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

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Abstract

A rapid expansion in demand for post-secondary education triggered an unprecedented boom in higher education programs in Colombia, raising concerns about their relevance 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, it is driven by student and program selection. Using rich administrative data that match 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 by 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 codes: 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, Busso, & Muñoz, 2015). The higher education (HE) system responded rapidly to the demand surge. New HE institutions and programs flourished across the region (Ferreyra, Avitabile, Botero Álvarez, Haimovich Paz, & Urzúa, 2017). Enrollment in higher education 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, Cristia, Hincapie, Messina, & Ripani, 2017).

This rapid and often disorderly expansion in the supply of HE has raised concerns about the quality of recently created programs and institutions (Ferreyra et al., 2017). However, poor labor market outcomes of graduates from new programs and institutions are consistent with other interpretations. Increasing enrollment may have resulted in lower average quality of the marginal student accessing tertiary education. Alternatively, new institutions and programs may have expanded in areas where the 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 supply to provide new programs that are less demanding. A careful examination of the value added of new programs and institutions needs to consider both supply and demand forces.

This paper identifies how the rapid expansion in the supply of HE in Colombia affected the value added in the system and the labor market outcomes of the graduates. Colombia constitutes an excellent case study for assessing changes in the value added 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 HE programs during the same period was unprecedented: it almost doubled, from 3,600 in 2001 to 6,276 programs in 2011 (Carranza & Ferreyra, 2019). Moreover, Colombia has particularly rich administrative data that can be used to assess the heterogeneity in the value added of HE programs.

To undertake this study, we match three sources of administrative data that provide detailed information on (i) student background prior to accessing HE, including their 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 standardized test scores at the time of 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 have been shown to be crucial determinants of long-term labor market outcomes (Oyer, 2006). To our knowledge, this is the first paper to assess heterogeneity in value added and labor market prospects across HE programs in a middle-income country, where HE programs and institutions are rapidly growing.

We find that graduating from a new program, defined as a program whose first graduate completed HE in 2002 or after, results in a large learning penalty compared with graduates from an existing program. The penalty ranges from -0.2 points of a standard deviation in the written communication test of the HE graduation exam, to -0.3 points in the 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 (2016), 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 value added, measured by the standardized test scores after HE graduation, with respect 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 unconditional test score penalties of new programs can be attributed to baseline student characteristics, among which the HS exit test scores clearly stand out. Hence, a fundamental driver of the learning gap between graduates from new and existing programs can be attributed to student readiness. Students from the upper tail of the distribution of HS exit exam scores are more likely to enroll in existing programs.

The differences in wages across graduates from new and existing programs are substantial. The unconditional entry wage penalty for graduates from new programs in their first jobs is 15 percent. In our preferred specification, this wage differential narrows to 3 percent after student and program characteristics are partialled out. About 3.7 percentage points of this difference is simply related to the fact that new programs tend to be shorter (one to three years of study). Three additional aspects explain most of the selection behind the entry wage penalty of new programs: (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 paper contributes to a large 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,[2] Latin America witnessed a rapid increase in demand for tertiary education during the 2000s. At the same time, the higher education premium fell, motivating studies that tease out the relative roles of demand and supply forces (Fernandez and Messina (2018), Acosta, Cruces, Gasparini, and Galiani (2019), Messina and Silva (2021)). Changes in the quality of recent HE graduates have not been central in 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 and Lee (2011), Juhn, Kim, and Vella (2005), Walker and Zhu (2008), Carneiro, Heckman, and Vytlacil (2011), and Moffitt (2008)). Compared with previous literature, this paper disentangles the roles of supply and demand forces in the heterogeneity of the returns to HE programs.

This study is also related to a rapidly growing literature that highlights the heterogeneity in the returns to HE, and how this heterogeneity may reflect differences in value added across programs, areas of study, or student selection. For the United States, Cunha and Miller (2014) use administrative data from Texas to estimate the value added of different schools on several labor market outcomes. They find that the large differences in the returns across colleges almost disappear after accounting for student self-selection. Kirkeboen, Leuven, and Mogstad (2016) show that in Norway there are large differences in labor market returns across fields of study after accounting for institution quality and

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

[2]Fiszbein, Schady, and Ferreira (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 that is suggestive of degraded quality among recent HE cohorts.

student self-selection. In Latin America, Rodríguez, Urzúa, and Reyes (2016) and González-Velosa, Rucci, Sarzosa, and Urzúa (2015) show that there is significant heterogeneity in the returns to post-secondary education in Chile and Colombia. Our paper complements these studies by focusing on the value added of new versus existing programs in a period of rapid expansion of the HE system.

A related literature highlights the importance of institution (or program) reputation in student selection and outcomes. Hastings, Neilson, and Zimmerman (2013), Hoekstra (2009), 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, a flagship state university in the United States, and a better quality school in Colombia, on a set of final outcomes including wages. MacLeod, Riehl, Saavedra, and Urquiola (2015) also examine the case of Colombia to test how school reputation, measured by the average admission HS 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 the graduates of new HE programs are explained by differences in value added (learning) in addition to a potential reputation penalty.

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 in detail the administrative data sets used in this study. Section 4 discusses the empirical strategy. Section 5 presents the results. Section 6 concludes.

2 Background: Evolution of Higher Education in Colombia

2.1 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 were required to go through 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 certifi-

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

cation for each program, HE institutions may apply for a non-mandatory accreditation of excellence, which is more demanding and provides recognition and reputation. Less than 10 percent of the HE institutions hold this accreditation of excellence during our period of study.[5]

The HE system in Colombia is populated by four types of institutions that differ by the length and nature of the programs they may 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 post-graduate specializations, but only universities can offer master's degrees (two-year post-graduate degrees) and PhDs.[6]

Two standardized tests are relevant to the HE system in Colombia, and information on them is collected by the Institute for the Assessment of Education (*ICFES*): an HS graduation standardized test (*Saber 11*) and an 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.[7] *Saber Pro* was first administered in 2003 for some programs; however, the exam was not mandatory as a prerequisite for graduation until 2009. Between 2009 and 2012, *Saber Pro* was specific for each area of study, and hence it was not comparable across areas. Starting in 2012, the test featured three common core exams shared across all areas. These assess written communication, critical reading, and quantitative reasoning skills.[8] We refer to *Saber Pro* as the HE graduation exam.

2.2 Expansion in the 2000s

Colombia witnessed a large and rapid expansion of secondary education coverage during the 2000s, a feature shared with most Latin American countries.[9] Figure 1 shows the numbers of HS graduates and students enrolled in college between 2001 and 2011.[10] HS graduation increased by a staggering 30

[5]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 go through the traditional certification process to register a new HE program.

[6]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, graduates from *SENA* are not included in the analysis.

[7]Over 90 percent of the students who take the *ICFES-Saber 11* test graduate from HS (Angrist, Bettinger, & Kremer, 2006)

[8]Law 1324 and Decree 3963 of 2009.

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

[10]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.

percent. Similarly, college enrollment following the *SNIES* 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. We use information on graduates at the program level reported by the *SNIES* to compute the number of HE programs. A new HE program is one whose first graduates finished school in 2002 or later. 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. Figure 2 shows the evolution in the number of graduates by type of program. 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 the supply of HE was a crucial factor in the expansion of HE enrollment (Carranza & Ferreyra, 2019).

New programs were created by institutions with lower quality standards. As noted in the previous section, an HE institution could opt to have a (non-mandatory) accreditation of excellence. Almost 45 percent of the existing programs are offered by HE institutions with an accreditation of excellence, compared with 30.7 percent in the case of new HE programs. This is an indication that the recent expansion of the supply of tertiary education in Colombia may have been accomplished at the cost of the marginal program having lower quality.

We next describe the evolution of the quality of students accessing the HE system over the same period. We do not have an absolute measure of quality, as the HS exit exam is not comparable across years. Quality is instead measured by the percentile score on the HS exit exam. By construction, as the system expanded, the mean percentile score at entry declined. More importantly, as shown in Figure 3, students accessing new HE programs are of lower quality. On average, the percentile score on the HS exit exam among students in new HE programs is 5 percentage points lower than the average percentile score of students enrolled in existing programs. Thus, a careful examination of the value added of new versus existing programs needs to take into account this negative selection.

3 Data

3.1 Data sources

This study uses four data sets from three sources of administrative data, including the characteristics of all HE institutions and programs, standardized test scores of the universe of students graduating from HE, pre- and post-graduation, and labor market outcomes for the universe of HE graduates. We describe the four data sets in the following subsections.

3.1.1 Higher Education Institutions: SNIES

SNIES collects information on the HE system in Colombia. *SNIES* maintains a database of information on pubic and private HE institutions, programs within an area of study, and their degree levels. In addition, *SNIES* reports the number of students enrolled and graduated from each program every year since 2000. With these data, it is possible to identify the institution attended, degree earned, and graduation year for all students who attended HE, which is crucial for separating new and existing programs. The programs are registered in the *SNIES* database with a unique code. A program's code may change over time only if changes are introduced in the curriculum such that the program requires a new certification to operate.

3.1.2 Standardized Test Scores: *Saber 11* and *Saber Pro*

The Colombian Institute for the Assessment of Education *(ICFES)* is in charge of assessing the quality of education by performing standardized tests at different levels. In this paper, we use information from two data sets that contain information on tests administered during the last year of HS (*Saber 11*) and before graduation from an HE program (*Saber Pro*). We call these tests the HS exit exam and the HE graduation exam, respectively.

The HS exit exam evaluates the following seven subjects: biology, math, philosophy, physics, chemistry, language, and social science. The total score corresponds to an average of these seven areas. In addition to the test scores and socio-demographic characteristics of students, the HS exit exam data include an identifier for the HS attended.

The HE graduation exam is a standardized test that evaluates students in their final year of college on general and specific competences. In this paper, we examine only the general competency tests (written communication, critical reading, and quantitative reasoning). In addition to the scores on the tests and the socio-demographic characteristics of the students, *ICFES* reports the semester in which the HE graduation exam was administered, an identifier for the program attended, 55 indicators for area of study (e.g., economics, administration, civil engineering, etc.), the duration of the program, 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.

3.1.3 Formality Status and Wages-*PILA*

For the labor market outcomes, we use the *Integrated Contribution Liquidation Form (PILA)*. The *PILA* collects information on wages and economic sector for all formal workers who pay their contributions to the social security system in Colombia. This system of information has existed since July 2007, but during the first year of operation, the coverage was incomplete. Thus, we use information from the *PILA* starting in 2008 until 2011, the last year of the *PILA* to which we had access.

3.2 Merged Data Sets, Variable Definitions, and Descriptive Statistics

The Ministry of Education, in collaboration with *ICFES*, matched the four data sets described above (*SNIES*, *PILA* and the HS exit and HE graduation exams administered by *ICFES*).[11] This matching process is not trivial, because individual IDs in Colombia change at age 18, and most students take the HS exit exam before this age. The matching algorithm uses individual identifiers, exact and phonetic variations of the first and last names, date of birth, and sex to maximize the matching of individuals who can be linked between the different administrative records. [12]

To carry out the empirical analysis, we created three data sets, depending on the outcome of interest. To study the effects of a new program on HE learning, we built a data set that includes all the HE graduates who took the HE graduation exam between 2011 and 2013. We call this data set the HE graduation exam sample. To study labor market outcomes, we built two additional data sets. The first includes all the HE graduates who finished school in 2002-2003 and went on to work during 2008-2011. We use this data set to assess the effects of a new program on the probability of working as a formal wage employee. The second includes the wages of all the HE graduates who took the HS exit exam in 2002-2003 and worked in the formal labor market during 2008-2011. We use this data set to investigate the impact of a new program on formal sector entry wages and wage growth.

[11]The methodological document that describes the matching of these date sets can be downloaded from ftp://ftp.icfes.gov.co. "Metodología del Cruce de Bases ICFES (MEN)" is produced by the Oficina Asesora - Gestión de Proyectos de Investigación.

[12]To assess the representativeness of the resulting sample, we compared the distribution of the share of wage employees in our data with a similar target population in nationally representative household surveys and found them to be very similar. The results are available upon request.

Our variable of interest is an indicator variable that takes the value 1 for new programs. New programs are defined as those whose first graduate concluded HE in 2002 or later.[13] We apply the following common restrictions in the three data sets. When individuals have more than one degree, we take the highest level obtained or the one finished more recently. If an individual takes more than one HS exit exam, we use the latest test score. We restrict the age distribution to individuals who took the HS exit exam before turning 30. This is fundamentally driven by the fact that the first observation of the HS exit exam we have is in 2001. Because on average individuals take this exam at age 17, by 2013 they would have been at most age 30.

A total of 374,718 students took the HE graduation exam between the second semesters of 2011 and 2013. We match these students with information on their HS exit exam from *ICFES* and information on the HE program in which they were enrolled and the date of graduation from *SNIES*. After matching both exams and applying the sample restrictions described above, we end up with a working sample of 253,627 observations for the analysis of the HE graduation exam. In this sample, 56.5 percent of the students graduated from a new HE program.

We restrict the labor market samples to individuals who took the HS exit exam in 2002 or 2003 and later graduated from an HE institution. Because we observe labor market outcomes in 2008-2011, this restriction guarantees that we virtually have the universe of HE graduates who finished HS in these two years, avoiding potential selection bias stemming from heterogeneity in student graduation times. The labor market samples include 75,314 individuals, among whom 52.7 percent graduated from an existing HE program and 47.3 from a new HE program.

Table 1 shows descriptive statistics from the HE graduation exam sample comparing graduates from new and existing HE programs. Students who attended new programs are very similar in terms of their average age (23 years) and gender (42 percent males). But the similarities stop here. Students who attended new programs were from lower socioeconomic backgrounds. In particular, the share of high-income students (those whose families make five times the minimum wage or more) is 13 percent, compared with 22 percent for those who attended an existing program. Furthermore, only 28 percent of the parents of students attending new programs have a college degree, compared with 39 percent for 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

[13] The SNIES data set also registers the date of creation of a program. However, there is a small number of programs for which this information is missing. In section 5.3 we show that the results in the paper are very similar with alternative definitions of new programs, including the registration date in *SNIES*.

percentile in this exam in math (language) is 54 (59), compared with 62 (67) for the students who attended an existing program. This gap is shown in Figure 3.

New and existing programs also differ significantly (Table 1). 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 new programs are offered by public HE institutions, compared with 44 percent of the existing programs. Across areas of study, economics, business administration, accounting, and education sciences have higher shares in new programs. In contrast, health sciences have a lower share in new programs. The last section in Table 1 shows that graduates from new programs have lower scores on the HE graduation exam compared with graduates from existing programs. Differences in HE graduation scores range from 0.22 of a standard deviation (written communication test) to 0.33 of a standard deviations (quantitative reasoning).

Table 2 shows descriptive statistics for the samples used for the labor market analyses. In line with the results for the HE graduation exam sample, graduates from new programs also have poorer labor market outcomes. 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 being a wage employee during the first years after college is 3 percentage points lower (0.68 vs. 0.65). We also calculate for each graduate the share of years engaged as a wage employee during the period of observation, as the ratio of the number of years observed in the sample and their potential (which depends on their year of graduation). Graduates from new programs spend on average 44 percent of their labor market trajectories in the formal sector, which is 2 percentage points lower than graduates from existing programs (46 percent).

4 Empirical Strategy

Consider the following reduced-form model:

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

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.

We examine several outcomes in this study. To evaluate learning, Y_{ist} corresponds to the percentile on the HE graduation exam score. We use the scores on the three generic subjects: written communication, critical reading, and quantitative reasoning. We consider four labor market outcomes. The first two are entry wages, as measured by the monthly wage in the first job after graduation, and wage growth, measured by the growth rate of the monthly wage for those workers observed in two consecutive years in the formal sector. The last two labor market outcomes measure formal sector attachment: a dummy variable for ever working as a formal wage employee during our period of study (2008-2011), and the fraction of years holding a formal job during 2008-2011.

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. Selection based on observable student and program characteristics is tackled by a rich set of covariates, which are described in the following.

Student readiness differs across new and existing program attendees. The regressions include a flexible specification of the HS exit exam scores in seven areas of study.[14] For each of these scores, we create categorical variables for the students by decile. This flexible specification allows for potential nonlinear effects of the test scores on Y_{ist}.[15]

An additional source of student selection may be related to the socioeconomic status of the family, which may affect HE test scores and labor market outcomes later in life beyond what is captured by the HS exit exam, for instance, through credit constraints and family connections. Even if students qualify for an HE institution or program, tuition in some private universities is high in Colombia, while student loans and financial aid are fairly limited. In a context of high variability in fees across programs, household socioeconomic background is likely to shape student choice, and this prevents the HE system from being a perfect sorting equilibrium (MacLeod et al., 2015). 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.[16] In Colombia, attending a private HS is a good predictor of socioeconomic status, as there is substantial dispersion in the prices charged (Angrist et al., 2006). Moreover, attending an elite HS is an important source of networks, which may become important later in life for labor market outcomes (Zimmerman, 2019).

New programs are different from old programs. They differ in length, area of study, and HE in-

[14]The seven areas are biology, math, philosophy, physics, chemistry, language, and social science.
[15]The results are robust to different specifications, including high-order polynomials or ventiles.
[16]We include HS fixed effects for 6,276 schools in our sample.

stitution, potentially hampering comparisons of student learning and labor market outcomes. There is consistent evidence of large heterogeneity in the returns to education by major and field.[17] In this context, lower wages after graduation could reflect the concentration of programs in fields or majors with low returns and not a penalty of attending a new program. Our regressions include 55 detailed indicators of field or area of study (e.g., economics, administration, and civil engineering).

Carranza and Ferreyra (2019) find that the creation of new 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 takes four or five years to complete; technological degrees, which usually last three years; and technical/professional degrees, which are typically 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 a 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 institution, 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.[18] However, we acknowledge that there is still potential for selection based on unobservables. We discuss this possibility in detail in the robustness section (5.3).

5 Results

5.1 New Programs and Student Learning

Table 3 shows the impact of attending a new HE program on the HE graduation test. The table includes three panels that consider the following subjects on the exam: (i) written communication, (ii)

[17] See J. Altonji, Arcidiacono, and Maurel (2016) and J. Altonji, Blom, and Meghir (2012) for summaries of the literature, and Kirkeboen et al. (2016), and Hastings et al. (2013) for applications in Norway and Chile.

[18] 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.

critical reading, and (iii) quantitative reasoning. Column 1 shows differences in means for all the students with a valid HE graduation test, and column 2 restricts the sample to those students for which we have a full set of non-missing covariates. The magnitudes in the two columns are very similar. If anything, the penalty associated with new HE programs is higher in the restricted sample, ranging from -0.33 standard deviation in quantitative reasoning to -0.22 in written communication. In column 3, we add the semester of the HE graduation test and demographic characteristics, which do not alter the results significantly.

The penalty associated with new HE programs is less than a third in column 4 in Table 3, where we control for the decile of the score on the HS exit exam in biology, math, philosophy, physics, chemistry, language, and social sciences. Thus, self-selection associated with skills before accessing HE accounts for a substantial fraction of the learning gap between new and existing HE programs. However, there is still a small gap in value added between new and existing HE programs, now ranging from -0.05 standard deviation in critical reading to -0.08 in written communication. Adding family income and parental education (column 5) and a full set of HS fixed effects (column 6) further reduces the estimated impact of a new HE program but only marginally. Column 7 controls for detailed areas of study (55 dummies) and the level of degree obtained (e.g., university, technological, and technical professional). Column 8 presents the complete control set, adding HE intuition characteristics: five dummies for the type of institution attended (e.g., university, technology school, technology institution), a public institution dummy, and an indicator of the location of the school (28 region fixed effects). Thus, in column 8 we compare new and existing programs of the same duration, within the same field, obtained from the same type of institution, and in the same region. The results suggest that a small penalty persists, ranging from -0.02 standard deviation in the reading and written communication scores to -0.04 in quantitative reasoning.

We have shown that new programs carry a very small penalty in HE graduation test scores, once differences in the baseline characteristics of the students and the characteristics of the programs have been partialled out. This contrasts with the large unconditional differences, showing the importance of selection based on observable characteristics. It also increases interest in understanding the contribution of each of the covariates to the observed differences between the unconditional means and the model with a full set of control variables. The policy implications underlying the learning penalty of new programs are radically different if these are related to family background, student readiness as measured by the HS exit exam, the area of the program, or the type of institution attended.

The results appear to indicate that HS graduation tests are the main factor behind differences in HE graduation test scores, because controlling for them in column 4 in Table 3 reduces the initial coefficient of NP_i by a factor of 3 to 4, depending on the area of the exam. By contrast, the education and income of the parents and the HS attended matter much less. However, this interpretation is potentially misleading, because the sequence in which we introduce the different sets of control variables in Table 3 matters for the results. Had we included parental education or income before controlling for the HS graduation test, we would have achieved a different conclusion.

We address the sequencing problem by following Gelbach (2016). He proposes a conditional decomposition to investigate the extent to which 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. We rewrite equation (1) as follows:

$$Y_{ist} = \alpha + \beta_1 NP_i + \beta_2 C_{it} + \varepsilon_{ist}, \tag{2}$$

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

$$\beta_1^{base} - \beta_1^{full} = \Gamma\beta_2 = \delta, \tag{3}$$

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 β_1 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 (Gelbach, 2016) for the HE graduation exams. The three columns show the decomposition for each of the subjects: written communication, critical reading, and quantitative reasoning. The first row, labeled "base," shows the penalty associated with a new program as shown in column 3 in Table 3, thus 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 on learning of attending a new program conditioning on the full set of controls. 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 5 transforms the coefficients to represent the contribution of each group in percentage points of the explained penalty. Figure 5 shows that the new-program learning penalty is by an large 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 lower performance of new HE programs was predetermined at entry. Students with lower scores are more likely to attend. 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.[19]

5.2 New Programs and Labor Market Outcomes

The labor market penalty for graduating from a new 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.[20] The first row presents the so-called 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

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

[20] 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 Appendix Tables 1, 2, 3, and 4.

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.

Graduates from new programs also have a disadvantage with respect to finding a formal job. They have 2 percentage points lower probability of ever being a wage employee (column 3 in Table 5). And they spend less time in the formal sector. On average, the HE graduates in our sample spend 45 percent of their time post-graduation as formal sector employees. According to the estimates in column 4 in Table 5, graduating from a new program reduces the time working as a formal wage employee by 1.3 percentage points.

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, attending a new HE program barely affects the probability of ever being a formal worker or wage growth. Only the effect on entry wages remains statistically different from 0. However, the difference is small compared with the large unconditional wage difference, 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 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 duration of the program 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 5 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 suggests that new programs are more likely to be created in areas of study where wages have been traditionally lower. Figure 4 provides suggestive evidence along these lines. The share of new programs is extremely low in high-paying areas such as engineering and medicine. This finding aligns with a growing body of international evidence that shows the importance of fields of study for wages (J. Altonji et al., 2016; Kirkeboen et al., 2016).

Student background, which is the key determinant of differences in learning between students attending new and existing programs, plays a secondary role in the case of entry wages. The baseline quality of the student, 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. The HS attended and the socioeconomic status of the family make comparatively smaller contributions.

On wage growth (column 2 in Table 5), the duration of the program 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, the fields of study where new programs concentrate compensate lower entry wages with higher wage growth during the first years after graduation. Among the student characteristics, the HS attended stands out, explaining some 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 statistically significant at the 10% level once program and student 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.[21]

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 (-.010 of -.021) of the penalty associated with the probability of ever being a formal employee, and up to 77 percent (-.010 of -.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 rest of the penalty is explained by the HS test scores.

5.3 Robustness

5.3.1 Selection on Unobservables

Students who attend new HE programs are fundamentally different from those attending existing programs; the former are from less wealthy households, their parents are less educated, they attended

[21]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, Messina, & Uribe Barrera, 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.

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 J. G. Altonji, Elder, and Taber (2005), Oster (2016) 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.

To simplify the exposition, suppose the outcome variable Y only depends on ability and the type of HE program attended (new versus existing). 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:

$$Y = \Omega NP + \beta_1 X_1 + \beta_2 X_2 + \varepsilon. \tag{5}$$

Define the proportional selection relationship as:

$$\frac{Cov\left(X_2, NP\right)}{Var\left(X_2\right)} = \delta \frac{Cov\left(X_1, NP\right)}{Var\left(X_1\right)},$$

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 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 (2016) 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 (2016) 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 score and entry wages. 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, duration of the program, 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 highest level of education of the parents) and the score on the HS exit exam.

Moving from the partial 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 6. 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 be indicative of a relatively large omitted variable bias. However, R^2 is also moving 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 6 shows how much the unobservable characteristics will affect the coefficient of interest under different assumptions. Columns 1 and 2 show the results for the HE graduation exam for 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, and under the same set of parameters, the effect would be indistinguishable from 0. 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 0 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.

5.3.2 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 HE expansion of the 2000s, including two-year programs. We assess how robust the results are to alternative definitions. Table 7 shows robustness checks for the HE graduation exam and entry wages to different ways of defining a new program. Regressions of the test score are shown in columns 1 to 4, and columns 5 to 8 show the results for wages. To facilitate the comparisons, the preferred specifications are shown in columns 1 and 5. Columns 2 and 6 define a new graduation threshold: 2003. Next, we take enrollment as the basis for identifying a new program. In columns 3 and 7, new programs are those that had no students enrolled in 2001 or earlier. Finally, we define new programs as those that were registered in SNIES after 2000 (columns 4 and 8). The results are quantitatively similar across specifications.

5.4 Heterogeneity

5.4.1 Distributional Effects

The small wages penalty for attending a new program may hide substantial heterogeneity across the distribution. There is an emerging literature that 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 forgone earnings are considered in the analysis. However, a large fraction of students have negative returns on their investments. Similar results are obtained for Colombia (González-Velosa et al., 2015). It is possible that some of these negative returns are 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 distribution. We follow Firpo, Fortin, and Lemieux (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 6. Contrary to expectations, the penalty for attending a new program is larger in the middle of the distribution than in the tails, peaking at around the 70th percentile with an estimated penalty of -6 percent. The penalty is much lower in the bottom half of the 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 distribution.

5.4.2 Heterogeneity by Program Duration and Field

González-Velosa et al. (2015) find that the negative returns to investments in HE in Colombia are more likely to occur in areas such as education, nursing, and design, and also vary by type of institution, being much more concentrated in technical institutes than in universities. Our results from the conditional decomposition suggest that the duration of the program and area of study are important for explaining the new-program penalty on entry wages. Therefore, we explore the heterogeneity of the new-program penalty by program duration and area of study (we aggregate the 55 areas into six broad areas). Figure 7 shows the results for the HE graduation exam for the quantitative reasoning component and entry wages in the full model described in Table 5. Panel A shows heterogeneity across program duration, and panel B shows the results across areas of study.

The penalty for technical professional studies is statistically indistinguishable from 0, although the standard errors are large. Bachelor's degrees carry a penalty of 0.05 standard deviation in quantitative reasoning and 4 percent lower entry wages. In both cases, the coefficients are statistically significant. Technology degrees lie in the middle. The penalty in learning is quantitatively small and statistically insignificant, while the wage penalty is comparable in size to the penalty for undergrads.

Across areas of study, we find that math, science, engineering, and architecture are the only areas that seem to have a significant penalty in learning and entry wages. The penalty is around -.07 standard deviation in quantitative reasoning and about -7 percent in entry wages. Economics, business administration, and accounting also present a statistically significant penalty in learning (-0.05 of a standard deviation), but not in wages. The large learning penalty across technical degrees is consistent with those being the most costly to set up (J. Altonji & Zimmerman, 2019), suggesting that a rapid supply expansion of those programs is likely to come at a cost of lower quality standards. Interestingly, the lower quality of new programs in technical degrees seems to be perceived by the market, as evidenced by significantly lower entry wages.

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 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 wage penalty between the new programs and existing programs is explained by student sorting. Lower ability students, as measured by a large set of cognitive test scores administered before admission, are more likely to attend newly created programs. The remaining fraction of the differences in average test scores and wages between graduates from new and existing programs is due to the choices made by HE institutions. New programs tend to be concentrated in areas of study that 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 the value added of HE institutions and programs, so it is fundamental that information campaigns take into account differences in student characteristics across programs and institutions. 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 standard socioeconomic background characteristics of the student goes a long way in ameliorating this issue. After controlling for student socioeconomic background and test scores at entry, we find that selection based on unobservables is fairly small for plausible assumptions.

7 References

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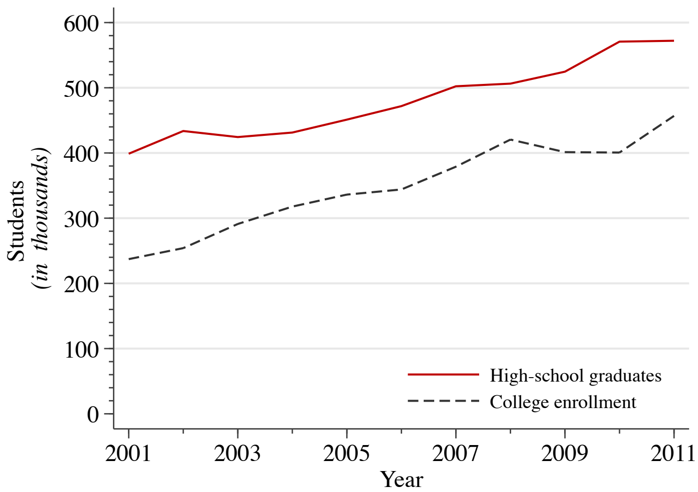
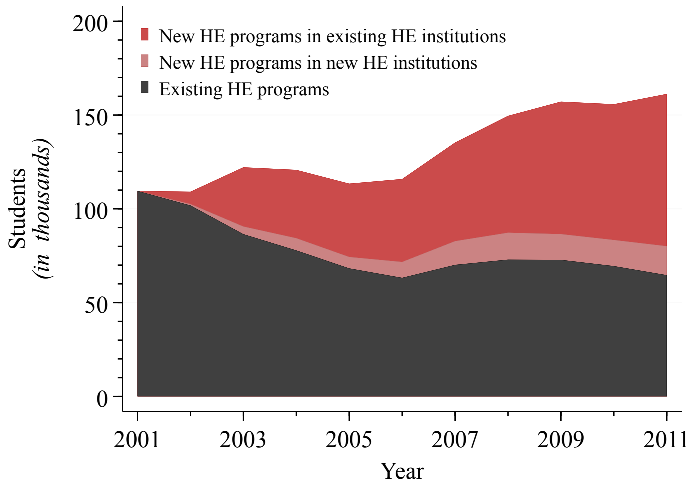
8 Figures

Figure 1: High School Graduates and the Demand for Higher Education



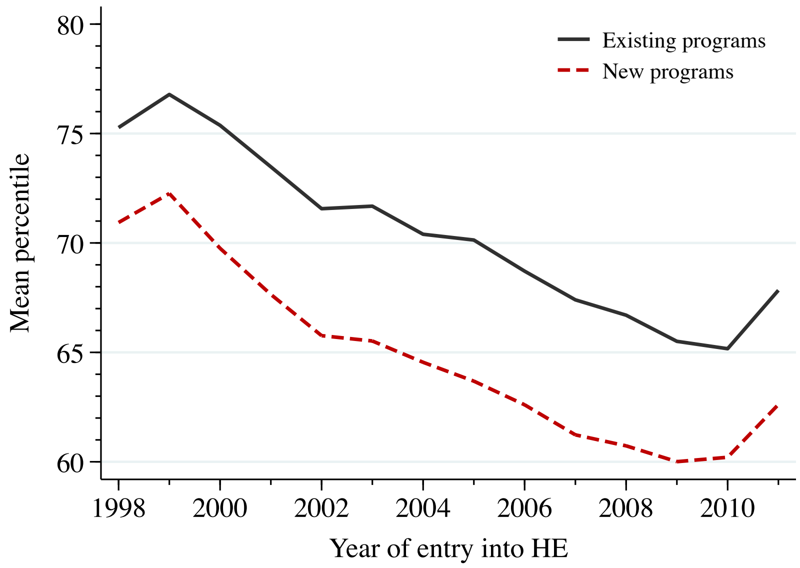
Notes: HS graduates represent the number of students taking the high school graduation standardized test, Saber 11. This test is mandatory for enrollment in higher education institutions. College enrollment represents the students enrolled in the first year of a higher education degree. We exclude the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

Figure 2: Higher Education Graduates by Program Type



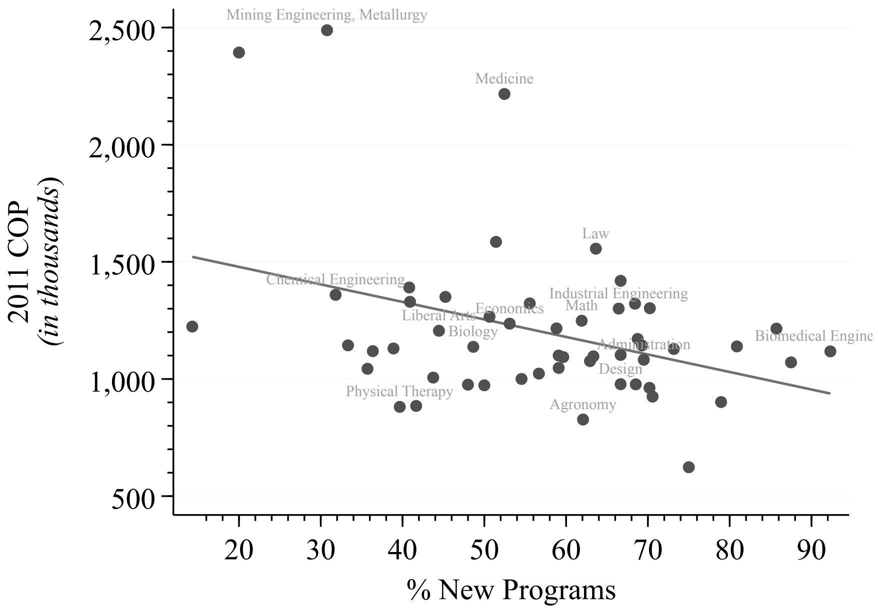
Notes: The figure shows the number of students graduating from a higher education (HE) institution, as reported in the National System of Higher Education Institutions (*SNIES*). New HE programs in existing HE institutions are those with the first graduate in 2002 or later. New programs in new institutions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

Figure 3: Higher Education Entry Test Scores by Type of Program



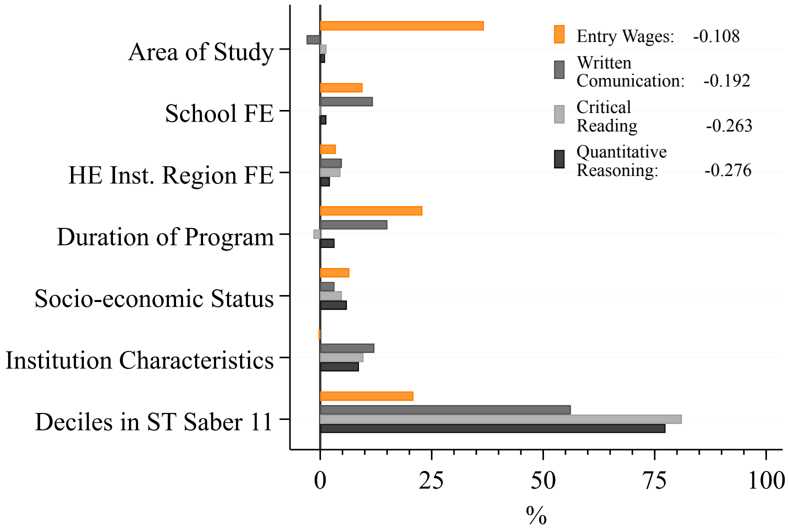
Notes: The figure shows the evolution of the mean percentile score on the high school exit graduation test for students entering the higher education (HE) system. New HE programs are those whose first graduate finished school in 2002 or later. Source: Sistema de Prevención y Análisis a la Deserción en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

Figure 4: Percentage of New Higher Education Programs by Degree vs. Entry Monthly Earnings



Note: The figure shows the relation between the entry average monthly earnings of each area of study and the share of new programs in each area of study. See section 3 in the text for details on the construction of the sample.

Figure 5: Gelbach Decomposition for the Effect of New HE Program. (% explained by each group of variables)



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.

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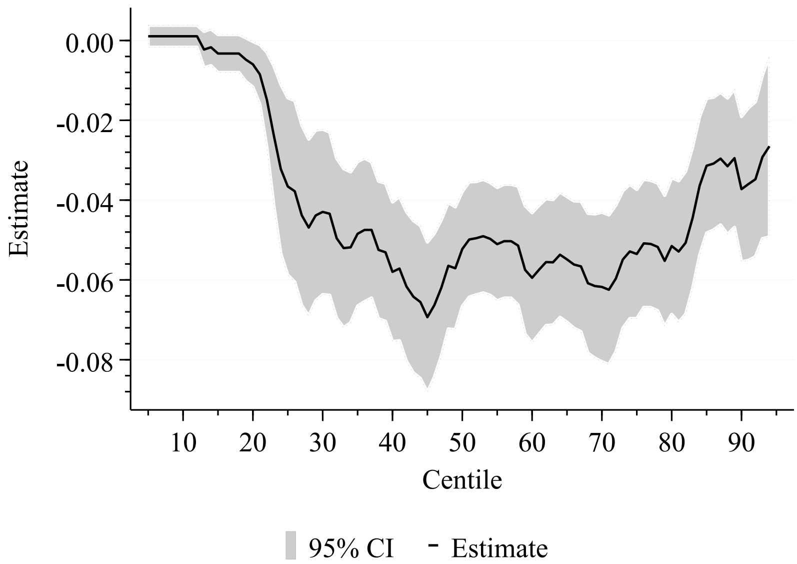
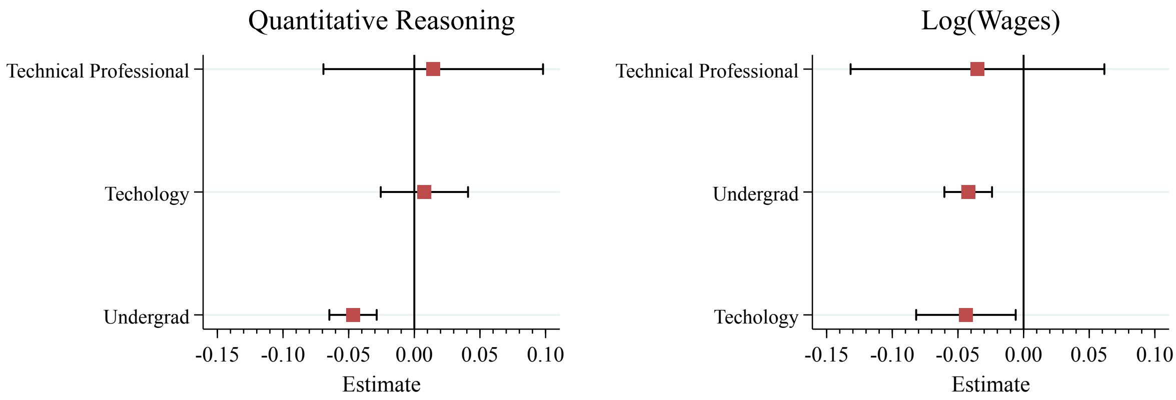
Figure 6: Unconditional Quantile Regressions for Entry Wages

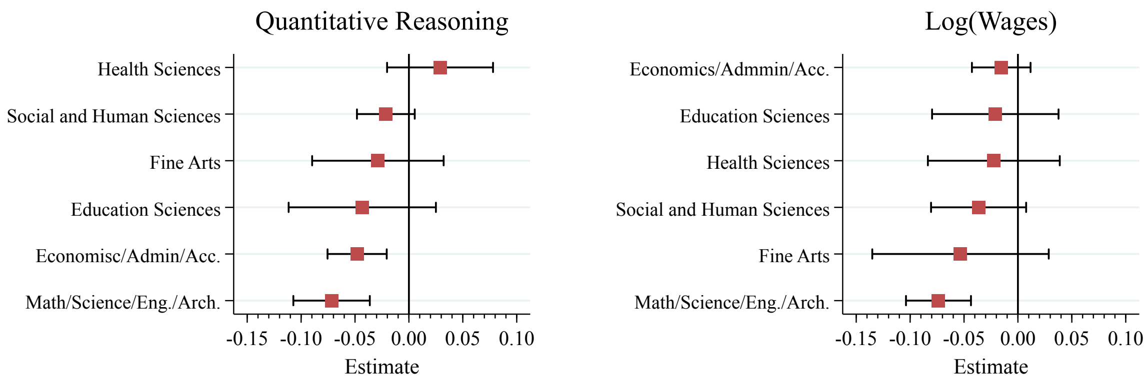


Note: The figure shows the effect of new programs on the unconditional distribution of (log) monthly wages in 2011 pesos. The solid line is the point estimate in each centile, and the grey area represents the 95 percent confidence interval.

Figure 7: Heterogeneity by Program Duration and Area of Study



A.Program Duration



B. Area of Study

Note: The dots are the coefficients of the effect of new programs on log wages (right graph) and the quantitative standardized score on the college graduation test (left graph) from a regression including only the individuals corresponding to each type of degree. Technical professional degrees usually have a duration of one year; technology degrees, two years; and undergraduate degrees, four to six years. The regression includes all the controls of the full model.

9 Tables

Table 1: Summary Statistics: Standardized Tests Sample

		Existing Program	New Program	Difference
Demographics	Age	22.92	22.93	-0.00
	Male	0.42	0.41	0.01
Income Level of the Family	Less than 2 Min. Wage	0.35	0.44	-0.08
	Between 2 and 5 Min. Wage	0.43	0.43	-0.01
	More than 5 Min. Wage	0.22	0.13	0.09
Parents' Education (max. level)	High-school drop out or less	0.21	0.29	-0.08
	Secondary complete and some college	0.40	0.44	-0.03
	College complete or higher	0.39	0.28	0.11
High School Characteristics	Academic	0.60	0.56	0.04
	Academic-Technical	0.21	0.22	-0.01
	Normalista	0.03	0.03	-0.00
	Technical	0.15	0.18	-0.02
Saber 11 (Percentiles)	Math	62.08	54.19	7.89
	Language	66.66	58.80	7.85
Type of HE Institution	Tech School	0.00	0.02	-0.02
	Technological Institution	0.02	0.07	-0.05
	College	0.16	0.25	-0.09
	Technical Professional	0.02	0.07	-0.05
	University	0.79	0.60	0.20
Public HE Institution	Public Institution	0.44	0.35	0.09
Area of Studies	Agriculture and Veterinary	0.02	0.01	0.01
	Fine Arts	0.05	0.05	0.00
	Education Sciences	0.05	0.09	-0.04
	Health Sciences	0.14	0.08	0.06
	Social and Human Sciences	0.18	0.16	0.02
	Economics, Administration and Accounting	0.26	0.33	-0.07
	Engineering, Architecture and Urban Studies	0.26	0.26	0.00
	Math and Science	0.03	0.01	0.02
Saber Pro (Score)	Written Communication	10.25	10.03	0.22
	Critical Reading	10.39	10.09	0.30
	Quantitative Reasoning	10.38	10.05	0.33
Observations		110,086	143,541	253,627

Notes: All the statistics in the table are from the sample of students from the higher education (HE) system taking the standardized test *ICFES* Saber Pro in 2011 to 2013. 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: Labor Market Outcomes

		Existing Program	New Program	Difference
Labor Market Outcomes	log of monthly income (2011 pesos)	13.91	13.76	0.15
	Change in log wages	0.17	0.15	0.02
	Formal	0.68	0.65	0.03
	Share of years as formal	0.46	0.44	0.02

Notes: All the statistics in the table are from the sample of graduates from the higher education system in Colombia between 2007 and 2011 taking the standardized test *ICFES* Saber 11 between 2002 and 2003. The number of individuals is 75,314. This corresponds to the sample of individuals with all the covariates. The wage is calculated only for the individuals with formal labor market status. Additional restrictions for the sample are discussed in the text. The difference between new and existing programs is statistically different from 0 at the 99 % confidence level. The exceptions are gender, between 2 and 5 times the minimum wage, and change in log wages, which are different from 0 at the 90 % confidence level, and secondary complete and some college, fine arts and engineering, architecture, and urban studies, which are not statistically different from 0.

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

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Written Communication Score								
New program	-0.20***	-0.22***	-0.21***	-0.08***	-0.07***	-0.06***	-0.04***	-0.02*
	[0.021]	[0.022]	[0.021]	[0.014]	[0.013]	[0.012]	[0.009]	[0.009]
Constant	10.21***	10.25***	3.35***	4.66***	5.01***	5.87***	8.35***	8.68***
	[0.017]	[0.017]	[0.381]	[0.284]	[0.275]	[0.273]	[0.244]	[0.246]
R^2	0.01	0.01	0.03	0.13	0.14	0.19	0.22	0.22
Critical Reading Score								
New program	-0.28***	-0.30***	-0.28***	-0.05***	-0.04***	-0.04***	-0.04***	-0.02**
	[0.028]	[0.028]	[0.027]	[0.011]	[0.011]	[0.010]	[0.007]	[0.007]
Constant	10.33***	10.39***	4.12***	6.38***	6.67***	6.76***	7.31***	7.79***
	[0.022]	[0.022]	[0.436]	[0.236]	[0.231]	[0.227]	[0.194]	[0.203]
R^2	0.02	0.02	0.05	0.40	0.41	0.44	0.45	0.46
Quantitative Reasoning Score								
New program	-0.30***	-0.33***	-0.31***	-0.07***	-0.07***	-0.06***	-0.06***	-0.04***
	[0.032]	[0.033]	[0.031]	[0.014]	[0.014]	[0.013]	[0.009]	[0.008]
Constant	10.31***	10.38***	5.47***	7.21***	7.35***	7.25***	8.05***	8.48***
	[0.027]	[0.029]	[0.463]	[0.247]	[0.245]	[0.244]	[0.199]	[0.207]
R^2	0.02	0.02	0.10	0.42	0.43	0.47	0.50	0.50
Exam Calendar	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Demographics	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Deciles in ST Saber 11	No	No	No	Yes	Yes	Yes	Yes	Yes
Family Inc. and Parents' Edu.	No	No	No	No	Yes	Yes	Yes	Yes
High School FE	No	No	No	No	No	Yes	Yes	Yes
Area of Study	No	No	No	No	No	No	Yes	Yes
Duration of Program	No	No	No	No	No	No	Yes	Yes
Institution Characteristics	No	No	No	No	No	No	No	Yes
HE Inst. Region FE	No	No	No	No	No	No	No	Yes
Observations	374,718	253,627	253,627	253,627	253,627	253,627	253,627	253,627

Standard errors clustered by program are in brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Notes: The Colombian examination for the quality of higher education (Saber Pro) is a standardized test measuring general abilities across degrees. The test scores have a mean of 10 and a standard deviation of 1. 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. Included controls are exam calendar: a set of dummies for the semester in which the Saber Pro was taken. Demographics: age, age2, 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.). Duration of program: 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]
Duration of Program	-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

Standard errors clustered by program are in brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Notes: 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

	(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]
Duration of Program	-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

Standard errors clustered by program are in brackets. $^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.001$. Notes: 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 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 that describe the type of area of study (e.g., economics, administration, civil engineering, etc.). *Duration of Program* 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 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: 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

Bootstrap standard errors are in brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Notes: This table shows the impact on the coefficient of new programs of potential selection on unobservable characteristics, based on Oster (2016). 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 higer 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.

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Table 7: Using Different Definitions of New Program

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	HE Graduation Exam				**Entry Wages**			
New Program	-0.04***	-0.03***	-0.01	-0.02*	-0.04***	-0.03***	-0.01	-0.01
	[0.008]	[0.008]	[0.008]	[0.009]	[0.008]	[0.008]	[0.009]	[0.009]
Constant	8.58***	8.58***	8.57***	8.57***	12.54***	12.53***	12.53***	12.48***
	[0.208]	[0.208]	[0.209]	[0.208]	[0.559]	[0.557]	[0.561]	[0.561]
Employment Region	No	No	No	No	Yes	Yes	Yes	Yes
Year and Graduation Date FE	No	No	No	No	Yes	Yes	Yes	Yes
Exam Calendar	Yes	Yes	Yes	Yes	No	No	No	No
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deciles in ST Saber 11	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Family Inc. and Parents' Edu.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
High School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Degree	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Duration of Program	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Institution Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HE Inst. Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.50	0.50	0.50	0.50	0.32	0.32	0.32	0.32
Observations	253,627	253,627	252,082	253,627	53,111	53,111	52,851	52,597

Standard errors clustered by program are in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$. Notes: This table shows the results using different definitions of new programs. Columns 1 and 5 show the full model for high school graduation exam and entry wages using our preferred definition of 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.

10 Annex

Appendix Table 1: Effect of New HE Programs on Entry Wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
New Program	-0.162***	-0.150***	-0.145***	-0.093***	-0.078***	-0.076***	-0.036***	-0.037***
	[0.018]	[0.018]	[0.016]	[0.014]	[0.013]	[0.013]	[0.008]	[0.008]
Constant	13.903***	13.898***	9.860***	10.630***	11.932***	12.485***	12.466***	12.498***
	[0.014]	[0.013]	[0.666]	[0.605]	[0.563]	[0.607]	[0.561]	[0.557]
Employment Region	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year and Graduation Date FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Demographics	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Deciles in ST Saber 11	No	No	No	Yes	Yes	Yes	Yes	Yes
Family Inc. and Parents' Edu.	No	No	No	No	Yes	Yes	Yes	Yes
High School FE	No	No	No	No	No	Yes	Yes	Yes
Area of Study	No	No	No	No	No	No	Yes	Yes
Level of Education	No	No	No	No	No	No	Yes	Yes
Institution Characteristics	No	No	No	No	No	No	No	Yes
HE Inst. Region FE	No	No	No	No	No	No	No	Yes
R^2	0.02	0.02	0.05	0.10	0.12	0.23	0.32	0.32
Observations	66,121	53,111	53,111	53,111	53,111	53,111	53,111	53,111

Standard errors clustered by program are in brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Notes: This table shows the effect of a new program on the log of real monthly wage in 2011 pesos. The wage is the reported wage in the social security records (*Planilla Integrada de Liquidacion de Aportes-PILA-*). The regressions include the students who graduated from the higher education (HE) system in Colombia between 2007 and 2011. The sample only includes the students for whom we were able to obtain their scores on the standardized test *ICFES* Saber 11 between 2002 and 2003. Individuals younger than 18 and older than 30 years and those in the army were dropped. Wages are available for employees but not for the self-employed. The included controls are year and graduation date FE: this includes a control for the year in the labor market and the year of graduation from HE. Age, age2, and gender. Percentile in the ST Saber 11: we include dummies for the decile of the student in each topic in the standardized test. The subjects evaluated are biology, math, philosophy, physics, chemistry, language, and social science. 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 categories that describe the type of area of study. (e.g., economics, administration, civil engineering, etc.).Duration of Program: dummies for technical, technological, and bachelor's diploma. The length of the program varies from one year for a technical diploma degree to five years for a standard undergraduate program. Institution Characteristics: including private or public and type of institution (technological institution, technical institution, college, university). HE Inst. Region FE: 28 dummies for the geographic location of the HE institution.

Appendix Table 2: Effect of New Programs on Change in Log Wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
New Program	-0.014	-0.015	-0.016*	-0.006	-0.004	-0.000	-0.008	-0.009
	[0.008]	[0.009]	[0.008]	[0.008]	[0.008]	[0.008]	[0.007]	[0.007]
Constant	0.161***	0.165***	-0.538	-0.246	-0.160	-0.652	0.332	0.437
	[0.006]	[0.006]	[0.592]	[0.594]	[0.591]	[0.738]	[0.746]	[0.750]
Employment Region	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year and Graduation Date FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Demographics	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Deciles in ST Saber 11	No	No	No	Yes	Yes	Yes	Yes	Yes
Family Inc. and Parents' Edu.	No	No	No	No	Yes	Yes	Yes	Yes
High School FE	No	No	No	No	No	Yes	Yes	Yes
Area of Study	No	No	No	No	No	No	Yes	Yes
Level of Education	No	No	No	No	No	No	Yes	Yes
Institution Characteristics	No	No	No	No	No	No	No	Yes
HE Inst. Region FE	No	No	No	No	No	No	No	Yes
R^2	0.00	0.00	0.02	0.02	0.02	0.18	0.20	0.20
Observations	38,702	29,593	29,593	29,593	29,593	29,593	29,593	29,593

Standard errors clustered by program are in brackets. $^{*}\ p < 0.05$, $^{**}\ p < 0.01$, $^{***}\ p < 0.001$. Notes: This table shows the effect of a new program on the log of real monthly wage in 2011 pesos. The wage is the reported wage in the social security records (*Planilla Integrada de Liquidacion de Aportes-PILA-*). The regressions include the students who graduated from the higher education (HE) system in Colombia between 2007 and 2011. The sample only includes the students for whom we were able to obtain their scores on the standardized test *ICFES* Saber 11 between 2002 and 2003. Individuals younger than 18 and older than 30 years and those in the army were dropped. Wages are available for employees but not for the self-employed. The included controls are year and graduation date FE: this includes a control for the year in the labor market and the year of graduation from HE. Age, age2, and gender. Percentile in the ST Saber 11: we include dummies for the decile of the student in each topic in the standardized test. The subjects evaluated are biology, math, philosophy, physics, chemistry, language, and social science. 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 categories that describe the type of area of study. (e.g., economics, administration, civil engineering, etc.).Duration of Program: dummies for technical, technological, and bachelor's diploma. The length of the program varies from one year for a technical diploma degree to five years for a standard undergraduate program. Institution Characteristics: including private or public and type of institution (technological institution, technical institution, college, university). HE Inst. Region FE: 28 dummies for the geographic location of the HE institution.

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Appendix Table 3: Effect of New Programs on the Probability of Being a Wage Employee

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
New Program	-0.023**	-0.028**	-0.021**	-0.011	-0.013	-0.007	-0.007	-0.007
	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]	[0.008]	[0.006]	[0.006]
Constant	0.690***	0.677***	-1.528***	-1.387***	-1.596***	-1.241**	-1.479***	-1.409***
	[0.006]	[0.006]	[0.400]	[0.398]	[0.392]	[0.420]	[0.420]	[0.415]
Year and Graduation Date FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Demographics	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Deciles in ST Saber 11	No	No	No	Yes	Yes	Yes	Yes	Yes
Family Inc. and Parents' Edu.	No	No	No	No	Yes	Yes	Yes	Yes
High School FE	No	No	No	No	No	Yes	Yes	Yes
Area of Study	No	No	No	No	No	No	Yes	Yes
Duration of Program	No	No	No	No	No	No	Yes	Yes
Institution Characteristics	No	No	No	No	No	No	No	Yes
HE Inst. Region FE	No	No	No	No	No	No	No	Yes
R^2	0.00	0.00	0.02	0.02	0.03	0.14	0.18	0.18
Observations	96,770	75,314	75,314	75,314	75,314	75,314	75,314	75,314

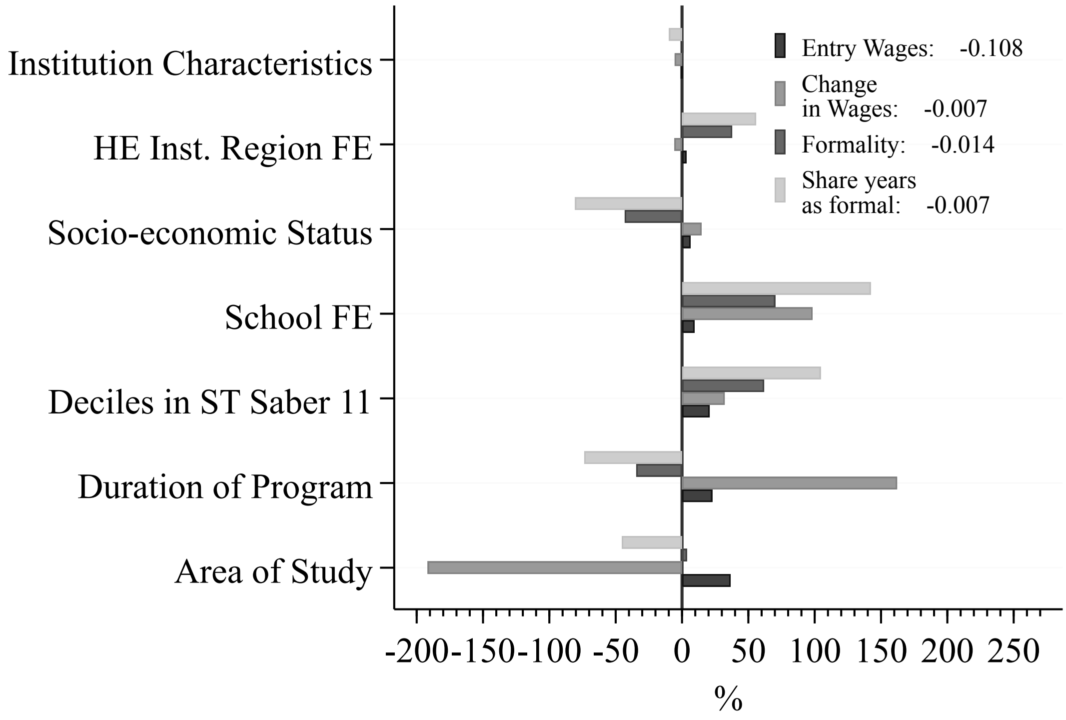
Standard errors clustered by program are in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$. Notes: This table shows the effect of a new program on the probability of ever being a formal salaried worker. The estimates in the table are the marginal effects calculated from a linear probability model with robust standard errors. The regressions include the students who graduated from the higher education system of Colombia between 2007 and 2011. The sample only includes the students for whom we were able to obtain their scores on the standardized test *ICFES Saber 11* between 2002 and 2003. Individuals in the army or those younger than 18 or older than 30 years are excluded. For details on the other set of controls, see the notes in Table 5 in the main text.

Appendix Table 4: Effect of New Programs on the Share of Years as a Wage Employee

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
New Program	-0.015*	-0.018**	-0.013*	-0.005	-0.007	-0.001	-0.005	-0.006
	[0.008]	[0.008]	[0.008]	[0.008]	[0.007]	[0.007]	[0.005]	[0.005]
Constant	0.463***	0.456***	-2.235***	-2.083***	-2.224***	-1.730***	-1.835***	-1.782***
	[0.006]	[0.006]	[0.297]	[0.296]	[0.287]	[0.303]	[0.309]	[0.308]
Year and Graduation Date FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Demographics	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Deciles in ST Saber 11	No	No	No	Yes	Yes	Yes	Yes	Yes
Family Inc. and Parents' Edu.	No	No	No	No	Yes	Yes	Yes	Yes
High School FE	No	No	No	No	No	Yes	Yes	Yes
Area of Study	No	No	No	No	No	No	Yes	Yes
Duration of Program	No	No	No	No	No	No	Yes	Yes
Institution Characteristics	No	No	No	No	No	No	No	Yes
HE Inst. Region FE	No	No	No	No	No	No	No	Yes
R^2	0.00	0.00	0.06	0.07	0.07	0.18	0.24	0.24
Observations	96,770	75,314	75,314	75,314	75,314	75,314	75,314	75,314

Standard errors clustered by program are in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$. Notes: This table shows the effect of a new program on the probability of ever being a formal salaried worker. The estimates in the table are the marginal effects calculated from a linear probability model with robust standard errors. The regressions include the students who graduated from the higher education system of Colombia between 2007 and 2011. The sample only includes the students for whom we were able to obtain their scores on the standardized test *ICFES Saber 11* between 2002 and 2003. Individuals in the army or those younger than 18 or older than 30 years are excluded. For details on the other set of controls, see the notes in Table 5 in the main text.

Appendix Figure 1: Gelbach Decomposition for the Effect of New Higher Education Programs (% explained by each group of variables)



Note: The figure shows the results from Gelbach (2016) decomposition. Each bar represents the share of the effect explained by each category. The legend on the top right shows the outcome and the explained difference. The coefficients and full decomposition exercise are in Table 5.