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Article

The Expansion of Higher Education in Colombia: Bad Students or Bad Programs?

Adriana Camacho, Julián Messina, and Juan Pablo Uribe

Abstract

A rapid expansion in demand for post-secondary education triggered an unprecedented boom of higher education programs in Colombia, raising concerns about their pertinence and quality. This paper shows that the penalty on student learning and labor market outcomes of attending a recently created program is large but, to a large extent, driven by student and program selection. Using rich administrative data that matches higher education school admission information, socioeconomic characteristics of the young graduates, standardized test scores pre- and post-higher education, and formal labor market outcomes, we characterize this selection process disentangling the relative roles of demand and supply forces. The main factor behind the learning penalty is student selection in baseline ability. In the case of labor market outcomes, the penalty is due to a combination of student and program characteristics.

JEL classification: I23, I24, I26

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1. Introduction

Over the past two decades, Latin America experienced a rapid surge in post-secondary readiness. High school graduation increased by 45 percent, from 31 percent in the early 1990s to 45 percent in the late 2000s (Bassi et al. 2015). The Higher Education (HE) system responded rapidly to the demand surge. New HE institutions and programs flourished across the region (Ferreyra et al. 2017). Higher education enrollment increased dramatically. Between 2004 and 2014, the gross enrollment rate in HE almost doubled in Brazil, and it increased by more than 10 percentage points in Costa Rica, Colombia, and Chile (Busso et al. 2017). The soar of gross enrollment rates in tertiary education constitutes a global trend (UNESCO 2020), affecting all regions in the developing world, including Sub-Saharian Africa (Darvas and Bawany 2017).

Increasing demand is stressing HE systems. This rapid and often disorderly expansion in HE supply has raised concerns about the quality of recently created programs and institutions (Ferreyra et al. 2017; UNESCO 2020).

Adriana Camacho is a senior executive at CAF-Development Bank of Latin America and the Caribbean; her email address is acamacho@caf.com. XXXXJulián Messina is Principal Economist at the Inter-American Development Bank and IZA; his email address is: julianm@IADB.ORG. Juan Pablo Uribe an economic consultant at Cornerstone Research; his email address is jp.uribe@cornerstone.com. We would like to thank the Colombian Ministry of Education and *ICFES* for providing the data used in this paper. We are also thankful to Javier Botero, Matías Busso, John Friedman, Luis Carlos Ricaurte, Emily Oster, Miguel Urquiola, Sergio Urzua, and seminar participants at Fedesarrollo, International Seminar for quality of Education ICFES-2017, LACEA Conference 2017, RIDGE education network, and the Universities of ORT-Uruguay, Padova, and Milano for their comments. Uribe coauthored this paper before joining Cornerstone Research. The views expressed herein are solely those of the author, who is responsible for the content, and do not necessarily represent the views of Cornerstone Research. Messina acknowledges financial support from Project PID2021-124237NB-I00 (financed by MCIN/ AEI /10.13039/501100011033/ and by FEDER Una manera de hacer Europa) and from Generalitat Valenciana, Consellería de Innovación, Universidades, Ciencia y Sociedad Digital through project Prometeo CIPROM/2021/068. A supplementary online appendix is available with this article at The World Bank Economic Review website.

However, poor test scores or labor market outcomes of new program graduates compared to existing program graduates do not necessarily imply poor quality of the former. Increasing HE enrollment may have resulted in a lower average quality of the marginal student accessing tertiary education. Alternatively, new institutions and programs may have expanded in areas where labor market premiums were lower. This may be the case if areas where returns are high require large investments to introduce new programs (e.g., engineering and medicine), or if the expansion to lower-ability students forces HE institutions to provide new programs that are academically less demanding. A careful examination of the relative returns of new versus existing programs and institutions needs to consider both student and program characteristics.

This paper evaluates the relative performance of new versus existing programs during a rapid period of expansion of the higher education sector in Colombia. Colombia constitutes an excellent case study for assessing changes in the returns of HE programs in the rapidly expanding systems of middle-income countries. The country experienced the highest increase in the High School (HS) graduation rate in Latin America. The graduation rate increased from 20 percent in the early 1990s to 47 percent in the late 2000s (Bassi et al. 2015). The rise in the number of post-secondary HE programs during the same period was unprecedented — it almost doubled, from 2,609 in 1999 to 5,101 programs in 2011 (see Figure 1). Moreover, Colombia has particularly rich administrative data that can be used to assess the heterogeneity in learning and wages across HE programs.

To undertake this study, we use three sources of administrative data that were matched by the Ministry of Education and provide detailed information on (i) student background before accessing HE, including socioeconomic status, the HS attended, and standardized test scores at HS exit; (ii) various characteristics of the HE programs and institutions from which the students graduated; and (iii) labor market outcomes. We identify the effects of graduating from a new HE program on HE standardized test scores at graduation, the probability of holding a formal job after graduation, entry-level wages, and wage growth. The estimates are purged from baseline student readiness, which we show accounts for major selection issues. Although we only observe labor market outcomes during the first few years after graduation, these are crucial determinants of long-term labor market outcomes (Oyer 2006).

We find that graduating from a new program, defined as a program whose first graduate completed HE in 2002 or after, is associated with a large learning penalty compared with graduates from an existing program. The penalty ranges from –0.2 points of a standard deviation in a written communication test to –0.3 points in a quantitative reasoning test. After controlling for a rich set of student and program characteristics, the learning penalty for graduates from new programs declines dramatically, ranging from –0.02 to –0.04 of a standard deviation. Following Oster (2019), we show that once we include these observable characteristics of students and HE institutions and programs, selection based on unobservables remains fairly limited, suggesting that the estimates are close to the population parameters. Hence, new programs present a small penalty in terms of learning, measured by the standardized test scores after HE graduation, compared to existing programs.

To assess the relative roles of student, program, and HE institutional characteristics in the observed unconditional test score gaps, we perform a decomposition following Gelbach (2016) that isolates the independent contribution of each covariate. We find that 60 percent of the new programs' unconditional test score penalties can be attributed to baseline student characteristics, among which the HS exit test scores stand out. Hence, a fundamental driver of the learning gap between graduates of new and existing programs can be attributed to student readiness. Students in the upper tail of the HS exit test score distribution are more likely to enroll in existing programs.

In terms of wages, the "naive" unconditional entry wage gap between graduates of new and existing programs in their first jobs is substantial, at 15 percent. However, once student and program characteristics have been accounted for, this wage differential narrows to 3 percent. About 3.7 percentage points of the unconditional wage gap can be attributed to new programs being shorter (one to three years of study). Three additional aspects close the wedge between the unconditional and conditional wage gap: (i) new HE programs are created in areas of study with low labor market returns; (ii) new HE programs attract students of lower baseline quality (measured by the HS exit standardized test scores); and (iii) new and existing programs attract students from different high schools, which, once student baseline test scores have been controlled for, suggests a role for network effects.

The results for wage growth and the formal sector attachment of the graduates broadly resemble the patterns described for entry wages.

This study contributes to a fast-growing body of literature that highlights the heterogeneity in HE returns. In developed countries, Bleemer (2021) found that students enrolled in non-selective universities in California have an average annual salary that is 5 percent lower than those studying in selective universities. In two meta-analyses mostly based on US studies, Lovenheim and Smith (2023) and Altonji et al. (2012) showed that college quality positively impacts earnings. However, Cunha and Miller (2014) and Mountjoy and Hickman (2021) found that the large differences in the returns across colleges almost disappear after accounting for student self-selection in Texas. In Latin America, Rodríguez et al. (2016), González-Velosa et al. (2015) and Melguizo and Wainer (2016) show that there is significant heterogeneity in the returns to post-secondary education programs in Brazil, Chile and Colombia. Hastings et al. (2013) and Saavedra (2009) use regression discontinuity approaches based on a standardized college entry test to identify the causal effect of attending a type of degree program in Chile and a better quality school in Colombia on a set of outcomes, including wages. Our paper complements these studies by focusing on the relative performance of young graduates of new and existing programs in a period of the region's rapid expansion of the HE system. Using a rich set of baseline student and program characteristics, we investigate the heterogeneity in the value added resulting from a relative comparison of new versus existing programs that may reflect marginal differences in learning and labor market outcomes across programs.

Related literature highlights the importance of an institution's (or program's) reputation in student selection and outcomes. For the United States, Webber (2014) found heterogeneity in the returns to various majors after accounting for cognitive and non-cognitive abilities. In line with these findings,Kirkeboen et al. (2016) show that in Norway similar heterogeneity persists after accounting for institution quality and student self-selection. MacLeod et al. (2017) also examine the case of Colombia to test how school reputation, measured by the average HS admission test score of its graduates, is correlated with students' wages. One advantage of our approach is that we examine HE graduation test scores and initial wages in the formal labor market. Possible reputation effects would be reflected in wages, but they will not affect HE graduation exams. Hence, by comparing the impact of new programs versus existing ones on these two outcomes, we can assess whether the lower wages obtained by graduates of new HE programs are explained by differences in baseline readiness, learning during HE, or an additional potential reputation penalty.

This paper also contributes to the literature that studies the determinants of the decline in wage inequality in Latin America.[1] Encouraged by policies that provide incentives for HS attendance and completion, Latin America witnessed a rapid increase in demand for tertiary education during the 2000s.[2] At the same time, the higher education premium fell, motivating studies exploring the relative roles of demand and supply forces (Acosta et al. 2019; Fernandez and Messina 2018; Messina and Silva 2021). Changes in the quality of recent HE graduates have not been central to the discussion.[3] This contrasts with studies of developed countries that establish that a rapid expansion in the demand for HE may result in lower quality of the marginal graduate, and hence, lower returns to schooling (Carneiro et al. 2011; Carneiro and Lee 2011; Juhn et al. 2005; Moffitt 2008; Walker and Zhu 2008). This paper contributes to this debate by disentangling the roles of student and program characteristics in determining the heterogeneity of learning and labor market outcomes across different HE programs during this period.

The rest of the paper is organized as follows. Section 2. introduces the institutional background of the HE system in Colombia and provides key stylized facts. Section 3. describes the administrative data sets used in this study. Section 4. discusses the empirical strategy. Section 5. presents the results. Section 6. concludes.

1 See Messina and Silva (2018) and the references therein.

2 Fiszbein et al. (2009) and Busso et al. (2017) document how conditional cash transfer (CCT) programs have increased HS attendance and completion in Latin America. For the specific case of *Familias en Acción*, the Colombian CCT program, see Baez and Camacho (2011).

3 Castro and Yamada (2013) show that the returns to education flattened in Peru during the 2000s, and discuss the declining quality of HE as a potential culprit. Messina and Silva (2018) show descriptive evidence in Argentina, Brazil, and Mexico suggesting degraded quality among recent HE cohorts.

2. Background: The Evolution of HE in Colombia

This section provides an overview of the regulations and distinctive features of Colombia's HE system, along with a summary of key trends that highlight the system's expansion during the 2000s.

Description of the Higher Education System

The HE system in Colombia is regulated by *Ley 30* of 1992. In the 2000s, the Ministry of Education introduced additional regulations on quality standards for HE programs. Specifically, HE institutions had to undergo a certification process to operate and start a new program.[4] Once a program is certified, it appears in the National System of Higher Education Institutions (*SNIES*), a national information system for HE institutions and programs. In addition to the required certification for each program, HE institutions may apply for a non-mandatory accreditation of excellence. The accreditation of excellence process is fairly involved, requiring elements of self-evaluation and an evaluation by peers. HE institutions with an accreditation of excellence do not need to undergo the traditional certification process to register a new HE program. Less than 10 percent of the HE institutions hold an excellence accreditation during our period of study.

The HE system in Colombia includes four types of institutions that differ by the length and nature of the programs they offer. Professional and technological institutions offer short-term (one, two, or three years) technical education. Colleges and universities also offer short-term technical education but are the sole institutions that may offer bachelor's degrees (four or five years). All institutions may offer one-year graduate specializations, but only universities can offer master's degrees (two-year graduate degrees) and PhDs.[5]

Two standardized tests, collected by the Institute for the Assessment of Education (*ICFES*), are relevant to the HE system in Colombia: a HS graduation standardized test (*Saber 11*) and a HE graduation standardized test *(Saber Pro)*. The former test has been mandatory for HS graduation and to enroll in HE institutions since 1980. We refer to (*Saber 11*) as the HS exit exam.[6] *Saber Pro* was first administered in 2003 for some programs; however, before 2009, there was ambiguity on who was supposed to take the exam and not all the areas of study had an exam. As a result, the overall uptake was low among HE graduates. In 2009, the government signed a new law that made the test mandatory for all HE graduates. The new law provided two years to adjust to the new system, and by the end of 2011, the *Saber Pro* started testing all graduating students on three common core components — written communication, critical reading, and quantitative reasoning skills.[7] We refer to *Saber Pro* as the HE graduation exam.

Expansion in the 2000s

Colombia witnessed a large and rapid expansion of secondary education coverage during the 1990s and 2000s, a feature shared with many Latin American countries.[8] Figure 2 shows the number of HS graduates and students

[4] Articles 58 to 60 of Law 30 of 1992 regulate the creation of public institutions, and Act 1478 of 1994 governs the creation of private institutions. Act 2566 of 2003 and Law 1188 of 2008 delineated parameters related to the minimum quality required by a HE institution to offer a new program.

[5] The National Training Service (*SENA*), which was established in 1957 to provide training to the labor force, also provides training for adults and HS graduates. *SENA* depends on the Ministry of Labor and is funded by a direct levy on payroll taxes. Because it does not belong to the HE system, *SNIES* does not have information on the programs offered by *SENA*. Hence, the analysis does not include graduates from *SENA*. In 2010, 17 percent of the enrollees in post-secondary education were enrolled in *SENA*.

[6] Over 90 percent of the students who take the *ICFES-Saber 11* test graduate from HS Angrist et al. (2006)

[7] In 2009, the government implemented Law 1324 and Decree 3963 to clarify the ambiguities generated by the previous laws. This law triggered substantial changes in the exam. Between 2009 and 2011, the ICFES introduced adjustments to the system, and only by the second semester of 2011 the exam had a common component that all graduates had to take. For a more detailed description of the regulatory framework of *Saber Pro* see Busso et al. (2023).

[8] The net enrollment rate in Latin America grew from 58 percent in 2004 to 74 percent in 2012 (OECD/CAF/ECLAC 2015).

enrolled in college between 2001 and 2011.[9] HS graduation increased by a staggering 30 percent.[10] Similarly, college enrollment shows a massive increase of 48 percent in just one decade.

Over the same period, there was a significant increase in the number of HE programs offered. Figure 1 shows that the rapid expansion of HE programs in Colombia started in 1999. After five years of relative stability, 904 new programs were introduced between 1999 and 2000, representing a growth rate of 35 percent. Between 1999 and 2011, HE programs almost doubled, from 2,609 to 5,101. We use data from the National System of Higher Education Institutions, *Sistema Nacional de Instituciones de Educación Superior, (SNIES)*, which tracks all HE programs and their graduates since 2001, to distinguish new from existing programs. In our baseline definition, programs from which at least one student graduated in 2001 are considered existing, while new programs are those whose first graduates finished school in 2002 or later. This captures the vast majority of new programs created in 1999 and after. Robustness checks using alternative definitions of the new program are provided in Section 5..

Figure 3 shows the evolution in the number of graduates by type of program. We divide the programs into three groups: new programs opened in existing HE institutions, new programs opened in new HE institutions, and existing programs in existing HE institutions. Existing programs did not grow in the number of graduates. Most of the new demand for post-secondary education was met by creating new programs in existing HE institutions. In 2011, around 220,000 students graduated from HE, among which 8 percent attended a new program offered by a new HE institution, and 52 percent attended a new program offered by an existing HE institution. The rapid growth in HE supply was a crucial factor in the expansion of HE enrollment (Carranza and Ferreyra 2019).

Students enrolling in new HE programs consistently exhibit lower HS test scores throughout the sample period compared to those entering established programs. The average percentile entry score on the HS exit exam among students of new HE programs is 5 percentage points lower than that of students enrolled in existing programs (Figure 4). Thus, a careful examination of the learning and labor market differences between graduates of new and existing programs needs to consider this negative selection, as we describe in detail in our empirical specification.

3. Data

This paper examines the differences in learning outcomes and labor market performance between graduates of new and existing programs. For the analysis, we created two separate datasets. The first data set tracks student learning outcomes, including students who graduated from high school between 2002 and 2011 and took the HE graduation exam between 2011 and 2013. The second data set tracks labor market outcomes, focusing on students who finalized HE between 2007 and 2011, for whom we observe labor market outcomes from 2008 to 2011. This section details the construction of each dataset and explains the various restrictions applied.

Learning outcomes–the HE exit graduation exam sample

Learning outcomes data are based on test scores at the end of HE. The Colombian Institute for the Assessment of Education, *Instituto Colombiano para la Evaluación de la Educación (ICFES)* is responsible for assessing the quality of education by performing standardized tests at different levels. Among these tests, *Saber Pro*, the HE exit exam, is a standardized test that evaluates students on general and specific competencies during the final year of their HE degree. It is administered and standardized every semester to have a mean of 10 and a standard deviation of 1. Starting in 2011, passing this test is a requirement for graduation from any HE program. The learning outcomes considered in this paper are the general competency tests—written communication, critical reading, and quantitative reasoning—administered in 2011–2013.

[9] HS graduates are defined as students taking the HS exit exam, excluding duplicates among students who take the exam multiple times, and exams that are suspected of fraud or left blank.

[10] Several factors likely contributed to the rapid expansion of secondary education coverage during this period. These include an increased education budget and the launch of *Familias en Acción*, the Colombian conditional cash transfer program, which mandates school enrollment as a condition for receiving benefits (Baez and Camacho 2011).

The *Saber Pro* dataset also includes a rich set of individual and program characteristics and can be matched with program information from *SNIES* to separate new from existing programs using unique program identifiers. Additional information includes the sociodemographic background of the students (family income and parental education), the semester in which they took the HE exit exam, the program attended, 55 indicators for the area of study of the program (e.g., economics, administration, civil engineering), the level of degree attained by the program (technical, technological, and bachelor's diplomas), the type of HE institution attended (technological institution, technical institution, college, or university), the geographic location of the HE institution, and an indicator of public/private ownership.

ICFES matched *Saber Pro* with a dataset containing standardized test scores from each student at the end of high school, *Saber 11*, the HS exit exam. The *Saber 11* dataset includes standardized tests on seven subjects: biology, math, philosophy, physics, chemistry, language, and social science, some family background characteristics, and unique identifiers of the high school attended by each student. The HS exit exam is a high-stakes exam. Most HE institutions condition their admission process on the HS exit exam, although admission rules vary across institutions.[11]

The resulting dataset from matching *Saber Pro*, *Saber 11*, and *SNIES* allows us to assess the learning gap between new and existing programs, controlling for baseline characteristics that are unavailable in most settings. We apply the following restrictions to the data: First, when individuals have more than one HE degree, we consider the highest level obtained or the most recently finished one. Second, we use the most recent test score if an individual takes more than one HS exit exam. Third, we restrict the sample to individuals who took the HS exit exam before turning 30. Fourth, we remove the military programs. After applying these restrictions, we have 374,718 individuals. We can match 70 percent of this sample to the Saber 11. Thus, our final sample includes 253,627 students who took the HS exit exam between 2002 and 2011 and the HE graduation exam between 2011 and 2013. [12] As demonstrated in Section 5., the differences in learning outcomes across graduates of new and existing programs are very similar in both the full graduation sample (including all 374,718 students) and the matched sample used for estimation (253,627 students).

The first three columns in Table 1 show descriptive statistics comparing new and existing HE program graduates in the learning sample. Between 2011 and 2013, 56 percent of the students graduated from a new HE program. Students who attended new programs are very similar in average age (23 years) and gender (42 percent males). But the similarities stop here. Students who attended new programs belong to families with lower socioeconomic status. In particular, the share of high-income students (whose families make five times the minimum wage or more) is 13 percent for students in new programs, compared with 22 percent for those who attended an existing program. Furthermore, only 28 percent of the parents of the students attending new programs have a college degree, compared with 39 percent of the students who attended existing programs. Among students who attended new programs, their baseline ability before attending HE, measured by the HS exit exam scores, is lower. Their average percentile in this math (language) exam is 54 (59), compared with 62 (67) for the students who attended an existing program. This gap is consistent with the gap we show in Figure 4 using data from the *Spadies*.[13]

New and existing programs differ significantly. New programs are less likely to be offered by universities and more likely to be offered by colleges and technical and professional institutes. About 35 percent of the students in new programs graduate from a public HE institution, compared to 44 percent of students graduating from existing programs. Across areas of study, economics, business administration, accounting, and education

[11] In Colombia, HE institutions have autonomy in setting their own admission rules. Many schools rely solely on the HS exit exams, others combine grades in the HS exit exam with interviews, and a few, such as the National University of Colombia—perhaps the most prestigious public institution—have their own entry exam and do not rely on the HS exit exam for admissions.

[12] Matching *Saber Pro* and *Saber 11* is not trivial because Colombian individual IDs change at age 18, while most students take the HS exit exam at age 17 or before. To improve the matching of individuals across different administrative records, *ICFES* employs a matching algorithm that utilizes individual identifiers, exact and phonetic variations of first and last names, date of birth, and sex in the two datasets.

[13] The *Spadies (Sistema de Prevención y Análisis de la Deserción en las Instituciones de Educación Superior)* is a different data set designed to analyze and prevent dropout rates in higher education institutions.

sciences have higher shares in new programs. In contrast, health sciences have a lower share in new programs.

Table 2 shows differences in learning outcomes between graduates from new and existing programs. Graduates from new programs have lower scores on the HE graduation exam than graduates from existing programs in the three general competency tests considered in the analysis. Differences in HE graduation scores range from 0.22 of a standard deviation (written communication test) to 0.33 of a standard deviation (quantitative reasoning).

Labor market outcomes sample

The main source of information in the labor market sample is administrative data from the Social Security System, the Integrated Contribution Liquidation Form, *Planilla Integrada de Liquidación de Aportes (PILA)*, collected by the Colombian Ministry of Health and Social Protection. The *PILA* collects information from all employees and self-employed workers who pay social security contributions. i.e., the formal sector. As a one-off effort to provide a better assessment of the functioning of the HE system, ICFES, the Ministry of Education, and the Ministry of Health and Social Protection matched and *Saber 11* with the *PILA* in 2012. [14] The resulting data includes all HE graduates between 2007 and 2011.

We calculate various labor outcomes for 2008–2011.[15] Since the *PILA* only includes formal workers while we observe all graduates from higher education, our first two indicators of labor market performance assess the probability of being a formal employee. The first indicator is the probability of ever being observed as a formal sector employee from 2008 to 2011. The second indicator measures the years working as a formal employee, constructed as the sum of years observed as a formal employee over the observation period divided by [2011-(year of graduation+1)]. The following two indicators of labor market performance permit the evaluation of wage gaps between graduates of new and existing programs. We define the entry wage as the first wage received after graduation. Additionally, we construct an indicator of wage growth for the subset of graduates observed in two consecutive years in the *PILA*.

We apply the same restrictions to the labor market data that we did to the learning data: we only consider the highest level obtained or the most recently completed degree if individuals have more than one HE degree, use their most recent test score if they took more than one HS exit exam, limit the sample to individuals who took the HS exit exam before turning 30, and remove military programs. After applying these restrictions, we had 387,741 HE graduates from 2007 to 2011 who were observed in the labor market from 2008 to 2011. Matching the *PILA* with *Saber 11* is more complex than the matching done for the learning sample, as students are farther apart in time and more likely to change their IDs. As a result of this matching, we retain 146,717 observations with complete information for all covariates. A limitation of the labor market sample is that *Saber 11* did not collect family background information between 2004 and 2007. Therefore, in the baseline sample, we focus on HE graduates from 2007 to 2011 who took the HS exit exam in 2002–2003. This further limits the sample to 75,314 individuals with full information. Restricting the sample to HS graduates from 2002–2003 excludes many HE graduates from short-term programs. To evaluate the impact of this restriction, we also examine an extended sample that includes all HE graduates for whom we can match their *Saber 11* test scores (146,717 observations), although in this case we cannot control for family characteristics. Importantly, the attrition rate is very similar for graduates of both new and existing programs across the different sub-samples. In the full sample (387,741 HE graduates), the share of graduates from new programs is 48.8 %, compared to 48.9 % in the extended sample (146,717 HE graduates) and 47,3 % in the baseline sample (75,314 HE graduates).

The second part of Table 1 shows descriptive statistics for the baseline sample used in the labor market analysis. Among the 75,314 graduates for whom we have full information, 52.7 percent graduated from an existing HE program and 47.3 from a new HE program. As expected, differences in observable characteristics between graduates of new and existing programs are very similar to those observed in the learning sample. Also in line with the HE graduation exam sample results, graduates from new programs have poorer labor market

[14] The methodological document that describes the matching of these datasets is called *Metodología del Cruce de Bases ICFES*, and was produced by the *Oficina Asesora - Gestión de Proyectos de Investigación*. The matching also includes *Saber PRO*, but the coverage of *Saber PRO* is incomplete for the period 2007–2011.

[15] We discard 2007 because the *PILA* was created in July 2007, and the coverage was incomplete during the first year of operation.

outcomes (Table 2). Among those employed in the formal sector, graduates from new programs earn about 15 percent less in their first job in the formal sector and exhibit lower wage growth. Their probability of ever being a wage employee during the first years after graduation is three percentage points lower (0.68 vs. 0.65). Moreover, graduates from new programs spend, on average, 44 percent of their labor market trajectories we observe in the formal sector, which is two percentage points lower than graduates from existing programs (46 percent).

4. Empirical Strategy

Consider the following reduced-form model:

$$Y_{ist} = \delta + \Omega NP_i + \alpha X_{it} + \beta Z_s + \varepsilon_{ist}, \quad (1)$$

where Y_{ist} represents the learning and labor market outcomes of interest for an individual i, who attended educational program s, at time t. Our variable of interest is denoted by NP_i, which is an indicator variable that equals 1 if individual i graduates from a new program and 0 otherwise.

The descriptive analysis of the previous section showed that student and program characteristics differ considerably across new and existing programs. Thus, education and labor market outcomes are potentially affected by fixed and time-varying individual and program characteristics, denoted by the vectors X_{it} and Z_s in equation (1), respectively. The issue of selection based on observable student and program characteristics is addressed using the extensive set of covariates detailed below.

Student readiness differs between attendees of new and existing programs. The regressions incorporate a flexible specification of HS exit exam scores across seven areas of study. Specifically, we include in the regression indicator variables for the decile score in each of the seven exams included in *Saber 11*. This flexible specification allows for potential nonlinear effects of the test scores on Y_{ist}.

Another factor influencing student selection could be the socioeconomic status of their families. This may impact higher education test scores and future labor market outcomes in ways not fully reflected by HS exit exam results, such as through credit constraints or family networks and connections. Even when students meet the qualifications for a HE institution or program, tuition fees at some private universities in Colombia remain high, while student loans and financial aid options are relatively limited. Given the significant variability in fees across different programs, a student's socioeconomic background is likely to influence their choice of institution, preventing the higher education system from functioning as a perfect sorting mechanism (MacLeod et al. 2017). To account for this fact, we include three sets of controls: (i) household income (divided into seven brackets), (ii) the highest level of education achieved by the parents, and (iii) the HS attended by the young graduates. Attending a private HS is a strong indicator of socioeconomic status in Colombia, given the significant variation in tuition fees charged (Angrist et al. 2006). Furthermore, attending an elite HS provides access to valuable networks, which can play a crucial role in shaping labor market outcomes later in life (Zimmerman 2019).

New programs are different from old programs. They differ in length, area of study, and HE institution, potentially hampering comparisons of student learning and labor market outcomes. For example, lower wages after graduation could reflect the concentration of new programs in fields or majors with low returns and not a penalty for attending a new program. Our regressions include 55 detailed indicators of the field or area of study (e.g., economics, administration, and civil engineering). Carranza and Ferreyra (2019) find that the expansion of existing bachelor's programs explains half of the enrollment expansion of the 2000s among high-ability students in Colombia. In contrast, new short-cycle programs explain 80 percent of the additional enrollment among low-ability students. This asymmetry in the type of students attending both types of programs could explain the new-program penalty. We include indicator variables for bachelor's degrees, which typically take four or five years to complete; technological degrees, which usually last three years; and technical/professional degrees, which are generally two-year programs. In addition, Carranza and Ferreyra (2019) show that public institutions were more likely to serve increasing student demand by expanding existing programs, at times in secondary locations in the process of decentralization. Meanwhile, private institutions were more likely to set up new programs. To capture these aspects, we include an indicator variable for public HE institutions, the type of HE institution attended (university, university institute, technology school, or technical/professional institution), and regional dummies (28) for the location of the HE institution the student attended.

The rich set of covariates included in the analysis should capture the main forces of student and program selection that may prevent $\hat{\Omega}$ from approximating the population parameter.[16] However, we acknowledge that there is still potential for selection based on unobservables. The robustness section discusses this possibility in detail (5.).

5. Results

We begin by presenting our findings on student learning, followed by an analysis of the effects of attending a new program on labor market outcomes.

New Programs and Student Learning

Table 3 shows the impact of attending a new program versus an existing program on the HE graduation test. The table includes three panels that consider the following subjects on the exam: (i) written communication, (ii) critical reading, and (iii) quantitative reasoning. Column 1 shows differences in means for all students with a valid HE graduation test, and Column 2 restricts the sample to those students for whom we have a full set of non-missing covariates. The magnitudes in the two columns are fairly similar. The "naive" learning penalty associated with new HE programs ranges from a –0.33 standard deviation in quantitative reasoning to –0.22 in written communication.

Column 3 of Table 3 presents the regressions of the fully controlled model. Controls include a full set of background student characteristics and key aspects of the HE programs. Among the latter, it is worth highlighting the level of degree attended, which differentiates between technical, technological, and bachelor's diplomas, and 55 areas of study dummies. This reduces the likelihood that new programs differ in the skill sets they provide compared to existing programs due to differences in focus. Essentially, we are comparing test scores among graduates with similar background characteristics who, for instance, earned a bachelor's degree in economics from either a new or an existing program. Differences between the fully controlled model and Column 2 are very stark. Compared to existing programs, the learning penalty associated with new programs is –0.02 standard deviations in the reading and written communication scores and –0.04 in quantitative reasoning. Thus, program and student characteristics explain about 90 percent of the apparent learning penalty that results from comparing unconditional differences in scores between graduates of the two types of degrees.

The sharp contrast between conditional and unconditional relative test scores reported in Table 3 shows the importance of student and program selection based on observable characteristics. It also increases interest in understanding the causes of such sharp differences. The policy implications underlying the learning penalties of new programs relative to existing programs differ radically if these penalties are related to family background, student readiness as measured by the high school exit exam, the area of the program, or the type of institution attended. However, attributing such differences to different sets of characteristics is subject to a well-known sequencing problem. The order in which controls are included matters for the interpretation of the results. Gelbach (2016) proposes a conditional decomposition to investigate how group-level heterogeneity in observable characteristics explains differences in observed outcomes between two groups—-in our case, individuals graduating from a new program and individuals graduating from an existing program. The proposed decomposition uses the omitted variable formula and allows for assessing the contribution of each covariate in a sequence-invariant way. Following Gelbach (2016), we rewrite equation (1) as follows:

$$Y_{ist} = \delta + \Omega NP_i + \beta C_{it} + \varepsilon_{ist}, \tag{2}$$

where C_{it} includes all the student and program characteristics we want to control for to purge $\hat{\Omega}$ from confounding effects. We label $\hat{\Omega}_1^{full}$ the coefficient of NP_i in the model that includes the full set of confounding effects (C_{it})

16 In particular, under the assumption that $E\left(NP_i, \varepsilon_{ist} | X_{it}, Z_s\right) = 0$, $\hat{\Omega}$ can be interpreted as the effect of new programs on wages.

and $\hat{\Omega}^{base}$ the estimated effect of NP_i when C_{it} is excluded from the regression. Then, following Gelbach (2016) and the omitted variable formula, it can be shown that:

$$\Omega^{base} - \Omega^{full} = \Gamma\beta = \Delta, \tag{3}$$

where the parameter matrix Γ represents the coefficients of an auxiliary regression of C_{it} on NP_i,

$$C_{it} = NP_i\Gamma + \epsilon_1. \tag{4}$$

Intuitively, the contribution of each coefficient to the difference in Ω between the base and full models depends on the correlation of the covariates with the dependent variable and the correlation of the covariates with NP_i. Because the omitted variable formula is linear in its components, the contribution of each covariate can be evaluated separately or across subgroups. Moreover, because the decomposition is computed from the full specification, it is order-invariant.

Table 4 shows the results for the conditional decomposition following Gelbach (2016) for the HE graduation exams. The three columns show the decomposition for each subject. The first row, labeled "base" shows the penalty associated with a new program conditioning on a basic set of controls: the exam calendar, gender, and a quadratic term for age. At the bottom of the table, the row labeled "full" shows the effects of attending a new program conditioning on the full set of controls on learning. These estimates coincide with column 8 in Table 3. Rows 2 to 8 show how much each group of covariates contributes to the new-program penalty. Figure 6 transforms the coefficients to represent the contribution of each group in percentage points of the explained penalty.

Figure 6 shows that the new-program learning penalty is, to the largest extent, explained by the HS exit standardized test scores. The baseline quality of the students explains between 55 and 75 percent of the new-program penalty, depending on the HE graduation test. Scores on the HS exit test explain –0.11 standard deviation of the baseline penalty in the written communication score (–0.20), –0.21 in critical reading (against a baseline penalty of –0.28), and –0.21 in quantitative reasoning (against –0.30 at baseline). Thus, much of what seemed to indicate the lower performance of new HE programs was predetermined at entry. Students with lower scores in HS are more likely to attend new programs. Family income and education of the parents play a small role in the new-program penalty. The HS attended has no explanatory power for the critical reading and quantitative reasoning scores, but it explains about 10 percent of the baseline penalty in the written communication score. The remaining difference between the baseline and full models is explained by the type of institution attended. This is consistent with the concentration of new HE programs in professional, technological, and college institutions, which, on average, show lower performance on the HE graduation tests than universities.[17]

New Programs and Labor Market Outcomes

The labor market penalty for graduating from a new program against an existing program almost disappears once we account for student and program characteristics. This contrasts significantly with the large differences in unconditional means. Table 5 shows the effect of new programs on the four labor market outcomes of interest.[18] The first row presents our base model, which includes controls for student gender, a quadratic term for age, years in the labor market, and year of graduation from HE. Differences in entry wages in the base model are very significant: graduates of new programs earn 14.5 percent less in their first formal job (column 1). They also experience slower wage growth (column 2). Annual wage growth is 1.6 percentage points lower for individuals who graduated from a new program, a significant effect considering that the average yearly growth of wages is 16 percent.

[17] In our data, the mean difference in HE graduation scores between universities and professional institutions is 10 percentage points.

[18] In the text, we present the results of the Gelbach decomposition. Full sequential regression results mimicking Table 3 for each of the labor market outcomes are included in Online Appendix Tables S1.1, S1.2, S1.3, S1.4.

The "naive" unconditional model also suggests that graduates from new programs are disadvantaged in finding a formal job, although the differences between the two groups are small. They have a 2 percentage point lower probability of ever being a wage employee (column 3 in Table 5), representing a 3 percent reduction relative to the baseline probability (68%) of being formal among graduates from existing programs. Additionally, they spend less time in the formal sector. On average, graduates from existing programs in our sample spend 46 percent of their time as formal sector employees in the first years of their careers. According to the estimates in column 4 of Table 5, graduating from a new program is associated with a reduction in the time working as a formal wage employee by 1.3 percentage points, i.e., a 2.8 percent reduction. Although the differences in formal sector employment between graduates of the two groups are small, this could potentially introduce an additional selection layer when evaluating the impact of graduating from new versus existing programs on wages and wage growth. However, as we shall see, the formality gap completely disappears once a full set of observables is introduced in the regression.

The full models at the bottom of Table 5 depict a very different picture. Once a full set of controls has been included in the regressions, graduating from a new HE program barely affects the probability of ever being a formal worker, the accumulated time spent working as a formal employee, or wage growth compared to graduating from an existing program. Only the effect on entry wages remains statistically different from 0. However, the average 'fully controlled' wage difference between graduates of new and existing programs is small compared with the large 'naive' wage gap, dropping from 14.5 to 3.7 percent. The rest of Table 5 examines the contribution of each set of covariates to movements in the coefficient of the new program from the base to the full models.

Program characteristics are the most important element behind the entry wage penalty associated with new programs. New programs are shorter, explaining part of the entry wage penalty. Column 1 in Table 5 shows that the level of degree attained explains 2.5 percent of the difference in entry wages. More interestingly, the area of study is the single most important factor behind the entry wage penalty for new programs. Figure 6 shows that it accounts for approximately 40 percent of the difference between the base and full models (4 percentage points of the 11 percent difference in entry wages between new and existing HE programs). This indicates that new programs are more likely to emerge in fields of study where wages have historically been lower. Figure 5 provides suggestive evidence along these lines. The share of new programs is extremely low in high-paying areas such as engineering and medicine.

Student background, a key determinant of differences in learning between students attending new and existing programs, plays a secondary role in the case of entry wages.[19] Baseline student quality, measured by the HS exit exam, explains 2.3 percentage points of the pay gap between new and existing programs, or about 20 percent of the difference between the base and full models. In contrast, the contributions of high school attended and socioeconomic status are relatively smaller.

On wage growth (column 2 in Table 5), the level of degree attained is the single most important factor behind the penalty for new programs. It explains about two-thirds of the 1.6 percentage points penalty for new programs in the base model. Interestingly, the area of study has a positive and significant effect in the decomposition. Thus, there is some regression to the mean: the fields of study where new programs concentrate compensate for lower entry wages with higher wage growth during the first years after graduation. The HS attended stands out among the student characteristics, explaining around 40 percent of the difference between the base and full models.

The effects of new programs on formal sector attachment, measured by the probability of ever being a wage employee (column 3 in Table 5), or the share of actual versus potential years as a wage employee (column 4 in Table 5), become very small and only statistically significant at the 10 percent level once the program and student

[19] Note, however, that the two samples differ. Compositional effects across students and/or programs in the learning and labor market samples may account for the varying influence of student and program characteristics on the gaps between new and existing programs. Nevertheless, we believe these compositional effects are likely minimal, given the short and contiguous time window covered by both samples. Furthermore, as shown in Table 1, the differences in observable characteristics between the two samples are very small, and the pattern of selection we describe between graduates of new and existing programs is consistent across both samples. However, results comparisons between the learning and labor market samples should be interpreted with this caveat in mind.

characteristics are partialled out. This is reassuring for the wage analyses, as it indicates that the results are not likely to be biased by unequal formal sector attachment between the two groups of graduates.[20]

Student background, as measured by the HS attended and the score on the HS exit exam, is the key factor accounting for the gap in formal labor market attachment between graduates from new and existing programs. The HS attended explains 47 percent (–0.010 of –0.021) of the penalty associated with the probability of ever being a formal employee, and up to 77 percent (–0.010 of –0.013) of the share of years working in the formal sector. This suggests the important role of networks that are formed early in life as determinants of finding a formal job after HE graduation. The HS test scores explain the rest of the penalty.

Table 6 repeats the labor market analysis for an extended sample that does not impose the restriction of taking the high school exit exam in 2002-2003. Hence, the new Gelbach decompositions include all higher education graduates for whom we can match their *Saber 11* test scores. In this sample, we cannot control for family background, which was shown to explain a minor part of the differences between the base and full models in Table 5. The results on this extended sample are qualitatively similar to those of Table 5.

Robustness

This section presents two robustness checks. First, it examines potential bias arising from unobserved variables. Second, it explores variations in the definitions of the variable of interest to assess whether the results remain consistent under these new specifications.

Selection on Unobservables

Students attending new HE programs fundamentally differ from those attending existing programs. They come from less wealthy households, their parents are less educated, they attended different high schools, and they enrolled in HE with fewer skills. Not surprisingly, accounting for these factors dramatically changes the estimated impact of attending a new program on learning, wages, and the probability of holding good jobs. Yet, no matter how rich our control set is, we cannot rule out that some unobserved factor may bias the estimated effects of interest.

Building on Altonji et al. (2005), Oster (2019) proposes a method for assessing the importance of potential omitted variable bias based on the changes in the R^2 and the coefficient of interest across specifications with different sets of control variables. The underlying intuition is that assessing the stability of the coefficient of interest when controls are added is informative about potential bias only when the new specification has a greater explanatory power of the outcome of interest.

To simplify the exposition, suppose the outcome variable Y only depends on the ability and the type of HE program attended (new versus existing). The ability has two components. One component is captured by the test score on the HS exit test (X_1). The other is unobserved by the econometrician (X_2). Thus, the outcome follows a linear model:

$$Y_{ist} = \alpha + \Omega NP_i + \beta_1 X^1_{ist} + \beta_2 X^2_{ist} + \varepsilon_{ist}. \quad (5)$$

Define the proportional selection relationship as:

$$\frac{Cov\left(X^2_{ist}, NP_i\right)}{Var\left(X^2_{ist}\right)} = \delta \frac{Cov\left(X^1_{ist}, NP_i\right)}{Var\left(X^1_{ist}\right)},$$

where δ is a coefficient of proportionality. Thus, selection on the unobservable variable X_2 is proportional to selection on the observable test score (X_1). A value of $\delta = 1$ suggests that selection on observables is as important

20 Some HE graduates may become employers, or self-employed professionals, introducing an additional potential selection channel. In the data, we do not observe the wages of self-employed workers. Because the wage analyses exclude self-employed workers we also limit the analysis of formal sector attachment to wage employees. However, in a working paper version of the paper (Camacho et al. 2017), we analyzed the impact of new programs on the probability of being a formal worker, defined as wage employees and self-employed workers who contribute to social security. The results are very similar to those reported in the text.

as selection on unobservables. We also define $\tilde{\Omega}$ and $\tilde{R^2}$ as the coefficients of interest and R^2 in a regression that includes X_1 and NP; and $\mathring{\Omega}$ and $\mathring{R}^2$ as those of the regression that only includes NP. In this simple setting, Oster (2019) shows that the omitted variable bias Π is defined by $\Pi = \left[\mathring{\beta} - \tilde{\beta}\right] \frac{R_{\max} - \tilde{R}}{\tilde{R} - \mathring{R}}$. In regressions with more than one covariate, the derivation is more involved, but the intuition discussed here carries through.

Thus, we need to define values for $R_{\max}$ and δ, which are unobservable. $R_{\max}$ is the potential maximum R^2 in a regression that includes the variable of interest, observed controls, and unobserved factors. Oster (2019) uses $R_{\max} = 1.3\tilde{R^2}$ as a standard threshold and $\delta = 1$ as a reasonable starting point. In our case, $\delta > 1$ seems unlikely given the rich set of controls included in our preferred specification and the possibility of controlling for baseline ability, as proxied by the HS exit exam score. Considering this, it seems more plausible that $0 \leq \delta \leq 1$.

We assess the robustness to selection on unobservables for the HE graduation exam in quantitative reasoning and entry wages.[21] We consider three values of $R_{\max}$: $1.15\tilde{R^2}$, $1.3\tilde{R^2}$, and $1.5\tilde{R^2}$ and two values of δ: 0.5 and 1. We allow for movements in R^2 between two models, which we label "partially controlled" and "fully controlled." The partially controlled model includes year effects, region dummies, basic demographics, and a full set of program characteristics: the area of study, level of degree attained, and HE institution characteristics. The fully controlled specification adds to the set of covariates the socioeconomic background of the student (i.e., family income and the highest level of education of the parents) and the score on the HS exit exam.

Moving from the partially to the fully controlled model has a significant impact on the estimated coefficient of attending a new program, as shown in the lower panel in Table 7. In the case of the HE graduation exam (entry wages), the coefficient of interest, $\hat{\Omega}$, moves from –0.14 (–0.07) to –0.04 (–0.04). If selection on unobservables is of similar importance as selection on observables, these sharp movements in the estimated coefficients may indicate a relatively large omitted variable bias. However, R^2 also moves dramatically between the two specifications. In the HE graduation exam, which is the specification where $\hat{\Omega}$ varied most, the R^2 almost doubles between the partial and fully controlled specifications, from 0.26 to 0.50. Thus, the omitted variable is likely to be smaller than anticipated by movements in the coefficients.

Table 7 shows how much the unobservable characteristics are likely to affect the coefficient of interest under different assumptions. Columns 1 and 2 show the results for the HE graduation exam in quantitative reasoning. Considering $\delta = 1$ and $R^2 = 1.3\tilde{R^2}$, the impact of a new program on the exit HE graduation exam would be positive, at 0.037 of a standard deviation. For entry wages, shown in columns 3 and 4, the effect would be indistinguishable from 0 under the same set of parameters. If instead, we assume that selection on unobservables is less important than selection on observables, with $\delta = 0.5$, presumably a reasonable assumption in our case, and holding constant $R^2 = 1.3\tilde{R^2}$, $\hat{\Omega}$ becomes indistinguishable from zero in the case of the HE graduation exam, and the penalty on entry wages declines to -2.3 percent. We conclude that in the presence of selection on unobservables, the impact of attending a new program on student learning and entry wages is economically small, possibly indistinguishable from zero.

Different Definitions of a New Program

We defined new programs as those whose first graduate finished school in 2002 or later. This definition captures the bulk of the higher education (HE) expansion of the 2000s, including two-year programs. Table 8 shows robustness checks for the HE graduation exam in quantitative reasoning and entry wages based on different ways of defining a new program. Columns 3–6 assess how results change when we change the threshold that defines a new program to programs whose first graduate finished school in 2004 or later (columns 3–4) and 2006 or later (columns 5–6). Columns 7–12 use student enrollment to define a new program. Because we observe in the data HE entrants starting in 2000, the first year we can define a new program is 2001 (columns 7–8), as those programs with no students enrolled in 2000. We also vary the cutoff to 2003 (columns 9–10) and 2005 (columns 11–12). Finally, we define new programs using the year of registration in the *SNIES* (columns 13–18). We define new programs as those registered in 1999 or later (columns 13–14), 2001 or later (columns 15–16), and 2003 or later (columns 17–18). The results are qualitatively and quantitatively similar across specifications. Wage

[21] Results for written communication and critical reading are very similar to quantitative reasoning. We do not show them to ease the exposition.

and learning penalties are large in all specifications that include only basic controls. If anything, when we use enrollment or registration in the *SNIES* as a criterion for defining a new program, the wage and learning penalty of a new program is smaller and often non-statistically significant after we include a full set of controls.

Distributional Effects

The small wage penalty for attending a new program may hide substantial heterogeneity across the wage distribution. An emerging literature highlights the large heterogeneity in the returns to HE programs in Latin America. Rodríguez et al. (2016) show that the returns to HE programs in Chile are positive on average, even when tuition fees and the opportunity cost of foregone earnings are considered in the analysis. However, many students have negative returns on their investments. Similar results are obtained for Colombia (González-Velosa et al. 2015). Some of these negative returns may be concentrated among a handful of new programs with large wage penalties.

To investigate this hypothesis, we analyze the impact on entry wages of a new program across the wage distribution. We follow Firpo et al. (2009), which allows for a simple approximation in the estimation of unconditional quantile regressions. The regression includes the same set of controls as those in the full model in Table 5. The results are displayed in Figure 7. Contrary to expectations, the penalty for attending a new program is larger in the middle of the wage distribution than in the tails, reaching its highest point at approximately the 70^{th} percentile with an estimated penalty of –6 percent. The penalty is much lower in the bottom half of the wage distribution, not being statistically different from zero in the first two deciles. Thus, the wage penalty for new programs is not particularly pervasive at the bottom of the wage distribution.

6. Conclusions

The rapid expansion in the demand for HE in Colombia was met by an equally fast increase in supply, raising concerns about the quality of new HE institutions and programs. Indeed, the test scores on HE graduation exams and the wages of graduates from programs created in the 2000s are substantially lower than those of graduates who attended existing, well-established programs. However, a large fraction of the penalty between the new programs and existing programs is explained by student sorting. Lower-ability students are more likely to attend newly created programs as measured by a large set of cognitive test scores administered before admission. The remaining fraction of the learning and labor market differences between graduates from new and existing programs is due to the choices made by HE institutions. This is particularly the case for labor market performance, where new programs concentrate on areas of study that traditionally exhibit lower returns, such as accounting, design, or veterinary medicine.

Improving the information available to HS graduates about their best career choices given their potential may be beneficial, as our evidence suggests a proliferation of new programs in areas where the schooling premium is low. However, acknowledging student sorting is key for assessing heterogeneity in the returns of HE institutions and programs. This is potentially challenging because student sorting is likely to respond to observable and unobservable characteristics. Our results show that collecting standardized test scores before accessing HE and the student's standard socioeconomic background characteristics goes a long way in tackling student sorting. After controlling for student socioeconomic background and test scores at entry, we find that selection into HE programs based on unobservables is fairly small for plausible assumptions.

References

Acosta, P., G. Cruces, L. Gasparini, and S. Galiani. 2019. "Educational upgrading and returns to skills in Latin America: Evidence from a supply-demand framework, 1990-2010." *Latin American Economic Review* 28 (18): 1–20.

Altonji, J., E. Blom, and C. Meghir. 2012. "Heterogeneity in human capital investments: High school curriculum, college major, and careers.". Working Paper 17985, National Bureau of Economic Research.

Altonji, J. G., T. E. Elder, and C. R. Taber. 2005. "An evaluation of instrumental variable strategies for estimating the effects of Catholic schooling." *Journal of Human Resources* 40 (4): 791–821.

Angrist, J., E. Bettinger, and M. Kremer. 2006. “Long-term educational consequences of secondary school vouchers: Evidence from administrative records in Colombia.” *American Economic Review* 96 (3): 847–862.

Baez, J. E., and A. Camacho. 2011. “Assessing the long-term effects of conditional cash transfers on human capital: Evidence from Colombia.” *World Bank Policy Research Working Paper Series*.

Bassi, M., M. Busso, and J. S. Muñoz. 2015. “Enrollment, graduation, and dropout rates in Latin America: Is the glass half empty or half full?.” *Economía* 16 (1): 113–156.

Bleemer, Z. 2021, 09. “Affirmative Action, Mismatch, and Economic Mobility after California’s Proposition 209*.” *The Quarterly Journal of Economics* 137 (1): 115–160.

Busso, M., J. Cristia, D. Hincapie, J. Messina, and L. Ripani. 2017. *Learning Better: Public Policy for Skills Development*. Number 8495 in IDB Publications (Books). Inter-American Development Bank.

Busso, M., S. Montaño, and J. Muñoz-Morales. 2023. “Signaling specific skills and the labor market of college graduates.” *Institute of Labor Economics (IZA)*.

Camacho, A., J. Messina, and J. P. Uribe. 2017. “The expansion of higher education in Colombia: Bad students or bad programs?.” *Documento CEDE No. 2017-13*.

Carneiro, P., J. J. Heckman, and E. J. Vytlacil. 2011. “Estimating marginal returns to education.” *American Economic Review* 101: 2754–2781.

Carneiro, P., and S. Lee. 2011. “Trends in quality-adjusted skill premia in the United States, 1960–2000.” *American Economic Review* 101 (6): 2309–2349.

Carranza, J. E., and M. M. Ferreyra. 2019. “Increasing higher education access: Supply, sorting, and outcomes in Colombia.” *Journal of Human Capital* 13 (1): 95–136.

Castro, J. F., and G. Yamada. 2013. “Declining higher education quality affects postsecondary choices: A Peruvian case.” *International Higher Education* 107 (68): .26–28.

Cunha, J. M., and T. Miller. 2014. “Measuring value-added in higher education: Possibilities and limitations in the use of administrative data.” *Economics of Education Review* 42 (0): 64 – 77.

Darvas, Peter, S. G. Y. S., and B. Bawany. 2017. *Sharing Higher Education’s Promise beyond the Few in Sub-Saharan Africa*. Directions in Development. Washington DC: World Bank.

DNP. 2002. “Sistema de ciudades: un análisis del estado actual de las ciudades y propuestas para el desarrollo de una red de ciudades.”. Documento CONPES 3189, Consejo Nacional de Política Económica y Social, República de Colombia.

Fernandez, M., and J. Messina. 2018. “Skill premium, labor supply, and changes in the structure of wages in Latin America.” *Journal of Development Economics* 135: 555 – 573.

Ferreyra, M. M., C. Avitabile, J. Botero Álvarez, F. Haimovich Paz, and S. Urzúa. 2017. *At a Crossroads : Higher Education in Latin America and the Caribbean*. Directions in Development. World Bank.

Firpo, S., N. M. Fortin, and T. Lemieux. 2009. “Unconditional quantile regressions.” *Econometrica* 77 (3): pp. 953–973.

Fiszbein, A., N. R. Schady, and F. H. Ferreira. 2009. *Conditional cash transfers: Reducing present and future poverty*. Washington DC: World Bank Publications.

Gelbach, J. B. 2016. “When Do Covariates Matter? And Which Ones, and How Much?.” *Journal of Labor Economics* 34 (2): 509–543.

González-Velosa, C., G. Rucci, M. Sarzosa, and S. Urzúa. 2015. “Returns to higher education in Chile and Colombia.” *Inter-American Development Bank*.

Hastings, J. S., C. A. Neilson, and S. D. Zimmerman. 2013. “Are some degrees worth more than others? Evidence from college admission cutoffs in Chile.” *National Bureau of Economic Research (19241)*.

Juhn, C., D. I. Kim, and F. Vella. 2005. “The expansion of college education in the united states: Is there evidence of declining cohort quality?.” *Economic Inquiry* 43 (2): 303–315.

Kirkeboen, L. J., E. Leuven, and M. Mogstad. 2016. “Field of Study, Earnings, and Self-Selection*.” *The Quarterly Journal of Economics* 131 (3): 1057–1111.

Lovenheim, M., and J. Smith. 2023. “Returns to different postsecondary investments: Institution type, academic programs, and credentials.” In *Handbook of the Economics of Education*, 187–318. Elsevier.

MacLeod, W. B., E. Riehl, J. E. Saavedra, and M. Urquiola. 2017, July. “The big sort: College reputation and labor market outcomes.” *American Economic Journal: Applied Economics* 9 (3): 223–61.

Melguizo, T., and J. Wainer. 2016. “Toward a set of measures of student learning outcomes in higher education: evidence from brazil.” *Higher Education* 72: 381–401.

Messina, J., and J. Silva. 2018. *Wage Inequality in Latin America : Understanding the Past to Prepare for the Future*. Washington DC: World Bank.

Messina, J., and J. Silva. 2021. “Twenty years of wage inequality in Latin America.” *World Bank Economic Review* 35 (1):

117–147.

Moffitt, R. 2008. "Estimating marginal treatment effects in heterogeneous populations." *Annales d'Economie et de Statistique*: 239–261.

Mountjoy, J., and B. R. Hickman. 2021, September. "The returns to college(s): Relative value-added and match effects in higher education.". Working Paper 29276, National Bureau of Economic Research.

OECD/CAF/ECLAC. 2015. *Latin American Economic Outlook 2015: Education, Skills and Innovation for Development.* Paris: OECD Publishing.

Oster, E. 2019. "Unobservable selection and coefficient stability: Theory and evidence." *Journal of Business & Economic Statistics* 37 (2): 187–204.

Oyer, P. 2006. "Initial labor market conditions and long-term outcomes for economists." *The Journal of Economic Perspectives* 20 (3): pp. 143–160.

Rodríguez, J., S. Urzúa, and L. Reyes. 2016. "Heterogeneous economic returns to post-secondary degrees: Evidence from Chile." *Journal of Human Resources* 51 (2): 416–460.

Saavedra, J. E. 2009. "The learning and early labor market effects of college quality: A regression discontinuity analysis." *Mimeo, Harvard University*.

UNESCO. 2020. *Towards universal access to higher education: international trends*. Unesco.

Walker, I., and Y. Zhu. 2008. "The College Wage Premium and the Expansion of Higher Education in the UK." *Scandinavian Journal of Economics* 110 (4): 695–709.

Webber, D. A. 2014. "The lifetime earnings premia of different majors: Correcting for selection based on cognitive, noncognitive, and unobserved factors." *Labour Economics* 28: 14–23.

Zimmerman, S. D. 2019. "Elite colleges and upward mobility to top jobs and top incomes." *American Economic Review* 109 (1): 1–47.

A Figures

Figure 1. Higher Education Programs in Colombia

F_programs.pdf

Source: The data before 2000 comes from DNP (2002) (Documento CONPES 3189). After 2000, we use the data from the SNIES and include all the programs with at least one enrollee.

Note: This figure includes all post-secondary programs — undergraduate, technical, and technological.

Figure 2. High School Graduates and the Demand for Higher Education

F1_demand_HE.pdf

Source: For High-school graduates, we use data from ICFES Saber 11 test. For College enrollment, we use the National System of Higher Education Institutions (SNIES)National System of Higher Education Institutions (SNIES).

Note: HS graduates represent the number of students taking the high school graduation standardized test, Saber 11. This test is mandatory for enrollment in higher education institutions. College enrollment represents the students enrolled in the first year of a higher education degree. We exclude the students in graduate programs and students in the National Apprenticeship Service (SENA).

Figure 3. Higher Education Graduates by Program Type

F2_Total_Students.pdf

Source: National System of Higher Education Institutions (*SNIES*)

Note: The figure shows the number of students graduating from higher education (HE) institutions, as reported in the National System of Higher Education Institutions (*SNIES*). New HE programs in existing HE institutions are those with the first graduate in 2002 or later. New programs in new institutions are offered by institutions whose first graduate finished school in 2002 or later. Existing HE programs are those with the first graduate in 2001 or earlier. We exclude graduate programs.

Figure 4. Higher Education Entry Test Scores by Type of Program

F_quality_evolmean_primiparo_grad.pdf

Source: Sistema de Prevención y Análisis a la Deserción en las Instituciones de Educación Superior (SPADIES).
Note: The figure shows the evolution of the mean percentile score on the high school exit graduation test for students accessing the higher education (HE) system. New HE programs are those whose first graduate finished school in 2002 or later.

Figure 5. Percentage of New Higher Education Programs by Degree vs. Entry Monthly Earnings

share_new_wages.pdf

Source: Authors analysis from National System of Higher Education Institutions (SNIES) and *Planilla Integrada de Liquidacion de Aportes-PILA-* datasets
Note: The figure shows the relation between the entry average monthly earnings and the share of new programs in each area of study.

Figure 6. Gelbach Decomposition for the Effect of New HE Program. (% explained by each group of variables)

Gelbach_ALL.pdf

Source: Authors analysis based on ICFES (Saber 11 and Saber Pro), National System of Higher Education Institutions (SNIES) and *Planilla Integrada de Liquidacion de Aportes-PILA-* datasets

Note: The figure shows the results from Gelbach (2016) decomposition. Each bar represents the share of the effect explained by each category. The coefficients and full decomposition exercises are in Tables 4 and 5.

Figure 7. Unconditional Quantile Regressions for Entry Wages

_gr_UQR_e_SchFE_wages.pdf

Source: Authors analysis based on ICFES (Saber 11), National System of Higher Education Institutions (SNIES) and *Planilla Integrada de Liquidacion de Aportes-PILA-* datasets. *Note*: The figure shows the effect of new programs on the unconditional distribution of (log) monthly wages in 2011 pesos. The solid line is the point estimate in each centile, and the grey area represents the 95 percent confidence interval.

B Tables

Table 1. Summary Statistics: Learning and Labor Samples

		Learning Sample			Labor Market Sample		
		Existing Program	New Program	Difference	Existing Program	New Program	Difference
Demographics	Age	22.92	22.93	-0.00	24.28	24.36	-0.07
	Male	0.42	0.41	0.01	0.42	0.41	0.01
Parents' Education (max. level)	Highschool drop out or less	0.21	0.29	-0.08	0.15	0.20	-0.05
	Secondary complete and some HE	0.28	0.31	-0.03	0.32	0.37	-0.05
	HE complete or higher	0.51	0.40	0.10	0.53	0.43	0.10
Income Level of the Family	Less than 2 Min. Wage	0.35	0.44	-0.08	0.38	0.47	-0.09
	Between 2 and 5 Min. Wage	0.43	0.43	-0.01	0.47	0.46	0.01
	More than 5 Min. Wage	0.22	0.13	0.09	0.14	0.06	0.08
High School Characteristics	Academic	0.60	0.56	0.04	0.59	0.54	0.05
	Academic-Technical	0.21	0.22	-0.01	0.26	0.28	-0.02
	Normalista	0.03	0.03	-0.00	0.02	0.03	-0.01
	Technical	0.15	0.18	-0.02	0.13	0.15	-0.02
Saber 11 (Percentiles)	Math	62.08	54.19	7.89	62.59	54.47	8.13
	Language	66.65	58.80	7.85	71.72	63.42	8.30
Type of HE Institution	Technological Institution	0.02	0.07	-0.05	0.02	0.03	-0.02
	College	0.16	0.27	-0.10	0.14	0.19	-0.06
	Technical Professional	0.02	0.07	-0.05	0.01	0.04	-0.03
	University	0.79	0.60	0.20	0.83	0.73	0.10
Public HE Institution	Public University	0.44	0.35	0.09	0.49	0.43	0.06
Area of Studies	Agriculture and Veterinary	0.02	0.01	0.01	0.02	0.01	0.01
	Fine Arts	0.05	0.05	0.00	0.05	0.04	0.00
	Education Sciences	0.05	0.09	-0.04	0.07	0.12	-0.05
	Health Sciences	0.14	0.08	0.06	0.17	0.09	0.08
	Social and Human Sciences	0.18	0.16	0.02	0.15	0.17	-0.01
	Economics, Administration and Accounting	0.26	0.33	-0.07	0.21	0.25	-0.04
	Engineering, Architecture and Urbanism	0.26	0.26	0.00	0.29	0.30	-0.00
	Math and Science	0.03	0.01	0.02	0.04	0.02	0.02
Observations		110,084	143,538	253,622	39,688	35,626	75,314

Source: Authors analysis based on ICFES and National System of Higher Education Institutions (SNIES) dataset. Data comes from the sample of students from the higher education (HE) system taking the standardized test *ICFES* Saber Pro from 2011 to 2013.

[a]The only difference that is not statistically different from 0 is age. All the other differences are statistically different from 0 at the 1 % confidence level except for engineering, architecture, and urban studies, and more than five times the minimum wage, which are different from 0 at the 10 % confidence level.

Table 2. Summary Statistics for Outcome Variables

		Existing Program	New Program	Difference	Observations
Saber Pro (Score)	Written Communication	10.25	10.03	0.22	253,622
	Critical Reading	10.39	10.09	0.30	253,622
	Quantitative Reasoning	10.38	10.05	0.33	253,622
Labor Market Outcomes	Formal	0.68	0.65	0.03	75,314
	Share of years as formal	0.46	0.44	0.02	75,314
	log of monthly income (2011 pesos)	13.91	13.76	0.15	39,375
	Change in log wages	0.17	0.15	0.02	25,205

Source: Authors analysis based on ICFES and National System of Higher Education Institutions (SNIES) dataset. See footnote in Table 1 for sample definitions.

[a]All differences between graduates of new and existing programs are statistically significant at the 1 % level.

Table 3. Effect of New Programs on the Higher Education Graduation Exam

	(1)	(2)	(3)
	Written Communication Score		
New program	-0.20***	-0.22***	-0.02*
	[0.021]	[0.022]	[0.009]
Constant	10.21***	10.25***	8.68***
	[0.017]	[0.017]	[0.246]
R^2	0.01	0.01	0.22
	Critical Reading Score		
New program	-0.28***	-0.30***	-0.02**
	[0.028]	[0.028]	[0.007]
Constant	10.33***	10.39***	7.79***
	[0.022]	[0.022]	[0.203]
R^2	0.02	0.02	0.46
	Quantitative Reasoning Score		
New program	-0.30***	-0.33***	-0.04***
	[0.032]	[0.033]	[0.008]
Constant	10.31***	10.38***	8.48***
	[0.027]	[0.029]	[0.207]
R^2	0.02	0.02	0.50
Controls	No	No	Yes
Observations	374,718	253,627	253,627

Source: Authors analysis based on ICFES and National System of Higher Education Institutions (SNIES) dataset.

[a] Standard errors clustered by program are in brackets. $^{*}\ p < 0.05$, $^{**}\ p < 0.01$, $^{***}\ p < 0.001$

[b] The Colombian examination for the quality of higher education (Saber Pro) is a standardized test measuring general abilities across degrees. The regressions include the students from the higher education system who have taken *ICFES* Saber Pro between 2011 and 2013, and the high school (HS) exit test *ICFES* Saber 11 between 2001 and 2011. Additional sample restrictions are discussed in the text. The test scores have a mean of 10 and a standard deviation of 1.

[c] Included controls are the following. Exam calendar: a set of dummies for the semester in which the Saber Pro was taken. Demographics: age, age square, and gender. Deciles in ST Saber 11: decile on the standardized test at HS exit in each of the following subjects: biology, math, philosophy, physics, chemistry, language, and social sciences. Family Inc. and Parents' Edu: seven dummies for household income brackets and maximum level of education of the two parents (none, incomplete primary, primary complete, secondary (HS) incomplete, secondary (HS) complete, technical or technological education incomplete, technical education or technology complete, college incomplete, college complete, postgraduate). HS FE: fixed effects for the school attended by the student. Area of study: includes 55 dummies that describe the type of area of study (e.g., economics, administration, civil engineering, etc.). Level of degree attained: dummies for technical, technological, and bachelor's diplomas. The program's length varies from one year for a technical diploma degree to four to six years for the standard undergraduate program. Institution characteristics: dummy for public institution and type of institution (technological institution, technical institution, college, university) set of dummies. HE Inst. Region FE: 28 dummies for the geographic location of the HE institution.

Table 4. Gelbach Decomposition: New Higher Education Program and HE Graduation Exam

	(1) *Written Communication*	(2) *Critical Reading*	(3) *Quantitative Reasoning*
Base	-0.212***	-0.281***	-0.314***
	[0.021]	[0.027]	[0.031]
Deciles in ST Saber 11	-0.108***	-0.213***	-0.214***
	[0.009]	[0.018]	[0.018]
Family Income and Parents' Education	-0.006***	-0.013***	-0.016***
	[0.001]	[0.002]	[0.002]
Area of Study	0.006	-0.004	-0.003
	[0.008]	[0.007]	[0.011]
Level of Degree Attained	-0.029***	0.004***	-0.009***
	[0.003]	[0.001]	[0.001]
Institution Characteristics	-0.023***	-0.026***	-0.024***
	[0.003]	[0.004]	[0.004]
HE Inst. Region FE	-0.009*	-0.012**	-0.006
	[0.004]	[0.005]	[0.004]
School FE	-0.023***	0.000	-0.004
	[0.004]	[0.002]	[0.003]
Full	-0.020*	-0.018**	-0.038***
	[0.009]	[0.007]	[0.008]
Difference	-0.192***	-0.263***	-0.276***
	[0.019]	[0.024]	[0.028]
Observations	253,627	253,627	253,627

Source: Authors analysis based on ICFES and National System of Higher Education Institutions (SNIES) dataset.

[a] Standard errors clustered by program are in brackets. $^{*}\ p < 0.05$, $^{**}\ p < 0.01$, $^{***}\ p < 0.001$

[b] The regressions include the students from the higher education system who have taken *ICFES* Saber Pro between 2011 and 2013, and the high school (HS) exit test *ICFES* Saber 11 between 2001 and 2011. Additional sample restrictions are discussed in the text. For details about the variables included in each category, see the notes in Table 3. The base model is equivalent to the model in column 3 in Table 3. The full model is equivalent to the model in column 8 in Table 3.

Table 5. Gelbach Decomposition: New Higher Education Program and Labor Market Outcomes – Graduates who Took Saber 11 in 2002-2003

	(1)	(2)	(3)	(4)
	Wages		**Formality**	
	Entry wages	*Wage growth*	*Ever formal*	*Formal years*
Base	-0.145***	-0.016**	-0.021**	-0.013*
	[0.016]	[0.008]	[0.009]	[0.008]
Deciles in ST Saber 11	-0.023***	-0.002***	-0.009***	-0.007***
	[0.002]	[0.000]	[0.001]	[0.001]
Family Income and Parents' Education	-0.007***	-0.001***	0.006***	0.006***
	[0.001]	[0.000]	[0.001]	[0.001]
Area of Study	-0.040***	0.013**	-0.001	0.003
	[0.010]	[0.005]	[0.005]	[0.005]
Level of Degree Attained	-0.025***	-0.011***	0.005***	0.005***
	[0.003]	[0.002]	[0.001]	[0.001]
Institution Characteristics	0.000	0.000	-0.000	0.001
	[0.001]	[0.000]	[0.001]	[0.001]
HE Inst. Region FE	-0.004***	0.000	-0.005**	-0.004**
	[0.001]	[0.001]	[0.002]	[0.001]
School FE	-0.010***	-0.007**	-0.010***	-0.010***
	[0.003]	[0.002]	[0.002]	[0.002]
Full	-0.037***	-0.009	-0.007	-0.006
	[0.008]	[0.007]	[0.006]	[0.005]
Difference	-0.108***	-0.007	-0.014**	-0.007
	[0.014]	[0.006]	[0.006]	[0.006]
Observations	53,111	29,593	75,314	75,314

Source: Authors analysis from National System of Higher Education Institutions (SNIES) and *Planilla Integrada de Liquidacion de Aportes-PILA-* dataset. Include students who took Saber11 in 2002-2003

[a] Standard errors clustered by program are in brackets. $^{*}\ p < 0.05$, $^{**}\ p < 0.01$, $^{***}\ p < 0.001$

[b] Column 1 shows the decomposition exercise for entry wage. Entry wage is defined as the first wage received by a graduate who joins the formal sector at some point in the sample. It is measured as the log of the monthly wage in 2011 COP pesos. Column 2 shows the decomposition for the wage growth measured as the difference in log wages between year $t + 1$ and the entry year, t. Column 3 shows the effect of the new program on the probability of ever being a formal wage employee. An individual is defined as formal if they were a formal wage employee at least once in our sample. Column 4 shows the effect of new programs on the share of years as a formal wage employee, defined as the sum of years observed as a formal wage employee over [2011-(year of graduation+1)]. The base model includes controls for age, age^2, gender, and dummies for the calendar years in the labor market and the year of graduation from HE. *Percentile in HS exit exam*: includes dummies for the decile of the student in each subject in the standardized test (biology, math, philosophy, physics, chemistry, language, and social science). *Family Inc. and Parents' Edu.* includes seven dummies for household income brackets and the maximum level of education of the two parents. *HS FE* has fixed effects for the school attended. *Area of Study* contains 55 categories describing the area of study (e.g., economics, administration, civil engineering, etc.). *level of degree attained* includes dummies for technical, technological, and bachelor's diplomas. The length of the program varies from one year for a technical diploma degree to four to six years for a standard undergraduate program. *Institution Characteristics* includes a dummy for a public institution and type of institution (technological institution, technical institution, college, or university). *HE Inst. Region FE* includes 28 dummies for the geographic location of the HE institution.

Table 6. Gelbach Decomposition: New Higher Education Program and Labor Market Outcomes – Graduates who took the Saber 11 Test in 2002-2007

	(1)	(2)	(3)	(4)
	Wages		**Formality**	
	Entry wages	*Wage growth*	*Ever formal*	*Share of years as formal*
Base	-0.153***	-0.020**	-0.026**	-0.016**
	[0.016]	[0.007]	[0.009]	[0.008]
Deciles in ST Saber 11	-0.023***	-0.003***	-0.007***	-0.006***
	[0.002]	[0.000]	[0.001]	[0.001]
Area of Study	-0.034***	0.010**	0.002	0.006
	[0.009]	[0.004]	[0.006]	[0.005]
Level of Degree Attained	-0.035***	-0.013***	0.004***	0.005***
	[0.005]	[0.002]	[0.001]	[0.001]
Institution Characteristics	-0.002	-0.001***	-0.003**	-0.002**
	[0.001]	[0.000]	[0.001]	[0.001]
HE Inst. Region FE	-0.004***	-0.000	-0.007***	-0.005***
	[0.001]	[0.001]	[0.002]	[0.001]
School FE	-0.021***	-0.010***	-0.007**	-0.007**
	[0.004]	[0.002]	[0.002]	[0.002]
Full	-0.035***	-0.004	-0.008	-0.007
	[0.007]	[0.006]	[0.006]	[0.005]
Difference	-0.118***	-0.016**	-0.017**	-0.010
	[0.014]	[0.005]	[0.007]	[0.006]
Observations	97,542	48,429	146,717	146,717

Source: Authors analysis from National System of Higher Education Institutions (SNIES) and *Planilla Integrada de Liquidacion de Aportes-PILA-* dataset. Include students who took Saber11 in 2002-2007

[a] Standard errors clustered by program are in brackets. $^{*}\ p < 0.05$, $^{**}\ p < 0.01$, $^{***}\ p < 0.001$

[b] See footnote of Table 5

Table 7. Selection on Unobservables: Higher Education Graduation Exam and Entry Wages

	(1)	(2)	(3)	(4)
	HE Graduation Exam		Entry Wages	
	$\delta = .5$	$\delta = 1$	$\delta = .5$	$\delta = 1$
$1.15R^2$	-0.020***	-0.002	-0.031***	-0.023***
	[0.004]	[0.004]	[0.003]	[0.007]
$1.3R^2$	-0.002	0.037***	-0.023***	-0.007
	[0.004]	[0.004]	[0.005]	[0.006]
$1.5R^2$	0.023***	0.091***	-0.013*	0.020**
	[0.004]	[0.005]	[0.006]	[0.007]
	Estimated $\hat{\Omega}_{NP}$ and R^2			
	HE Graduation Exam		Entry Wages	
	$\hat{\Omega}_{NP}$	R^2	$\hat{\Omega}_{NP}$	R^2
No Covariates	-0.33	0.02	-0.15	0.02
Partially controlled	-0.14	0.26	-0.07	0.19
Fully Controlled	-0.04	0.50	-0.04	0.32

Source: Authors analysis from ICFES, National System of Higher Education Institutions (SNIES) and *Planilla Integrada de Liquidacion de Aportes-PILA-* dataset.

[a] Bootstrap standard errors are inbrackets.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

[b] This table shows the impact on the coefficient of new programs of potential selection on unobservable characteristics, based on Oster2016. HE graduation exam refers to test scores in quantitative reasoning. δ is the relative importance of unobservables. If $\delta = 1$ (columns 2 and 4), the selection on observables, is as important as the selection on unobservables. If $\delta = 0.5$ (columns 2 and 4), selection on unobservables is less important than selection based on observable characteristics. The partially controlled model includes year effects, region dummies, basic demographic characteristics, and the full set of higher education (HE) descriptors (area of study and institution characteristics). The fully controlled model includes socioeconomic background (parental income and education) and high school exit test scores, as described in Tables 3 and 5.

Table 8. Effect of New Programs Using Different Definitions of New Program

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	Graduates						**Enrollment**						**Registration**					
	02		04		06		01		03		05		99		01		03	
Panel A. Effects of new programs on Quantitative Reasoning.																		
New Program	-0.33***	-0.04***	-0.30***	-0.03***	-0.27***	-0.02**	-0.30***	-0.01	-0.23***	0.00	-0.26***	-0.03**	-0.33***	-0.02**	-0.30***	-0.02*	-0.29***	-0.02**
	[0.033]	[0.008]	[0.031]	[0.008]	[0.031]	[0.008]	[0.031]	[0.008]	[0.033]	[0.009]	[0.033]	[0.010]	[0.030]	[0.008]	[0.031]	[0.009]	[0.037]	[0.010]
Constant	10.38***	8.59***	10.33***	8.59***	10.27***	8.58***	10.32***	8.58***	10.26***	8.55***	10.24***	8.61***	10.33***	8.58***	10.28***	8.57***	10.24***	8.58***
	[0.029]	[0.207]	[0.025]	[0.207]	[0.021]	[0.207]	[0.023]	[0.208]	[0.020]	[0.208]	[0.019]	[0.210]	[0.023]	[0.207]	[0.021]	[0.208]	[0.018]	[0.208]
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.02	0.50	0.02	0.50	0.01	0.50	0.02	0.50	0.01	0.50	0.01	0.50	0.02	0.50	0.02	0.50	0.01	0.50
Observations	253,622	253,622	253,622	253,622	253,622	253,622	252,077	252,077	252,077	252,077	252,077	252,077	253,622	253,622	253,622	253,622	253,622	253,622
Panel B. Effects of new programs on entry wages.																		
New Program	-0.15***	-0.04***	-0.15***	-0.03***	-0.14***	-0.02**	-0.17***	-0.01	-0.13***	-0.01	-0.17***	-0.02	-0.19***	-0.02**	-0.18***	-0.01	-0.18***	-0.02
	[0.018]	[0.008]	[0.018]	[0.008]	[0.017]	[0.009]	[0.015]	[0.008]	[0.018]	[0.010]	[0.021]	[0.015]	[0.015]	[0.008]	[0.015]	[0.009]	[0.018]	[0.014]
Constant	13.90***	12.54***	13.88***	12.53***	13.85***	12.51***	13.88***	12.54***	13.85***	12.52***	13.84***	12.52***	13.88***	12.52***	13.86***	12.49***	13.84***	12.49***
	[0.013]	[0.559]	[0.012]	[0.557]	[0.011]	[0.557]	[0.012]	[0.560]	[0.010]	[0.563]	[0.010]	[0.563]	[0.012]	[0.554]	[0.011]	[0.555]	[0.010]	[0.557]
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
R^2	0.02	0.32	0.02	0.32	0.01	0.32	0.02	0.32	0.01	0.32	0.00	0.32	0.02	0.32	0.02	0.32	0.01	0.32
Observations	53,111	53,111	53,111	53,111	53,111	53,111	52,851	52,851	52,851	52,851	52,851	52,851	53,111	53,111	53,111	53,111	53,111	53,111

Source: Authors analysis from ICFES, National System of Higher Education Institutions (SNIES) and *Planilla Integrada de Liquidacion de Aportes-PILA-* dataset.

[a] Standard Errors Clustered by Program in Brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$.

[b] This table shows the results using different definitions of new programs. HE graduation exam refers to test scores in quantitative reasoning. Columns 1 and 5 show the full model for the HE graduation exam and entry wages using our preferred definition of the new program. In columns 2 and 6, a new program is one with the first graduate in 2004. In columns 3 and 7, we use enrollment instead of graduation to define a new program. A new program is one with the first enrolled student in 2002. Columns 4 and 8 use registration in SNIES to detect a new program. A program is new if it was registered in 2000 or later. All the specifications include the same controls. See Tables 3 and 5 for details on the set of control variables.