WORKING PAPERS

N° 1717

February 2026

"The Dynamic Market for Short-Cycle Higher Education Programs"

Juan Esteban Carranza, Maria Marta Ferreyra
and Ana Gazmuri

Toulouse School of Economics

The Dynamic Market for Short-Cycle Higher Education Programs*

Juan Esteban Carranza† María Marta Ferreyra‡

Ana Maria Gazmuri§

Abstract

We explore the dynamics of short-cycle higher education programs (SCPs) in Colombia and focus on the responsiveness of SCP supply to local economic activity and the presence of competitors. Using data from 2003 to 2019, we document a high turnover of SCPs compared to bachelor's programs. Institutions adjust their offerings by opening and closing programs; according to our estimates, SCP opening and closing in private institutions is more responsive to local economic activity than in public institutions. Institutions often open and close programs simultaneously, possibly due to capacity constraints, and seem to compete in segmented markets.

JEL codes: E24, I21

*A version of this paper was originally circulated with the title "The Supply Side of Short-Cycle Higher Education Programs," which served as a background paper for the World Bank's volume "The Fast Track to New Skills: Short-Cycle Higher Education Programs in Latin America and the Caribbean." Comments from the editors and three anonymous referees have greatly enhanced the current paper. We thank Andrea Franco, Manuela Granda, Gabriel Suarez Obando, and Nicolas Torres for excellent research assistance. We thank Marina Bassi, Rajeev Darolia, Gabriel Demombynes, Jean-Francois Houde, Armando Mendoza, Ricardo Paredes, Kevin Stange, Daniel Toro, Jaime Torrado, Sergio Urzua, and Ulrich Zachau for helpful comments and conversations, as well as participants at multiple seminars and conferences. We thank Colombia's Ministry of Education and SENA for facilitating our access to data. Ferreyra thanks The World Bank for financial support. Gazmuri acknowledges funding from the French National Research Agency (ANR) under the Investments for the Future (Investissements d'Avenir) program, grant ANR-17-EURE-0010. The views expressed in this publication are those of the authors and do not necessarily reflect the views of the World Bank, the Banco de la Republica, or the countries they represent.

†Banco de la Republica. Email: jcarraro@banrep.gov.co

‡The World Bank. Email: mferreyra@worldbank.org

§Toulouse School of Economics, University of Toulouse Capitole, Toulouse, France. Email: ana.gazmuri@tse-fr.eu

1. Introduction

Short-cycle higher education programs (SCPs) have an important role in the formation of skilled human capital. These programs, which typically last two or three years, are shorter than bachelor's programs, have a clear labor market focus, and are usually oriented toward specific occupations. They capture about a quarter of higher education students worldwide and a third in the US, where they provide associate's degrees and are mostly taught at community colleges (Ferreyra et al., 2021).[1] A growing literature shows their positive (albeit heterogeneous) returns.[2] Their ability to form skilled human capital fast and efficiently is critical at this time when much of the workforce may need upskilling or reskilling due to technological changes.

By addressing such needs, the institutions that provide SCPs can contribute to local economic development.[3] Little is known, however, about the responsiveness of SCP supply to local economic conditions. If the SCP supply is responsive, then the policymaker can trust the SCP providers to modify their supply as needed; if it is not, then the policymaker must incentivize SCP providers to adapt their supply to local needs. Thus, in this paper we study program openings and closings in the SCP market in Colombia. We document the relatively frequent opening and closing of programs and investigate institutions' decisions to open new programs and close existing ones. While program supply can also be altered by opening and closing institutions, in this paper we focus on the opening and closing of programs while taking as given the set of existing institutions.[4]

Colombia's setting is interesting for several reasons. Although SCPs only attract 9% percent of higher education students in Latin America, they attract about a third in

[1] These programs have different names in different countries. UNESCO labels them all as "short-cycle programs" and classifies them as ISCED 5.

[2] Most of the existing literature focuses on community colleges in the US and generally shows positive returns, although with significant heterogeneity across fields and institutions (Jepsen et al., 2014; Dadgar and Trimble, 2015; Stevens et al., 2019; Liu et al., 2015; Grosz, 2020). Outside the US, Aucejo et al. (2023) show large returns for Further Education Colleges (a mix of private and public institutions) in the U.K. and, on average, returns are high for most fields in Chile (Ferreyra et al., 2017) and Peru (Ferreyra et al., 2021) but less so in Colombia (Dinarte-Diaz et al., 2024; Ferreyra et al., 2021). Returns also vary depending on students' outside options, both in the US (Mountjoy, 2022) and developing countries (Ferreyra et al., 2024).

[3] In the US and Canada, a primary mission of community colleges is to respond to local economic conditions and to serve the economic and social needs of the community (Cohen and Brawer, 2003; Asian Development Bank, 2015). At the same time, community colleges are sometimes criticized for their inability to keep pace with changes in the labor market (National Academies of Sciences, Engineering and Medicine, 2017).

[4] Not only does this focus simplify our analysis; it is also consistent with the fact that, as documented in Section 3.2, most program openings take place within existing institutions.

Colombia. Unlike the US, where one type of provider—community colleges—attracts the vast majority of students, the SCP supply in Colombia encompasses a variety of institutions resulting in a rich setting to investigate market dynamics. Providers in Colombia include public and (non-profit) private higher education institutions as well as SENA (National Learning Service). The latter is a well regarded, decades-old public workforce training institution (not a higher education institution) with branches throughout the country that has only recently begun providing SCPs. Since SENA's decisions are made at the national level and outside the education domain, we focus on the program offerings by higher education institutions (henceforth, institutions) and take SENA's offerings as given. Further, Colombia boasts rich higher education and labor market administrative data. For every program, the data identifies the provider institution, field of study (e.g., business, health) and location. Program examples are graphic design technician at *Corporacion Escuela de Artes y Letras* in Bogota (in the arts field), and telecommunication and electronics technologist at *Corporacion Universitaria Centro Superior* in Cali (in the electronics and telecommunication field).

Using data from the universe of SCPs and bachelor's programs offered between 2003 and 2019, we show that that SCPs have a high turnover rate—higher, in fact, than that of bachelor's programs. In our sample, SCPs have a shorter average life than bachelor's programs, as well as higher opening and closing rates. This leads us to ask whether the SCP "churn" might respond to changes in economic activity and labor demand. *Answering this question poses two problems. First, higher education indicators are typically reported by field of study whereas economic activity indicators are reported by economic sector. Second, the correlation between the local SCP supply of programs and the local demand for SCP graduates might not be causal but driven by unobserved shocks to the local SCP market that affect both SCP supply and related economic activity.*[5]

To address these issues, we construct two measures of local labor demand for each possible field-location pair using student-level data for all higher education graduates working in the formal sector between 2007 and 2013. The first one is the local GDP by field of study, built as a shift-share variable based on national sector-level GDP and local employment shares of graduates from a field of study working in specific economic

[5]Throughout this paper, we distinguish between the local labor market for SCP graduates and the local SCP education market, which is the local education market that produces SCP graduates. We seek to study program opening and closing in the local SCP market in response to changes in the local labor market for SCP graduates, being careful not to mistake unobserved changes in the SCP education market for changes in the local labor market for SCP graduates.

sectors. The underlying assumption is that aggregate, national shocks to an economic sector (e.g., mining) affect the local demand for graduates from a specific field (e.g., arts) only to the extent to which those graduates are locally employed in the sector. The second measure is the local relative employment of field graduates, which is the share of SCP graduates from the field of interest who are working locally.

Our main finding is that SCP openings and closings are more responsive at private than public institutions, and both are more responsive than those of bachelor's programs. In terms of program opening, the greater responsiveness of private institutions is accounted for by the fact that private institutions are more likely than their public counterparts to open programs in fields where they previously had no offerings; their responsiveness is similar to public institutions in fields where they already had offerings. We also find that SCP openings by non-university institutions are more responsive than those by universities.

In terms of program closing, we find that institutions respond to positive local labor demand shocks by *closing* programs. This seemingly counter-intuitive finding is largely accounted for the fact that institutions often open and close programs in the same field and location in short succession, with private institutions again being more responsive than their public counterparts. We interpret this finding as evidence of capacity constraints: when institutions with limited capacity and resources (such as classrooms and instructors) wish to open a new program, they may need to close others in order to liberate resources for the new program. The finding that positive demand shocks create program turnover echoes well-known empirical evidence from other industries (Dunne et al., 1988) showing that positive demand shocks generate not only firm opening but also closing.

These extensive margin responses on program opening and closing are consistent with our intensive margin findings. We show that both the number of SCPs and their enrollment rise in response to a positive labor demand shock (especially on the part of private institutions), with virtually no such changes on the part of bachelor's programs.

Although we lack the data to establish why responsiveness varies across institutions and program types, based on conversations and anecdotal evidence we conjecture that private SCP providers are more responsive than their public counterparts because they are more flexibly managed and have a greater need to offer market-relevant products, as they rely almost solely on tuition revenues. In addition, public institutions may have other missions (e.g., promoting social mobility or territorial development) besides responding to local labor market needs. Similarly, non-university institutions may

be more responsive than universities because they tend to be smaller, more specialized in SCPs, and managed more flexibly than universities. The supply of bachelor's programs may be slower to adjust than that of SCPs because they are longer, more theoretical, and mostly offered by universities, which are less nimble and flexible than non-university institutions.

We also examine whether SCP openings are affected by competition. Competition measures are likely endogenous because institutions open and close programs in a location and field in response to common unobserved shocks. To tackle this issue, we build instruments for the number of competing programs using proxies of competitors' costs of opening new programs as well as SENA's budget, which is determined at the national rather than local level. We find that both public and private institutions are less likely to open programs in field-location pairs with more competitors, whether public or private.[6] In contrast, neither public nor private institutions respond to SENA's competition, possibly because SENA's programs are not viewed as close substitutes to those offered by the institutions.

Overall, our findings suggest that private SCP providers are better positioned than public SCP providers—and than bachelor's programs—to address today's rapidly changing skill needs. While public SCPs and bachelor's might be able to address them as well, they might additional financial and regulatory incentives to do it faster. Although we lack the data necessary to establish whether the SCP churn has raised or lowered average program quality in Colombia, our finding of heterogeneous responsiveness across institution types creates two policy implications for countries wishing to expand their SCP supply. First is the need to regulate SCPs in an agile fashion, without stifling their dynamism to respond to labor market needs yet carefully monitoring their quality and outcomes. Second is the role of public funding design—the more an institution's funding relates to enrollment or student labor market outcomes, the more responsive it appears to student and local labor market demand.[7]

To our knowledge, this is the first paper to investigate the dynamics of SCP supply in a developing country.[8] Even for developed economies, the literature is scarce. Cellini

[6]Our finding that opening is affected by the presence of competitors is consistent with results from the Industrial Organization literature (Mazzeo, 2002; Seim, 2006).

[7]On accountability in higher education, see Deming and Figlio (2016), Matsudaira and Turner (2020) and Cellini and Blanchard (2022). In the US, past regulations succeeded at limiting the activities of low-performing programs and institutions (Darolia, 2013; Looney and Yannelis, 2022; Cellini et al., 2020). Even if not fully implemented, the more recent Gainful Employment Rule might have provided a threat, leading many low-performing programs to close (Kelchen and Liu, 2022).

[8]Carranza and Ferreyra (2019) study the supply of bachelor's programs in Colombia. In contrast, the current paper focuses on the SCP market and the supply-side responses to economic activity and

(2009) finds that a funding increase for community colleges raises their enrollment and lowers that of for-profit schools. Nevertheless, for-profits in the US have entered growing fields much faster than community colleges (Deming et al., 2012; Armona et al., 2022). Similar to our findings on private institution's greater responsiveness to local conditions, Deming et al. (2012) and Gilpin et al. (2015) find that for-profits in the US are faster in program (or field) opening and closing than community colleges.

Studies on the relationship between SCPs and labor market conditions usually focus on students' demand for SCPs, showing higher community college enrollment during recessions (Kane and Rouse, 1999; Mullin and Phillippe, 2009; Hillman and Orians, 2013; Barr and Turner, 2015). Less is known, however, about institutions' response to the local economy or about competition among providers. Gilpin et al. (2015) study the effect of labor market conditions on enrollment and degree completion for associate's degrees in the US. In line with our results, they find a much stronger response at private than public (community) colleges. Grosz (2022) studies whether local employment changes relate to changes in the community college programs completed by students, an outcome that could be driven either by students or institutions. He finds that most of this correlation is explained by student enrollment rather than by colleges altering their capacity, which is consistent with our finding of public institutions' low responsiveness to local labor market conditions. In the context of 4-year programs, Conzelmann et al. (2023) analyze the response in the number of degrees awarded to shifts in labor demand. According to their estimates, responses are stronger in less-selective institutions, which may have more excess capacity and therefore greater ability to respond to changing student demand. Nonetheless, since enrollment or graduation are equilibrium outcomes, using them as dependent variables confounds supply and demand responses. When an institution operates below capacity, for example, enrollment changes might be completely driven by student rather than institution decisions. While we also examine effects on the number of programs and enrollment, the core of our analysis is based on supply-side measures—program openings and closings—that unequivocally capture institutions' decisions.

The remainder of the paper is organized as follows. Section 2 describes our data and institutional framework, Section 3 presents descriptive statistics, and Section 4 describes our empirical strategy. Section 5 presents the estimation results, and Section 6 concludes.

competition, which are not studied in that paper.

2. Institutional background and data

2.1 SCPs in Colombia

In Colombia, the share of higher education students enrolled in SCPs has grown substantially since the early 2000s and reached 31 percent in 2019. The most popular SCP programs confer degrees in areas such as management, logistics, culinary arts, environmental resources, information systems, auto mechanics, manufacturing processes, pharmacy administration, financial accounting, work health and safety, electromechanics, and hospitality. Based on online job postings in Colombia (Galindo and Kutscher, 2021), about a quarter of jobs require at least an SCP degree. SCP graduates are most commonly demanded for positions such as sales supervisor; engineering technologist; business operations, financial, advertising, or public relations specialist; medical diagnosis assistant; video and audio technician; web developer; network administrator; and information clerk. Most of these postings are for jobs in the departments (akin to States in the US) of Antioquia, Bogota-Cundinamarca, Valle, Santander, Bolivar, and Atlantico.

SCPs encompass technical and technological programs (two and three years long, respectively) and are provided by public institutions, private institutions, and SENA.[9] The latter—which is not a higher education institution—has provided workforce training since its inception in the 1950s, and only added SCPs to its menu of offerings in 2003. While institutions are overseen by the Ministry of Education, SENA is under the purview of the Ministry of Labor, and its central authorities are appointed by the national government. It has a dedicated funding source (payroll taxes), and its budgetary allocations are made at the national level. SENA's presence across departments reflects historical patterns that, similar to other SENA-related decisions, follow national directives and are outside the scope of the Ministry of Education.

By law, private institutions must be not-for-profit. Student tuition constitutes the vast majority of private institutions' revenue. On average, tuition at private institutions is substantially higher than at public institutions, which can subsidize tuition because they receive public funding. SENA programs are free. Academic selectivity (as measured by students' average score at their high school mandatory closing exam) is highest at public institutions, followed by private institutions and SENA (which, in

[9] Almost two thirds of SCPs in Colombia are three-years long. This is true overall, by provider type, and for most combinations of field of study and provider type. We repeated all the analyses presented here for two- and three-year programs separately, and results were practically the same for both sets of programs. Results are available upon request.

fact, does not use test scores for admission). Appendix Figure A.1 compares average tuition and student characteristics across these different institutions. As a result of tuition and admission practices, students sort across institutions. The poorest, least-prepared students attend SENA; among the remaining students, those with higher income and lower academic readiness attend private institutions.

Most institutions are in urban areas and are local, though some institutions have branches in multiple cities. None of them, however, captures more than 4% of total SCP enrollment. We focus on programs located in the country's 13 metropolitan areas, which concentrate most of the national enrollment (panel (a) of Figure 1).[10] Much of the recent SCP enrollment growth in metropolitan areas is explained by SENA (panel (b) of Figure 1). Total enrollment in public and private institutions has also risen—particularly at private institutions—albeit at a lower rate.

Since each metropolitan area is located in a different department, for brevity in what follows we use "department" or "location" to designate metropolitan areas. Table 1 shows descriptive statistics for the 13 departments of interest. It shows that, while the number of SCPs and institutions varies substantially across departments, the percentage of higher education students is about 30% in most departments. This substantial share makes it important to understand how the SCP supply responds to local labor market demands and, because the share is quite similar across departments, shows that our analysis is not driven by any one of them. Three types of institutions are allowed to offer SCPs: technological and technical institutes (allowed to offer only SCPs); technological schools (*Instituciones Universitarias*, allowed to offer short-cycle and bachelor's programs but not graduate programs); and universities (allowed to offer SCPs, bachelor's and graduate programs). Given SENA's peculiarities, in what follows we focus exclusively on the SCP supply from public and private institutions while taking SENA's supply as given.

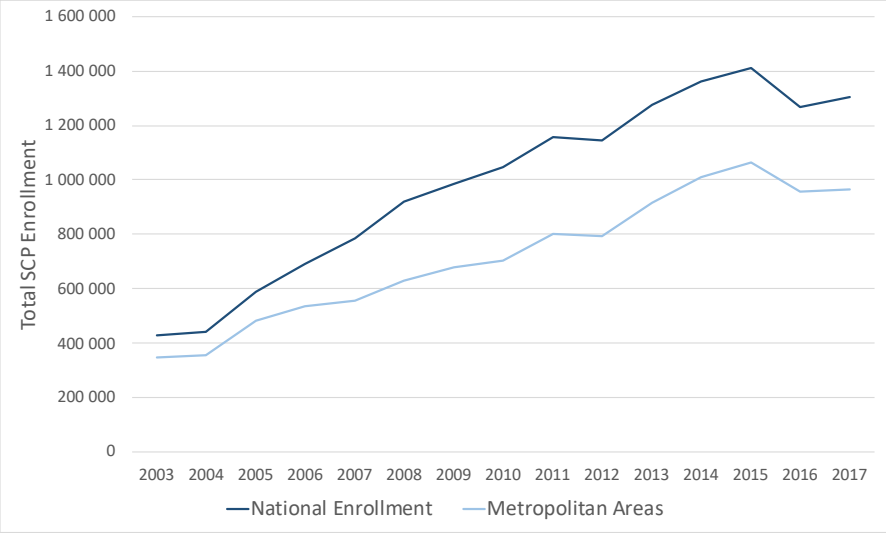
2.2 Data sources

We leverage multiple data sources. First, we use the National Higher Education Information System (SNIES), which covers the universe of bachelor's programs and SCPs. We use SNIES data between 2003 and 2019. For every program, it reports the institution, location, length, field of study, and enrollment. We define a program as

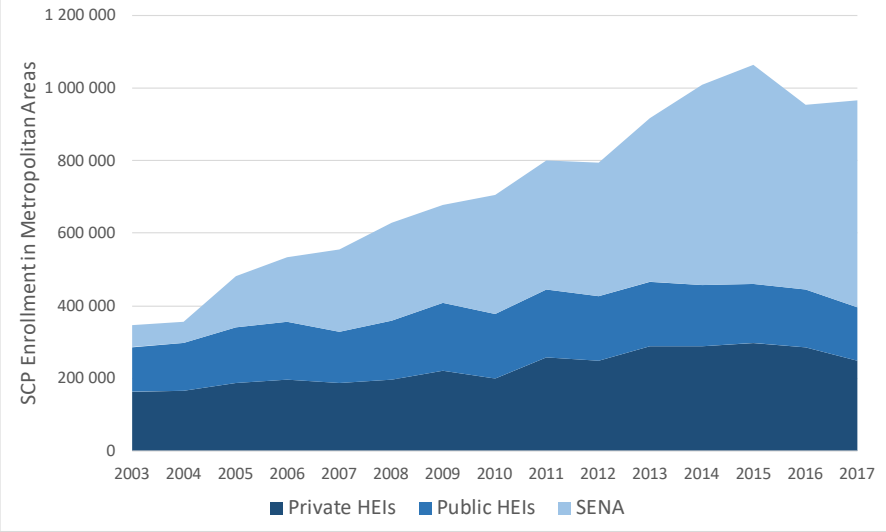
[10] We define metropolitan areas as in Duranton (2015), where municipalities are aggregated into metropolitan areas based on commuting patterns. This definition yields 13 metropolitan areas in the whole country, all of which are included in our analysis.

Figure 1: SCP Enrollment Growth in Colombia

(a) Total SCP Enrollment



(b) Enrollment in Metropolitan Areas



Note: Panel (a) shows total number of students enrolled in SCPs by year for Colombia ("national enrollment") and metropolitan areas ("metropolitan areas"). Panel (b) focuses exclusively on SCP enrollment in metropolitan areas and shows the fraction of those students enrolled in private institutions, public institutions, and SENA by year.

Table 1: SCPs by Department in Colombia

Department	Number of SCPs	Number of institutions	% Total Enrollment in SCP	% SCP Enrollment by Type of Institution			
				SENA	Technological and Technical Institutes	Technological Schools	Universities
Antioquia	371.2	44.26	40.39	64.37	4.98	23.99	6.66
Atlantico	180.24	19.82	27.54	46.36	28.58	18.83	6.22
Bogota	621.61	74.8	32.72	41.7	32.39	20.42	5.5
Bolivar	143.8	14.9	43.79	64.08	15.13	15.55	5.25
Caldas	81.94	12.49	26.7	78.12	11.22	0.88	9.78
Cordoba	57.23	9.39	22.55	84.42	11.6	1.69	2.29
Meta	71.18	13.25	29.49	79.51	12.3	7.32	0.86
Nariño	77.84	12.18	23.28	84.68	2.2	9.06	4.06
N. de Santander	106.94	12.35	20.83	61.22	22.44	0.2	16.14
Risaralda	97.46	12.31	33.84	62.99	14.88	11.03	11.09
Santander	185.16	21.52	40.6	66.41	20.54	8.08	4.96
Tolima	111.19	11.78	44.89	59.77	29.88	1.75	8.6
Valle	262.29	33.81	34.77	53.76	23.01	9.06	14.16

Note: This table displays information for Colombia's 13 metropolitan areas (designated as "departments" and identified by their department names), all of which are included in our empirical analysis. For each variable, the table shows the average between 2003 and 2019. Percentage of enrollment in short-cycle programs is relative to the department's total higher education enrollment. The last four columns correspond to the percentage of SCP enrollment by institution type (percentages add up to 100 by department).

a combination of institution, degree, and department; when an institution offers the same program in two different departments, there are two separate program codes and these count as two different programs. We exclude online programs because we cannot assign them a geographic location. Our sample, which consists of in-person programs taught in the country's 13 metropolitan areas, accounts for 73% of the national SCP enrollment between 2003 and 2019. We use SNIES to identify program openings and closings.

Second, we use the Labor Observatory for Education (OLE). For the 2007-2013 period, OLE tracks individuals who graduated from higher education beginning in 2001 and work in the formal sector. For every graduate, it reports her program of study, work location, and economic sector of work. Third, we use annual GDP data from the National Statistics Agency (DANE) between 2003 and 2019. These data are reported at the national level by economic sector. We use OLE and DANE data to build our local labor demand measures. Fourth, we use data on annual SENA budgets at the department level between 2003 and 2017 to build instruments for competition. As indicated above, SENA revenues come from dedicated payroll taxes and are allocated across departments by SENA central authorities. All monetary values are expressed in current Colombian pesos (COP).

Overall, our data includes 13 departments; 279 institutions; 3,463 SCPs; and 4,392 bachelor's programs (the latter are included for some comparisons relative to SCPs).

SNIES classifies programs into 24 fields of study; we aggregate these fields into four "field categories": Business and Social Science, Arts and Architecture, Sciences, and Engineering (the latter includes computer- and technology-related fields). Table A.1 lists all fields and field categories. We aggregate fields in this fashion to include institution x field category fixed effects in our empirical analysis. We use "field" and "field category" to denote the detailed and aggregate field classifications, respectively.

Our sample includes 312 field-location combinations (13 locations x 24 fields of study) from 2003 to 2019. An observation in our sample is an institution-department-field of study-year combination. We define the opening and closing years as the first and last year with positive freshmen enrollment, respectively. A program is considered active as long as it has positive freshmen enrollment. This is because, when institutions decide to close a program, they stop accepting freshmen but allow their current students to stay enrolled until finishing the program. We analyze openings between 2004 and 2019 and closings between 2004 and 2018 (since our last available year is 2019, we cannot tell whether a program with zero freshman enrollment in 2019 maintains it in subsequent years).

3. Descriptive statistics

3.1 Programs, openings, and closings

In our sample, 77 percent of SCPs are provided by private institutions (Table A.1, in terms of number of programs). Most SCPs are in Business and Social Sciences, followed by Engineering. Public and private institutions specialize in different fields: 51% of private institution students are enrolled in Business and Social Sciences programs, whereas an almost equal percentage (48%) of public institution students are in Engineering. This specialization pattern is consistent with the fact that public institutions, by virtue of receiving public funding, are better equipped than private institutions (which rely almost exclusively on tuition revenue) to offer high-cost programs.

In the average year, our sample includes 156 institutions providing 1,209 SCPs and features 137 SCP openings, 127 closings, and 606 institution-field-location combinations with at least one active SCP (Table A.2, top and middle panel). These combinations are important because, as described below, we examine program openings and closings on the part of institutions at the field-location level. We examine, for example, whether *Universidad del Valle* opens a health program in Cali. On average,

124 institution-field-location combinations have at least one SCP opening per year (the number is 113 for SCP closings). Since some of our analyses compare SCPs to bachelor's programs, Table A.2 includes descriptive statistics for bachelor's programs as well. Although these outnumber SCPs and are offered by a greater number of institutions, on average, bachelor's programs have about the same number of program openings as SCPs and a substantially lower number of program closings. This leads us to compare opening and closing *rates* between SCPs and bachelor's programs and to examine their turnover.

3.2 Turnover and Types of Program Openings

A distinctive aspect of SCPs is their high turnover—much higher, on average, than that of bachelor's programs. Of the SCPs offered in a year, on average 11% have opened—or closed—that year (panel A of Table 2). As expected from the previous paragraph, a lower percentage of bachelor's programs open or close per year (6% and 4%, respectively). Similarly, SCPs have a much shorter average life than bachelor's programs (6-6.5 vs. 9.5 years).[11] In our empirical analysis, we examine whether the greater "churn" of SCPs relative to bachelor's programs can be attributed to their greater responsiveness to local labor market demand.

Following Dunne et al. (1988), we look at different opening types for SCPs and bachelor's programs between 2004 and 2019 in panel B of Table 2. We distinguish between the opening of new programs at new and existing institutions;[12] among the latter, an institution may open new programs in an existing or a new location. Similarly, it may open new programs in a field where it was already operating or a new one. About 80% of openings for SCPs and bachelor's programs take place in existing locations (rows 1 and 2 of panel B); more than half of the openings take place not only in existing locations but also in existing fields (row 1).

To study openings, we must define the set of potential openings, which is the set of institution-field location-year combinations where we could potentially observe program openings. Regardless of the definition, only some potential openings become the actual openings that we observe in our data. We explore two definitions, which

[11] We compute this difference as a lower bound of the actual difference in program average life between SCPs and bachelor's programs. The reason is that, since we do not observe the opening date for programs opened before 2000, we assume they opened in 2000. This underestimates average program length for bachelor's programs *vis-a-vis* SCPs because almost half of bachelor's programs opened before 2000, relative to only 30 percent of SCPS.

[12] An institution is classified as "new" in its first year and as "existing" in subsequent years.

Table 2: Program Turnover and Types of Program Opening

	Panel A: Program Turnover		
	Private SCPs	Public SCPs	Bachelor's
Avg. Program Life (in Years)	6.1	6.5	9.5
Avg. Percent of New Progrs. per Year	11.1	11.5	6.1
Avg. Percent of Progrs. Closing per Year	11.2	8.6	4.2

	Panel B: Types of Program Openings		
	Private SCPs	Public SCPs	Bachelor's
1. Existing Institution, Existing Loc., Existing Field	63.3%	53.9%	53.1%
2. Existing Institution, Existing Loc., New Field	18.3%	25.5%	27.2%
3. Existing Institution, New Loc., Existing Field	9.7%	9.9%	10.7%
4. Existing Institution, New Loc., New Field	0.4%	0.2%	0.9%
5. New Institution	8.4%	10.5%	8.2%

Note: Averages are calculated for the 13 metropolitan areas included in the empirical analysis for 2004-2019. For a given year, the percentage of new and closing programs is relative to all programs offered that year (from 2004 to 2019 for new programs, and from 2004 to 2018 for closing programs). Panel A shows averages across years. SCPs include those offered by public and private institutions but exclude SENA programs. Panel B shows percentages relative to the total number of programs that opened across all field-location combinations and years. "Loc." indicates location. "Existing" and "new" location indicate whether the institution already operates or not, respectively, in that location at the time of opening the program.

we call *broad* and *narrow*. Under the broad definition, we assume that an institution can open programs in any location, regardless of whether it already operates there. Under the narrow definition, an institution can open programs only in the locations where it already operates. In both cases, the institution can open programs in any field). These definitions reflect different expansion strategies: in the broad definition, the institution considers opening programs even in locations where it does not currently operate (which yields 312 field-location combinations for potential openings); in the narrow definition, it only considers opening programs in locations where it already operates (which yields 24 fields for potential openings). These definitions, of course, only affect the set of potential openings; the set of actual openings is the same in both cases.

On average, we have about 4,900 potential openings per year under the narrow definition and 67,600 under the broad one (Table A.2, bottom panel). Since, as discussed above, most openings in our data happen in existing locations, we use the narrow definition in the remainder of the paper and relegate estimates for the broad definition to Appendix B.

4. Empirical strategy

4.1 General framework

To study an institution's decision to open or close programs, we focus on how it responds to local changes in economic activity and competition. Our empirical approach is based on the following equation:

$$Y^c_{jkdt} = f(Z_{kdt}, X_{jkdt}) + \varepsilon_{jkdt} \tag{1}$$

where Y^c_{jkdt} is outcome c for institution j in field k and department d at time t. Outcomes can be binary (such as opening and closing) or continuous (such as number of programs and enrollment).

When binary outcomes are modeled, equation (1) can be understood as the reduced form of a discrete choice model for institutions in a structural model of strategic interaction among institutions. We do not estimate a structural model in this paper, nor do we take a stance regarding potential objective functions for the institutions in such a model. Indeed, it would be reasonable to assume that different types of institutions have different objective functions. Private institutions, for instance, might primarily seek to attract students in order to cover their costs, whereas public institutions (or SENA, if we modeled its behavior) might pursue objectives related to geographic inclusion and social mobility.

In equation (1), the outcome variable Y is a function of field-location specific factors Z_{kdt} and control variables X_{jkdt}. Our main goal is to study the effects on outcomes of field-location level exogenous shocks to economic activity, which we denote as G_{kdt}. We also study the effects of field-location market competition, denoted as M_{kdt} (both G_{kdt} and M_{kdt} are described below). In our empirical analysis, we set $Z_{kdt} = G_{kdt}$ or $Z_{kdt} = M_{kdt}$. Control variables in X_{jkdt} include three sets of fixed effects: institution x field category, department, and year fixed effects, where the institution x field category fixed effects capture differences across institutions in their relative strength in the various field categories. The error term, ε_{jkdt}, captures unobserved idiosyncratic variation such as cost heterogeneity among institutions and fields.

When estimating (1), the main challenge is the potential correlation between ε_{jkct} and field-location level economic activity, G_{kdt}, or competition, M_{jdt}. This endogeneity could arise, for example, if shocks to the local supply of higher education induced program opening but also caused economic activity to increase in related industries.

To address this concern, we construct G_{kdt} so as to avoid correlation with unobserved factors affecting the local SCP supply, and construct instruments for M_{kdt}.

In the following subsections we describe the construction of the economic activity variables and the instruments for competition. We also describe the linear specifications of (1) for SCP opening and closing as well as our identification strategy.

4.2 Openings, closings, and economic activity

4.2.1 Construction of economic activity measures

In order to estimate the effect of economic activity shocks on program openings and closings, we construct the following two exogenous variables in G_{kdt} to capture the strength of the local labor demand for graduates from a specific field of study:

Local GDP by field. This is a shift-share variable that measures the local economic activity associated with a field of study. Since DANE reports economic activity at the industrial sector rather than the field of study level—and does so for the nation rather than individual departments—we exploit the distribution of SCP graduates' employment in the sector across fields of study and departments to estimate local measures of GDP by field. For a given year, we interact sector-level GDP at the national level with local time-invariant employment shares by field and economic sector (obtained from OLE) as follows:

$$\widetilde{GDP}_{dkt} = \sum_{s \in \mathrm{S}} (GS_{dks} * GDP_{st}) \tag{2}$$

In this expression, S is the set of economic activity sectors reported by DANE, and GDP_{st} is sector s's national GDP in year t. GS_{dks} is the time invariant share of SCP graduates who work in sector s in department d and have graduated from a field-k program, relative to all SCP graduates employed in sector s across the 13 departments:

$$GS_{dks} = \frac{\text{\# of SCP graduates from field } k \text{ employed in sector } s \text{ and dept } d}{\text{total \# of SCP graduates employed in sector } s} \tag{3}$$

To avoid a correlation between $\widetilde{GDP}_{dkt}$ and ε_{jkdt} in equation , these shares are computed using graduates from a field who work in a department regardless of where they studied, *excluding* graduates from programs offered in that department. The shares sum to one by sector when adding over all fields and departments. They are

time-invariant and are calculated by pooling all years available in OLE (2007 through 2013).[13]

Our local-GDP-by-field variable measures the local exposure of graduates from a field of study to national sector-level economic shocks. The intuition is that, while a national sector-level shock affects the sector's total demand for SCP graduates, the effect varies across departments and fields depending on their share in that demand (Bartik, 1991; Goldsmith-Pinkham et al., 2020). If much of the demand comes from a specific department and is for graduates from a specific field, then that field-location combination will be more affected by the shock than others.

Two examples can illustrate the logic of our shift-share variable. First, the manufacturing sector in Colombia experienced fast growth between 2010 and 2015, largely driven by a generalized import tariff reduction that lowered the cost of imported inputs for manufacturing. This trade shock increased manufacturing production in departments close to the coasts, such as Atlantico and Valle. In Atlantico, 25% of SCP graduates working in the manufacturing sector have a degree in Mechanical Engineering and 20% a degree in Business, which means that the manufacturing shock had a large impact on the Atlantico-mechanical engineering GDP and Atlantico-business GDP and raised the demand for SCP graduates in those fields and locations.[14] Second, the mining industry experienced sharp growth between 2006 and 2012 due to the discovery of oil fields, which increased petrochemical production in the country's major production sites, located in the Santander and Bolivar departments. In Santander, 23% of SCP graduates working in mining have a chemical engineering degree, which means that the mining shock strongly affected the Santander-chemical engineering GDP and raised the demand for chemical engineering SCP graduates in Santander.[15]

[13]While we would have preferred to have used shares from some year prior to the beginning of our sample (2003), data from OLE is only available since 2007. If we had used time-invariant shares from a single year between 2007 and 2013 rather than pooling 2007 through 2013, many of these shares would have been equal to zero for the small departments. Among the years with OLE availability, 2013 is the one for which these issues are least concerning. When we use shares for 2013 rather than pooling 2007 through 2013, results are practically the same.

[14]The labor shares mentioned in this paper were calculated using OLE.

[15]In these examples, the GS_{dks} shares are equal to 1% for Atlantico-mechanical engineering and Atlantico-business, and 2% for Santander-chemical engineering. These shares are low because they are relative to the total number of SCP graduates employed in the corresponding sector (manufacturing and mining in the first and second example, respectively), where the total is computed over all fields and departments in the country. Nonetheless, when these small shares are multiplied by the large values of national GDP by sector, GDP_{st}, we obtain values for local GDP by field, $\widetilde{GDP}_{dkt}$, that are sizable and display substantial variation over time and across sectors and fields.

While shift-share variables are often used as instrumental variables, in this paper we use them as independent variables to quantify local economic activity associated with a specific field of study.[16]

Local field relative employment. This variable measures the share of field-k graduates among all SCP graduates working in a location. Using OLE data from 2007 to 2013, we obtain the total number of SCP graduates employed in a department independently of where they studied, *excluding* graduates who studied in that department. We calculate relative employment for field k in department d and year t as follows:

$$RE_{dkt} = \frac{\#\text{ of SCP graduates from field } k \text{ employed in department } d \text{ in year } t}{\#\text{ of SCP graduates employed in department } d \text{ in year } t} \quad (4)$$

This variable captures the field's local importance (in terms of employment) relative to other fields. In the first example above, if an increasing share of workers with SCP degrees in Atlantico are mechanical engineering graduates, this indicates an increase in the Atlantico labor demand for such graduates.

The identification of institution responses to changes in economic activity hinges on the exogeneity of the local GDP by field and local field relative employment variables. The key feature of the employment shares in (2) and (4) is that they are based on graduates who work in a location rather than those who studied there, and, for greater rigor, exclude graduates who obtained their degree in the location. In other words, the shares are based on SCP graduates who obtained their degree elsewhere and moved into the department for work. If these employment shares were based on the SCP graduates who obtained their degree in the department of interest rather than those who merely work there, they could be correlated with local shocks to the SCP market and would therefore not be exogenous. And, if the employment shares included graduates who obtained their degree in the same department where they work (i.e., individuals who did not move for work), they might capture correlated shocks between the SCP and labor markets at the local level.

An additional identification concern is that the SCP markets could be interconnected across departments, in which case a shock to the SCP market in one department might affect the supply of SCP graduates working in the other department. This is rarely the case in Colombia, where most departments are separated by natural geographic barriers and workers rarely commute between metropolitan areas. The only

[16]Shift-share variables are commonly used to alleviate endogeneity problems (Bartik, 1991). For their use in the context of short-cycle programs, see Armona et al. (2022), Grosz (2022), and Conzelmann et al. (2023).

exceptions might be the department pairs of Risaralda-Caldas and Atlantico-Bolivar. As a robustness check, we conduct the main opening analyses excluding these pairs.

4.2.2 Estimating the effect of local economic shocks on program opening and closing

The analyses of program opening and closing are inherently different. The full set of potential openings is not observed, as we only observe actual openings. In contrast, the full set of potential closings is observed because any existing program can potentially close. This creates an asymmetry that complicates the comparability of opening and closing analyses. In addition, when opening a program an institution has to decide whether it will add offerings to a field where it is already operating or a new one. While opening a program entails the creation of a new product, opening a new field implies a greater degree of innovation than expanding the offer in an existing one because it requires costly activities such as developing new curricula, hiring new faculty, and deploying new infrastructure.

For these reasons, when analyzing opening decisions we adopt two approaches: a one-stage and a two-stage approach. In the one-stage approach we model the unconditional opening problem, which is the institution's decision to open a new program in any field, regardless of whether the institution already had offerings in that field or not. In the two-stage approach, the first stage models whether the institution operates in a field, and the second stage models whether the institution opens a program in an existing field. In other words, the second stage models opening conditional on being active in a field (or "conditional opening"). Since both conditional openings and closings take place in the field-location pairs where the institution already operates, they share the same set of observations and are therefore comparable.

Program opening. For the one-stage (unconditional) opening approach, we estimate the following equation:

$$\text{Opening}_{jkdt} = \alpha_G G_{kdt-1} + \alpha_t + \alpha_d + \alpha_{jf} + \varepsilon_{jkdt}, \tag{5}$$

For the second (two-stage) opening approach, we estimate the following two equations

for the first and second stage, respectively:

$$\text{Offer Field}_{jkdt} = \beta_G G_{kdt-1} + \beta_t + \beta_d + \beta_{jf} + \epsilon_{jkdt} \tag{6}$$

$$\text{Opening}_{jkdt} = \gamma_G G_{kdt-1} + \gamma_t + \gamma_d + \gamma_{jf} + \xi_{jkdt}. \quad \text{if Offer Field}_{jkdt} = 1 \tag{7}$$

In equations (5)-(7), Opening_{jkdt} is an indicator for whether institution j opens any new program in field k, department d, and year t; and $\text{Offer Field}_{jkdt}$ is an indicator for whether institution j offers field k in department d and year t. Although both (5) and (7) model institution j's decision to open a new program in k, d, and t, (5) allows for program openings in any field—including those where the institution does not yet operate—whereas (7) focuses on program openings in a field conditional on the institution already operating in it. Subscript f refers to the field category encompassing field k.[17] We refer to equations (5), (6) and (7) as unconditional opening, field participation, and conditional opening regressions respectively.

In all our regressions, the explanatory variables are lagged to account for the fact that it takes institutions time to open or close programs in response to market conditions. When opening programs, for instance, institutions need time to develop the curricula, recruit faculty, set up infrastructure, and obtain authorization from the regulatory authority. All our specifications include vectors α, β, and γ of year, department, and institution x field category fixed effects, respectively. This last set of fixed effects captures time-invariant characteristics specific to an institution and field category that may influence opening and closing decisions, such as the institution's reputation in a field category.[18]

In these equations, our determinant of interest is G_{kdt-1}, which addresses the following thought experiment. Consider, for instance, an increase in the local demand for veterinary graduates in Cali. Will a local institution open new programs in veterinary in response to this increased demand, holding other things constant? Our estimation answers this question and investigates whether the answer varies depending on program and institution type.

One last caveat is in order. Our opening and closing analyses are conducted at the

[17] While the strict notation for field category would be $f(k)$, we slightly abuse notation and simplify it to f.

[18] In the dependent and independent variables in this and other regressions, field k refers to the 24 fields listed in Table A.1 while field category f refers to the four *aggregate* field categories from that table. We use institution x field category fixed effects (rather than institution x field fixed effects) for a more parsimonious model and because some institution-field combinations have very few openings and closings.

(institution, field, location, year) level rather the (institution, program, year) level. For example, we do not examine whether *Politecnico Grancolombiano* opens or closes the Financial Specialist program in the business field in Bogota—or how many programs it opens or closes—but whether it opens or closes *any* program at all in this field-location. Opening and closing are therefore decisions on the extensive margin; in Section 5.3 we include evidence on the intensive margin for number of programs and enrollment.

Program closing. The analysis of closing decisions is analogous to that of conditional opening in (7). The estimating equation is

$$Closing_{jkdt} = \eta_G G_{kdt-1} + \eta_t + \eta_d + \eta_{jf} + \nu_{jkdt} \tag{8}$$

where $Closing_{jkdt}$ is an indicator for whether institution j closes any existing program in field k, department d, and year t; G_{kdt} is defined as above, and η is a vector of coefficients and fixed effects. We reiterate that the set of observations used to estimate closing decisions is the same as that for conditional opening decisions.

To better understand program turnover, we analyze simultaneous opening and closing decisions. We estimate the same specification as in (8) but change the dependent variable to $OpeningAndClosing_{jkdt}$, which is an indicator of whether the institution opens and closes programs in the same field and department within a two year period.[19]

4.3 Program opening and competition

We analyze how unconditional opening decisions respond to competition by estimating the following regression:

$$Opening_{jkdt} = \alpha_M M_{jkdt-1} + \alpha_t^M + \alpha_d^M + \alpha_{jf}^M + \varepsilon_{jkdt}^M \tag{9}$$

where $Opening_{jkdt}$ is defined as above and α^M is a vector of coefficients and fixed efects. The three variables in M_{jkdt} quantify the competition faced by institution j in field k, department d, and year t; they include the number of programs offered in that field, department, and year by each of the following provider types (excluding the own institution, j): public institutions, private institutions, and SENA.[20] The number of competing programs is endogenous by definition, as all institutions are likely to

[19]Some programs change their SNIES code but not their name. We filter out these cases and do not include them in our analysis.

[20]These numbers do not include the programs offered by the own institution j.

respond to the same unobserved market shocks.

To address this endogeneity, we construct four instruments for M_{jkdt}. The first three draw on the fact that institutions tend to open programs in locations where they already operate (Table 2 panel B, rows 1 and 2), presumably because opening costs are lower than in new locations. For instance, if public institutions had offered a large number of programs in Bogota in 2004, they would have had the infrastructure required to open additional programs in Bogota in later years. Therefore, we use the number of programs offered by public institutions, private institutions, and SENA in department d in the baseline year of 2004 as an opening cost proxy for each provider type and interact them with local GDP by field, as we expect competition to matter more in markets with greater economic activity. The interactions give the instruments variation over time and across fields. For institution j in department d, field k, at time t, the three instruments are constructed as follows:

$$IV^{H}_{jdkt} = \#\text{ of Prog}^{H}_{-j,d,2004} \cdot \widetilde{GDP}_{dkt-1} \tag{10}$$

where $\#$ of $\text{Prog}^{H}_{-j,d,2004}$ is the total number of programs offered in 2004 by *other* providers of type H (public institutions, private institutions, and SENA) in department d. Institutions' local presence and infrastructure in 2004 are arguably predetermined and uncorrelated with later supply-side shocks, while local economic activity by field is exogenous by construction.

Our fourth instrument for the number of competing programs is SENA's budget by department and year. The assumption is that local SENA budgets are uncorrelated with ε^{M}_{jkdt}, conditional on controls. This instrument is valid because SENA's budget allocations are largely a political matter and are determined at the national rather than local level. We make the caveat that, since we do not observe local SENA budgets by field, our fourth instrument varies over time and across departments but not across fields.[21]

Table 3: Descriptive Statistics for the Variables Used in Regression Analyses

Panel A: Opening Regressions		
	Mean	Std. Dev.
1. Indicator for New SCP - Unconditional	0.023	0.148
2. Indicator for Offering Field - Unconditional	0.137	0.344
3. Indicator for New SCP - Conditional	0.164	0.371
4. GDP by field - Unconditional	4.33	9.55
5. GDP by field - Conditional	9.24	16.44
6. Local field Relative Employment - Unconditional	0.048	0.072
7. Local field Relative Employment - Conditional	0.111	0.110
8. Number of SENA SCPs - Unconditional	12.12	9.45
9. Number of Private SCPs - Unconditional	16.37	16.46
10. Number of Public SCPs - Unconditional	3.94	2.96

Panel B: Closing Regressions		
	Mean	Std. Dev.
11. Indicator for Closing an SCP	0.222	0.416
12. GDP by field	9.24	16.44
13. Field Relative Employment	0.111	0.110

Note: This table presents the mean and standard deviation for the variables used in the main regressions in the empirical analysis for SCP opening and closing. Panel A shows the variables used in the opening regressions (for 2004-2019) and panel B the variables used in the closing regressions (for 2004-2018). Number of observations (total over all years): 68,654 for unconditional entry in panel A, 9,696 for conditional entry in panel A; and 9,042 for closing in panel B. In each panel, an observation is an institution-field-department-year, anddependent and independent variables are in the top and bottom portions, respectively. GDP by field is measured in billions of COP, and the number of competing programs is expressed in tens of programs.

4.4 Summary statistics

Table 3 shows summary statistics for the variables utilized in our opening and closing regressions (panels A and B, respectively). On average, only 2.3% of all possible institution-location-field combinations exhibit program opening (row 1, unconditional sample) whereas 13.7% of all those possible combinations are active and contain program offerings (row 2, unconditional sample). Among active combinations, 16.4% exhibit program openings (row 3, conditional sample) and 22.2% program closings (row 11).

In the unconditional sample, on average a field captures 4.8% of the local employment of SCP graduates and is associated with a local GDP of approximately 4.3 billions of Colombian pesos (rows 6 and 4, respectively). In the conditional sample, these figures change to 11.1% (row 7) and 9.2 billions of Colombian pesos (row 5), respectively.

[21] While our instruments are predictive of the number of competing programs for an institution in a specific field-location market, there are no available instruments (at least, not to our knowledge) for the number of competing programs conditional on the institution already participating in a market. Given the lack of instruments for conditional opening or closing, we only analyze the impact of competition on unconditional program opening.

In other words, institutions seem more likely to have offerings in field-location combinations with greater labor demand On average, an institution considering whether to open a new program in any field in an existing location faces considerable competition—16.4 competing programs offered by private institutions, 3.9 by public institutions, and 12.1 by SENA (rows 8-10).[22]

5. Results

5.1 Openings and local economic activity

Table 4 presents the estimates of Equations (5)-(7), which show the relationship between an institution's decision to open a program in a field-location market and the market's local economic activity, as measured by the local GDP by field and field relative employment variables. Although we focus on the opening and closing of SCPs, we show estimates for bachelor's programs as well for comparison's sake. Columns 1 to 3 show estimates from regressions using the local GDP by field measure, lagged one year. Columns 4 to 6 show estimates from regressions using the local field relative employment measure, also lagged one year. Columns 1 and 4 correspond to SCPs in private institutions, columns 2 and 5 to SCPs in public institutions, and columns 3 and 6 to bachelor's programs. To facilitate the interpretation and discussion, we report the elasticity of opening probability with respect to local GDP by field and local field relative employment, evaluated at the sample means, and use it as our responsiveness measure in the discussion that follows.[23] We focus our discussion on the estimates using GDP by field because this variable is available for the entire 2004-2019 period whereas local field relative employment is only available for 2007-2013.

Panel A presents unconditional opening estimates, which show a significant effect oflocal economic activity on SCP openings. This result is important because it shows that both public and private institutions adjust their SCP supply to exogenous changes in economic activity, even over relatively short periods of time. Nevertheless, the degree of responsiveness is much higher for private than public institutions, as illustrated by the corresponding elasticities. A 1%-increase in local economic activity in a field raises

[22]The summary statistics presented in Table 3 pertain to the narrow definition of potential openings because those are our preferred results. The number of observations, and hence the summary statistics, are different for the broad definition because the number of potential openings is higher.

[23]These elasticities are reported in the bottom row of each panel. Given our linear specifications, the elasticities are estimated as $\alpha_G \cdot \bar{G}/\overline{opening}$, where $\bar{G}$ and $\overline{opening}$ represent the mean of the regressor of interest and dependent variable, respectively.

the probability that an institution opens a program in that field by 0.47% among local private institutions but only 0.12% among local public institutions. Since our estimates control for institution x field category fixed effects, they are not driven by differential patterns of field specialization between public and private institutions. The responsiveness of bachelor's programs to local economic activity is similar to that of public SCPs—namely, substantially lower than that of private SCPs. All qualitative patterns regarding elasticities are robust to the use of local field relative employment instead of GDP by field.

Panel B shows the two-stage opening estimates. Panel B1 shows estimates for field participation and panel B2 for conditional opening. These regressions illuminate the extent to which program opening is driven by the decision to open new fields rather than opening new programs in existing fields. The estimated elasticities from panel B1 are quantitatively similar to those from panel A. Given the inclusion of institution x field category fixed-effects, these estimates reflect changes in field offerings within an institution and field category over time. For example, in the field category of Engineering, *UniMinuto* in Cali might enter the Electronic and Telecommunications field in response to an increase in local economic activity related to this field. According to our estimates, private institutions are more responsive in terms of field opening than public institutions (elasticities are equal to 0.31 and 0.11, respectively).

In contrast, panel B2 shows that private and public institutions are similarly responsive when opening a new program in an existing field. According to our estimates, their probability of opening a new program in an existing field rises by about 0.15% in response to a 1% increase in local economic activity in the field. Therefore, the mechanism that makes private institutions more responsive than public institutions is their greater likelihood, compared to public institutions, of opening new fields. If we view the opening of a new field as innovation and the opening of a new program in an existing field as specialization (in the field), we can conclude that public and private institutions are equally likely to specialize through their program openings yet private institutions are more likely to innovate.

The fact that private institutions are more responsive to local labor demand than public institutions does not mean that public institutions do not open new programs. As Table 2 and the "Mean of Dependent Variable" rows of Table 4 show, public and private institutions have very similar program opening rates. Instead, our estimates imply that program openings on the part of public institutions are less responsive than those of private institutions to a particular driver—local labor market demand—

though they might be more responsive to other drivers. While we lack detailed data to investigate alternative drivers, we hypothesize these may be related to the mission, funding, governance, and management of the institutions.[24] For example, while both public and private institutions may have the goal of responding to labor market needs, public institutions may have additional goals related to equity and inclusion and may place a relatively lower weight than private institutions on responding to labor market needs. In terms of funding, private institutions do not receive public funding and must therefore offer programs relevant to the local economy in order to attract students and obtain tuition revenue, whereas the public funding received by public institutions might not be related to local labor market needs or program enrollment. In search of program relevance, private institutions might interact more than public institutions with local employers when selecting their offerings. And, since private institutions typically have a leaner, more agile governance than public institutions, they are better positioned to respond swiftly to changing labor market needs. Bachelor's programs, in turn, are at best as responsive as SCPs from public institutions.[25]

We further explore heterogeneous responsiveness to local labor market demand by estimating separate opening models for the three institution types that provide SCPs. Appendix Table A.3 shows the corresponding estimates. Columns 1 and 2 show estimates for technological and technical institutions, columns 3 and 4 for technological schools, and the last two columns for universities. The estimates using local GDP by field show that the responsiveness of technological and technical institutes (which specialize in SCPs) and technological schools (offering SCPs as well as bachelor's programs) is quite similar and higher than that of universities (which teach the full spectrum of degrees, ranging from SCPs to PhDs). As is the case when comparing public and private SCP providers, these differences are larger in the unconditional opening and field offering decisions than in the conditional opening decision. Patterns are less clear using local field relative employment, probably because local field relative employment

[24] In principle, different capacity constraints across institutions could help explain the variation in their responsiveness. It is not clear, however, what effect these constraints would have. On the one hand—as we discuss in the analysis of simultaneous openings and closings below—capacity constraints might be the reason why institutions simultaneously open and close programs in a given field, in which case capacity constraints would lead to greater responsiveness. On the other hand, public and private institutions have similar likelihoods of opening new programs—as discussed above—which suggests that capacity constraints have similar effects on them (if they have an effect at all). We believe, then, that the factors outlined in the text above are more likely than capacity constraints to explain differences in responsiveness, although a final conclusion cannot be reached without capacity data.

[25] In public institutions, leadership bodies often include faculty, staff, and student representatives, and decisions are made in a highly consultative manner involving committees and voting. In contrast, private institution governance and decision-making are usually more corporate, executive, and faster.

only covers a subset of sample years.

We conjecture that non-university institutions are more responsive to local economic conditions than universities because they are more specialized in SCPs and their institutional setup is simpler, leaner, and more executive than that of universities. Anecdotal evidence indicates that, relative to universities, non-university institutions are in closer contact with the private sector and operate more flexibly. Because they supply not only SCPs but also bachelor's and, in some cases, PhD programs, universities lack such flexibility. Based on conversations with university leaders, universities that offer both SCPs and bachelor's programs struggle to manage the two very different sets of students and faculty involved in the two program types. In addition, universities' ability to alter their offerings is limited by their fixed costs, which are higher than for non-university institutions.[26]

In the Appendices we present robustness checks. In Appendix Table A.4 we address the identification concern related to interconnected locations. We exclude the Risaralda-Caldas and Atlantico-Bolivar department pairs, which are arguably highly connected. Results are almost identical to those for the full sample. In Appendix B, Tables B.1 and B.2 replicate Tables 4 and 7, respectively, using the broad definition of potential openings. Results are qualitatively similar to those using the narrow definition.

[26]We find similar patterns when looking separately at public and private institutions for each of the three institution types. Results are available upon request.

Table 4: Program Opening and Economic Activity

	Priv. SCP	Pub. SCP	Bach.	Priv. SCP	Pub. SCP	Bach.
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Unconditional opening - Dep. Var.: Indicator for Opening a New Program						
GDP by Field (lagged)	0.0023***	0.0009***	0.0007***			
	(0.0002)	(0.0003)	(0.0001)			
Relat. Empl. (lagged)				0.4548***	0.3354***	0.1866***
				(0.0461)	(0.0743)	(0.0307)
Constant	0.0149	-0.0335*	0.0222	-0.0354***	0.0213	-0.0003
	(0.0288)	(0.0154)	(0.0211)	(0.0102)	(0.0276)	(0.0078)
N. of Observations	52,699	15,955	89,559	11,097	3343	18905
Mean of Dep. Var.	0.02	0.03	0.02	0.02	0.03	0.02
Elasticities	0.47	0.12	0.14	0.89	0.53	0.45
Panel B: Two-stage Opening Analysis						
Panel B1: Field of Study Offering - Dep. Var.: Indicator for Offering a Field						
GDP by Field (lagged)	0.0094***	0.0045***	0.0062***			
	(0.0002)	(0.0006)	(0.0002)			
Relat. Empl. (lagged)				2.0132***	1.4367***	1.4259***
				(0.0704)	(0.1145)	(0.0577)
Constant	0.1936***	0.0293	0.9115***	0.2255***	-0.0134	0.9500***
	(0.0413)	(0.0415)	(0.0192)	(0.0445)	(0.0169)	(0.0450)
N. of Observations	52,699	15,955	89,559	11,097	3,343	18,905
Mean of Dep. Var.	0.14	0.16	0.23	0.16	0.17	0.26
Elasticities	0.31	0.11	0.11	0.62	0.41	0.27
Panel B2: Opening Cond. on Offering the Field - Dep. Var.: Indicator for Opening a New Program						
GDP by Field (lagged)	0.0023***	0.0046***	-0.0001			
	(0.0004)	(0.0017)	(0.0002)			
Relat. Empl. (lagged)				0.3152***	0.4520*	0.0613
				(0.1062)	(0.2511)	(0.0481)
Constant	0.1811	0.5406**	0.0574	-0.0845	0.9730**	-0.0110
	(0.1139)	(0.1873)	(0.0354)	(0.1256)	(0.3552)	(0.0562)
N. of Observations	7,165	2,531	20,819	1,731	569	4,887
Mean of Dep. Var.	0.16	0.17	0.09	0.16	0.18	0.08
Elasticities	0.15	0.14	-0.01	0.23	0.23	0.07

Note: Panel A reports the unconditional opening analysis, where the dependent variable is an indicator for whether institution j opens a new program in department d and field k in year t. The number of observations includes all potential openings under the narrow definition, i.e., all institutions that have existing campuses in a given department. The unit of observation is an institution-field-department-year combination. GDP by field is measured in billions of COP and relative employment is between zero and one; both variables are included with a one-year lag. Panels B1 and B2 present the two-stage opening estimates. In Panel B1, the dependent variable is an indicator for offering the field; in Panel B2, the dependent variable is an indicator for opening a new program conditional on offering the field. In panel B1, the observations are the same as in panel A. In panel B2, the number of observations includes only existing combinations of institution-field-department-year. All regressions include department, year, and institution x field category fixed effects. *,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.

5.2 Closings and local economic activity

In our closing analysis, the unit of observation is an institution-field-department year conditional on the institution having had at least one program in that field-department combination. Closing estimates are directly comparable to those of conditional openings (panel B2 of Table 4) because they use the same set of observations.

Panel A in Table 5 shows the estimates of equation (8). As in the opening regressions, we find a *positive* correlation between closings and economic activity both for private and public SCPs, though exit coefficients for public SCPs are less precise than for private SCPs. Mirroring the conditional opening elasticities, closing elasticities are higher for private than public SCPs, and higher for SCPs than bachelor's programs. When using local GDP by field (columns 1 through 3), for private institutions closing elasticities are in the same range as conditional opening elasticities (0.11 v. 0.15), and similarly for public institutions (0.07 v. 0.11). Since conditional opening elasticities are slightly higher than closing elasticities, local positive demand shocks seem to have a positive net effect on the number of SCP offerings.

While it makes sense that an institution would open a program in response to a positive labor demand shock, it is counter-intuitive that it would also close programs in those circumstances. Upon further investigation, we find that 47% of program closings are accompanied by program openings by the same institution, in the same location and field, within a two-year window. Therefore, we examine whether such episodes of simultaneous openings and closings are associated with local economic activity.

Panel B in Table 5 shows estimates for regressions where the dependent variable is the indicator $OpeningAndClosing_{jkdt}$.[27] We find positive and significant coefficients for private and public SCPs (elasticities are equal to 0.27 and 0.20, respectively). For bachelor's programs, coefficients are not statistically significant. In other words, in response to positive demand shocks institutions not only open some SCPs but also close others, thereby contributing to program turnover or "churn."[28] This echoes well-known results from other industries (Dunne et al., 1988) where positive demand shocks lead not only to firm opening but also closing, thereby creating firm turnover. We interpret this finding as evidence of institutions' capacity constraints—when seeking

[27] Although this variable looks at simultaneous opening and closing within a two-year period, estimates are similar for a one-year window. Results are available upon request.

[28] For instance, in 2018 the *LCI Technological Foundation* closed Technologist in Fashion Design and opened Technologist in Photography and Digital Imaging (both in Bogota, in the Arts field), and in 2006 the *Latin American University Corporation* closed Professional Technician in Executive Assistantship and opened Professional Technician in Human Resources Administration (both in Atlantico, in the Business field).

to open new (perhaps more modern) programs, given their limited resources (e.g., infrastructure and faculty) institutions may need to close existing programs to obtain resources for the new ones.

To summarize, both private and public institutions open and close programs in a field-location market in response to an increase in market economic activity. In terms of openings, private institutions are more responsive than public institutions—mostly because they are more likely to open new fields—and non-university institutions are more responsive than universities. Both public and private universities open and close programs simultaneously in response to positive demand shocks, which we interpret as evidence of capacity constraints. Bachelor's programs, in turn, are less responsive than SCPs, both in terms of program opening and closing .

Table 5: Closing Decisions and Economic Activity

	Priv. SCP	Pub. SCP	Bach.	Priv. SCP	Pub. SCP	Bach.
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Closing Decisions - Dep. Var.: Indicator for Closing a Program						
GDP by Field (lagged)	0.0027***	0.0033*	0.0003			
	(0.0005)	(0.0017)	(0.0002)			
Relat. Empl. (lagged)				0.3281***	0.2937	0.0780*
				(0.1088)	(0.2509)	(0.0417)
Constant	0.0025	0.6401***	0.0546*	-0.0459	0.7028***	-0.0855*
	(0.1144)	(0.2181)	(0.0300)	(0.0741)	(0.2360)	(0.0456)
N. of Observations	6,703	2,339	19,267	1,731	569	4,887
Mean of Dep. Var.	0.175	0.138	0.058	0.142	0.104	0.0433
Elasticities	0.16	0.12	0.04	0.27	0.26	0.16
Panel B: Simult. Opening and Closing - Dep. Var.: Opening and Closing within a Two-Year Period						
GDP by Field (lagged)	0.0026***	0.0041**	0.0002			
	(0.0004)	(0.0014)	(0.0001)			
Relat. Empl. (lagged)				0.3212***	0.4231*	0.0618
				(0.0904)	(0.2049)	(0.0317)
Constant	-0.0016	0.6746**	0.0357	-0.0827*	0.9905***	-0.0353
	(0.0513)	(0.2265)	(0.0229)	(0.0382)	(0.0261)	(0.0321)
N. of Observations	6,703	2,339	19,267	1,731	569	4,887
Mean of Dep. Var.	0.088	0.089	0.029	0.072	0.065	0.018
Elasticities	0.31	0.23	0.05	0.52	0.59	0.30

Note: Each column presents the coefficients from an OLS regression. The unit of observation is an institution-field-department-year combination. The number of observations is slightly less than in the conditional opening analysis in Table 4, panel B2, because it includes one fewer year, as we do not observe which programs close in the last year of our dataset. All regressions include department, year, and institution x field category fixed effects. *,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.

5.3 Number of programs and enrollment

The previous subsections have examined opening and closing decisions at extensive margin. We now turn to the intensive margin, as we expect that changes in field-level local economic activity would also affect how many programs are offered and how many students enroll in them. Although student enrollment is an equilibrium outcome—depending both on institutions' and students' decisions—enrollment estimates provide evidence on the intensity of market responses.

We examine the effects of local economic activity on the number of programs and enrollment in Table 6. The dependent variable is the number of programs and enrollment (panels A and B, respectively) by institution, field, department, and year. The set of observations is the same as in the conditional opening and closing analyses (panel B2 of Table 4 and Table 5). Since we include institution x field category fixed effects, we interpret the coefficients as changes at the institution x field category level.

We find that the number of programs offered by an institution in a field-location market rises with an increase in local economic activity, both at private and public institutions (panel A of Table 6). This net growth in program number is consistent with our estimates showing stronger unconditional opening than closing responses to local economic activity (section 5.2). The elasticity is greater for private than public institutions (as with openings), and the elasticity for bachelor's programs is close to zero.

Enrollment rises as well in private and public SCPs in response to a local demand increase for graduates in the field (panel B of Table 6), as in Grosz (2022). Consistent with the opening responses, the enrollment elasticity with respect to labor demand changes is higher for private than public institutions (0.42 v. 0.16, respectively). Enrollment elasticities are larger than opening elasticities because they account for additional students at *all* programs—both new and existing, not just new. [29]

To summarize, both public and private institutions respond to an increase in local demand by field by opening new programs and closing existing ones. On balance, this results in an increased supply of programs in the market. Local demand shocks elicit a response not only on the part of institutions but also on the part of students, who respond through enrollment decisions. In all cases, responses are larger at private than public institutions, and for SCPs than bachelor's programs.

[29] The enrollment increase may not just be a student response but also a capacity response on the part of the institution, which might increase the number of seats available in a market. Even in this case, we would not observe an enrollment increase if students did not take the additional seats.

Table 6: Number of Programs and Enrollment

	Priv. SCP	Pub. SCP	Bach.	Priv. SCP	Pub. SCP	Bach.
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Number of Programs						
GDP by Field (lagged)	0.051***	0.038***	-0.004***			
	(0.004)	(0.009)	(0.001)			
Relat. Empl. (lagged)				6.930***	5.773***	1.036***
				(0.695)	(0.996)	(0.196)
Constant	0.411**	-2.227**	5.015***	-0.669**	-2.194	4.714***
	(0.182)	(1.125)	(0.084)	(0.296)	(1.671)	(0.212)
N. of Observations	7,165	2,531	20,819	1,731	569	4,887
Mean of Dep. Var.	1.97	1.77	1.69	1.94	1.75	1.67
Elasticities	0.28	0.11	-0.02	0.42	0.30	0.06
Panel B: Enrollment						
GDP by Field (lagged)	10.13***	14.77***	-4.84***			
	(1.04)	(3.49)	(0.49)			
Relat. Empl. (lagged)				1378.1***	1870.9***	144.1
				(170.5)	(685.2)	(107.5)
Constant	-462.6***	-2017.4***	2227.9***	-621.2***	-4392.2***	2227.7***
	(58.5)	(677.6)	(55.1)	(128.7)	(1254.3)	(121.8)
N. of Observations	7,165	2,531	20,819	1,731	569	4,887
Mean of Dep. Var.	257.1	474.9	590.1	292.4	556.7	602.9
Elasticities	0.42	0.16	-0.06	0.55	0.31	0.02

Note: Each column presents the coefficients from an OLS regression. In Panel A, the dependent variable is the number of programs offered by institution j in department d and field k in year t; in panel B, it is the total enrollment in that institution, department, field and year. In both panels, the unit of observation is an institution-field-department-year combination. The set of observations is the same in as the conditional opening analysis in Table 4, panel B2. GDP by field is measured in billions of COP and relative employment is between zero and one; both variables are included with a one-year lag. All regressions include department, year, and institution x field category fixed effects. *,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.

5.4 Openings and competition

Table 7 shows estimates for equation (9). We base our analysis on the same set of observations as in the unconditional opening sample (panel A of Table 4). We present estimates with and without instruments. Instruments are constructed as described in section 4. Columns 1 and 3 present OLS estimates; we expect these to be upward-biased because the number of competing programs is likely correlated with unobserved shocks in the error term.

Columns 2 and 4 present 2SLS estimates using our instruments (first-stage regressions are shown in Table A.5 of the Appendix). At the bottom of Table 7, we present the statistics for weak instruments and over-identification tests for the 2SLS estimates. The instruments are much stronger for private than public institutions but the weak identification test is safely above the critical values for both institution types.

Table 7: Opening Decisions and Competition

Dependent Variable: Indicator for Opening a New Program				
	Private institutions		Public institutions	
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
N. of Private SCPs (lagged)	-0.003***	-0.168***	0.002**	-0.130***
	(0.001)	(0.016)	(0.001)	(0.049)
N. of Public SCPs (lagged)	0.001	-0.078*	-0.015***	-0.111***
	(0.001)	(0.046)	(0.003)	(0.031)
N. of SENA SCPs (lagged)	0.000	0.001	0.002***	0.011*
	(0.000)	(0.005)	(0.001)	(0.007)
Constant	-0.013	2.320***	0.143***	2.516***
	(0.010)	(0.449)	(0.040)	(0.628)
N. of Observations	49,848	45,195	14,688	13,271
Mean of Dep. Variable	0.0196		0.0240	
Weak identification test:				
Kleibergen-Paap rk Wald F stat		99.2		12.4
Overidentification test:				
Hansen J statistic		15.51		0.26

Note: Each column presents coefficients from a regression where the dependent variable is an indicator for whether institution j opens a new program in department d and field k in year t (field can be new or existing). The independent variables are the market number of SCPs offered by private institutions, public institutions, and SENA. The unit of observation is an institution-field-department-year combination. All regressions include controls for institution relative size in the department and field relative size in the institution, plus year, department, and institution x field category fixed effects. Columns (1) and (3) show OLS estimates, and columns (2) and (4) show the corresponding 2SLS estimates. The endogenous variables are the number of SCPs offered by private institutions, public institutions, and SENA. Instruments are the number of programs offered by each provider type in 2004 interacted with lagged GDP-by-field and SENA's budget for the department and year. Variables indicating number of programs are measured in tens. All explanatory variables are included with a one-year lag.*,**, and *** denote significance at the 10, 5 and 1% levels. Standard errors are clustered at the institution-year level.

As expected, the 2SLS coefficients on the number of private and public competitors are all negative and much larger, in absolute value, than the OLS estimates. Two main patterns stand out. First, both private and public institutions respond to the presence of competitors, whether public or private. Based on the 2SLS coefficients, the probability of a private institution opening a new SCP falls by about 17 (8) percentage points in response to ten additional programs taught by private (public) institutions. Similarly, the probability of a public institution opening a new program falls by about 13 (11) percentage points in response to ten additional programs taught by private (public) institutions. The second pattern emerging from Table 7 is that neither public nor private institutions respond to SENA's competition. Findings are robust to using the broad definition of potential openings, as shown in Appendix B (Table B.2).

These estimates suggest that public and private institutions behave as typical competitors, in that the presence of competing programs in a field-location market—whether offered by institutions of the same type or not—discourages openings in that

market. Neither public nor private institutions, however, respond to the presence of SENA's programs in the market. For decades, SENA has provided vocational training programs (lasting only a few weeks or months) and only started offering SCPs in the early 2000s. As a result, students might perceive SENA's SCPs differently from those provided by higher education institutions. In addition, SENA is regulated by the Ministry of Labor rather than the Ministry of Education and has a dedicated funding source (payroll taxes), all of which might affect its programs' content and delivery. Because SENA is fundamentally different in these ways, higher education institutions might not view it as a competitor.

6. Conclusion

This paper studies the opening and closing of SCPs in Colombia between 2003 and 2019. We show that these programs exhibit high turnover rates—higher, in fact, than traditional bachelor's programs. We build measures of local labor demand for each field of study-location pair, and find that the greater "churn" of SCPs relative to bachelor's programs is due to the greater responsiveness of their program opening and closing decisions to local labor demand changes. Private SCP providers are more responsive than their public counterparts, mostly because they are more likely to open programs in new fields where they had no previous offerings. We also find that institutions not only open new programs in response to positive local labor demand shocks but also close existing ones, a fact mostly accounted for by the fact that institutions often open and close programs within the same field in short succession, probably reflecting capacity constraints.

Our analysis of opening responses to the presence of competitors, suggests that SCP providers compete in highly segmented markets, where SENA programs are not viewed as close substitutes for those offered by higher education institutions.

Two important caveats are in order. First, due to data limitations, we cannot study the impact of opening and closing decisions on the distribution of program quality. Ideally, these decisions would contribute to raising average program quality, though we cannot assess whether this is the case. Second, also due to data limitations we cannot study alternative mechanisms the institutions might use to respond to local labor demand, such as curriculum revisions and training upgrades. It is likely, however, that the same institutions that open and close programs, update their offer in those ways as well by virtue of being innovative, thereby creating a correlation between the observed

and unobserved responses to local labor demand. If this is the case, our analysis is indicative of institutions' overall responsiveness to local economic shocks.

Our finding of greater responsiveness among private than public institutions is consistent with evidence for the US, where private (for-profit) institutions tend to show stronger and more flexible responses than community colleges. This consistency might raise the concern that, although private institutions in Colombia are not-for-profit, they might still behave in ways that are detrimental to student outcomes, as has been the case with some for-profit institutions in the US.[30] Although, as explained above, we cannot establish the impact of SCP turnover on the distribution of program quality, recent estimates of SCP value added in Colombia to academic and labor outcomes (Dinarte-Diaz et al., 2024) indicate that, on average, the value added of SCPs provided by private institutions is not significantly different from that of public institutions, controlling for covariates such as program duration, age, institution's size and field specialization, and city size.

All in all, our results indicate that, given their responsiveness to local labor market demand, SCPs are seemingly well positioned to respond to today's rapidly changing skills demand, particularly relative to bachelor's programs and especially at private institutions. The greater responsiveness of private institution might be due to their almost total reliance on tuition revenue, which forces them to offer market-relevant products, and to their flexible manamagent, which allows for fast decisions on program offerings. To the extent that this conjecture is correct, it indicates the need to fund and regulate higher education institutions and programs to maximize their responsiveness to changing local conditions without sacrificing their quality and value added to the students.

References

Armona, L., Chakrabarti, R., and Lovenheim, M. F. (2022). Student debt and default: The role of for-profit colleges. *Journal of Financial Economics*, 144:67–92.

Asian Development Bank (2015). *The role of community colleges in skills development: Lessons from the Canadian experience for developing Asia.* Asian Development Bank, Mandaluyong City, Philippines.

[30]Despite their nimbleness, for-profits have been controversial in the US because they cost more yet generate lower earnings, higher debt, and lower repayment rates than comparable programs at other institutions, even after controlling for confounding factors. See, for instance, Armona et al. (2022), Cellini and Turner (2019), and the references therein.

Aucejo, E., Hupkau, C., and Ruiz-Valenzuela, J. (2023). Where versus what: College value-added and returns to field of study in further education. *Journal of Human Resources*, 58(5):1–51.

Barr, A. and Turner, S. (2015). Out of work and into school: Labor market policies and college enrollment during the great recession. *Journal of Public Economics*, 124:63–73.

Bartik, T. J. (1991). *Who benefits from state and local economic development policies?* W.E. Upjohn Institute for Employment Research.

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

Cellini, S. R. (2009). Crowded colleges and college crowd-out: The impact of public subsidies on the two-year college market. *American Economic Journal: Economic Policy*, 1(2):1–30.

Cellini, S. R. and Blanchard, K. J. (2022). Using a high school earnings benchmark to measure college student success. implications for accountability and equity. *Post-secondary Equity and Economics Research (PEER) Project Report*.

Cellini, S. R., Darolia, R., and Turner, L. J. (2020). Where do students go when for-profit colleges lose federal aid? *American Economic Journal: Economic Policy*, 12(2):46–83.

Cellini, S. R. and Turner, N. (2019). Gainfully employed? assessing the employment and earnings of for-profit college students using administrative data. *Journal of Human Resources*, 54(2):342–370.

Cohen, A. M. and Brawer, F. B. (2003). *The American community college*. John Wiley & Sons.

Conzelmann, J. G., Hemelt, S. W., Hershbein, B., Martin, S. M., Simon, A., and Stange, K. M. (2023). Skills, majors, and jobs: Does higher education respond? Working Paper Series 31572, National Bureau of Economic Research.

Dadgar, M. and Trimble, M. J. (2015). Labor market returns to sub-baccalaureate credentials: How much does a community college degree or certificate pay? *Educational Evaluation and Policy Analysis*, 37(4):399–418.

Darolia, R. (2013). Integrity versus access? the effect of federal financial aid availability on postsecondary enrollment. *Journal of Public Economics*, 106:101–114.

Deming, D. J. and Figlio, D. (2016). Accountability in US education: Applying lessons from K–12 experience to higher education. *Journal of Economic Perspectives*, 30(3):33–56.

Deming, D. J., Goldin, C., and Katz, L. F. (2012). The for-profit postsecondary school sector: Nimble critters or agile predators? *Journal of Economic Perspectives*, 26(1):139–64.

Dinarte-Diaz, L., Ferreyra, M. M., Melguizo, T., and Sanchez-Diaz, A. (2024). The value added of short-cycle higher education programs to student outcomes: Evidence from colombia. *Economics of Education Review*, 101:102563.

Dunne, T., Roberts, M. J., and Samuelson, L. (1988). Patterns of firm entry and exit in US manufacturing industries. *The RAND Journal of Economics*, pages 495–515.

Duranton, G. (2015). Delineating metropolitan areas: Measuring spatial labour market networks through commuting patterns. *The Economics of Interfirm Networks*, 4:107–133.

Ferreyra, M. M., Avitabile, C., Álvarez, J. B., Paz, F. H., Urzúa, S., et al. (2017). *At a Crossroads: Higher Education in Latin America and the Caribbean*. The World Bank.

Ferreyra, M. M., Dinarte, L., Urzua, S., and Marina, B. (2021). *The fast track to new skills: Short-cycle higher education programs in Latin America and the Caribbean*. The World Bank.

Ferreyra, M. M., Galindo, C., and Urzúa, S. S. (2024). Labor market effects of short-cycle higher education programs: Lessons from Colombia. Working Paper Series 30178, National Bureau of Economic Research.

Galindo, C. and Kutscher, M. (2021). Online job vacancies and short-cycle programs in latin america. Technical report, Background paper for The Fast Track to New Skills: Short Cycle Higher Education Programs in Latin America and the Caribbean, World Bank.

Gilpin, G. A., Saunders, J., and Stoddard, C. (2015). Why has for-profit colleges' share of higher education expanded so rapidly? Estimating the responsiveness to labor market changes. *Economics of Education Review*, 45:53–63.

Goldsmith-Pinkham, P., Sorkin, I., and Swift, H. (2020). Bartik instruments: What, when, why, and how. *American Economic Review*, 110(8):2586–2624.

Grosz, M. (2020). The returns to a large community college program: Evidence from admissions lotteries. *American Economic Journal: Economic Policy*, 12(1):226–253.

Grosz, M. (2022). Do postsecondary training programs respond to changes in the labor market? *Journal of Human Capital*, 16(4):461–487.

Hillman, N. W. and Orians, E. L. (2013). Community colleges and labor market conditions: How does enrollment demand change relative to local unemployment rates? *Research in Higher Education*, 54(7):765–780.

Jepsen, C., Troske, K., and Coomes, P. (2014). The labor-market returns to community college degrees, diplomas, and certificates. *Journal of Labor Economics*, 32(1):95–121.

Kane, T. J. and Rouse, C. E. (1999). The community college: Educating students at the margin between college and work. *Journal of Economic Perspectives*, 13(1):63–84.

Kelchen, R. and Liu, Z. (2022). Did gainful employment regulations result in college and program closures? *Education Finance and Policy*, 17(3):454–478.

Liu, V. Y., Belfiel, C. R., and Trimble, M. J. (2015). The medium-term labor market returns to community college awards: Evidence from North Carolina. *Economics of Education Review*, 44:42–55.

Looney, A. and Yannelis, C. (2022). The consequences of student loan credit expansions: Evidence from three decades of default cycles. *Journal of Financial Economics*, 143(2):771–793.

Matsudaira, J. and Turner, L. J. (2020). Towards a framework for accountability for federal financial assistance programs in postsecondary education. *The Brookings Institution*.

Mazzeo, M. J. (2002). Product choice and oligopoly market structure. *RAND Journal of Economics*, 33(2):221–242.

Mountjoy, J. (2022). Community colleges and upward mobility. *American Economic Review*, 112(8):2580–2630.

Mullin, C. M. and Phillippe, K. (2009). Community college enrollment surge: An analysis of estimated fall headcount enrollments at community colleges. Policy Brief 2009 01PBL, American Association of Community Colleges.

National Academies of Sciences, Engineering and Medicine (2017). *Building America's skilled technical workforce*. National Academies Press.

Seim, K. (2006). An empirical model of firm entry with endogenous product-type choices. *The RAND Journal of Economics*, 37(3):619–640.

Stevens, A. H., Kurlaender, M., and Grosz, M. (2019). Career technical education and labor market outcomes evidence from California community colleges. *Journal of Human Resources*, 54(4):986–1036.

Online Appendix A: Additional Tables and Figures

Table A.1: Distribution of Programs by Field

Field	Number of SCPs (1)	% Enrollment (2)	% Enrollment (Public) (3)	% Enrollment (Private) (4)
Business and Social Sciences	**1,657**	**43.9**	**37.17**	**51.1**
Business	1,037	29.0	18.46	33.43
Social Sciences	252	6.3	10.16	6.40
Economics	176	4.9	3.84	5.46
Accounting	192	3.7	4.71	5.80
Arts and Architecture	**454**	**10.4**	**5.95**	**15.29**
Arts	423	9.6	4.46	14.57
Architecture	31	0.8	1.49	0.72
Sciences	**163**	**5.7**	**8.80**	**3.46**
Health	99	4.3	3.72	2.60
Agronomy and Veterinary	42	0.8	3.22	0.60
Math and Natural Sciences	22	0.6	1.86	0.26
Engineering	**1,189**	**40.1**	**48.09**	**30.16**
Systems	450	11.8	9.67	14.01
Electronic and Telecommunications	231	6.8	9.67	5.76
Industrial	173	8.1	6.32	4.59
Mechanical	106	4.8	6.20	2.11
Electrical	50	1.6	4.46	0.53
Environmental and Sanitary	45	2.4	1.98	1.09
Civil	30	1.5	2.60	0.34
Biomedical	10	0.5	0.62	0.19
Agribusiness and Food	19	0.2	0.99	0.41
Chemical	17	0.7	0.99	0.34
Agronomic and Livestock	9	0.1	0.50	0.19
Agriculture and Forest	6	0.1	0.62	0.04
Administrative	3	0.0	0.00	0.11
Mining and Metallurgy	2	0.2	0.25	0.00
Other engineering	38	1.3	3.22	0.45
Total Number of SCPs:	**3,463**			
Public institutions	807			
Private institutions	2,656			

Note: This table presents information by field of study. Column 1 shows number of short cycle programs per field; columns 2, 3 and 4 show percentage of SCP enrollment by field (overall, in public institutions, and in private institutions respectively). SENA programs are not included. Columns 2, 3, and 4 each sum up to 100. Fields are aggregated into four "field categories" (shown in boldface). Number of programs is the count of distinct programs that are offered during the sample period (2003-2019); percentages of students by field are computed based on sample period totals.

Table A.2: Opening and Closing

	SCPs	Bachelor's Programs
Avg. Number of Programs Offered per Year	1,208.7	2,239.3
Avg. Number of New Programs per Year	136.6	136.4
Avg. Number of Closed Programs per Year	127.0	90.6
Avg. Number of Institutions Active per Year	155.7	176.4
Avg. Number of Institution-Field-Depts per Year Offering at least One Program	606.3	1,314.6
Avg. Number of Institution-Field-Depts with at least One New Program per Year	123.6	144.1
Avg. Number of Institution-Field-Depts with at least One Closing Program per Year	112.8	107.1
Avg. Number of Potential Openings per Field-Dept under Narrow Definition per Year	4,921.2	6,987.9
Avg. Number of Potential Openings per Field-Dept under Broad Definition per Year	67,586.7	67,967.4

Note: This table presents the average, over all years from 2003 to 2019, for variables associated with opening and closing. SCPs and Bachelor's programs include those provided by public and private institutions. SENA programs are not included. "Dept" stands for "department".

Table A.3: Program Opening and Economic Activity: Responses by Institution Type

	Technological and Technical Institutes		Technological Schools		Universities	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Unconditional Opening - Dep. Var.: Indicator for Opening a New Program						
GDP by Field (lagged)	0.0028***		0.0020***		0.0005**	
	(0.0003)		(0.0002)		(0.0002)	
Relat. Empl. (lagged)		0.5961***		0.4512***		0.1952***
		(0.0725)		(0.0685)		(0.0541)
Constant	-0.0638**	-0.1570***	-0.0005	0.0193	-0.0228*	-0.0255
	(0.0277)	(0.0519)	(0.0094)	(0.0219)	(0.0123)	(0.0202)
N. of Observations	25,476	5,324	26,086	5,360	17,092	3,756
Mean of Dep. Var.	0.03	0.04	0.02	0.02	0.01	0.01
Elasticities	0.44	0.77	0.39	0.90	0.13	0.68
Panel B: Two-stage Opening Analysis						
Panel B1: Field of Study Offering - Dep. Var.: Indicator for Offering a Field						
GDP by Field (lagged)	0.0101***		0.0082***		0.0057***	
	(0.0003)		(0.0004)		(0.0005)	
Relat. Empl. (lagged)		2.0956***		2.0593***		1.3960***
		(0.1031)		(0.0982)		(0.1060)
Constant	-0.0015	-0.6543***	0.0160	-0.0705*	-0.0863**	0.4961***
	(0.0377)	(0.0373)	(0.0187)	(0.0391)	(0.0378)	(0.0384)
N. of Observations	25,476	5,324	26,086	5,360	17,092	3,756
Mean Dep Var	0.16	0.18	0.14	0.16	0.12	0.13
Elasticities	0.30	0.55	0.26	0.63	0.18	0.54
Panel B2: Opening Cond. on Offering the Field - Dep. Var.: Indicator for Opening a New Program						
GDP by Field (lagged)	0.0022***		0.0029***		0.0005	
	(0.0005)		(0.0007)		(0.0012)	
Relat. Empl. (lagged)		0.4015***		0.3437*		0.1119
		(0.1349)		(0.1744)		(0.2398)
Constant	0.4818***	0.6899*	0.2470	1.0099***	1.0173***	-0.3344
	(0.1446)	(0.3719)	(0.2002)	(0.1599)	(0.1208)	(0.3000)
N. of Observations	4,061	964	3,575	840	2,060	496
Mean Dep Var	0.19	0.20	0.16	0.15	0.12	0.11
Elasticities	0.13	0.22	0.16	0.25	0.03	0.11

Note: This table presents the same analysis as Table 4, but separately for each type of institution offering SCPs. Panel A reports the unconditional opening analysis, where the dependent variable is an indicator for whether institution j opens a new program in department d and field k in year t. The number of observations include all potential openings under the narrow definition. GDP by field is measured in billions of COP and relative employment is between zero and one; both variables are included with a one-year lag. Panel B1 uses an indicator for offering the field as dependent variable, whereas Panel B2 uses an indicator for opening a new program conditional on offering the field. All regressions include department, year, and institution x field category fixed effects. *,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.

Table A.4: Program Opening and Economic Activity: Excluding Highly Connected Locations

	Priv. SCP	Pub. SCP	Bach.	Priv. SCP	Pub. SCP	Bach.
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Unconditional Opening - Dep. Var.: Indicator for Opening a New Program						
GDP by Field (lagged)	0.0023***	0.0008***	0.0007***			
	(0.0002)	(0.0003)	(0.0001)			
Relat. Empl. (lagged)				0.4841***	0.2649***	0.2100***
				(0.0539)	(0.0738)	(0.0346)
Constant	0.0192	-0.0312**	0.0199	-0.0279***	0.0234	-0.0003
	(0.0287)	(0.0159)	(0.0211)	(0.0103)	(0.0277)	(0.0083)
N. of Observations	42,210	12,840	71,029	9,263	2,797	15,556
Mean of Dep. Var.	0.022	0.023	0.021	0.024	0.024	0.021
Elasticities	0.578	0.152	0.162	0.954	0.518	0.474
Panel B: Two-stage Opening Analysis						
Panel B1: Field of Study Offering - Dep. Var.: Indicator for Offering a Field						
GDP by Field (lagged)	0.0091***	0.0043***	0.0060***			
	(0.0003)	(0.0006)	(0.0002)			
Relat. Empl. (lagged)				2.0559***	1.4474***	1.5288***
				(0.0866)	(0.1273)	(0.0615)
Constant	0.1949***	-0.0008	0.9066***	0.2251***	-0.0136	0.9424***
	(0.0416)	(0.0335)	(0.0206)	(0.0483)	(0.0166)	(0.0483)
N. of Observations	42,210	12,840	71,029	9,263	2,797	15,556
Mean of Dep. Var.	0.136	0.158	0.238	0.150	0.167	0.259
Elasticities	0.363	0.120	0.122	0.638	0.412	0.281
Panel B2: Opening Cond. on Offering the Field - Dep. Var.: Indicator for Opening a New Program						
GDP by Field (lagged)	0.0023***	0.0046***	-0.0001			
	(0.0004)	(0.0017)	(0.0002)			
Relat. Empl. (lagged)				0.3939***	0.3017	0.0564
				(0.1221)	(0.2854)	(0.0578)
Constant	0.1912*	0.7175***	0.0508	-0.0345	0.9718***	0.0315
	(0.1145)	(0.1705)	(0.0358)	(0.1415)	(0.3522)	(0.0608)
N. of Observations	5,745	2,029	16,900	1,386	467	4,035
Mean of Dep. Var.	0.159	0.147	0.088	0.157	0.146	0.081
Elasticities	0.186	0.190	-0.010	0.284	0.182	0.061

Note: This table presents the same analysis as Table 4 but excluding the regions of Risaralda, Caldas, Atlantico, and Bolivar which are more interconnected than the rest of the departments. Panel A reports the unconditional opening analysis, where the dependent variable is an indicator for whether institution j opens a new program in department d and field k in year t. The number of observations include all potential openings under the narrow definition. GDP by field is measured in billions of COP and relative employment is between zero and one; both variables are included with a one-year lag. Panel B1 uses an indicator for offering the field as dependent variable, whereas Panel B2 uses an indicator for opening a new program conditional on offering the field. All regressions include department, year, and institution x field category fixed effects. *,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.

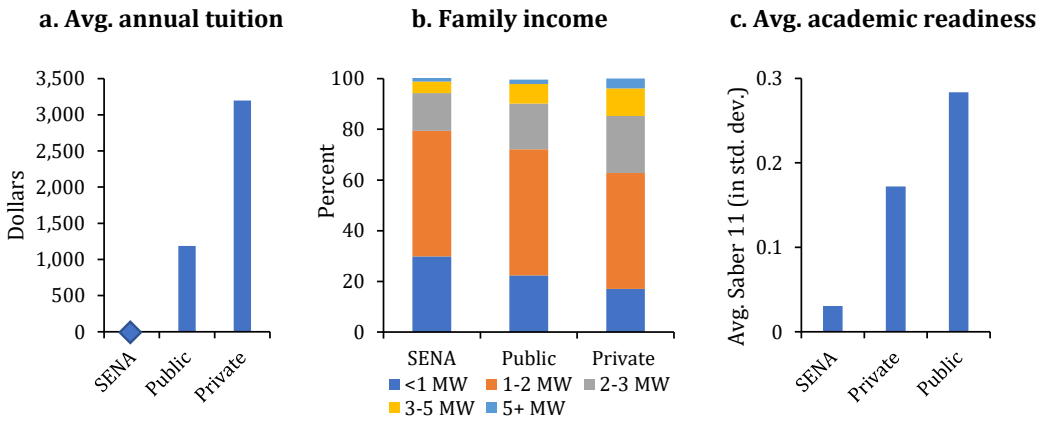
Table A.5: Programs Opening and Competition: First-Stage Regressions

Endogenous Competition Variables in Opening Regressions

Dependent Variable :	N. of Private SCPs	N. of Public SCPs	N. of SENA SCPs
	(1)	(2)	(3)
Panel A: Regressions for Private institutions			
N. of Private Progr. in 2004*L.GDP by Field	0.0001***	-0.0001***	-0.0002***
	(0.0000)	(0.0000)	(0.0001)
N. of Public Progr. in 2004*L.GDP by Field	0.0002	-0.0010***	-0.0017***
	(0.0003)	(0.0001)	(0.0006)
N. of SENA Progr. in 2004*L.GDP by Field	-0.0012**	0.0022***	0.0038***
	(0.0006)	(0.0002)	(0.0011)
SENA Budget (in billions of COP)	0.0049***	0.0016***	0.0206***
	(0.0008)	(0.0003)	(0.0020)
Constant	10.0724***	8.1025***	9.3110***
	(0.5546)	(0.1502)	(0.9171)
N. of Observations	45195	45195	45195
F-test for Excluded Instruments	238.88	90.35	66.18
Panel B: Regressions for Public institutions			
N. of Private Progr. in 2004*L.GDP by Field	0.0001***	0.0001***	-0.0002***
	(0.0000)	(0.0000)	(0.0000)
N. of Public Progr. in 2004*L.GDP by Field	-0.0002	0.0013***	-0.0009**
	(0.0002)	(0.0001)	(0.0004)
N. of SENA Progr. in 2004*L.GDP by Field	-0.0004*	-0.0023***	0.0021***
	(0.0002)	(0.0002)	(0.0006)
SENA Budget (in billions of COP)	0.0032**	0.0036***	0.0179***
	(0.0015)	(0.0006)	(0.0033)
Constant	11.3586***	8.1636***	1.6156
	(1.0084)	(0.5917)	(3.2449)
N. of Observations	13271	13271	13271
F-test for Excluded Instruments	43.15	47.28	18.85

Note: This table presents the coefficients from the first-stage regressions for the endogenous variables in Table 7: number of private SCPs, public SCPs, and SENA SCPs measured in tens, for the 2004-2019 period. The instruments are the number of these programs offered in 2004 interacted with the lagged GDP-by-field variable as well as SENA's budget for the department lagged one period ("L." is lagged). The regressions include department, year, and institution x field category fixed effects. Panel A shows the regressions corresponding to private institutions (column 1 in Table 7) and panel B those for public institutions (column 3 in Table 7). The bottom line presents the F-test statistic for excluded instruments. *,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.

Figure A.1: Tuition and Student Characteristics by SCP Provider Type



Note: Panel a shows average annual tuition by institution provider type (in PPP dollars of 2019). Panel b shows, for each institution provider type, the classification of students based on their family monthly income level. Panel c shows the average score in the national mandatory high school closing exam (*Saber 11*), which is a measure of academic readiness for higher education. MW = monthly minimum wage. Panels b and c show averages for the SCP graduates included in the Labor Observatory of Education (OLE) in 2013. Source: SNIES, OLE, and Saber 11.

Online Appendix B: Analysis Using Broad Definition of Potential Openings

In this Appendix we repeat the opening analyses using the broad definition of potential openings, whereby institutions can open programs in new locations (e.g.,by opening new campuses), either in existing or new fields. With this new definition, the number of observations in the unconditional opening regressions increases dramatically, and the average opening probability decreases by about 10 times. Table B.1 shows the estimates. Only panels A and B1 change relative to Table 4, since the conditional opening sample is not affected by the potential opening definition (we include the same three panels as in Table 4 for completeness).

Coefficients in Table B.1 are much smaller than those in Table 4 and the corresponding elasticities larger, consistent with the fact that, by definition, average opening probability is much lower under the broad definition. Nevertheless, when analyzing the elasticities, both tables tell a similar story. In panel A, a 1%-increase in local labor demand in a field raises the probability of a new program being opened in that field by about 0.8% at local private institutions, but only 0.2% at public institutions. The differences are slightly smaller in the field participation decisions shown in Panel B1.

Table B.2 repeats the analysis from Table 7 using the broad definition of potential openings. Again, coefficients are smaller than in the original table yet the patterns are the same.

Table B.1: Program Opening and Economic Activity: Broad Definition of Potential Openings

	Priv. SCP	Pub. SCP	Bach.	Priv. SCP	Pub. SCP	Bach.
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Unconditional Opening - Dep. Var.: Indicator for Opening a New Program						
GDP by Field (lagged)	0.0007***	0.0002***	0.0004***			
	(0.0001)	(0.0000)	(0.0000)			
Relat. Empl. (lagged)				0.0247***	0.0180***	0.0139***
				(0.0026)	(0.0041)	(0.0023)
Constant	-0.0000	0.0028**	0.0031	-0.0019***	0.0022	0.0020**
	(0.0015)	(0.0009)	(0.0016)	(0.0005)	(0.0017)	(0.0007)
N. of Observations	770,880	233,600	999,808	153,945	46,650	199,662
Mean of Dep. Var.	0.0015	0.0018	0.0018	0.0018	0.0022	0.0019
Elasticities	0.79	0.18	0.37	0.77	0.45	0.40
Panel B: Two-stage Opening Analysis						
Panel B1: Field of Study Offering - Dep. Var.: Indicator for Offering a Field						
GDP by Field (lagged)	0.0028***	0.0010***	0.0031***			
	(0.0001)	(0.0001)	(0.0001)			
Relat. Empl. (lagged)				0.1103***	0.0757***	0.1045***
				(0.0053)	(0.0069)	(0.0054)
Constant	0.0128***	0.0245***	0.0902***	0.0292***	0.0259***	0.1033***
	(0.0033)	(0.0034)	(0.0022)	(0.0035)	(0.0071)	(0.0054)
N. of Observations	770,880	233,600	999,808	153,945	46,650	199,662
Mean of Dep. Var.	0.009	0.011	0.021	0.011	0.012	0.024
Elasticities	0.51	0.16	0.25	0.55	0.35	0.24
Panel B2: Opening Cond. on Offering the Field - Dep. Var.: Indicator for Opening a New Program						
GDP by Field (lagged)	0.0023***	0.0046**	-0.0001			
	(0.0004)	(0.0017)	(0.0002)			
Relat. Empl. (lagged)				0.3152**	0.4520	0.0613
				(0.1062)	(0.2511)	(0.0481)
Constant	0.1811	0.5406**	0.0574	-0.0845	0.9730**	-0.0110
	(0.1139)	(0.1873)	(0.0354)	(0.1256)	(0.3552)	(0.0562)
N. of Observations	7165	2531	20819	1731	569	4887
Mean of Dep. Var.	0,16	0,17	0,09	0,16	0,18	0,08
Elasticities	0,15	0,14	-0,01	0,23	0,23	0,07

Note: Panel A reports the unconditional opening analysis, where the dependent variable is an indicator for whether institution j opens a new program in department d and field k in year t. The number of observations is the number of all possible institution x field x department x year combinations. GDP by field is measured in billions of COP and relative employment is between zero and one; both variables are included with a one-year lag. In Panel B1, the dependent variable is an indicator for offering the field; in Panel B2, it is an indicator for opening a new program conditional on offering the field. All regressions include department, year, and institution x field category fixed effects. *,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.

Table B.2: Opening Decisions and Competition - Broad Definition for Potential Openings

Dependent Variable: Indicator for Opening a New Program				
	Private institutions		Public institutions	
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
N. of Private SCPs (lagged)	-0.001***	-0.008***	0.001***	0.011***
	(0.000)	(0.002)	(0.000)	(0.005)
N. of Public SCPs (lagged)	0.000**	-0.048***	-0.003***	-0.068***
	(0.000)	(0.008)	(0.001)	(0.011)
N. of SENA SCPs (lagged)	0.000	0.005***	0.000***	0.009***
	(0.000)	(0.001)	(0.000)	(0.002)
N. of Observations	823,680	722,700	249,600	219,000
Mean of Dep. Variable	0.0014		0.0017	
Weak identification test:				
Kleibergen-Paap rk Wald F stat		610.79		285.94
Overidentification test:				
Hansen J statistic		172.41		36.01

Note: Each column presents coefficients from a regression where the dependent variable is an indicator for whether institution j opens a new program in department d and field k in year t, for the 2004-2019 period. The independent variables are the field-location market number of SCPs offered by private institutions, public institutions, and SENA. All regressions include controls for institution size in the department and field size in the institution, plus year, department, and institution-category fixed-effects. Columns (1) and (3) show OLS estimates, and columns (2) and (4) show the respective 2SLS estimates. The endogenous variables are the number of SCPs offered by private institutions, public institutions, and SENA. Instruments are the number of programs offered by each provider type in 2004 interacted with lagged GDP-by-field and SENA's budget for the department and year. All variables indicating number of programs are measured in tens. All explanatory variables are included with a one-year lag.*,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.