degree at the 10th percentile has a negative return of -16 percent. In Colombia, most technical education graduates obtain returns ranging from -33 to 25 percent depending on the education program they choose.

In both countries, there is a significant dispersion in the net returns to higher education and, as will be seen below, a significant proportion of graduates could be facing negative returns. This means that, for many higher education graduates, net earnings might have been higher if they had not completed college and, instead, received the 75th percentile of the distribution of earnings of workers who only completed secondary education. In both Chile and Colombia, this problem is particularly widespread among technical graduates.

Table 1. Average and Dispersion: Net Returns to Higher Education (in percent)¹⁶

	Chile		Colombia	
	University	Technical	University	Technical
Average	62	0	26	-2
Median	52	-5	22	-5
10th percentile	-15	-41	-23	-33
90th percentile	167	52	78	25
Standard deviation	66	38	45	64

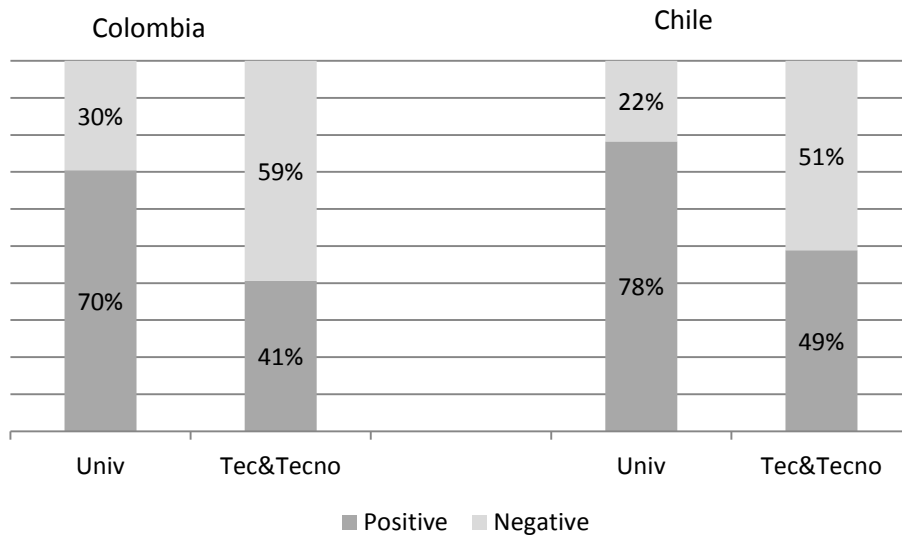
Source: Authors' preparation based on data from the Ministry of Education in both Colombia and Chile.

Figure 4 illustrates this point. The bars show the share of higher education graduates with returns above or below zero by type of degree: technical or university. The first two bars show the results for Colombia, where 30 percent of people who have college degrees and 59 percent of those who completed technical and technological studies face negative returns. In the case of Chile, 22 percent of graduates with university degrees and 51 percent with technical degrees face earning returns below zero.

Based on these results, for a significant proportion of young people in Chile and Colombia, investing in higher education, especially in technical degrees, may bring economic losses. Since low-income students traditionally favor technical education, this result has particularly negative implications in terms of inequality.

¹⁶ These results are obtained assuming a 6 percent discount rate and using the 75th percentile of the distribution to counterfactual earnings of high school graduates. Table A2 in the Appendix shows the results under alternative parameters. The results are sensitive to the parameter choice, stressing the importance of the rationale behind the assumptions. Rankings in net returns across careers and universities, however, are mostly insensitive to the parameter choice

Figure 4. Share of Higher Education Graduates with Positive/Negative Returns

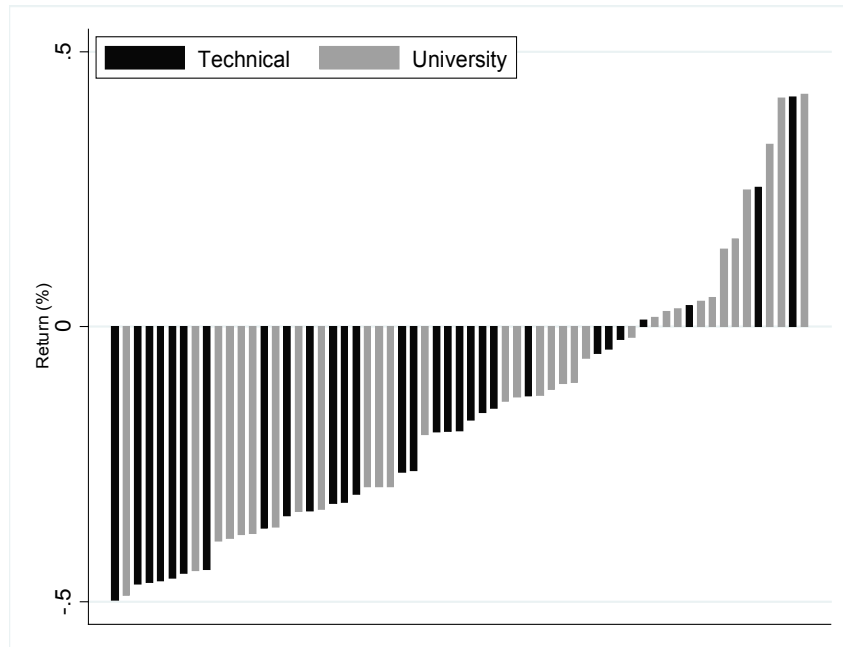


Source: Authors' preparation based on data from the Ministry of Education in both Colombia and Chile.

However, even if the average returns to technical education are lower than those of university degrees, this does not mean that technical education is always a less profitable alternative. In fact, for some degrees and HEIs, choosing a technical pathway may be the best option. Figures 5 and 6 illustrate this point with data for accounting degrees in Colombia and design in Chile. These careers are in high demand in both countries, and are frequently offered in the technical and university streams.

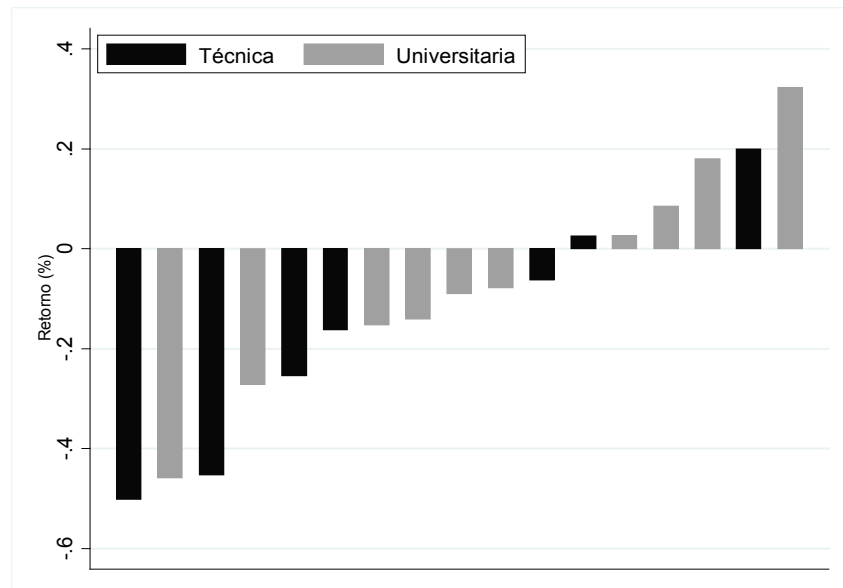
Figure 5 shows the net returns to studying accounting in Colombia. Each bar shows the estimated return to a program in a specific HEI. Darker bars correspond to technical or technological programs. The results indicate that while the least profitable accounting degrees in Colombia are technical, some technical degrees have higher returns than university programs. Figure 6 illustrates the same point with data for the career of design in Chile, in which completing a technical program can be more profitable than earning a university degree.

Figure 5. Net Returns to Accounting Degrees in Colombia: Technical versus University (in percent)¹⁷



Source: Authors' preparation using data from the Colombian Ministry of Education.

Figure 6. Net Returns to Design Degrees in Chile: Technical versus University (in percent)



Source: Authors' preparation using data from the Chilean Ministry of Education.

¹⁷ With our data, we constructed net returns for accounting degrees offered in 217 HEIs. For reasons of space, we only plotted the returns of the 38 degrees with the largest number of graduates in our database (100 or more for technical and 200 or more for university).

4.1 Heterogeneity in the Returns by Institution

A more detailed analysis of the dispersion in the magnitude of the returns to higher education shows that, in both Chile and Colombia, the net economic benefit of graduating in a particular degree can be very high or very low depending on the HIE. Figures 7 and 8 illustrate this point, using data from the 10 most demanded technical and university programs in Colombia and Chile. The vertical axes measure the net returns yielded by each degree.

Panel A in Figure 7 shows the returns to the 10 most popular technical/technological degrees in Colombia, accounting for 65 percent of the total degrees in these categories,¹⁸ while panel B shows the result for the 10 most demanded university degrees, representing 60 percent of the total in this category. The circles show the average return of each degree and their size is weighted by of the number of students. The bars show the range between maximum and minimum return, and are therefore a measure of the dispersion in the returns to the same degree across different HEIs.

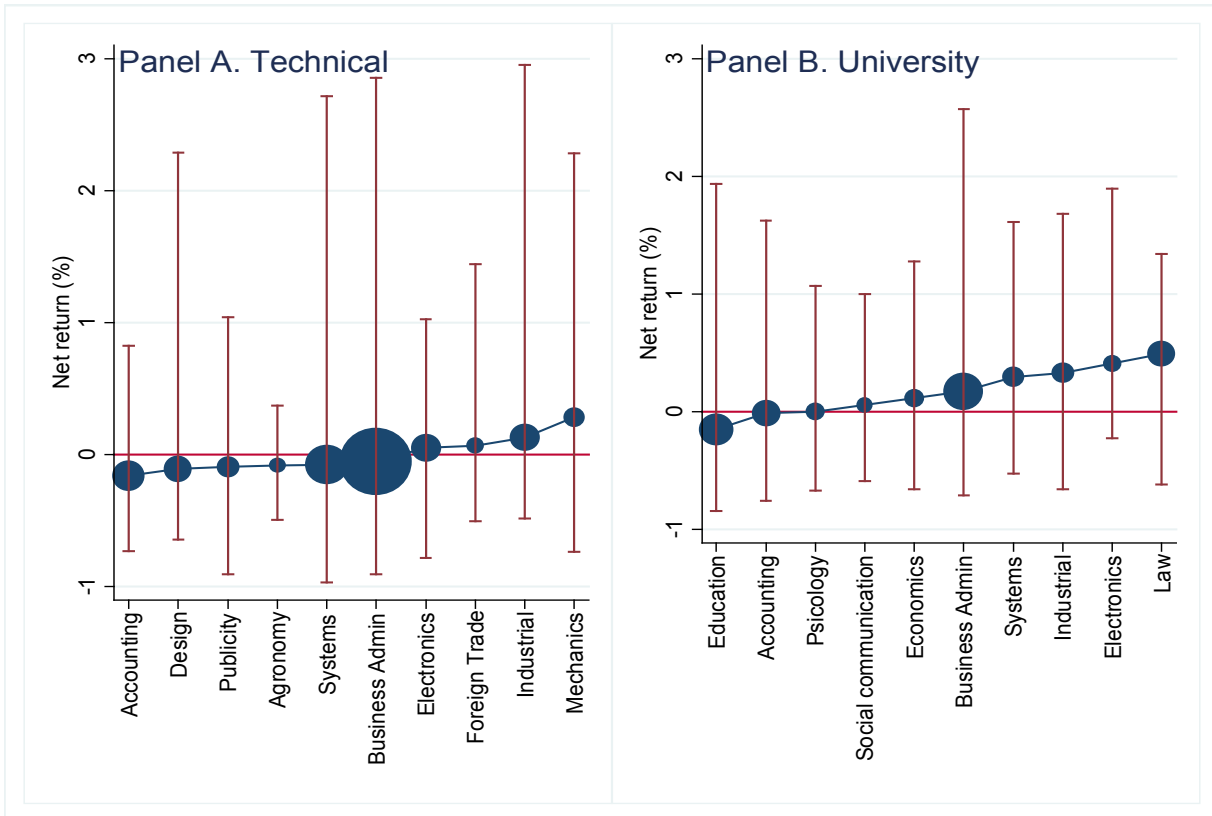
Two important points emerge from Figure 7. First, the most popular technical degrees in Colombia (such as agriculture, accounting, and business administration) have negative average returns. Second, there is an enormous dispersion in returns, both for technical and technological and university degrees. For example, a person who obtains a technical or technological degree in mechanics could have, according to the educational institution chosen, net negative returns of almost -100 percent or net positive returns greater than 200 percent. In the case of university degrees, there is also an enormous variation. These results highlight the importance of building information on the relative performance of educational institutions in the country to help prospective students make decisions and inform public policy design. They also underscore the challenge faced by quality assurance systems given the wide dispersion in the performance of HEIs.

Figure 9 replicates the same exercise using data from the main higher education degrees in Chile: the ten most popular technical degrees, accounting for 44% of total enrollment and the

¹⁸ Even though technical and technological careers in military, police and security are among the most demanded, we choose to exclude them from the analysis given the exceptional characteristics of the institutions that regulate the training and salaries of the members of the Colombian security forces.

top ten college degrees, with 56% of enrollments. As in Colombia, many highly demanded degrees yield negative returns. The case of the technical degrees in education, gastronomy, and nursing is particularly worrisome, since the returns are always negative, regardless of the institution where the degrees are obtained.

Figure 7. Net Returns to the Most Popular Degrees in Colombia: Averages and Dispersion¹⁹



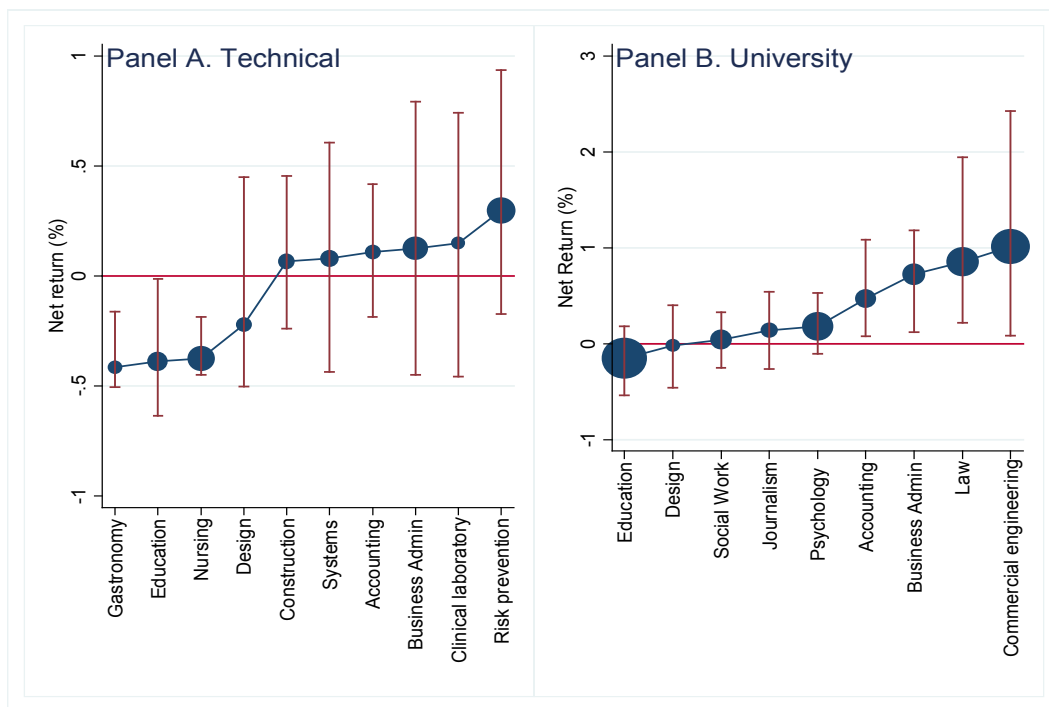
Source: Authors' preparation based on data from the Colombian Ministry of Education.

Results in Figures 6 and 7 suggest that the within-degree variation in net returns is smaller in Chile than in Colombia. This could be reflecting not only a greater homogeneity of institutions and students in Chile, but also differences in the characteristics of the data. While in

¹⁹ Net returns are calculated assuming a 6 percent discount rate and the 75th percentile as counterfactual reference income. The numbers of HEIs used to calculate the averages and dispersions of returns to university degrees are as follows: administration, 154; education, 88; social communication, 51; law, 85; psychology, 65; economics, 64; public accounting, 96; systems engineering, 110; electronics engineering, 62; and industrial engineering, 68. For technical degrees, the numbers of HEIs are as follows: agronomy, 18; advertising, 17; design, 32; administration, 112; foreign trade, 20; accounting, 41; systems, 91; electronics, 42; mechanics, 31; and industrial, 19.

Colombia we obtained the average return to each degree–institution from individual-level earnings data, in Chile we used data from the mifuturo.cl web portal, which reports average ranges of earnings for each degree–institution at an interval of 100,000 Chilean pesos. Thus, by construction, the dispersion in the return is reduced. Moreover, the number of HEIs per degree with which we calculated this dispersion is much higher in Colombia than in Chile.²⁰ In Chile, nonetheless, there is significant within-degree dispersion, as is the case of the technical degree in systems that can yield returns between -43 and 60 percent, depending on the institution.

Figure 8. Net Returns to the Most Popular Degrees in Chile: Averages and Dispersion²¹



Source: Authors' preparation based on data from the Chilean Ministry of Education.

²⁰ The reason is that there are fewer HEIs in Chile than in Colombia, which has a larger population. In addition, as mentioned above, not all HEIs in Chile report their data to the mifuturo.cl database, while the Colombian data includes the entire universe of HEIs. Finally, in the Colombian databases, names of degrees are more aggregated than in Chile.

²¹ Net returns are calculated assuming a 6 percent discount rate and the 75th percentile as counterfactual reference income. The numbers of HEIs used to calculate averages and dispersions of technical degrees are as follows: business administration and associated management, 15; computer technician, 9; construction and civil works, 7; food and cooking, 5; social work, 5; legal technician, 10; assistant preschool teacher, 6; general accounting, 5; and clinical laboratory technician, 5. For universities, the numbers of HEIs are as follows: primary education teacher, 26; physical education teacher, 14; social work, 24; psychology, 29; business administration and associated management degrees, 9; nursing, 20; computer engineering, 25; management and economics, 33; law, 21; and civil industrial engineering, 25.

4.2 The "Value" of the Tuition Fee

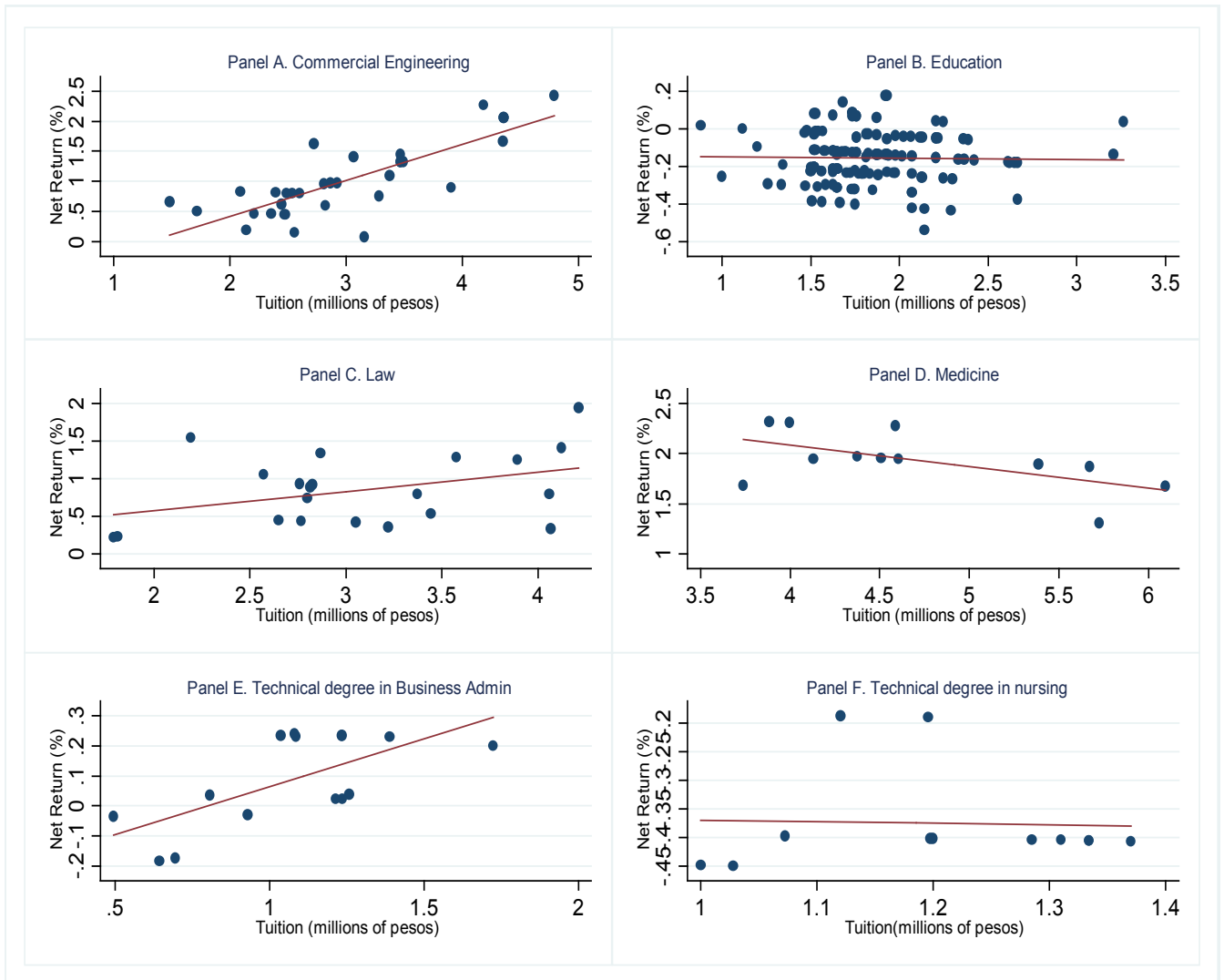
Given the large dispersion in the returns of each education program, it is important to analyze what kind of information prospective students can use to assess the relative profitability of each alternative. A natural candidate is the cost of the tuition fee, which, in theory, should reflect the return to investing in each program. The evidence for Chile, however, suggests that HEIs that charge a higher tuition are not necessarily the most profitable. Figure 9 uses scatterplots to show the association between the tuition and return for six highly demanded programs. According to these results, students enrolled in education, medicine, or technical nursing programs will pay higher tuition fees in the institutions that have lower profitability.²²

Tuition fees are not always positively correlated with the rate of return. A simple econometric result can hint at why this may be the case. When looking at the determinants of the tuition, the variables associated with the HEIs are more important than those associated with the degree.²³ In other words, tuition variation across universities is larger than across degrees. This could be reflecting a pricing system in which, when deciding the tuition fee, HEIs not only consider aspects associated with cost, profitability, and demand for each particular degree, but also implement a cross subsidy scheme which flattens the tuition within the institution: for some degrees, the tuition is set below cost and in others, above. The University of the Andes in Colombia, for example, charges the same tuition fee for almost all of its degrees, in spite of the significant cross-degree variation across in cost and demand. Hence, instead of signaling the rate of return to each degree, tuitions could merely reflect the value the market gives to each HEI.

²² This exercise, for now, cannot be replicated for Colombia because the information on tuition fees is aggregated by type of degree and institution. These are reported in Table A3 in the Appendix.

²³ HEI has more explanatory power to explain the variance in the tuition than the degree. In a regression in which the dependent variable is the tuition, t dummies that identify the degree have less explanatory power (R2 adjusted = 61 percent) than dummies that identify the institution (R2 adjusted = 69 percent).

Figure 9. Association Between Tuition Fees and Net Returns

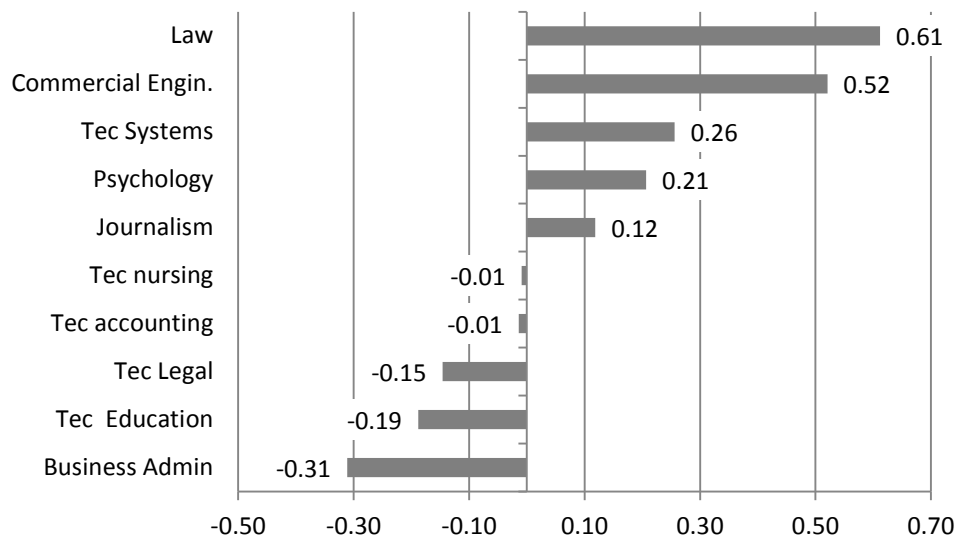


Source: Authors' preparation based on data from the Chilean Ministry of Education.

4.4 The "Value" of Accreditation

Likewise, institutional accreditation does not seem to give a clear signal of the net return to higher education degrees. Figures 10 and 11 illustrate this point for Chile and Colombia, respectively. We constructed these figures with data of highly demanded degrees offered by a large number of HEIs with and without accreditation ($n \geq 5$ in each category of HEI).²⁴ For each of these degrees, we compared the average net return obtained by graduates in accredited HEIs with that obtained in non-accredited HEIs. The bars show the difference between these net returns and take a positive value if the students who attend accredited HEIs have higher returns. For example, Figure 10 shows that in Chile, graduates with journalism degrees in accredited HEIs have a net return that is 12 percentage points higher than graduates with the same degree from non-accredited HEIs. In contrast, for students who follow a technical degree in business administration, it is more profitable to attend an HEI without accreditation, since the net return in accredited HEIs is, on average, 31 percentage points lower.

Figure 10. Net Return to Accredited versus Non-Accredited HEIs in Chile

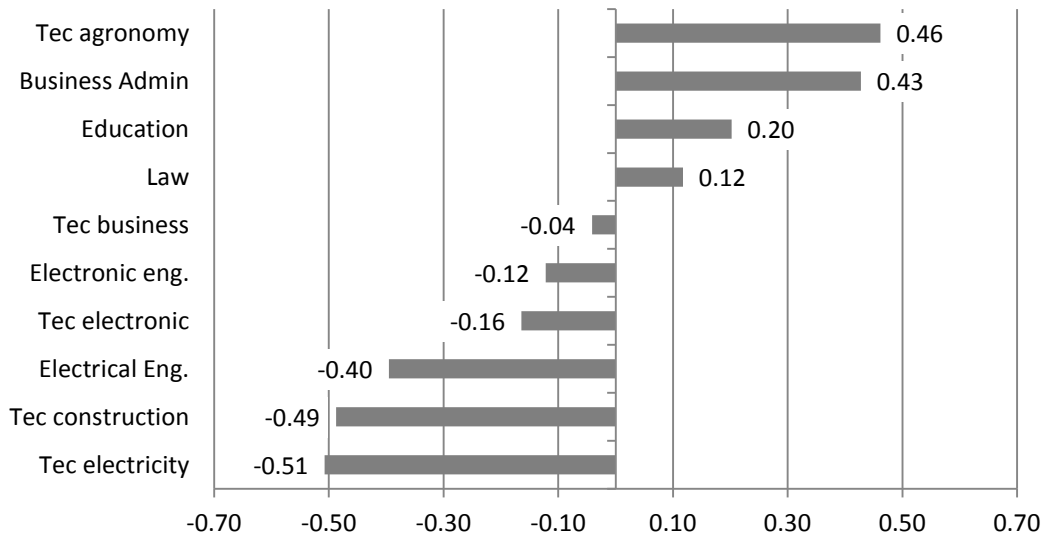


Source: Authors' preparation based on data from the Chilean Ministry of Education.

²⁴ Information on institutional accreditation in Colombia is obtained from the report published by the SNIES on its website. Accreditation data are updated through January 2014. In the case of Chile, the information on institutional accreditation can be found on the mifuturo.cl web portal, and is also updated through 2014.

In Colombia, some highly demanded degrees also have a lower relative rate of return in accredited HEIs (see Figure 11). In university degrees (e.g., electrical engineering) and in technical degrees (e.g., construction), students attending non-accredited HEIs obtain higher average returns.

Figure 11. Net Return to Accredited versus Non-Accredited HEIs in Colombia



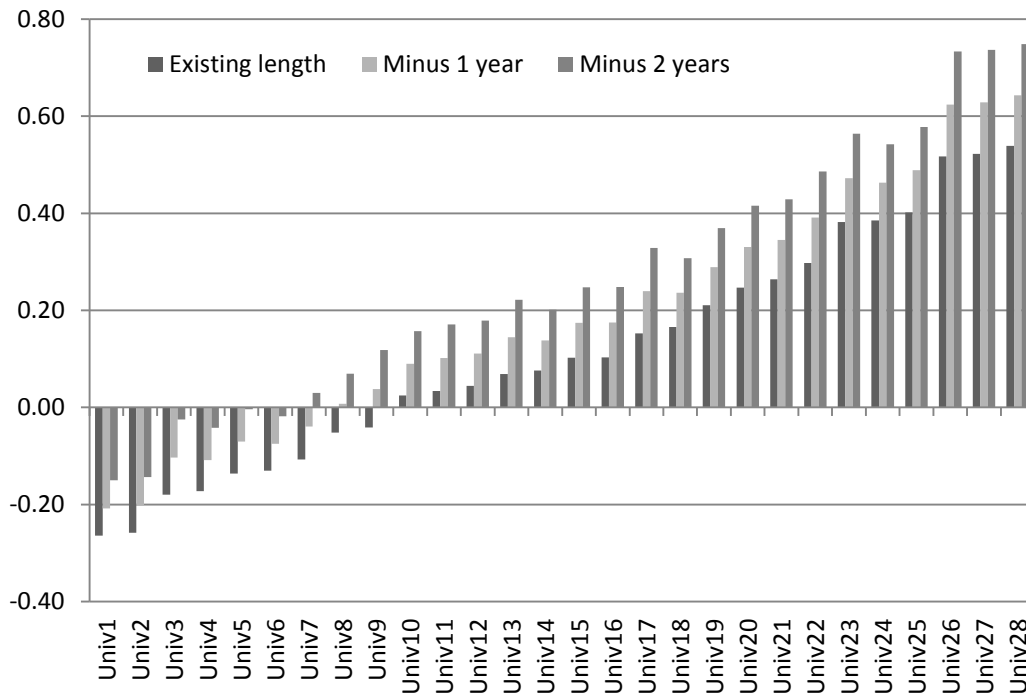
Source: Authors' preparation based on data from the Colombian Ministry of Education.

4.5 Career Duration

Finally, we examine how our estimates of the net returns to tertiary education will be affected under alternative scenarios of career duration. Recently, policymakers in Chile have discussed the implications of shortening the length of tertiary education programs in an attempt to curb the costs and dropout rates. This has given rise to debates regarding the effects on quality and efficiency (Pey, Duran, and Jorquera, 2012). We contribute to this discussion by simulating the net returns to different journalism programs in Chile, under alternative duration scenarios. The bars in Figure 12 show the net returns of a journalism degree in each of 28 universities, with the existing length and with a reduction in the duration of the program of one or two years. Clearly,

the shortening the program leads to increased profitability. In a few cases, this may even imply a shift from negative to positive returns.

Figure 12. Net Returns of the Journalism Degree in Chile: Alternative Durations



Source: Authors' preparation based on data from the Chilean Ministry of Education.

4.6 Sensitivity Analysis and a Word of Caution

Given that our goal is to replicate the economic analysis that the public might make based on the information accessible in web portals, we face some methodological limitations. Since we do not explicitly model the schooling decision, the observed variation in the rates of return may not only be reflecting dispersion in the quality and relevance of the degrees, but also dispersion in the skills of the students entering the system.²⁵ Moreover, some of our results are sensitive to the

²⁵ As part of our research agenda, we plan to exploit the administrative databases of the standardized tests for secondary and tertiary education in Colombia (SABER PRO and SABER 11). This will allow us to estimate the

parameters we use in the estimation, such as the reference income used to construct the counterfactual and the discount rates. Table A2 in the Appendix herein presents summary statistics of the returns using alternative parameters. We interpret estimates of the returns using the 50th percentile as a counterfactual as an upper bound.

Our estimates also hinge upon the estimated parameters of the Mincer equations used to extrapolate income trajectories throughout the working lifecycle (equation 1 above). A steeper [flatter] earnings age profile for post-secondary graduates will clearly increase [decrease] our estimates of the profitability of each degree. Given that the web portals that we use as our data source only report the income data for a given year, we need to extrapolate the earnings throughout the lifecycle using a stable and arguable imprecise parameter derived from household surveys. To account for this, we undertake a sensibility analysis in which we experiment with different values of the returns to age for higher education graduates, using estimated returns for individuals with secondary education as a baseline.²⁶ Intuitively, this exercise aims at answering the following question: how much higher should the returns to age be for higher education graduates vis-à-vis secondary graduates so that, in our calculations, all the careers in Chile and Colombia are profitable? The results of this exercise show that, in Colombia, the returns to age of individuals with a post-secondary degree should be 5 times as high as those of individuals with only high school education. In the case of Chile, they should be twice as large.²⁷ Thus, particularly in the case of Colombia, we were only able to derive positive returns for all degrees in the higher education system in a scenario of rather steep earnings profiles.

Despite the caveats to our methodology, interesting conclusions emerge that can contribute to the discussion on the quality and the relevance of higher education in Chile, Colombia and the rest of the region. These are discussed in the next and final section.

returns to education in a more robust way, using a structural model in which the career decision is based on unobservable characteristics.

²⁶ We derive different values of the derivative of earnings with respect to age; $\partial y / \partial \text{age} = \beta_1 + \beta_2 \text{age}$, using the values of our counterfactual (i.e., high school graduates in the 75th percentile) as a benchmark.

²⁷ See Table A4 in the Appendix for the complete set of results of the simulation.

5. Conclusions

This study uses the information published by the Ministry of Education in both Chile and Colombia to estimate the economic returns to higher education, disaggregated by degree and institution. We replicate the economic exercise that households may carry out, with the information available, when making the decision to invest in higher education and choosing a specific degree and institution. Our results suggest that investing in higher education is not always profitable. Some degrees yield quite high rates of return, as is the case in the fields of law in Colombia and risk prevention in Chile. There is, however, a significant variation in the net returns across degrees and across institutions for a given degree. For example, a university career in design in Chile and a technical degree in systems in Colombia can yield positive or negative returns depending on the HEI, and these returns will have an enormous dispersion. As a result, a significant number of graduates from the higher education system run the risk of obtaining negative net economic returns. The problem is more severe in the case of technical degrees: in Chile, 51 percent of the students in technical programs would have been better off financially without higher education, while in Colombia this share increases to 59 percent. Since technical programs tend to attract low-income students, this result is particularly worrisome; the system could be failing precisely those students for whom making a mistake is more costly.

In spite of the existence of major institutional differences, higher education systems in Chile and Colombia share some fundamental flaws. Public financing systems do not create incentives for quality; on the other contrary, instruments such as SGL in Chile may have caused HEIs to lower their academic standards. With respect to quality assurance, the minimum requirements for operation of an HEI are lax, and the labor market performance of graduates is not a core input in the accreditation process. Mechanisms that guarantee the relevance of the labor market degrees are nonexistent, even in the case of technical education, whose main objective is to train students for work. In fact, in both countries the absence of mechanisms to assure relevance extends beyond the higher education system, and is a deficiency of the training and educational system as a whole. Moreover, debates regarding crucial policies such as a reduction in program duration, are often taken without assessing the evidence on key aspects, such as their economic effects.

The results presented in this document highlight the urgent need to build and disseminate information on labor market outcomes so that prospective students and policymakers can make informed decisions. This is an essential requirement in higher education systems that guarantee economic benefits and social mobility.

References

- Aedo, C. and I. Walker. 2012. *Skills for the 21st Century in Latin America and the Caribbean*. Directions in Development. Washington, DC: World Bank.
- Bassi, M. and S. Urzúa. 2010. “Educación en Chile: el desafío está en la calidad.” Nota Técnica No. IDB-TN-271. Washington, DC: Inter-American Development Bank.
- Espinosa, R., M. Sarzosa. and S. Urzúa.. Forthcoming. “Latent Skills and College Attendance.” College Park, MD: University of Maryland.
- Heckman, J., J. Stixrud, and S. Urzúa. 2006. “The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior.” *Journal of Labor Economics* 24(3): 411–82.
- Hernández, G. 2010. “¿Cuán rentable es la educación superior en Colombia?” *Lecturas de Economía* 73: 181–214.
- Lustig, N., L. F. López-Calva, and E. Ortiz-Juarez. 2013. “Deconstructing the Decline in Inequality in Latin America.” Policy Research Working Paper 6552. Washington, DC: World Bank.
- Ministry of Education, Chile. Undated. <http://www.mifuturo.cl/>.
- . 2011. “Educación técnica profesional en Chile: antecedentes y claves de diagnóstico.” Santiago, Chile: Centro de Estudios de Ministerio de Educación.
- OECD (Organisation for Economic Co-operation and Development). 2013a. *El aseguramiento de la calidad en la educación superior en Chile en el 2013*. Paris, France: OECD Publishing.
- . 2013. *Economic Survey: Colombia 2013b: Economic Assessment*. Paris, France: OECD Publishing.
- OECD (Organisation for Economic Co-operation and Development), IBRD (International Bank for Reconstruction and Development), and World Bank. 2012. *Reviews of National Policies for Education: Tertiary Education in Colombia 2012*. Paris, France: OECD Publishing.
- Prada, M. F. and S. Urzúa. 2013. “One Size Does Not Fit All: The Role of Vocational Ability on College Attendance and Labor Market Outcomes.” College Park, MD: University of Maryland.

Pey, R, F. Durán y P. Jorquera. 2012. Informe para la toma de decisiones sobre duración de las carreras de pregrado en el CRUCh. Consejo de Rectores de Universidades Chilenas.

Rau, T. E. Rojas, and S. Urzúa. 2013 “Loans for Higher Education: Does the Dream Come True?” *NBER Working Paper No. 19138*.

Reyes, L., J. Rodríguez, and S. Urzúa. 2013. “Heterogeneous Economic Returns to Postsecondary Degrees: Evidence from Chile.” *NBER Working Paper No. 18817*.

Urzúa, S. 2012. “La rentabilidad de la educación superior en Chile: revisión de la base de 30 años de políticas públicas.” *Estudios Públicos* 125.

Appendix

Table A1. Parameters and Information Sources

Parameters/Value	Justification/Source
Discount rate: 6%	For CAE, the interest rate is 6 percent and for Credit Access CPI plus 6 percent or CPI plus 9 percent, according to the applicant's socioeconomic level.
Earnings for high school graduates with no higher education (75th percentile). Chile: 412,529 (27 years old). Colombia: 840,000 (23 years)	CASEN 2011 in Chile and GEIH 2013 in Colombia.
Mincer model parameters in Chile. Secondary: 0.05664 and -0.0005, Technical: 0.040701 and -0.0004, Higher: 0.0981 and -0.001. In Colombia: Secondary: 0.082224 and -0.0001, Technical: 0.06461 and -0.00067, Higher: 0.082967 and -0.00083	CASEN 2011 in Chile and GEIH -3Q in Colombia. Individuals who are studying are excluded.
Tuition fees, enrollment, and length of degree for each degree and institution	Chile: Data provided by the Ministry of Education and reported in the mifuturo.cl website. Colombia: Data provided by the OMEL and reported in the graduadoscolombia.edu.co website

Table A2. Net Return Estimates Using Alternative Parameters

	Discount rate	Percentile of earnings distribution used to build counterfactual	Mean	Median	p10	p90	Standard deviation
Panel A: CHILE							
University	6	50	1.73	1.54	0.44	3.51	1.12
	6	75	0.62	0.52	-0.15	1.67	0.66
	9	50	1.15	1.04	0.09	2.51	0.92
	9	75	0.27	0.21	-0.35	1.08	0.54
Technical	6	50	0.70	0.64	0.00	1.59	0.66
	6	75	0.00	-0.05	-0.41	0.52	0.38
	9	50	0.51	0.44	-0.11	1.31	0.58
	9	75	-0.10	-0.15	-0.47	0.37	0.34
Panel B: Colombia							
University	6	50	0.82	0.76	0.11	1.56	0.65
	6	75	0.26	0.22	-0.23	0.78	0.45
	9	50	0.51	0.46	-0.09	1.14	0.55
	9	75	0.05	0.01	-0.37	0.48	0.39
Technical	6	50	0.41	0.37	-0.04	0.80	0.92
	6	75	-0.02	-0.05	-0.33	0.25	0.64
	9	50	0.28	0.24	-0.14	0.64	0.86
	9	75	-0.11	-0.14	-0.40	0.14	0.60

Table A3. Average Tuition for First Year Students (in Colombian pesos)

Type of HEI	Type of degree	Public HEIs	Private HEIs
Technical Professional Institute	Technical	\$588,558	\$1,181,804
	Technological	\$562,400	\$1,205,515
	University	\$747,270	\$1,775,668
Technological Institute	Technological	\$593,396	\$1,349,642
	University	\$1,212,740	\$1,378,011
University Institute	Technical	\$588,067	\$1,552,174
	Technological	\$480,905	\$1,782,484
	University	\$1,058,524	\$1,862,291
	Specialization	\$2,525,854	\$5,168,992
	Master		\$5,641,489
University	Technical	\$576,970	\$1,184,887
	Technological	\$465,742	\$1,455,597
	University	\$657,518	\$4,231,949
	Specialization	\$2,886,220	\$6,415,376
	Master	\$3,616,651	\$8,106,900
	Doctorate	\$4,271,840	\$9,767,694

Source: Authors' preparation based on data from the Colombian Ministry of Education.

Table A4. Sensitivity Analysis: Earnings Age Profiles

Multiples of returns to schooling of high school graduates	B_1	B_2	Percentage of graduates facing negative returns	
			Technical degrees	University degrees
Colombia				
1	0.082224	-0.001	48%	68%
2	0.164448	-0.00201	28%	30%
3	0.246672	-0.00301	8%	12%
4	0.328896	-0.00401	3%	3%
5	0.41112	-0.00502	1%	2%
Chile				
1	0.05664	-0.005	25%	45%
2	0.113286	-0.00006	0%	1%

Note: This table shows the share of graduates facing negative returns assuming different Mincerian parameters that describe the earnings profile.