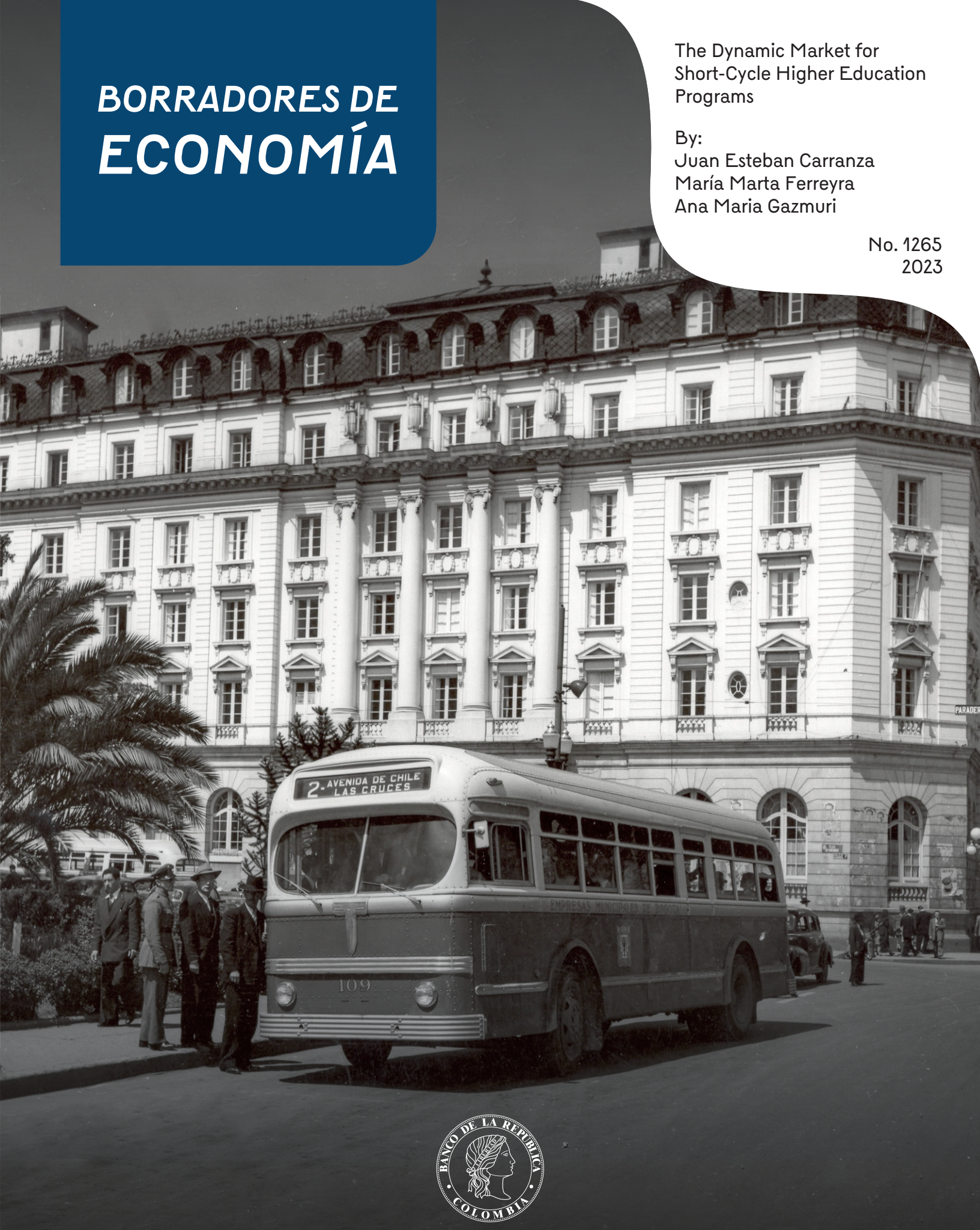
BORRADORES DE ECONOMÍA

The Dynamic Market for Short-Cycle Higher Education Programs

By:
Juan Esteban Carranza
María Marta Ferreyra
Ana Maria Gazmuri

No. 1265
2023



BANCO DE LA REPÚBLICA
COLOMBIA

The Dynamic Market for Short-Cycle Higher Education Programs*

Juan Esteban Carranza† María Marta Ferreyra‡

Ana Maria Gazmuri§

The views expressed in this document are the sole responsibility of the authors and do not represent the views of Banco de la República or its Board of Directors.

Abstract

We investigate the entry and exit of short-cycle higher education programs (SCPs), which last two or three years and can address local skill needs. Exploiting administrative data from Colombia, we study markets defined by geographic location and field of study. We find that institutions open new programs in response to local labor market demand, competition, and costs. Within markets, they often close and open programs simultaneously, possibly due to capacity constraints. SCPs are more responsive to local labor market demand than bachelor's programs; private and non-university SCP providers are the most responsive. These findings have implications for workforce development.

Keywords: higher education, supply, short-cycle programs.
JEL codes: E24, I21.

*We thank Andrea Franco, Manuela Granda, 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. All errors are ours.

†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

El mercado dinámico de programas de educación superior de ciclo corto*

Juan Esteban Carranza† María Marta Ferreyra‡

Ana Maria Gazmuri§

Las opiniones expresadas en este documento son responsabilidad exclusiva de los autores y no representan el punto de vista del Banco de la República ni de su Junta Directiva.

Resumen

Investigamos la entrada y salida de programas de educación superior de ciclo corto (SCPs por su acrónimo en inglés), que son los programas de educación técnica y tecnológica que duran dos o tres años y que van dirigidos a cubrir necesidades de los mercados de trabajo locales. Aprovechamos datos administrativos del sistema colombiano de educación superior, enfocándonos en mercados definidos por su localización geográfica y por su campo de estudio. Encontramos que las instituciones introducen programas nuevos en respuesta a la demanda del mercado local de trabajo, a la competencia y a sus costos. Observamos que las instituciones con frecuencia abren y cierran programas de forma simultánea en el mismo mercado, debido posiblemente a restricciones de capacidad. La oferta de estos programas es más sensible a la demanda local de trabajo que la oferta de programas profesionales, en particular en el caso de las instituciones privadas. Los resultados tienen implicaciones para las políticas de desarrollo de la fuerza de trabajo.

Palabras clave: educación superior, oferta, programas de ciclo corto.
Códigos JEL: E24, I21.

*Agradecemos a Andrea Franco, Manuela Granda y Nicolás Torres por su excelente asistencia en la investigación. Agradecemos a Marina Bassi, Rajeev Darolia, Gabriel Demombynes, Jean-Francois Houde, Armando Mendoza, Ricardo Paredes, Kevin Stange, Daniel Toro, Jaime Torrado, Sergio Urzua y Ulrich Zachau por sus útiles comentarios y conversaciones, así como a los participantes en múltiples seminarios y conferencias. Agradecemos al Ministerio de Educación de Colombia y al SENA por facilitar nuestro acceso a los datos. Ferreyra agradece al Banco Mundial por el apoyo financiero. Gazmuri agradece la financiación de la Agencia Nacional de Investigación de Francia (ANR) en el marco del programa Inversiones para el Futuro (Investissements d'Avenir), subvención ANR-17-EURE-0010. Todos los errores son nuestros.

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

‡Banco Mundial. Correo: mferreyra@worldbank.org

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

1. Introduction

Short-cycle higher education programs (SCPs) are an important vehicle to form 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 towards specific occupations. They capture about a quarter of higher education students worldwide and a third in the U.S., 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 heterogenous) returns.[2] Their ability to form skilled human capital fast and efficiently is critical at this time when much of the workforce needs to be upskilled or reskilled due to technological changes.

By responding to these needs, the higher education institutions (HEIs) that provide SCPs can contribute to local economic development.[3] Little is known, however, about the responsiveness of SCP supply to local economic conditions. Thus, in this paper we study program entry (opening) and exit (closing) in the SCP market in Colombia. We document the relatively frequent entry and exit of programs in the market and investigate institutions' decisions to open new programs and close existing ones.

Colombia's setting is interesting for several reasons. Although SCPs only attract nine percent of higher education students in Latin America, they attract about a third in Colombia. Unlike the U.S., where one type of provider—community colleges—attracts the vast majority of students, the SCP supply in Colombia encompasses a greater variety of institutions and yields a rich setting to investigate market dynamics. Colombia providers include public and (non-profit) private HEIs as well as SENA (National Learning Service). The latter is a decades-old public workforce training institution (not an HEI) with branches throughout the country, that only recently has

[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 U.S. 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 U.S., 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 (Ferreyra et al., 2020, 2021). Returns also vary depending on students' outside option, both in the U.S. (Mountjoy, 2022) and developing countries (Ferreyra et al., 2022).

[3] In the U.S. 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).

begun providing SCPs. Since SENA's decisions are made at the national level, outside the education domain, we focus on public and private HEIs' supply, taking SENA's offerings as given. Further, Colombia boasts rich higher education and labor market administrative data. We use data from the universe of SCPs and bachelor's programs offered between 2003 and 2019, as well as individual-level data for all higher education graduates working in the formal sector between 2007 and 2013.[4] We study program entry and exit at the market level, defined as a combination of geographic location (e.g., Bogota, Medellin) and field of study (e.g., health, agronomy and veterinary.)[5] This definition captures entry and exit variation across locations and fields.

We show 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 entry and exit rates. This leads to the question of whether the SCP "churn" might be in response 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 indicators are reported by economic sector. Second, the correlation between the local SCP supply and the local demand for graduates might not be causal but rather driven by unobserved shocks to the local SCP market.[6]

To bridge the gap between fields and economic sectors, we construct two measures of local economic activity associated with specific fields of study. The first one is the local GDP by field of study. It is a shift-share variable that combines data on sector-level GDP at the national level with local time-invariant employment shares by economic sector and field of study. 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 that sector.[7] The second measure of local economic activity by field of study is the

[4]As described in detail below, a program is defined as the combination of an institution, program code, and location. Program examples are graphic design technician at *Corporacion Escuela de Artes y Letras* in Bogota, and telecommunication and electronics technologist at *Corporacion Universitaria Centro Superior* in Cali.

[5]Market examples are health in Medellin, business in Medellin, health in Bogota, and business in Bogota. Note that "entry" and "exit" always refer to programs and not to HEIs.

[6]Throughout this paper, we distinguish between the local labor market for SCP graduates and the local SCP market, which is the local education market that produces SCP graduates.

[7]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). While these variables are often used as instrumental variables, in this paper we use them as independent variables to quantify the local economic activity associated with a specific field of study.

field share of local employment of SCP graduates—among all SCP graduates employed locally, the percentage that graduated from a specific field. To avoid endogeneity, these measures are computed based on graduates from a specific field who work in a location regardless of where they obtained their degree. By using information on graduates who work in a location rather than those who obtained their degree in it, our measures capture features of the local labor market rather than the local SCP market. For robustness, we also construct more stringent measures based exclusively on the SCP graduates employed in a location who did *not* obtain their degree there (henceforth, "movers" to their work location); our results are practically unchanged when using these alternative measures.

We find that SCP openings are indeed responsive to changes in economic activity and local labor demand shocks. Responsiveness, however, varies across institution types. In particular, the probability that a private HEI opens a new program in response to increase in demand is significantly higher than the probability that a public HEI does so. The greater responsiveness of private HEIs might be due not only to their more flexible management but also their greater reliance on tuition revenues, which forces them to offer market-relevant products. Although both universities and non-university HEIs can offer SCPs, non-university HEIs are more responsive than universities, possibly because they are nimbler, smaller, and more specialized in SCPs than universities. Further, SCP entry is more responsive than bachelor's program entry, which helps explain the greater turnover among SCPs than bachelor's programs. Longer and more theoretical than SCPs, bachelor's programs may be harder to set up and slower to produce graduates in response to labor market changes.

Our results indicate that SCP openings are also affected by cost considerations, as institutions are more likely to open new programs in locations where they already have some infrastructure or fields in which they are relatively specialized. Additionally, we examine whether SCP entry is affected by competition. This is challenging as measures of competition are likely endogenous. As HEIs in a given market open and close programs in response to common unobserved shocks, simply regressing entry decisions on the number of programs offered by competing institutions in the market would yield biased estimates. 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 institutions tend to respond to the presence of same-type competitors (public HEIs respond to public HEIs, and similarly for private HEIs), thereby suggesting a

pattern of segmented competition. Further evidence of segmentation is that SENA's competition does not elicit a response from either public or private HEIs, likely because SENA's programs are not viewed as close substitutes to those offered by the HEIs.[8]

SCP closings encompass two distinct decisions–whether to close any program at all in a market, and which one to close. We find that the first decision is correlated with the decision to open new programs in the same market. We interpret this as evidence of capacity constraints, as institutions may need to close a program in a market to liberate resources for a new one. As for the second decision, we find that private HEIs close programs with low enrollment growth; we do not find a similar response among public HEIs. Perhaps surprisingly, private HEIs are more likely to close programs in fields and locations where local labor demand has risen. In other words, private HEIs not only open but also close programs in response to positive labor demand shocks. This turnover echoes well-known empirical evidence from other industries (Dunne et al., 1988) showing that positive demand shocks generate firm turnover.

Overall, our findings suggest that SCPs' responsive supply might help address the changing skill needs in today's economy. At the same time, we lack the data necessary to measure program quality and, as a result, cannot establish whether the SCP churn has raised or lowered average program quality in Colombia. Nevertheless, since we show that the level of responsiveness varies across HEI types, our findings entail 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 yet carefully monitoring 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 it responds to student and labor market demand.[9]

To our knowledge, this is the first paper to investigate the dynamics of SCP supply in a developing country.[10] Even for developed economies, the literature is scarce. Cellini

[8]Our finding that entry is affected by the presence of competitors is consistent with results from the Industrial Organization literature (Mazzeo, 2002; Seim, 2006). Similarly, our finding that entry is more likely in locations where HEIs already have infrastructure is consistent with Jia (2008), who shows that firms tend to locate stores close to each other to exploit scale economies. In the K-12 education sector, Ferreyra and Kosenok (2018) find that charter schools open in neighborhoods with greater demand and lower costs.

[9]On accountability in higher education, see Deming and Figlio (2016), Matsudaira and Turner (2020) and Cellini and Blanchard (2020). In the U.S., 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).

[10]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 U.S. have entered growing fields much faster than community colleges (Deming et al., 2012; Armona et al., 2022). Similar to our findings on private HEI's greater responsiveness to local conditions, Deming et al. (2012) and Gilpin et al. (2015) find that for-profits in the U.S. are faster in program (or field) opening and closing than community colleges.[11]

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 HEIs' 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 U.S.. In line with our results, they find a much stronger response at for-profit than community colleges. Grosz (2022) studies whether local employment changes relates 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 HEIs' low responsiveness to local labor market conditions. In the context of 4-year programs, Conzelmann et al. (2023) analyze the response in number of degrees awarded to shifts in labor demand. Their results suggest that responses are stronger in less-selective institutions, possibly because they face less supply-side constraints. Nonetheless, using enrollment or graduation as the dependent variable confounds supply and demand responses because they are equilibrium outcomes, reflecting both student and HEI decisions. When an institution operates below capacity, for example, enrollment changes might be completely driven by student rather than institution decisions. In contrast, our supply-side measures—program entry and exit—unequivocally capture institution 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, Section 6 offers a discussion, and Section 7 concludes.

competition, which are not studied in that paper.

[11] Despite their nimbleness, for-profits have been controversial in the U.S. 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).

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. SCPs encompass technical and technological programs (two and three years long, respectively) and are provided by public and private HEIs, and by SENA—which is not an HEI. The latter has provided workforce training since its inception in the 1950s, and only added SCPs to its menu of offerings in 2003. While HEIs are overseen by the Ministry of Education, SENA is under the purview of the Ministry of Labor. It has a dedicated funding source (payroll taxes), with budgetary allocations determined at the national level.

SENA programs are free, yet the HEIs charge tuition. Public HEIs receive public funding and are therefore able to charge a subsidized tuition; tuition is substantially higher at private HEIs, which do not receive any type of public funding. On average, academic selectivity is highest at public HEIs, followed by private HEIs and SENA (which, in fact, does not use test scores for admission). As a result of tuition and admission practices, students sort across institutions (Figure A.1). The poorest, least-prepared students attend SENA; among the remaining students, those with the higher income and lower academic readiness attend private HEIs.

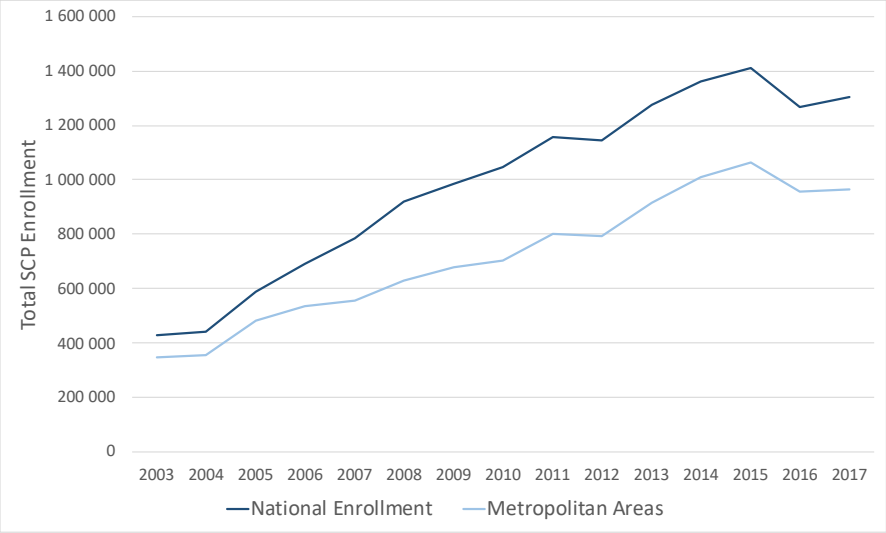
In contrast with private providers, which are mostly located in urban areas, SENA is spread throughout municipalities of all sizes. While SENA captures about 60% of total enrollment, no other institution attracts more than 4%. On average, HEIs have approximately 1.7 branches each; most HEIs are local, and very few have branches in multiple cities. We focus on programs located in the country's thirteen metropolitan areas, which concentrate most of the national enrollment (panel (a) of Figure 1).[12] Much of their enrollment growth is explained by SENA (panel (b) of Figure 1). Total enrollment in public and private HEIs has also risen—particularly at private HEIs—albeit at a lower rate.

To open a new program, HEIs need an authorization (or operating license) from the Ministry of Education, which can take a year or two to arrive and must be renewed periodically. In contrast, they do not need an authorization to close a program. Table 1 shows descriptive statistics for the Colombian departments (akin to U.S. states) where

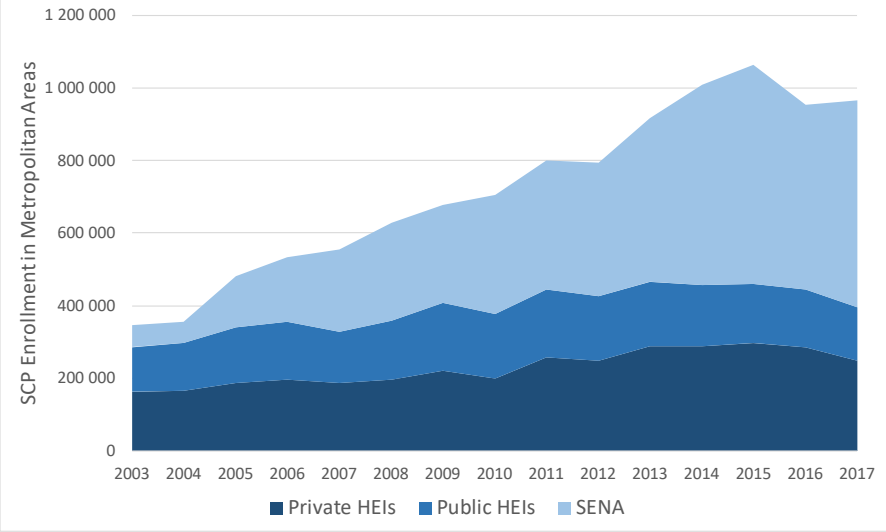
[12]We define metropolitan areas as in Duranton (2015), where municipalities are aggregated into metropolitan areas based on commuting patterns. This definition yields 13 metropolitan areas, all of which are included in our analysis.

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 SCP programs 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 HEIs, public HEIs, and SENA by year.

the metropolitan areas are located. The number of SCPs and HEIs varies substantially across departments, but the percentage of higher education students attending SCPs is about 30% in most of them. Three types of HEIs offer SCPs: technological and technical institutes (only allowed to offer SCPs), technological schools (*Instituciones Universitarias*, allowed to offer short-cycle and bachelor's programs but not graduate programs) and universities (the most prestigious institutions, allowed to offer the whole range of undergraduate and graduate programs). Since each metropolitan area is located in a different department, in what follows we use the term "department" to designate locations, and use it interchangeably with "location". Given SENA's peculiarities, we focus on the SCP supply from public and private HEIs while taking the supply of SENA's programs as given.

Table 1: SCPs by Departament in Colombia

Department	Number of SCPs	Number of HEIs	% 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 the 13 departments that contain the metropolitan areas included in our empirical analysis. For each variable, it shows average over years between 2003 and 2019. Percentage of enrollment in short-cycle programs is relative to total higher education enrollment in the department. The last four columns correspond to the percentage of SCP enrollment by institution type (they add up to one by department).

2.2 Data Sources

We leverage multiple Colombian data sources. First is the National Higher Education Information System (SNIES), which covers the universe of higher education programs (bachelor's and SCP) and contains program-level information on institution, geographic location, field of study, length, and enrollment. We use SNIES data between 2003 and 2019. We define a program as a combination of institution, program code, and department; when an institution offers the same program in two different departments, it counts as two different programs. We focus on in-person SCPs located in metropolitan

areas; we exclude online programs because we cannot map them a geographic location. Our SCP sample that accounts, on average, for 73% of the national SCP enrollment.

Our second data source is 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 each graduate, it includes program identifiers that allow us to find the program in SNIES, and also labor market information such as work location and economic sector of work. Third, we use use annual GDP data by department and economic sector from the National Statistics Agency (DANE) between 2003 and 2019. Fourth, we use information on SENA's department-level budget, which quantifies SENA's resources by department and year.) All monetary values are expressed in Colombian pesos (COP).

Overall, our data includes 13 departments; 279 HEIs; 3,463 SCPs; and 4,392 bachelor's programs (the latter are included for some comparisons relative to SCPs). Programs are classified into 24 fields of study. In some of our analyses, we aggregate these into four "field categories" (Table A.1 lists all fields and field categories). We analyze entry between 2004 and 2019 and exit between 2004 and 2018 (since our last available year is 2019, we cannot identify which programs closed that year).

We study program entry and exit at the market level, defined as a combination of location and field of study. Our sample include 312 markets (13 locations times 24 fields of study). By definition, an HEI that offers programs in multiple fields of study participates in multiple markets; in a given year, it might open or close programs in some markets but not others.

3. Descriptive Statistics

3.1 Programs, Entry, and Exit

In our sample, 77 percent of SCPs are provided by private HEIs. Most SCPs are in business and social sciences followed by engineering, which includes computer- and technology-related fields (Table A.1). Public and private HEIs specialize in different fields: 51 percent of private HEI students are enrolled in business and social sciences programs, whereas an almost equal percentage (48 percent) of public HEIs students are in engineering. This is consistent with the fact that public HEIs—which receive public funding—are better equipped than private HEIs to provide high-cost programs.

For the average year, our sample includes 156 institutions providing 1,209 SCPs,

with 137 SCP openings and 127 closings (Table A.2, top and middle panel). It also includes, on average, 606 HEI-field-location combinations with at least one active SCP. These combinations are important because, as described below, we examine program opening on the part of HEIs at the market (field-location) level.[13] On average, 124 HEI-field-location combinations have at least one new SCP per year (the number is 113 for SCP closings). Since some of our analysis compares SCPs to bachelor's programs, Table A.2 also shows descriptive statistics for bachelor's programs. Although bachelor's programs outnumber SCPs and a greater number of HEIs offer bachelor's programs than SCPs, 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 entry and exit *rates* between SCPs and bachelor's programs, and to examine their relative turnover.

3.2 Turnover and Entry Types

A distinctive aspect of SCPs is their high turnover—much higher, on average, than that of bachelor's programs. In any given year, 11.2% of the SCPs offered are new—having opened just that year—while 10.6% of SCPs exit (or close) that year (panel A of Table 2). These percentages, which are quite similar for public and private HEIs, are much higher than for bachelor's programs, for which they equal 6.1 and 4.2 percent respectively. Similarly, SCPs have a much shorter average life than bachelor's programs (6.2 v. 9.5 years).[14] In our empirical analysis we examine whether this greater "churn" of SCPs than bachelor's program is indicative of a greater responsiveness to local labor market demand.

Following Dunne et al. (1988), in panel B of Table 2 we look at different entry types for SCPs and bachelor's programs between 2004 and 2019. We distinguish entry of new programs at new institutions and at existing institutions; 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 entry of SCPs and bachelor's programs takes place in existing locations, and about

[13] We examine, for example, whether *Universidad del Valle* opens a program in the market defined by health in Cali.

[14] We view this difference as a lower bound of the actual difference in program average life between SCPs and bachelor's programs. The reason is that we do not observe program entry date for programs that opened before 2000, and 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.

Table 2: Program Turnover and Entry Type

	Panel A: Program Turnover			
	All SCPs	Private SCPs	Public SCPs	Bachelor's
Avg. Program Life (in Years)	6.2	6.1	6.5	9.5
Avg. Percent of New Progrs. per Year	11.2	11.1	11.5	6.1
Avg. Percent of Progrs. Closing per Year	10.6	11.2	8.6	4.2

	Panel B: Entry Type			
	All SCPs	Private SCPs	Public SCPs	Bachelor's
Existing HEI, Existing Loc., Existing Field	60.8%	63.3%	53.9%	53.1%
Existing HEI, Existing Loc., New Field	20.2%	18.3%	25.5%	27.2%
Existing HEI, New Loc., Existing Field	9.7%	9.7%	9.9%	10.7%
Existing HEI, New Loc., New Field	0.3%	0.4%	0.2%	0.9%
New HEI	8.9%	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 percent of new and closing programs are 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. Short-cycle programs include those offered by public and private HEIs but exclude SENA programs. Panel B shows percentages relative to the total number of programs that opened across all markets and years. "Loc." indicates location. "Existing" and "new" location indicate whether the HEI already operates or not, respectively, in that location.

half in existing locations and fields where the HEIs were already active. These rates are similar for private and public HEIs, although public HEIs are more likely to open programs in new fields.

When studying entry, it is important to define the universe of potential entrants, whose decisions are our object of study. Regardless of the definition, only some potential entrants actually enter and constitute the observed entrants. We explore two definitions. In the broad one, we assume all existing institutions can potentially open programs in any location and field regardless of whether they already operate in that location. In the narrow one, institutions can potentially open programs in any field but only in locations where they already operate. These definitions reflect different expansion strategies for an institution: in the broad definition, the institution considers opening programs even in locations where it does not currently operate; in the narrow definition, it only considers opening programs in locations where it already operates. These definitions, of course, only affect the set of potential entrants; the set of actual entrants is the same in both cases. For SCPs, we have about 4,900 potential entrants under the narrow definition and 67,600 under the broad one (Table A.2, bottom panel).

4. Empirical Strategy

4.1 General Framework

To study HEIs' decision to open or close programs, we focus on how they respond to local changes in economic activity, costs, and competition. Our empirical approach is based on the following equation:

$$I^c_{jkdt} = f(G_{kdt}, M_{jdt}, X_{jkdt}) + \varepsilon_{jkdt} \tag{1}$$

where I^c_{jkdt} is a binary indicator for activity c on the part of institution j in field k, department d at time t (recall that a market is a k, d combination). Activity c refers to program entry or exit (opening or closing a program, respectively). It depends on market-level economic activity, G_{kdt}; institution-level costs, X_{jkdt}; and market-level competition, M_{jdt}. We use the word "determinants" to refer collectively to G_{kdt}, X_{jkdt}, and M_{jdt}. The error term, ε_{jkdt}, captures unobserved idiosyncratic variation such as cost or financial aid heterogeneity among HEIs and fields.

This equation is consistent with a number of underlying structural models. Regardless of a structural model's stance on the HEI objective function (e.g., profits, prestige, student placement), this equation presents HEIs as responding to expected student demand (presumably correlated with local labor market demand), market structure and competition, and costs. As a result, the entry and exit probabilities delivered by equation 1 are consistent with a variety of plausible structural models.

In this equation, endogeneity might arise due to possible correlation between ε_{jkct} and market-level economic activity, G_{kdt}, or competition, M_{jdt}. We address this concern in two ways. First, variables in G_{kdt} are uncorrelated with unobserved factors affecting the local SCP supply. Second, we construct instruments for M_{jdt}. Below we describe the construction of the entry and exit determinants, the linear specifications of (1) used to study SCP entry and exit, and our identification strategy.

4.2 Entry and Exit Determinants

Market-level economic activity. Variables in G_{kdt} seek to capture the local labor demand for graduates from a specific field of study. They include local GDP by field and field relative employment. Local *GDP by field* is a shift-share variable that measures the local economic activity associated with the employment of graduates from a specific field of study. For a given year, we interact sector-level aggregate activity at the

national level (from DANEA) with local time-invariant employment shares by field and economic sector (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 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:

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

Importantly, these shares are based on graduates from a field who work in a given location regardless of where they studied. This is because (2) attempts to measure local demand for field graduates rather than their local supply. The shares sum to one by sector when adding over all fields and departments. They are time-invariant and calculated by pooling all years available in OLE (2007 through 2013).[15]

Our GDP-by-field variable captures the notion that exposure to the aggregate, national shocks experienced by an economic sector varies across SCP graduates depending on their field of study, work location, and work sector. The aggregate shock to sector s is captured by GDP_{st}. Although this sector-specific shock is common to all departments and fields, the degree of exposure for field-k graduates who work in department d is determined by the time-invariant employment share, GS_{dks}(Bartik, 1991; Goldsmith-Pinkham et al., 2020). In the simplest case, if all SCP graduates employed in sector s in the country had graduated from the same field and worked in the same department, then that department and field would absorb the full shock to the sector.

We proceed similarly to construct local *field relative employment*, which captures the share of local employment of SCP graduates that is accounted for by the specific field. We use OLE data from 2007 to 2013 to obtain the total number of SCP graduates employed in a given department, independently of the department where they studied.

[15]While we would have preferred to have used shares from some year prior to the beginning of our study period (2003), OLE is only available beginning in 2007. If we had used time-invariant shares from a single year rather than pooling all available years, this would have yielded shares equal to zero or one for some small departments. Among the years with OLE availability, 2013 is the one where these issues are least concerning. When we use shares for 2013 rather than pooling 2007 through 2013, results are virtually unchanged.

Among them, for a given year we calculate the proportion of graduates with a field-k degree as follows:

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

Institution-level costs. Variables in X_{jkdt} include two cost proxies: the HEI's relative size in the department (its share of the department's total SCP enrollment) and the HEI's degree of specialization in the field (the field's enrollment share within the institution). We expect institutions with a large share of SCP students in the department (i.e.,"large" HEIs) to have low entry costs by virtue of their infrastructure and popularity. Similarly, we expect institutions that are more specialized in a field to have lower entry costs into it by virtue of already having field-specific resources (e.g., facilities and faculty).

Market-level competition. Variables in M_{jdt} include the number of SCPs offered in the field and department by each of the following three types of providers: public HEIs, private HEIs, and SENA.

4.3 Entry

We use the following linear probability model to study how HEIs decide whether to open new SCPs in a particular market:

$$Entry_{jkdt} = \alpha_G G_{kdt-1} + \alpha_X X_{jkdt-1} + \alpha_M M_{kdt-1} + \alpha_t + \alpha_d + \alpha_f + \varepsilon_{jkdt} \quad (5)$$

where $Entry_{jkdt}$ is an indicator for whether institution j opens a new program in field k, department d, and year t. Note that the dependent variable measures entry on the extensive margin (whether the HEI opens or not a program) rather than the intensive margin (how many programs it opens). In this and other regressions, the explanatory variables are lagged to account for the fact that it takes HEIs some time to open or close programs in response to market conditions. When opening programs, for instance, institutions need time to develop the curriculum, recruit faculty, set up infrastructure, and obtain authorization from the regulatory authority. All our specifications include year, department, and field-category (denoted by f) fixed effects.[16]

[16]In the dependent and independent variables in this and other regressions, field k refers to the 24 fields listed in Table A.1 yet the field-category fixed effects, α_f, refer to the four *aggregate* field categories from that table. We use field-category fixed effects for a more parsimonious model—particularly since we also include year and department fixed effects—and because some of the 24

Our main 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 HEI open new programs in veterinary in response to this increased demand?

4.4 Exit

We examine exit at two levels. In the first one (program level), the HEI decides whether to close a specific existing program—for instance, whether *Politecnico de Medellin* closes its Lab Technician program in 2010. In the second one (market level), the HEI decides whether to close any program at all in a given field and department.

To analyze *program-level* closings, we estimate the following specification, where the dependent variable, $Exit_{ijkdt}$, is an indicator for whether institution j closes (existing) program i in field k and department d in year t:

$$Exit_{ijkdt} = \gamma_G G_{kdt-1} + \gamma_X X_{jkdt-1} + \gamma_M M_{kdt-1} + \gamma_t + \gamma_d + \gamma_f + \varepsilon_{jkdt} \tag{6}$$

In addition, to explore whether institutions close programs with declining enrollment, we estimate the following specification:

$$Exit_{ijkdt} = \sum_{\tau=t-2}^{t-1} \eta_\tau \Delta Enrollment_{i\tau} + \eta_G G_{kdt-1} + \eta_X X_{jkdt-1} + \eta_t + \eta_d + \eta_f + \varepsilon_{ijkdt} \tag{7}$$

where the explanatory variables include the program's proportional enrollment change between $t-2$ and $t-1$, and $t-3$ and $t-2$.

Our *market-level* exit analysis is motivated by the fact that, when opening a new program in a market, 35% of the times the institution also closes a program in that market. To capture this phenomenon of an HEI's simultaneous entry and exit in a given (location-field) market, we estimate the following exit specification:

$$Exit_{jkdt} = \delta_E Entry_{jkdt} + \delta_G G_{kdt-1} + \delta_t + \delta_d + \delta_f + \varepsilon_{ijkdt} \tag{8}$$

where $Exit_{jkdt}$ is an indicator for whether institution j closes any program in field k and department d in year t; and $Entry_{jkdt}$ is an indicator for whether j opens any program in the same field, department, and year.

fields have very few observations.

An institution's simultaneous entry and exit in a given market may have several possible explanations. Mechanically, a program's SNIES code could change even if the program itself did not, which would create fake entry and exit. We filter out these cases, which generally consist of programs that keep their name but change code. A more interesting explanation is that, in order to open a new program in a market, the institution may need to close another one in order to liberate capacity. In this case, entry and exit might happen contemporaneously or a few periods apart. We explore correlation between exit and entry in the same period as well as one-period apart.

4.5 Identification

Effect of local economic activity on entry or exit

Identification of the HEI responses to changes in economic activity depend on the exogeneity of entry and exit determinants, conditional on controls. As specified in (3), the key feature of the shares used to construct the GDP-by-field measure is that they are based on graduates who work in a given location rather than those who studied there. Similarly, as specified in (4), our relative employment variable measures the proportion of SCP graduates from a field who work in a department independently of where they studied. If these two variables were based on the SCP graduates who obtained their degree in the given department rather than those who work there, they might be correlated with local SCP demand and supply and might not be exogenous. As a robustness check, we also construct a version of the employment shares in (3) and (4) *excluding* workers that graduated in the same department where they work (namely, only based on "movers").

Effect of competition on entry or exit

The variables in M_{jdt}, which pertain to the local number of competing programs in the field, are endogenous because they are likely correlated with unobserved factors affecting entry. We construct four instruments for competition. The first three draw on the fact that HEIs tend to open programs in markets where their entry cost is low. As seen in Table 2 panel B, HEIs are most likely to open programs in locations where they already operate. We use the number of programs from competitors in the baseline year of 2004 as a proxy for their entry costs. For instance, if public HEIs had offered a large number of programs in Bogota in 2004, they would have had the infrastructure required to open additional programs in later years. Moreover, institutions' market

presence and infrastructure in 2004 are arguably predetermined and uncorrelated with later supply-side shocks.

We interact the baseline number of programs with our local GDP-by-field variable, (2), which makes the instrument vary over time and across fields. In other words, the effect of the baseline number of competitors on the contemporaneous number of competitors varies over time and across fields depending on local economic activity by field, which is exogenous by construction. These interactions give us three instruments, based on the baseline supply of each of the three types of competitors (public HEIs, private HEIs, and SENA). For institution j in department d, field k, at time t, the three interactions are as follows:

$$IV^{H}_{jdkt} = \#\text{ of Prog}^{H}_{-j,d,2004} \cdot \widetilde{GDP}_{dkt-1} \tag{9}$$

where $\#$ of $\text{Prog}^{H}_{-j,d,2004}$ is the total number of programs offered in 2004 (first year of our entry analysis) by *other* providers of type H (public, private, and SENA) in department d.

Our fourth instrument for the number of competitors is SENA's budget by department and year. Since SENA's budget is largely a political matter and is determined at the national rather than local level, it constitutes a valid instrument. We make the caveat that, since we do not observe SENA's budget by field, this additional instrument varies over time and across departments but not across fields.

4.6 Summary Statistics

Table 3 shows summary statistics for the variables utilized in entry and exit regressions (panels A and B, respectively). When considering the narrow entrant definition (i.e., HEIs can open new programs in any field as long as they already operate in that location), only 2.3 percent of all possible (HEI, location, field) combinations in the sample exhibit entry. This fraction drops to 0.3 percent for the broad entrant definition (e.g., HEIs can open new programs in any location and field). For potential entrants,[17] their field captures approximately 4.7 percent of the local employment of all SCP graduates, and is associated with a local GDP of approximately 4.8 billions of Colombian pesos. On average, an HEI considering whether to open a new program in any field in its ex-

[17]Summary statistics described here pertain to the narrow entrant definition because those are our preferred results. The number of observations, and hence the summary statistics, are different for the broad entrant definition because the number of entry opportunities is larger.

Table 3: Descriptive Statistics for the Variables Used in the Empirical Analysis

Panel A: Entry Regressions		
	Mean	Std. Dev.
Indicator for New SCP (Narrow Entrant Definition)	0.023	0.148
Indicator for New SCP (Broad Entrant Definition)	0.003	0.052
GDP by field	4.83	10.79
Field Relative Employment	0.047	0.075
Number of SENA SCPs	12.12	9.45
Number of Private SCPs	16.37	16.46
Number of Public SCPs	3.94	2.96
HEI Enrollment Share in Department:		
Public HEIs	0.111	0.162
Private HEIs	0.035	0.050
Field Enrollment Share in HEI:		
Public HEIs	0.291	0.278
Private HEIs	0.364	0.294

Panel B: Exit Regressions		
	Mean	Std. Dev.
Indicator for Closing an SCP	0.106	0.308
Indicator for Closing an Bachelor's Program	0.041	0.199
GDP by field	17.345	24.417
Field Relative Employment	0.144	0.124
Proportional Enrollment Change	0.371	8.666
Number of SENA SCPs	12.88	9.92
Number of Private SCPs	18.51	16.56
Number of Public SCPs	4.07	2.76
HEI Enrollment Share in Department:		
Public HEIs	0.110	0.159
Private HEIs	0.035	0.051
Field Enrollment Share in HEI:		
Public HEIs	0.289	0.277
Private HEIs	0.364	0.294

Note: This table presents the mean and standard deviation for the variables used in the main regressions in the empirical analysis for SCPs. Panel A shows the variables used in entry regressions (for 2004-2019) and panel B shows the variables used in exit regressions (for 2004-2018). In each panel, dependent and independent variables are in the top and bottom portion, respectively. In Panel A, an observation is an HEI-field-department-year. The dependent variable means (top portion) are shown for both definition of potential entrants, while independent variable means (bottom portion) are shown for potential entrants according to the narrow definition (means are almost the same for entrants according to the broad definition). GDP by field is measured in billions of COP, and number of competing programs are expressed in tens of programs. (One-year) proportional enrollment change is between 0 and 1. Table shows overall sample means. Over all years, the number of SCP observations (potential entrants) is 1,073,280 (broad definition) and 70,632 (narrow definition). In Panel B, an observation is an existing SCP and the total number of observations is 17,895.

isting location faces considerable competition in that location—16.4 programs taught by private HEIs, 3.9 by public HEIs, and 12.1 by SENA. Our cost proxies show that potential entrants (narrow definition) among public HEIs capture, on average, 11 percent of the location's total SCP enrollment relative to only 3.5 percent among private

HEIs, consistent with the fact that public HEIs are larger, on average, than private HEIs. Private HEIs, in turn, are more specialized than their public counterparts: on average, a field captures 36 percent of the institution's enrollment among private HEIs but only 29 percent among public HEIs.

In the sample, 10.6 percent of existing programs are closed at some during the sample period. For existing programs, the field under consideration employs, on average, 14.4 percent of local employment of SCP graduates, and program enrollment grows, on average, by 37 percent relative to the previous year, although with great variation among programs and years.

5. Results

5.1 Entry and local economic activity

We estimate several specifications of Equation (5) using both the broad and narrow definitions of entry, and including different sets of controls. Table 4 presents the estimates of Equation (5) without institution- or market-level controls (namely, setting $\alpha_X = \alpha_M = 0$). These estimates show the relationship between between an HEI's decision to open a program in a market and the market's local economic activity, as measured by the GDP-by-field and field relative employment variables. Our main results are those using GDP by field because this variable is available for the entire 2004-2019 period, whereas field relative employment is only available for 2007-2013.

Panels A and B show results for GDP by field using the narrow and broad definition of potential entrants, respectively. Column (1) shows the results for all SCPs and columns (2) and (3) show results separately for private and public institutions. Given the greater turnover of SCPs than bachelor's programs, for comparison Column (4) shows estimates of the entry regression for bachelor's programs. To facilitate results' interpretation and comparison, the last row of each panel reports the elasticity of entry probability with respect to GDP by field and field relative employment, evaluated at the sample means.

Both panels show a significant correlation between SCP entry and local economic activity. Coefficients in panel B are much smaller than those in panel A and the corresponding elasticities are larger, consistent with the fact that, by definition, average entry probability is much lower under the broad than the narrow definition of potential

Table 4: Program Entry and Economic Activity

Dependent Variable : Indicator for Opening a New Program				
	All SCPs	Private SCPs	Public SCPs	Bachelor's
	(1)	(2)	(3)	(4)
Panel A: GDP (2004-2019); Narrow Entrant Definition				
GDP by Field (lagged)	0.0018***	0.0020***	0.0007***	0.0008***
	(0.0001)	(0.0001)	(0.0002)	(0.0001)
Constant	0.0006	-0.0073*	0.0211*	0.0189***
	(0.0034)	(0.0037)	(0.0085)	(0.0033)
N. of Observations	68,654	52,699	15,955	89,559
Mean of Dep. Variable	0.023	0.022	0.027	0.020
Elasticities	0.39	0.47	0.11	0.18
Panel B: GDP (2004-2019); Broad Entrant Definition				
GDP by Field(lagged)	0.0006***	0.0007***	0.0002***	0.0004***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	-0.0007	-0.0021***	0.0040***	0.0026***
	(0.0004)	(0.0004)	(0.0009)	(0.0004)
N. of Observations	1,004,480	770,880	233,600	999,808
Mean of Dep. Variable	0.0016	0.0015	0.0018	0.0018
Elasticities	0.71	0.87	0.20	0.41
Panel C: Employment (2007-2013); Narrow Entrant Definition				
Field Relat. Employment (lagged)	0.4095***	0.4473***	0.2844***	0.1629***
	(0.0364)	(0.0426)	(0.0668)	(0.0320)
Constant	-0.0129	-0.0203**	0.0043	0.0108***
	(0.0056)	(0.0057)	(0.0134)	(0.0054)
N. of Observations	14,971	11,480	3,491	19,679
Mean of Dep. Variable	0.026	0.024	0.031	0.020
Elasticities	0.75	0.87	0.43	0.39
Panel D: Employment (2007-2013); Broad Entrant Definition				
Field Relat. Employment(lagged)	0.0220***	0.0238***	0.0160***	0.0126***
	(0.0017)	(0.0020)	(0.0031)	(0.0018)
Constant	0.0010	-0.0004	0.0054**	0.0036***
	(0.0006)	(0.0005)	(0.0019)	(0.0006)
N. of Observations	323,575	248,325	75,250	322,070
Mean of Dep. Variable	0.0019	0.0017	0.0023	0.0019
Elasticities	0.61	0.71	0.36	0.34

Note: Each column presents the coefficients from an OLS 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. Elasticities of entry probability with respect to the corresponding economic activity variable, evaluated at the sample means, are reported at the bottom of each panel. GDP by field is measured in billions of COP and field relative employment is between zero and one; both variables are included with a one-year lag. All regressions include department, year, and field-category fixed effects. *,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.

entrants.[18] Nevertheless, both panels tell a similar story: a 1%-increase in local labor demand in a field raises the probability of a new program being opened in that field by about 0.5-0.9% at local private HEIs, but only 0.1%-0.2% at public HEIs. Since these estimates control for field categories, they are not driven by differential field specialization between public and private HEIs. Instead, they are likely driven by different funding, governance, and management regimes. Private HEIs do not receive public funding and only attract students if they offer relevant programs, whereas the public funding received by public HEIs is not necessarily related to their enrollment or local labor market needs. Further, public HEIs may have less ability than private HEIs to respond to local labor market changes because they are larger, more bureaucratic, and have a more complex governance.

Importantly, our estimates indicate that bachelor's programs are less responsive to local economic activity than SCPs. While setting new SCPs should be, in principle, easier than setting up new bachelor's—therefore explaining the greater responsiveness of SCPs than bachelor's programs—it is worth noting that the greater responsiveness of SCPs is driven by private HEIs, as the responsiveness of public HEIs offering SCPs is similar to that of bachelors' programs. In other words, the responsiveness of private SCP providers is not merely due to their programs being short but may be related to the funding and management factors cited above, all of which might lead them to interact more with local employers when selecting their offerings.

Panels C and D show estimates using relative employment by field as the measure of local labor demand for the narrow and broad definition of potential entrants, respectively. They tell a similar story as those from panels A and B even though relative employment by field is available for a shorter period than GDP by field. Therefore, in what follows we focus on the narrow definition and leave results using the broad definition to the appendices; results are generally robust under both definitions. As an additional robustness check (see Section 4), we repeat these entry regressions using a version of the GDP-by-field and relative employment variables that is exclusively based on "movers," namely students who work in a department but obtained their degree in a different one. Table A.3 shows these results, which are practically identical to the ones from panels A and B in Table 4.

We would expect changes in labor demand not only to motivate the opening of new SCPs but also the enrollment of new, additional students—either in existing or new

[18] Given our linear specification, the reported elasticities are calculated as $\alpha_G \cdot \bar{G}/\overline{Entry}$, where $\bar{G}$ and $\overline{Entry}$ represent the mean of the regressor of interest and dependent variable, respectively. Since $\overline{Entry}$ is smaller for the broad than narrow entrant definition, the corresponding elasticity is larger.

programs. We examine aggregate enrollment effects (Table A.4) and find that, indeed, enrollment in a field and department rises in response to a local demand increase for graduates in the field, as in Grosz (2022). Consistent with entry responses, the enrollment elasticity with respect to labor demand changes is higher for private than public HEIs (1.2 v. 0.9, respectively). Enrollment elasticities are larger than entry elasticities because they account for all additional students—both at new and existing programs, and not just those at new ones. Nevertheless, the main message from these results is that not only do HEIs respond to economic activity changes; students respond as well.

We further explore heterogeneous responsiveness to local labor market demand by looking at the three HEI types that provide SCPs (Table A.5.) Both the estimates using GDP-by-field and field relative employment show that technological and technical institutes (which specialize in SCPs) as well as technological schools (offering SCPs as well as bachelor's programs) are more responsive than universities (which teach the full spectrum of degrees, ranging from SCPs to PhDs). Through greater specialization in SCPs, non-university HEIs have an institutional setup readily geared towards SCPs, which makes them nimble and fast. Anecdotal evidence indicates that these institutions are in closer contact with the private sector than universities and operate more flexibly. Because they supply not only SCPs but also bachelor's and, in some cases, PhDs, universities lack this 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. In addition, high fixed costs limit their ability to change their offerings.[19]

Overall, the main takeaway from this analysis is that SCP entry is responsive to local labor market demand, particularly on the part of private and non-university HEIs.

5.2 Entry, costs, and competition

We now estimate specifications of Equation 5 that incorporate cost proxies, X_{jkdt}, in addition to local economic activity by field (see Table 5). As expected, lower costs are positively associated with entry for both public and private HEIs. Larger institutions (where size is measured by the institution's enrollment share in the department) are more likely to open new programs in any field, and institutions that are more specialized in a particular field (as measured by the fraction of their students enrolled in the field)

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

are more likely to open programs in it. Comparing the entry elasticities with respect to these variables for private and public HEIs, we find that private HEIs are more sensitive to specialization than public HEIs, consistent with their lack of public funding—in the absence of public funding, they must avoid the fixed cost of opening programs outside their field of specialization. Meanwhile, public HEIs tend to be more responsive to size than private HEIs, consistent with their larger size.

Table 5: Program Entry and Proxies for Cost

Dependent Variable : Indicator for Opening a New Program (Narrow Entrant Definition)			
	All SCPs	Private SCPs	Public SCPs
	(1)	(2)	(3)
GDP by Field(lagged)	0.0012***	0.0014***	0.0004*
	(0.0001)	(0.0001)	(0.0002)
HEI share in Dept.(lagged)	0.1067***	0.1310***	0.0879**
	(0.0188)	(0.0236)	(0.0286)
Field share in HEI(lagged)	0.1456***	0.1397***	0.1571***
	(0.0091)	(0.0098)	(0.0216)
Constant	-0.0090**	-0.0150***	0.0039
	(0.0034)	(0.0037)	(0.0083)
N. of Observations	62,822	48,527	14,295
Mean of Dep. Variable	0.0203	0.0194	0.0236
Elasticities:			
HEI share in Dept.	0.18	0.16	0.26
Field share in HEI	0.31	0.31	0.28

Note: Each column presents the coefficients from an OLS 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 2004-2019. GDP-by-field is in billions of COP; HEI share in the department and field share within the HEI are enrollment shares and range between zero and one. All independent variables are lagged one year. All regressions include department, year, and field-category fixed effects. *,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.

Table 6 shows estimates of a specification of Equation 5 incorporating market competition, M_{kdt}, while controlling for entry costs because an institution's number of competitors is likely correlated with its size and specialization. For instance, an institution attracting a high share of local SCP students and highly specialized in a field might face low entry costs in that department and field, thereby deterring competitors' entry. Columns 1 and 3 present OLS estimates. We expect them to be upward-biased, as the number of competing programs is likely correlated with unobserved shocks in the error term and might lead to a positive correlation between entry decisions and number of competitors. Columns 2 and 4 present the corresponding 2SLS estimates, where we correct for endogeneity using the instruments described in Section 4 (Table A.6 shows the first-stage regressions). At the bottom of the table, we present the statistics for weak IV tests and over-identification tests for the 2SLS estimates. The

instruments are much stronger for private institutions, with a weak identification test that is safely above the critical values. In the case of public HEIs, the instruments are weak, therefore we also include the Anderson-Rubin Wald test, which is robust to weak instruments. This test shows that we can reject the null hypothesis that coefficients on all endogenous variables are not significantly different from zero. In other words, we can rule out that the three coefficients in Column 4 on the number of competitors are all zero.

Table 6: Entry Decisions and Market Structure

Dependent Variable: Indicator for Opening a New Program (Narrow Entrant Definition)				
	Private HEIs		Public HEIs	
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
N. of SENA SCPs (lagged)	-0.0004	0.006	0.0018**	0.010
	(0.0002)	(0.003)	(0.0006)	(0.006)
N. of Private SCPs (lagged)	-0.0036***	-0.112***	0.0029*	-0.056
	(0.0006)	(0.011)	(0.0011)	(0.035)
N. of Public SCPs (lagged)	0.0027**	-0.074	-0.0221***	-0.095**
	(0.0010)	(0.045)	(0.0038)	(0.037)
HEI share in Dept.(lagged)	0.1138***	-0.541***	0.0411	-0.158
	(0.0223)	(0.139)	(0.0247)	(0.109)
Field share in HEI (lagged)	0.1610***	0.086***	0.1401***	0.093*
	(0.0099)	(0.012)	(0.0210)	(0.042)
Constant	0.0055	1.811***	0.1413***	1.303***
	(0.0090)	(0.408)	(0.0277)	(0.336)
N. of Observations	49,848	45,581	14,688	13,405
Mean of Dep. Variable	0.0189		0.0240	
Weak identification tests:				
Cragg-Donald Wald F stat		25.723		5.492
Kleibergen-Paap rk Wald F stat		140.835		3.280
Anderson-Rubin Wald test		100.61		21.95
Overidentification test:				
Hansen J statistic		18.404		4.495

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 market number of SCPs offered by private institutions, public institutions, and SENA, plus controls for proxies of the cost of opening a program: HEI's enrollment share of SCP students in the department (total over all fields) and the field's enrollment share within the HEI. 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 HEIs, public HEIs, and SENA (first three independent variables). 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. All regressions include department, year, and field-category fixed effects. *,**, and *** denotes significance at the 10, 5 and 1% level. 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 HEIs respond mostly to the presence

of same-type competitors. Based on the 2SLS coefficients, the probability of a private HEI opening a new SCP in a market falls by about 0.11 (or 11 percentage points) in response to ten additional programs taught by private HEIs in that market. Similarly, the entry probability of a new SCP on the part of a public HEI falls by about 0.1 (or 10 percentage points) in response to ten additional programs taught by other public HEIs. Second, neither public nor private HEIs seem to respond to SENA competition. Findings are robust to using the broad definition of potential entrants (Table A.7).

These estimates suggest that public and private HEIs compete in different segments of the market and differentiate their products. This is consistent with their different specialization patterns and the student sorting described in Section 2.1. For example, competition may be particularly fierce among private HEIs—all of which are seeking to attract the same pool of students by offering relatively similar programs—but not between public and private HEIs, which attract different types of students and offer different products. Private HEIs, for instance, tend to emphasize student services, private sector connections, and job search assistance more than public HEIs, but the latter offer subsidized tuition and a different portfolio of programs. SENA programs, in turn, may be altogether different from those offered by public or private institutions, explaining why they do not elicit any competitive response on the part of HEIs. Indeed, for decades SENA has provided vocational training programs (lasting a few weeks or months) and has only recently entered the SCP market. As a result, students might perceive SENA's SCPs as different from those provided by public or private institutions. Further, SENA provides different skills than those provided by the HEIs—more focused on occupational training than on socio-emotional competencies—and a different student experience.

To summarize, when deciding whether to open a program in a given market, institutions respond to local labor market demand, cost considerations, and the presence of same-type competitors. We now turn to discussing our exit estimates.

5.3 Exit

5.3.1 Exit at the individual program level

We start with the decision to close a specific, existing program. Table 7 shows estimates for equation 7. The decision to close an individual program does not appear related to local labor demand, either at private or public HEIs (columns 1, 2, 4, and 5). It is not related to the presence of competitors either (Table A.8, panel B). Based

on conversations with HEI directors, we look at enrollment changes as a possible determinant of program closings (Table 7, columns 3 and 6). Holding local labor demand constant, in period t private HEIs are more likely to close programs with lower enrollment growth between $t-2$ and $t-1$, consistent with their full dependence on tuition revenue. Program closings at public HEIs, in contrast, do not respond to enrollment growth, consistent with their weaker relationship between funding and enrollment.

Table 7: Program Exit and Economic Activity

	Dependent Variable: Indicator for Closing a Specific Program					
	Private HEIs			Public HEIs		
	(1)	(2)	(3)	(4)	(5)	(6)
GDP by Field(lagged)	0.0001		0.0002	-0.0004		-0.0000
	(0.0001)		(0.0002)	(0.0005)		(0.0004)
Field Rel. Employment(lagged)		0.0059			0.0728	
		(0.0521)			(0.0933)	
Enrollment Change(lagged)			-0.0054***			-0.0002
			(0.0013)			(0.0002)
Constant	0.0210	0.0573*	0.0194	0.0532*	0.0571	0.0406
	(0.0173)	(0.0276)	(0.0181)	(0.0241)	(0.0308)	(0.0236)
N. of Observations	13,423	3,389	10,069	4,463	1,174	3,286
Mean of Dep. Variable	0.112	0.093	0.094	0.090	0.069	0.062

Note: In this table, the unit of observation is an incumbent program. Each column presents the coefficients from an OLS regression of an indicator for whether incumbent program i in department d and field k is closed in year t and the independent variables on our GDP-by-field and relative employment-by-field measures, and the one-year proportional enrollment change, all lagged one year, for the 2004-2018 period. GDP by field is measured in billions of COP, field relative employment is between zero to one, and enrollment change is the proportional change between years $t-2$ and $t-1$. All regressions include department, year, and field-category fixed effects. *,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.

To further explore the relationship between closings and enrollment changes, Table 8 regresses closing decisions on both one-lagged (between $t-2$ and $t-1$) as well as two-lagged (between $t-3$ and $t-2$) proportional enrollment changes. Once again, private HEIs respond to enrollment growth whereas public HEIs do not. Among private HEIs, more recent enrollment changes seem more impactful on program closing.

We also look at the relationship between program closing and cost proxies. As in the entry analysis, we expect that lower costs (as captured by larger size or greater specialization) would lower the probability of closing a program. Columns 2 and 4 show that greater specialization in a field lowers the probability of closing programs in it (the effect is more precisely estimated for private than public than public HEIs). And, among private HEIs, larger institutions are (marginally) less likely to close programs. In other words, program closing at private HEIs appears driven by enrollment changes and cost of provision (particularly specialization), but no determinant besides enrollment change is more than marginally significant to explain closings at public HEIs.

Table 8: Program Exit and Cost Proxies

Dependent Variable: Indicator for Closing a Specific Program				
	Private HEIs		Public HEIs	
	(1)	(2)	(3)	(4)
Lagged Enrollment Change	-0.0108***	-0.0105***	-0.0001	-0.0001
	(0.0023)	(0.0023)	(0.0002)	(0.0002)
Two-Lagged Enrollment Change	-0.0039**	-0.0039**	-0.0001	-0.0001
	(0.0013)	(0.0013)	(0.0002)	(0.0002)
Lagged Field Share in HEI		-0.0340**		-0.0543*
		(0.0125)		(0.0216)
Lagged HEI Share in Dept		-0.2058*		-0.0918
		(0.0839)		(0.0880)
Lagged GDP by Field		0.0004		-0.0000
		(0.0002)		(0.0005)
Constant	0.0295	0.0570*	0.0417	0.0606*
	(0.0215)	(0.0231)	(0.0248)	(0.0268)
N. of Observations	8,581	8,578	2,861	2,861
Mean of Dep. Variable	0.097	0.097	0.058	0.058

Note: In this table, the unit of observation is an incumbent program. Each column presents the coefficients from an OLS regression of an indicator for whether incumbent program i in department d and field k is closed in year t, on lagged proportional enrollment change ($t-1$ minus $t-2$) and two-lagged proportional enrollment change ($t-2$ minus $t-3$), for the 2004-2018 period. Columns (2) and (4) also include cost proxies (the HEI's enrollment share in the department and the field's enrollment share in the HEI, both between zero and one) and GDP-by-field (in billions of COP), all lagged one year. All regressions include department, year, and field-category fixed effects. *,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.

5.3.2 Exit at the market level

Motivated by the fact that many HEIs open and close programs simultaneously, we now turn to how HEIs decide whether to close any program at all in a market. Table 9 shows estimates for equation 8. We control for both contemporaneous and lead entry to capture the possibility that institutions might close a program in the current period to make room for a new one in the future.

Controlling for field-level local economic activity, at the market level we find a positive correlation between entry and exit decisions, both for private and public institutions (columns 2, 3, 5, and 6). In other words, an institution's decision to close programs in a field and department is correlated with its own decision to open new programs in that market either in the current or next period. We interpret this finding as evidence of capacity constraints—when seeking to open a new (perhaps more modern) program, given their limited resources HEIs may need to reallocate infrastructure and faculty away from other programs onto the new one.[20]

[20]For instance, in 2018 the LCI Technological Foundation in Bogota closed "Technologist in Fashion Design" and opened "Technologist in Photography and Digital Imaging," and in 2006 the Latin American University Corporation in Atlantico closed "Professional Technician in Executive Assistantship" and opened "Professional Technician in Human Resources Administration."

Table 9: Program Exit and Entry

Dependent Variable: Indicator for Closing Any Program						
	Private HEIs			Public HEIs		
	(1)	(2)	(3)	(4)	(5)	(6)
GDP by Field(lagged)	0.0015***	0.0018***	0.0016***	-0.0001	-0.0006	-0.0007
	(0.0003)	(0.0003)	(0.0003)	(0.0008)	(0.0006)	(0.0006)
Open Program (year t+1)		0.1042***	0.0983***		0.1751***	0.1565***
		(0.0213)	(0.0207)		(0.0377)	(0.0367)
Open Program (year t)			0.1001***			0.1364***
			(0.0182)			(0.0291)
Constant	0.0193	-0.0008	-0.0041	0.0586	0.0417	0.0297
	(0.0277)	(0.0211)	(0.0212)	(0.0348)	(0.0261)	(0.0258)
N. of Observations	6,703	6,087	6,087	2,339	2,170	2,170
Mean of Dep. Variable	0.175	0.122	0.122	0.139	0.098	0.098

Note: In this table, each column presents the coefficients from a regression of an indicator for whether institution j closes any (at least one) program in field k and department d in year t, on indicators for whether institution j opens any (at least one) program in field k and department d in year t or $t+1$, as well as the lagged GDP-by-field (measured in billions of COP), for 2004-2018. All regressions include department, year, and field-category fixed effects. *,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.

Another important finding emerges from Table 9. Consistent with our entry estimates, public HEIs do not respond to changes in economic activity when deciding to close programs in a market (column 4). Meanwhile, private HEIs respond to them but in a counter-intuitive manner, since they close more programs in markets with higher labor demand (column 1). In other words, in response to positive demand shocks private HEIs not only open some programs (Section 5.1) but also close others, thereby contributing to program turnover or "churn." This echoes well-know results from other industries (Dunne et al., 1988) where positive demand shocks leads not only to entry but also exit of firms and creates firm turnover.

To summarize, both public and private HEIs tend to open and close programs in a market simultaneously, likely due to capacity constraints. When choosing which program to close, private HEIs close those with relatively low enrollment growth and high costs. Among private HEIs, positive local labor market shocks drive not only entry but also exit (and therefore turnover) of programs.

6. Discussion

Overall, our results show that SCPs are more responsive to local economic activity than bachelor's programs and that, among SCP providers, private HEIs are more responsive than public HEIs. These findings are consistent with private HEIs' funding and management and, in principle, bode well for their ability to respond to the economy's changing skill needs.

The patterns from the analysis related to competition suggest that SCP providers

compete in highly segmented markets, and that SENA programs are not viewed as close substitutes to those offered by public or private HEIs. When opening new programs, HEIs respond mainly to competition from same-type HEIs and to costs, opening more programs in their fields of specialization or in locations where they are relatively large. They do not respond to competition from SENA. An interesting finding is that when institutions open a program in a market they often close others in the same market, presumably to liberate resources. Importantly, private HEIs not only open but also close programs in response to positive shocks in economic activity, generating program turnover or "churn".

An important caveat is that, due to data limitations, we cannot study the impact of entry and exit 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. Therefore, while HEIs's responsiveness might indeed respond to the skills needs to the economy, we cannot establish whether their responses improve the average quality of the offerings. It is also worth emphasizing that our estimates correspond to reduced-form specification and not to structural parameters which could be used in counterfactual simulations.

7. Conclusion

This paper studies entry and exit of SCPs in Colombia across markets defined as field of study-location combinations. We show that these programs exhibit high turnover rates—higher, in fact, than traditional bachelor's programs—providing evidence of a highly dynamic market that could respond to the changing skill needs of the economy. We find that, when opening new programs, institutions respond to changes in local economic activity. Private institutions are more responsive than public ones, presumably because they depend more on tuition revenues and operate more flexibly. Further, non-university institutions are more responsive than universities, likely because they are nimbler and more specialized in SCPs. Our results are robust to multiple specifications and definitions of potential entrants.

Overall, our results are consistent with evidence for SCPs in the U.S., where private for-profit institutions tend to show stronger and more flexible responses than community colleges. One important difference with that literature is our reliance on direct supply-side measures (program entry and exit) rather than equilibrium outcomes (student enrollment or graduation). Another one is our study of exit, which has not been

explored much in the literature, and our systematic investigation of entry and exit determinants.

All in all, our results indicate that, given their responsiveness to local labor market demand, SCPs seem well positioned for the skill provision currently needed by Colombia and other countries alike. They also highlight the need to fund and regulate institutions and programs in order to maximize their responsiveness to changing local conditions without sacrificing, of course, 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.

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. (2020). 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.

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., Franco Hernandez, A., Melguizo, T., and Sanchez Diaz, A. M. (2020). Estimating the contribution of short-cycle programs to student outcomes in Colombia. World Bank Policy Research Working Paper 9424, World Bank, Washington, DC.

Ferreyra, M. M., Galindo, C., and Urzúa, S. S. (2022). Labor market effects of short-cycle higher education programs: Lessons from Colombia. Working Paper Series 30178, National Bureau of Economic Research.

Ferreyra, M. M. and Kosenok, G. (2018). Charter school entry and school choice: the case of Washington, DC. *Journal of Public Economics*, 159:160–182.

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.

Jia, P. (2008). What happens when wal-mart comes to town: An empirical analysis of the discount retailing industry. *Econometrica*, 76(6):1263–1316.

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: 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 HEIs	807			
Private HEIs	2,656			

Note: This table presents information at the field-of-study level. 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 HEIs, and in private HEIs respectively). SENA programs are not included. Columns 2, 3, and 4 each sum up to 100. Fields are aggregated into four "field categories". Number of programs is the count of distinct programs that are offered during the sample period (2004-2019); percentages of students by field are computed based on sample period totals.

Table A.2: Entry and Exit

	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 Closing Programs per Year	127.0	90.6
Avg. Number of HEIs Active per Year	155.7	176.4
Avg. Number of HEI-Field-Depts per Year Offering at least One Program	606.3	1,314.6
Avg. Number of HEI-Field-Depts with at least One New Program per Year	123.6	144.1
Avg. Number of HEI-Field-Depts with at least One Closing Program per Year	112.8	107.1
Avg. Number of Potential Entrants per Field-Dept under Narrow Definition per Year	4,921.2	6,987.9
Avg. Number of Potential Entrants per Field-Dept under Broad Definition per Year	67,586.7	67,967.4

Note: This table presents the average, over all years from 2004 to 2019, for variables associated with entry and exit. SCPs and Bachelor's programs include those provided at public and private institutions. SENA programs are not included. "Dept" stands for "department".

Table A.3: Program Entry and Economic Activity using Only Movers

Dependent Variable : Indicator for Program Opening - GDP Measure with Only Movers

	Panel A: Narrow Entrant Definition			
	All SCPs	Private SCPs	Public SCPs	Bachelors
	(1)	(2)	(3)	(4)
L.GDP by Field (using only movers)	0.0016***	0.0019***	0.0004	0.0006
	(0.0001)	(0.0002)	(0.0002)	(0.0001)
Constant	0.0009	-0.0065	0.0171	0.0192
	(0.0032)	(0.0035)	(0.0080)	(0.0031)
N. of Observations	62,822	48,527	14,295	83,733
	Panel B: Broad Entrant Definition			
	All SCPs	Private SCPs	Public SCPs	Bachelors
	(1)	(2)	(3)	(4)
L.GDP by Field (using only movers)	0.0005***	0.0007***	0.0002***	0.0004***
	(0.0000)	(0.0001)	(0.0000)	(0.0000)
Constant	0.0001	-0.0012***	0.0043***	0.0031***
	(0.0003)	(0.0003)	(0.0009)	(0.0004)
N. of Observations	1,004,480	770,880	233,600	999,808

Note: This table presents the same regression shown in Panels A and B from Table 4 but using an alternative variable for GDP by field, in which the enrollment shares used as weights only include the "movers" (students who work in a given department but did not obtain their degree there). GDP by field is measured in billions of COP; "L." indicates lagged. All regressions include year, department, and 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: SCP Enrollment and Economic Activity

Dependent Variable: Total SCP Enrollment by Dept-Field-Year

	All SCPs	Private	Public
GDP by Field (lagged)	766.4124***	262.2605***	40.5253***
	(5.3091)	(2.5430)	(2.5092)
Constant	-543.6767***	-1006.2352***	1109.9461***
	(167.6649)	(80.3098)	(79.2408)
N. of Observations	3,608	3,608	3,608
Mean of Dep. Variable	2,080.01	550.26	425.33

Note: In this table, each column presents the coefficients from a regression of aggregate SCP enrollment in department d and field k in year t on lagged GDP by field, for the 2004-2019 time period. Column (1) includes all SCP enrollment in private HEIs, public HEIs and SENA; column (2) includes only enrollment in private HEIs; and column (3) only enrollment in public HEIs. GDP by field is measured in billions of COP. All regressions include department, year, and 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: Program Entry and Economic Activity: Responses by HEI Type

Dependent Variable : Indicator for Opening a New Program (All SCPs offered by HEIs)

Panel A: Narrow Entrant Definition						
	Technological and Technical Institutes		Technological Schools		Universities	
	(1)	(2)	(3)	(4)	(5)	(6)
L.GDP by Field	0.0024***		0.0017***		0.0005***	
	(0.0002)		(0.0002)		(0.0001)	
L.Field Relative Empl.		0.5741***		0.4476***		0.1820***
		(0.0691)		(0.0631)		(0.0492)
Constant	-0.0218***	-0.0398***	0.0131*	-0.0052	0.0099	0.0018
	(0.0056)	(0.0104)	(0.0057)	(0.0081)	(0.0061)	(0.0069)
N. of Observations	25,476	5,468	26,086	5,550	17,092	3,953
Mean of Dep. Variable	0.030	0.036	0.022	0.023	0.015	0.014

Panel B: Broad Entrant Definition						
	Technological and Technical Institutes		University Institutions		Universities	
L.GDP by Field	0.0009***		0.0006***		0.0001***	
	(0.0001)		(0.0001)		(0.0000)	
L.Field Relative Empl.		0.0278***		0.0247***		0.0105***
		(0.0031)		(0.0030)		(0.0023)
Constant	-0.0043***	-0.0025***	0.0020***	0.0052***	0.0007	0.0005
	(0.0006)	(0.0007)	(0.0007)	(0.0015)	(0.0005)	(0.0006)
N. of Observations	374,636	122,537	349,816	111,952	280,028	89,086
Mean of Dep. Variable	0.0021	0.0023	0.0016	0.0021	0.0009	0.009

Note: In this table, each column presents the coefficients from an OLS 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 2004-2019. Each column corresponds to a separate regression by institution type. GDP by field is measured in billions of COP and field relative employment is between zero and one; both variables are included with a one-year lag ("L." is lagged). Panel A shows the results using the narrow definition of potential entrants, while panel B uses the broad definition. All regressions include department, year, and 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.6: Entry and Market Structure: First-Stage Regressions

Endogenous Market Structure Variables in Entry Regressions

Dependent Variable :	N. of Private SCPs	N. of Public SCPs	N. of SENA SCPs
	(1)	(2)	(3)
Panel A: Regressions for Private HEIs			
N. of Private Progr. in 2004*L.GDP by Field	0.0003***	-0.0001***	-0.0003***
	(0.0000)	(0.0000)	(0.0001)
N. of Public Progr. in 2004*L.GDP by Field	0.0017***	-0.0011***	-0.0021**
	(0.0004)	(0.0001)	(0.0007)
N. of SENA Progr. in 2004*L.GDP by Field	-0.0041***	0.0023***	0.0043***
	(0.0007)	(0.0002)	(0.0012)
SENA Budget (in billions of COP)	0.0032***	0.0013***	0.0258***
	(0.0007)	(0.0003)	(0.0019)
Constant	10.7128***	8.0969***	8.6058***
	(0.1446)	(0.0656)	(0.3740)
N. of Observations	45,195	45,195	45,195
F-test for excluded instruments	418.70	131.69	55.29
Panel B: Regressions for Public HEIs			
N. of Private Progr. in 2004*L.GDP by Field	0.0001***	0.0002***	-0.0000
	(0.0000)	(0.0000)	(0.0001)
N. of Public Progr. in 2004*L.GDP by Field	0.0001	0.0018***	0.0005
	(0.0006)	(0.0003)	(0.0012)
N. of SENA Progr. in 2004*L.GDP by Field	-0.0008*	-0.0034***	-0.0002
	(0.0009)	(0.0004)	(0.0019)
SENA Budget (lagged) (in billions of COP)	0.0031***	0.0032***	0.0231***
	(0.0004)	(0.0002)	(0.0009)
Constant	10.5320***	7.9299***	8.9981***
	(0.2692)	(0.1213)	(0.7321)
N. of Observations	13,271	13,271	13,271
F-test for excluded instruments	25.29	45.63	14.69

Note: This table presents the coefficients from the first-stage regressions for the endogenous variables in Table 6: 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 field-category fixed effects. Panel A shows the regressions corresponding to private HEIs (column 1 in Table 6) and panel B those for public HEIs (column 3 in Table 6). First-stage regressions for columns 2 and 4 in Table 6 are similar to those presented here (not shown). 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.

Table A.7: Entry Decisions and Market Structure

Dependent Variable: Indicator for Opening a New Program (Broad Entrant Definition)

	Private HEIs		Public HEIs	
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
N. of SENA SCPs (lagged)	0.000	0.007***	0.000***	0.011***
	(0.000)	(0.001)	(0.000)	(0.002)
N. of Private SCPs (lagged)	-0.001***	-0.008***	0.001***	0.012**
	(0.000)	(0.002)	(0.000)	(0.004)
N. of Public SCPs (lagged)	0.000***	-0.042***	-0.003***	-0.070***
	(0.000)	(0.008)	(0.001)	(0.011)
HEI share in Dept.(lagged)	0.221***	0.213***	0.100***	0.037*
	(0.021)	(0.025)	(0.016)	(0.017)
Constant	0.003**	0.353***	0.020***	0.347***
	(0.001)	(0.045)	(0.003)	(0.066)
N. of Observations	823,680	770,880	249,600	233,600
Mean of Dep. Variable	0.0014		0.0017	
Weak identification tests:				
Cragg-Donald Wald F stat		198.008		56.672
Kleibergen-Paap rk Wald F stat		666.312		275.914
Overidentification test:				
Hansen J statistic		175.419		38.666

Note: In this table, 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 market number of SCPs offered by private institutions, public institutions, and SENA, plus controls for proxies of the cost of opening a program: HEI's enrollment share of SCP students in the department (total over all fields) and the field's enrollment share within the HEI. 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 HEIs, public HEIs, and SENA (first three independent variables). 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 the variables indicating number of programs are measured in tens. All explanatory variables are included with a one-year lag. All regressions include department, year, and field-category fixed effects. *,**, and *** denotes significance at the 10, 5 and 1% level. Standard errors are clustered at the institution-year level.

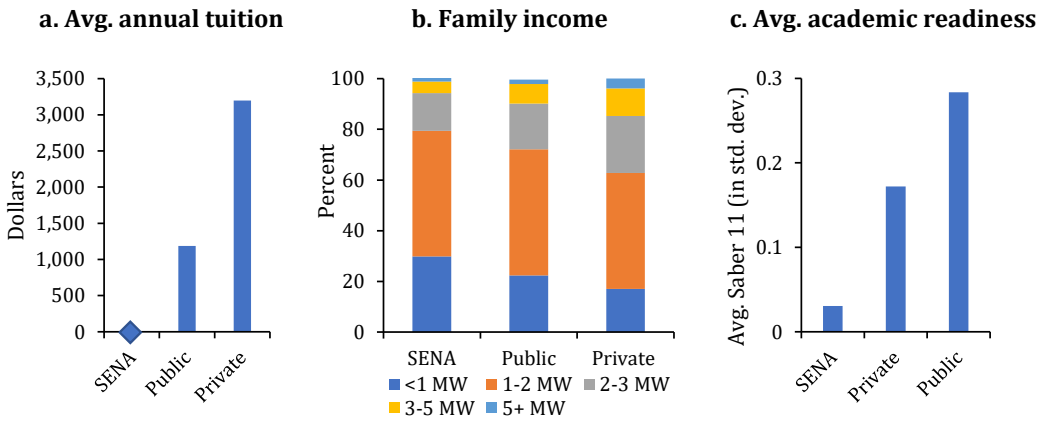
Table A.8: Exit Decisions and Market Structure

Dependent Variable: Indicator for Program Closing

	Private HEIs		Public HEIs	
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
N. of SENA SCPs (lagged)	0.0036**	0.0066	0.0029	0.0098
	(0.0012)	(0.0041)	(0.0019)	(0.0093)
N. of Private SCPs (lagged)	-0.0017	-0.0279	0.0021	-0.0048
	(0.0033)	(0.0182)	(0.0040)	(0.0651)
N. of Public SCPs (lagged)	0.0075	-0.1815	-0.0007	-0.0311
	(0.0089)	(0.0930)	(0.0096)	(0.0392)
HEI share in Dept.(lagged)	-0.3370**	-0.7168*	-0.1795	-0.2557
	(0.1112)	(0.2837)	(0.1330)	(0.1817)
Field share in HEI (lagged)	-0.0157	0.0012	-0.0359	-0.0394
	(0.0135)	(0.0214)	(0.0267)	(0.0442)
Constant	-0.0183	2.0229*	0.0370	0.2141
	(0.0894)	(1.0030)	(0.0836)	(0.8239)
N. of Observations	11,496	10,069	3,786	3,286

Note: In this table, each column presents the coefficients from a regression of an indicator for whether institution j closes a program in department d and field k in year t on the market total number of SCPs offered by private institutions, public institutions, and SENA, for 2004-2018. In columns (2) and (4) we also control for our proxies for the cost of opening a program. HEI share in a department is the HEI's enrollment share of SCP students in the department (total over all fields), and field share in HEI is the enrollment share of the field within the HEI. All variables indicating number of programs are measured in tens. Panel A and B show OLS and 2SLS estimates, respectively. The endogenous variables are the number of SCPs offered by private institutions, public institutions, and SENA (first three independent variables). Instruments are the number of programs offered by provider type in 2004 interacted with lagged GDP-by-field variable as well as SENA's budget for the corresponding department and year (first-stage regressions are available upon request). All explanatory variables are included with a one-year lag. HEI share in the department and field share within the HEI are enrollment shares and range between zero and one. All regressions include department, year, and field-category fixed effects. 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 HEI provider type (in PPP dollars of 2019). Panel b shows, for each HEI 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 exit 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.