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Quality Illusions: Private College Openings and the Rise of Low-Quality Secondary Schools

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Resumen

La educación superior ha crecido de manera significativa en los países en desarrollo. Los investigadores han estudiado ampliamente sus efectos sobre múltiples variables de resultado, como el logro educativo, el mercado laboral, la salud, entre otros, pero poco se sabe sobre sus efectos en los mercados de educación básica. Utilizando un enfoque de estudio de eventos, evaluamos empíricamente las implicaciones de la expansión de la educación superior privada en la calidad promedio y composición de las escuelas secundarias privadas en la principal ciudad de Perú. Mostramos que la proporción de escuelas secundarias privadas de mala calidad aumenta en 2.5 puntos porcentuales, ya que estas tienden a ubicarse estratégicamente cerca de nuevas universidades privadas para beneficiarse de la percepción positiva asociada al entorno de educación superior. Este fenómeno es el que denominamos como efecto de señalización distorsionada espacialmente. Los resultados destacan la importancia de abordar los efectos negativos de la expansión desregulada de la universidad privada fomentada por el Decreto Legislativo No 882 de 1996 "Ley de Promoción de la Inversión en Servicios Educativos" no solo en la calidad de la educación superior, sino también en la de los mercados de educación básica.

Palabras claves: expansión de la educación superior privada, escuelas secundarias privadas, países en desarrollo, mala calidad, principal ciudad de Perú, estudio de eventos.

Abstract

Higher education has grown dramatically in developing countries. Researchers have widely studied its effects on multiple outcomes such as educational attainment, labor market, health, among others, yet little is known about its effects on lower schooling markets. Using an event study approach, we empirically assess the implications of private college expansion on the average quality and composition of private secondary schools in Peru's main city. We show that the share of bad-quality private secondary schools increases by 2.5 percentage points, as these tend to locate strategically near new private universities to benefit from the positive perception associated with the higher education environment. We call this phenomenon the spatially distorted signaling effect. The results highlight the importance of addressing the negative effects of the deregulated private college expansion fostered by the 1996 Legislative Decree No 882 "Law to Promote Investment in Educational Services" not only on the quality of higher education, but also on the quality of lower schooling markets.

Keywords: higher education expansion, private secondary schools, developing countries, bad quality, main Peru’s city, event study.

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Introduction

In developing countries, higher education has experienced a substantial expansion. Its gross enrollment ratio has increased from 19% in 2000 to 40% in 2020 (UNESCO, 2022). In Peru, the number of universities has grown from 74 in 2000 to 139 in 2019 which represents a growth of 87% (SUNEDU, 2020), led mainly by private for-profit institutions (Chong, Lavado, & Yamada, 2023). Several authors have studied the implications of the expansion of higher education in Peru and reveal that, despite greater access, there has been a decline in the quality of education and an increase in for-profit institutions that have led to greater underemployment and social inequalities (Chong et al., 2023; Sanchez, Favara, & Porter, 2021; Yamada, Lavado, & Martinez, 2016). On the basic education side, Rentería (2023) has examined the collateral effects of private school expansion in Peru, finding that it has neither increased access to formal and high quality secondary schools nor improved wages in the mid-term. Nevertheless, one less explored area is how the expansion of higher education affects the quality and composition of lower levels of education, particularly in private secondary schools.

The objective of this paper is to estimate the effect of opening new private college campuses on the average quality and composition of private secondary schools in Peru's main city. We seek to encompass not only the creation of new colleges but also new campuses of an existing college. Peru's main city and capital, Lima, has more than 10.6 million inhabitants which represents more than 30% of the country (INEI, 2020), and has concentrated the majority of educational expansion. According to Balarin, Kitmang, Rodríguez, and Ñopo (2018), Lima concentrates half of Peru's total private enrollment. Moreover, private school enrollment in this megacity has grown from 37% in 2007 to 48% in 2015 (Balarin et al., 2018), likewise, the concentration of peruvian college campuses in Lima increased from 34% in 2000 to 41% in 2015 (SUNEDU, 2017). The rapid expansion of private schools, often of low cost and poor quality (Sanz, 2015), raises concerns about its negative effects on access to equitable education that can promote equality of educational opportunities. Therefore, it is critical to understand the drivers of this phenomenon and to determine whether it is associated with the expansion of private college campuses.

To explain how the entry of a private university campus influences the local

composition and quality of private secondary schools, we develop a theoretical model grounded in the concept of spatially distorted signaling. Building on the classic signaling theory of Spence (1973), we propose that in markets with imperfect information, the location of a private secondary school near a university can act as a misleading signal of quality, even when the school offers substandard education. This mechanism is especially relevant in deregulated urban markets like Lima, where families lack reliable information about school quality and instead rely on spatial cues and reputational spillovers. We formalize this idea in a two-layer mathematical model that captures both household school choice and the entry decision of private schools. In equilibrium, the model predicts a higher density of school entry near the university, particularly by low-quality providers who capitalize on spatial signals to attract students.

To the best of our knowledge, only one study has addressed the impact of opening new higher education institutions on school markets in a developing country. Jagnani and Khanna (2020) evaluate the effect of new elite public universities opening on school markets in India where the main mechanism is the creation of an educational hub which increases public infrastructure investments that in turn reduce the entrance costs for private schools. Our paper contributes to expand this nascent literature in three ways. First, we focus on the effect of the creation of new private college campuses, which have been the main source of higher education expansion in Lima and the majority of developing countries. Second, we analyze heterogeneous effects depending on school quality. Third, we are the first to provide evidence of what we call the ”spatially distorted signaling” which consists of low-quality schools locating near newly established universities to benefit from a perceived educational environment, despite offering substandard educational services.

To address our objective, we use several national datasets and other auxiliary sources. First, the School Census provides us with the schools' adresss among other characteristics. We complement this dataset using auxiliary georeferenced data from Google Maps API. Second, the Peruvian Ministry of Education (MINEDU) provides us with a georeferenced dataset on the entire universe of colleges which we complement using university websites (opening date) and Google Maps API (coordinates). Third, the Student Census Assessment provides us with information on grades (reading and maths) at the student-school level, which we use to measure school quality.

The effect of opening new private college campuses on the share of private secondary schools is hard to address because there are various variables that may affect both the decision to open a new campus and also the creation of new private schools[1]. In order to deal with this non-random treatment assignment, we use an event study framework which allows for causal inference to be made in the face of an assignment of this type (Borusyak, Jaravel, & Spiess, 2024). This empirical approach reduces reliance on assumptions compared to a difference-in-differences design (Miller, 2023). Moreover, it is possible to incorporate a control group using the not yet treated units following the cutting-edge diff-in-diff and event studies literature (Borusyak et al., 2024; Callaway & Sant'Anna, 2021). Our main assumption is that not yet treated units (neighborhoods in our case) are similar to treated ones in terms of whether they will receive a college at some point in the study period. Therefore, we restrict our analysis to neighbourhoods that received a college campus between 2000 and 2019, avoiding comparisons between dissimilar locations[2]. Furthermore, we exploit the timing variation of new college campuses opening and account for potential time-invariant unobserved factors influencing local secondary school markets quality composition, and college campuses openings using neighbourhood fixed effects and year fixed effects to control for time-specific events.

The results show that the opening of a new private college campus in a neighbourhood increases the share of bad quality schools by 2.5 pp. According to our theoretical model, this occurs because of the spatially distorted signaling effect: low-quality private schools strategically enter near the new campus to exploit the perceived association with a higher education institution. In an environment with limited information and weak regulation, proximity to a university acts as an indirect but powerful signal of legitimacy and educational value, allowing schools with low academic standards to attract families based on location rather than quality.

The paper proceed as follows: Section 2 describes the Institutional Setting. Section 3 reviews relevant literature. In Section 4, we present the theoretical framework guiding our analysis. Section 5 describes the data used in this study, followed by Sec-

[1] In fact, several authors have found a relation between economic development (Glewwe & Jacoby, 2004; Schofer, 1975), public investments (Jagnani & Khanna, 2020; Pal, 2010), among others variables, with both decisions.

[2] For our analysis, we define neighbourhood as a 1.5-kilometer radius around the location of a new private college campus

tion 6, which details the empirical approach. Section 7 discusses the empirical results. Section 8 presents the robustness tests. Section 9 concludes with the policy implications.

1 Institutional Setting

Like many developing countries, Peru has experienced a dramatic expansion of its education system over the past two decades. The main drivers were the following laws. First, the Legislative Decree No. 882 of 1996 “Law to Promote Investment in Educational Services”. Second, the General Education Law promulgated in 2003 that allows any natural or legal person to establish a school, which led to the proliferation of private institutions, especially in urban areas (General Law of Education 2003, Art. 5). Consequently, a drastic increase in the supply of both private higher and basic education occurred. For a stylized representation of the Peruvian educational system, see the Table 1.

1.1 Basic Education

The compulsory basic education in Peru begins with primary education which lasts six years and usually starts at the age of six. Then, students move on to secondary education at the age of 12, which lasts five years. For our analysis, we focus only on secondary schools. These are divided into public and private institutions. Public secondary schools are free with only small administrative fees and do not require an entrance exam. Private secondary schools, in contrast, have several payment and admission systems. Some authors classify private schools as either low-cost or high-cost based on the monthly tuition; low-cost schools charge less than 200 soles[3] per month (Balarin et al., 2018; MINEDU, 2018).

[3] One dollar was on average 3.31 soles in 2019 (BCRP, 2019).

Table 1
Peruvian Educational System Structure

Age Group	Local Name	Years	Compulsory	ISCED 2011 Equivalent
0-2	Educación Inicial (Primer Ciclo)	3	No	ISCED 0 Early childhood education
3-5	Educación Inicial (Segundo Ciclo)	3	Yes	ISCED 0 Pre-primary education
6-11	Educación Primaria	6	Yes	ISCED 1 Primary education
12-16	Educación Secundaria	5	Yes	ISCED 2 and 3 Lower and upper secondary education
17+	Educación Superior	1+	No	ISCED 4+

Note: This table presents the peruvian educational system structure.
Source: Guadalupe, León, Rodríguez, and Vargas (2017), UNESCO (2012) and Rentería (2022). Own elaboration.

On the supply side, like higher education, the expansion of secondary schools was led mainly by private schools. In fact, the share of private secondary schools in urban areas increased from 36.22% in 1993 to 48.75% in 2016 (Guadalupe et al., 2017). Moreover, it is essential to understand who school founders are. Balarin et al. (2018) conducts qualitative research and points out that the main founders in San Juan de Lurigancho, which is a representative district of Lima, are teachers. The characteristics of these teachers differ depending on the characteristics of the schools they lead. On the low-cost private schools side, these are mostly over 40 years old, 84% live in the same district in which their school is located, generally less than 15 minutes away, almost 30% are located in human settlements and around 60% are women. On the other hand, in high-cost private schools, the characteristics remain unchanged with the exception that 66% live in the district in which their school is located and are willing to tolerate greater distances, in addition, only 5% live in human settlements.

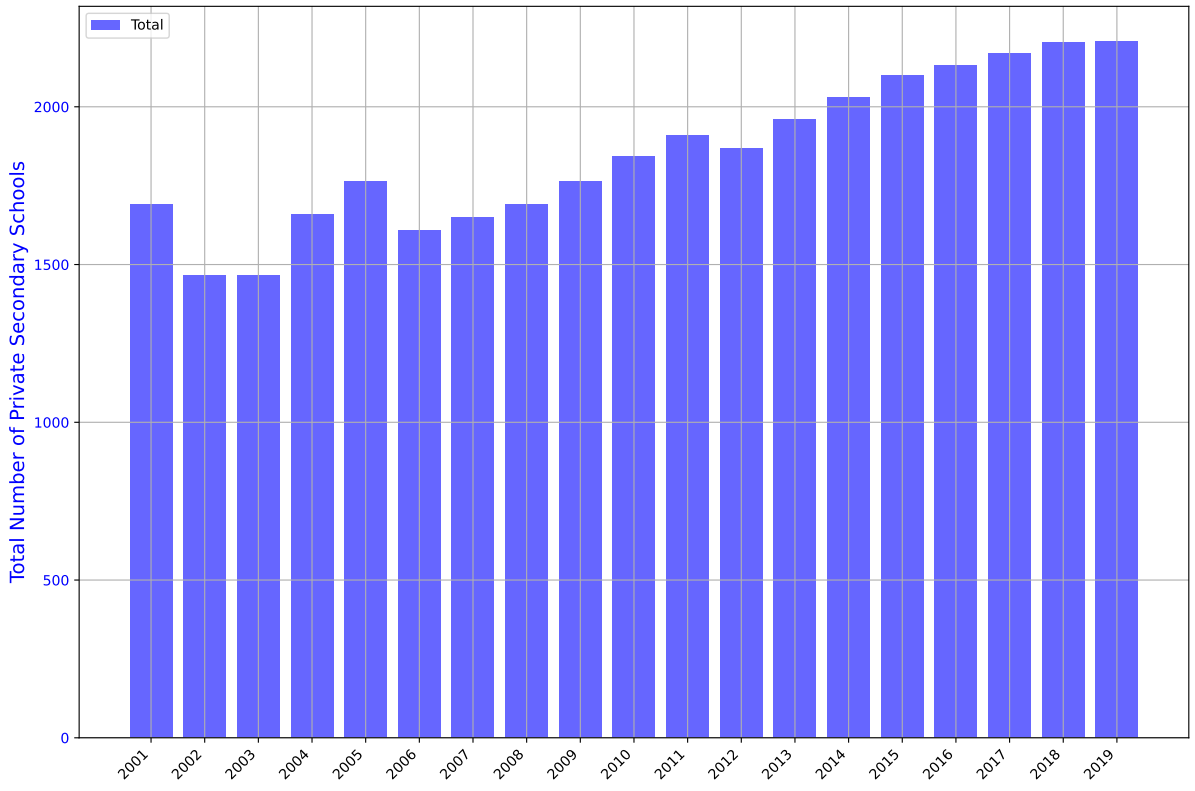
On the demand side, applicants to secondary education are usually adolescents over 12 years of age nonetheless the enrollment decision is made by the parents. Their decision to enroll in private secondary education is influenced by several factors, including the perceived quality of private education given a discredited public education (Sanz, 2015), the socioeconomic status of their families (Saavedra & Gutierrez, 2020), and the geographical accessibility of schools (Balarin et al., 2018). Additionally, Balarin et al. (2018) finds that both low and high-cost schools have a commercial orientation where they seek to satisfy the demand, on the part of parents, to prepare their children for higher education. In fact, enrollment in private secondary schools has almost doubled between 2000 and 2016, increasing from 349 to 619 thousand students (MINEDU, 2018).

1.2 Higher Education

The post-secondary education system in Peru does not have a centralized admission system and is divided into colleges and technical institutes[4]. For further analysis, we will focus on colleges, which offer 5-years undergraduate programs that grant a bachelor's degree. Colleges are divided into public and private institutions. Public

[4]The technical institutes in Peru are the equivalent of community colleges in the US.

Figure 1
Number of Private Secondary Schools Over Time in Lima



Note: For the purposes of the study, we kept the schools correctly georeferenced.
Source: School Census. Own elaboration.

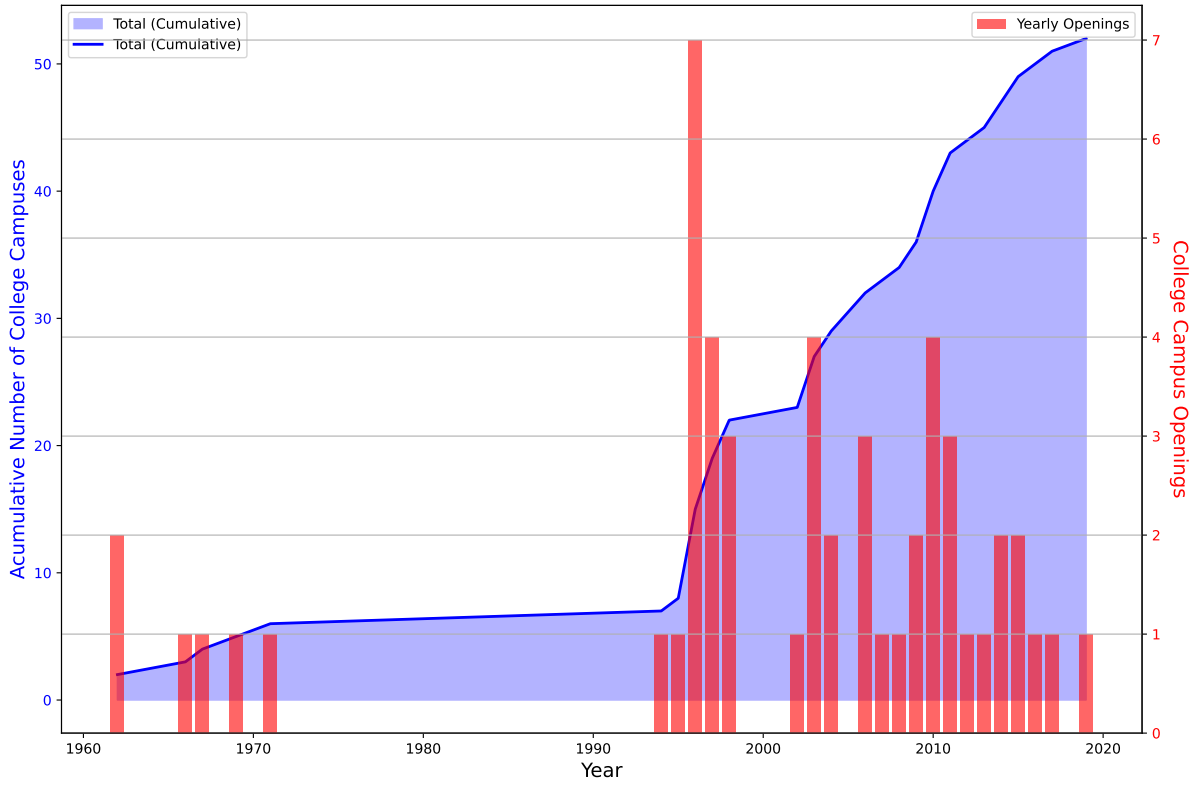
colleges are funded by the government and charge students only a small fee for enrollment, with no monthly tuition fees, attracting a large number of applicants. Private colleges, on the other hand, have several payment systems which reflects significant heterogeneity in tuition fees according to the socioeconomic level of the students they seek to attract.

On the supply side, the number of colleges has experienced a growth of 87% between 2000 and 2019 (SUNEDU, 2020). This expansion was driven mainly by for-profit private colleges (Chong et al., 2023). Due to concerns about the quality of these new institutions, the National Superintendency of Higher University Education (SUNEDU) was created in 2014 to supervise and ensure the quality of higher education through a licensing policy. Thus, those institutions that did not meet the standards were given two years to cease operations. Indeed, around a third of Peruvian colleges that did not obtain licensing between 2018 and 2020 had to close (Magnaricotte & Flor-Toro, 2022).

On the demand side, college applicants are a group of young people generally

over 16 years given that this is the age when they usually finish high school. When these students complete compulsory basic education, they can choose between the following options: entering the labor market directly, preparing at a pre-college academy before applying to a college, or applying immediately after finishing school. This decision is influenced by various socioeconomic factors, such as the socioeconomic status and educational level of their families (Chong et al., 2023), the upward social mobility desire (Saavedra & Gutierrez, 2020; Sanz, 2015), and academic characteristics (Chong et al., 2023). According to SUNEDU (2017), the demand for higher education has expanded dramatically with an annual growth rate of enrollment of 7.57% from 2000 to 2015 due to economic and population growth, which has provided families more financial resources and increased the number of potential applicants.

Figure 2
Private College Campus Openings Over Time in Lima



Note: If the exact date of the campus's opening is unknown, the date of the university's creation is used for the purposes of this figure. In the event study, only campuses with a specific opening date are used.
Source: DIGESU, University websites. Own elaboration.

1.3 The Interactions Between the Two Markets

The expansion of private college campuses and the growth of private secondary schools in Lima are not independent phenomena. Rather, they reflect the dynamics of two markets that are interlinked through both demand- and supply-side channels. First, there is strong evidence of complementarity between these two educational levels. Many private secondary schools — especially those in urban areas — adopt a commercial orientation that explicitly emphasizes preparation for college entrance exams (Balarin et al., 2018). This aligns with the finding that families consider secondary education as a stepping stone toward higher education (Balarin et al., 2018; Sanz, 2015). Hence, the opening of a nearby college can increase the perceived returns to secondary education, especially private education, thus shifting local demand toward private secondary schools.

Second, supply-side responses suggest that entrepreneurs in the education sector may exploit this complementarity. This suggests the presence of (partial) vertical integration in educational provision, where providers align incentives and branding across secondary and tertiary levels. For example, some private schools advertise high college admission rates and even highlight affiliations with specific universities[5]. Conversely, new universities may choose to open campuses in neighborhoods with existing or potential demand for preparatory education, knowing that this co-location enhances their appeal.

Finally, as shown in Table 2, districts with rapid university expansion, such as Los Olivos, tend to exhibit socioeconomic characteristics conducive to dual-market growth — a young population, high firm density, and lower poverty. These conditions reduce the frictions for both school and college entrepreneurs, creating locally self-reinforcing educational ecosystems.

In sum, the evidence suggests that the higher education and secondary education markets in Lima are not only sequential in terms of student life cycles but also economically and spatially interdependent.

[5]For example, see how these two schools advertise their agreements with universities: https://www.magister.edu.pe/ingreso-a-universidades/ and https://www.colegio-humboldt.edu.pe/sp/diversos/convenios/index.php

Table 2
Comparison between Los Olivos and the Average of Lima Districts in 2017

District	Poverty Rate	Number of teenagers (12-16 years)	Number of firms
Los Olivos	7.88%	22,125	5,553
Lima (mean)	11.12%	14,557.81	3,655.37

Note: This table presents descriptive statistics for Los Olivos and the mean of Lima.
Source: Poverty Map (2018), Population Census (2017), MTPE (2017). Own elaboration.

2 Literature review

The literature examining higher education expansion and its spillover effects is extensive and involves a large variety of domains. Several authors have studied its effects on labor markets (Berlingieri, Gathmann, & Quinckhardt, 2022; Liu, 2015), innovation (Andrews, 2023), economic activity (Cantoni & Yuchtman, 2014), health outcomes (Baltagi, Flores-Lagunes, & Karatas, 2023; Fletcher & Noghanibehambari, 2024), and college enrollment (Ferhat, 2022; Soliz, 2018). Most results revealed either positive or null effects suggesting the existence of local spillovers.

These studies have effectively studied the effect of opening new colleges on numerous outcomes, but they have primarily focused on developed countries. Nonetheless, there is a growing literature focusing on developing countries trying to assess this effect in different backdrops of social and economic structure. For instance, Magnaricotte and Flor-Toro (2022) study the effect of opening new college campuses in Peru and found an increase in the college enrollment rates but the preexisting ethnic gaps related to access to higher education remained. From a gender perspective, Elsayed and Shirshikova (2023) address the effect of the construction of public universities in Egypt and find an increase in the probability of obtaining a post-secondary degree for women, as well as greater female labor participation and a reduction in the probability of getting married before 18. Additionally, Sekhri, Hossain, and Khosla (2024) show an improvement in several human capital outcomes such as college enrollment and the reduction in child marriage for women due to the construction of new local colleges in India.

Despite this growing literature of college expansion and its spillover effects for developing countries, its effect on lower schooling levels has not been assessed at all. To our knowledge, the only paper that endeavor this analysis is Jagnani and Khanna (2020). They studied the effect of opening new elite public colleges on primary and secondary schooling markets in India and found an increase in the number of private schools and its enrollment rate at the expense of public schools. They argue that the mechanism leading this effect was the increase of public infrastructure investments due to the creation of an educational hub. These findings do not apply to the Peruvian case for three main reasons. First, the higher education expansion in Peru has been led mainly by private for-profit institutions and not by public ones. Second, the school mar-

ket is highly fragmented, as private schools proliferate as small firms in direct response to local demand and not to infrastructure-related costs. Third, the private education expansion in Peru occurred mainly in urban areas and the growth has been particularly concentrated in Peru's main city, which is exactly where our analysis takes place. No other province individually rivals its density of new private universities. This makes Lima a particularly relevant setting for analyzing the effects of college expansion.

Our paper aims to fill this gap by presenting some of the first estimates of the effect of opening new private college campuses on the average quality of private secondary schools in surrounding neighborhoods of a megacity in a developing country. A number of questions regarding the nature of private schools that are created, their effects on learning, as well as other possible mechanisms that may explain it remain to be addressed. Although Jagnani and Khanna (2020) evaluate the effect of higher education institutions, they remain focused on elite public colleges. This study examines the impact of private college expansion in Peru's main city, a trend that has driven the growth of higher education in the developing world. Consequently, it is relevant to other Latin American countries, where private higher education has also experienced dramatic growth (Yamada & Lavado, 2018). Moreover, in these countries, private schools often capture large market shares, reflecting similar dynamics (Dinerstein, Morales, Neilson, & Otero, 2023). Finally, it goes further by studying whether the private secondary schools created are good or low quality.

3 Theoretical Framework

Our theoretical model relies on the development of the concept of spatially distorted signaling. We derive this concept from Spence (1973) signaling theory, which indicates that certain observable attributes can convey information about the quality of a good or service in markets where such quality is not perfectly observable. In the educational context, this theory has been applied to explain how a university degree functions as a signal to employers or consumers (Caplan, 2019; Weiss, 1995).

For our model, we modify this concept by proposing that when a school is located near a university (higher education institution), it may convey an implicit signal of belonging to a legitimate or quality educational environment, even if its actual academic performance is low. This is especially likely in markets with imperfect information and high search costs, such as the educational market (Akerlof, 1970; Hastings, Kane, & Staiger, 2006). It is even more relevant in the Peruvian context where, as mentioned in the Institutional Setting section, parents do not know the actual quality of schools and must rely on other subjective means to evaluate them and decide where to enroll their children.

Thus, we propose the concept of the spatially distorted signaling effect as follows: the location of an educational institution near a university acts as an indirect signal of quality that can mislead families, benefiting schools with low standards through a positive spatial association and leveraging the reputation of a higher education institution. Furthermore, the effect is stronger when families have limited information about the actual quality of schools; the education market is deregulated; and there are perceived positive externalities from proximity to higher education institutions. Furthermore, this effect is especially relevant for low-cost and low-quality private schools with small margins, which cannot compete on actual quality but can compete on the visible signals they obtain by being located near higher education institutions.

We formalize our spatially distorted signaling concept by building a two–layer mathematical model to explain why the opening of a private university campus triggers a spatial re□allocation of private secondary schools in urban areas.

- **Demand side:** households trade off tuition, transport and *perceived* quality that decays with distance to the campus.

- **Supply side:** schools maximise profit subject to a convex cost function and a fixed cost of entry.
- **Market equilibrium:** free entry pins down tuition and determines how many schools locate at every distance d from the campus.

3.1 Demand: the school choice problem

A representative household derives the following utility function:

$$U(x, d) = \beta\, Q(d) + w + a - C, \qquad \beta > 0 \tag{1}$$

where $Q(d)$ is the perceived quality, d denotes the distance from the school to the campus, w the household wealth, and a the student ability. The cost function is as follows:

$$C = T + tx \tag{2}$$

which collects the tuition fee T and transport cost tx, where $x \sim \mathsf{U}[0, X_{\mathsf{max}}]$ is the distance from household to school.

Schools perceived quality nearby the new campus increases due to reputation effects (δ) which we call "spatially distorted signaling". The quality function is as follows:

$$Q(d) = Q_0 + \delta\, e^{-\lambda d}, \qquad \delta, \lambda > 0. \tag{3}$$

A household enrolls if $U(x, d) \geq U_{\mathsf{th}}$ (outside option - utility). Define

$$K(d) = U_{\mathsf{th}} - \beta Q(d) + T, \tag{4}$$

so that the condition becomes $w + a \geq K(d) + t\,x$. For tractability we assume that the composite term $w + a$ is uniformly distributed on $[W_{\mathsf{min}}, W_{\mathsf{max}}]$[6] and independence from x, the conditional enrolment probability is

$$P_{x,d} \;=\; \frac{W_{\mathsf{max}} - \big[K(d) + t\,x\big]}{W_{\mathsf{max}} - W_{\mathsf{min}}}, \quad \text{for } W_{\mathsf{min}} \leq K(d) + t\,x \leq W_{\mathsf{max}}.$$

[6]The exact distribution is triangular when w and a are independently uniform; here we adopt the uniform simplification to keep the demand function linear.

With N_h households and x which is uniformly distributed, aggregate demand faced by a school at distance d is

$$\begin{aligned} D(d) &= \frac{N_h}{X_{\max}(W_{\max} - W_{\min})} \int_0^{X_{\max}} \left[W_{\max} - K(d) - t\,x\right] dx \\ &= \frac{N_h}{W_{\max} - W_{\min}} \left\{ \beta Q(d) - T - U_{\text{th}} + W_{\max} - \tfrac{t\,X_{\max}}{2} \right\}. \end{aligned} \tag{5}$$

Demand declines in d because perceived quality decays.

3.2 Supply: the school entry problem

Let $S(d)$ be the number of student–years the school supplies at distance d. Running the school entails a linear cost $C_s S(d)$, a quadratic cost $C_q S(d)^2$ ($C_q > 0$), and a fixed entry cost $F > 0$. Profit is therefore

$$\Pi = T\,S(d) - C_s S(d) - C_q S(d)^2 - F. \tag{6}$$

Maximising (6) w.r.t. $S(d)$ yields

$$S^*(d) = \frac{T - C_s}{2C_q}, \qquad \Pi^*(d) = \frac{(T - C_s)^2}{4C_q} - F. \tag{7}$$

Under free entry, schools locate until profits are driven to zero:

$$\Pi^*(d) = 0 \implies T^* = C_s + 2\sqrt{C_q F}. \tag{8}$$

Tuition must cover the marginal cost plus a premium that compensates the fixed cost.

Substituting (8) into (7),

$$S^* = \sqrt{\frac{F}{C_q}} > 0, \tag{9}$$

which is constant across locations.

3.3 Equilibrium

Let $N_s(d)$ be the equilibrium density of schools at distance d. Market clearing requires

$$N_s(d)\, S^* = D(d) \quad \Longrightarrow \quad N_s(d) = \sqrt{\frac{C_q}{F}}\, D(d).$$

Because $D'(d) < 0$ (see (5)),

$$\frac{dN_s}{dd} = \sqrt{\frac{C_q}{F}}\, D'(d) < 0.$$

Hence the equilibrium number of schools increases strictly with less distance from the campus. Given that low-quality schools benefit from the spatially distorted signaling effect, the share of low-quality private schools will increase nearby the new university[7].

[7] For more comparative statics, see Table 7

4 Data

Our data comes from three sources. The first source is the School Census which provides data for each school in Peru for every year since 1998 and exceptionally in 1993. It includes information on the schools' address and others institution characteristics. However, most data do not have the coordinates, but only the address. To deal with this problem, we use Google Maps API to obtain the coordinates of all the addresses provided by the census to complete the database. For the purposes of the study, we stuck with private secondary schools. We focus on Lima and keep schools that are into a neighborhood level which we define as a 1.5-kilometer radius around the location of a new college campus, using the school coordinates per year. This neighborhoods would be the treated units.

The second source is a georeferenced dataset on the entire universe of college campuses provided by the Ministry of Education. The data includes the coordinates of new universities and their respective campuses in Lima. Since we do not have the creation date data for each specific campus, we use auxiliary sources and perform a complex data recompilation complex. First, we review the websites of each university, specifically the History section, to obtain the data on the date of creation of each campus. Second, since many universities do not report this data on their websites, we chose to search in news, official college youTube channels or social networks. Third, we used the licensing reports which have data on the date of creation of each degree and in which campus it is taught, from which we infer the date of creation of each university campus. We use this data to obtain our treatment timing variable which is the opening of a new private college or campus and use its coordinates and creation date to link it to the nearby schools provided by the first source.

The third database is the Census Student Assesment, which includes the grades in reading and maths for all secondary school students at the national level in 2015, 2016, 2018 and 2019. Given that our period analysis is 2000-2019 we stick with the results of the most recent year before the last year which is 2018 and assuming that the academic performance of schools is generally invariant over time. We aggregate the reading and maths grades at the school level. Since we want to generate a measure of school quality, we average the math and reading scores at the school level to obtain a single score for the school's educational level and then calculate the z-score. Finally,

we use this z-score to obtain percentiles and identify the schools in the top/bottom 20% of academic performance. This generates the main dependent variable, an indicator that takes the value of 1 if the school is in the bottom 20% of academic performance and 0 otherwise.

5 Empirical approach

We evaluate the effect of opening a new private college campus on the share of bad/good quality private secondary school using an event study approach. This method takes advantage of the timing when a neighborhood had a new private college campus open. It is normally used instead of the difference-in-differences method, due to its flexibility in not requiring an exogenous change as a treatment (Miller, 2023). It is also capable of providing a causal effect when a control group composed of units (neighborhoods) not yet treated is incorporated (Borusyak et al., 2024).

We restrict our sample to neighborhoods which we define as a 1.5-kilometer radius around the location of a new private college campus. This gives us a total of 21 neighborhoods[8]. An example of a neighborhood is shown in the following Figure 3[9], where the university campus as well as the good and bad quality private secondary schools can be seen before and after the opening of the campus. It is clearly observed how the number of bad quality schools increases while the number of good schools remains unchanged, which exemplifies the effect on the share of bad/good quality schools.

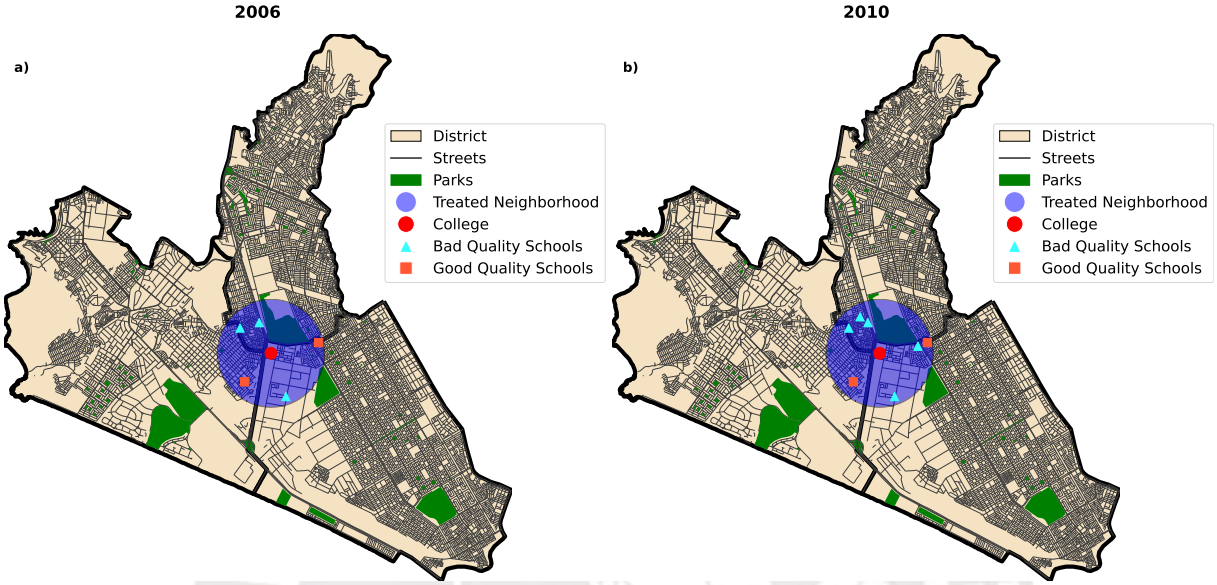
Our approach prevents us from comparing a neighborhood that has received a private college campus with another that has never received it, as they would likely differ in terms of background and other socioeconomic factors, potentially biasing our estimates (Jagnani & Khanna, 2020). To validate the robustness of the results, other neighborhood definitions will also be used in the Robustness Checks subsection. Furthermore, we only focus on private college campuses created between 2000 and 2019 because considering years outside this time interval would bias our estimates given that two major events occurred in 1996 and 2020. Indeed, the dramatic growth in the number of universities is a consequence of the 1996 Legislative Decree No 882 ”Law to Promote Investment in Educational Services” (Yamada, Castro, Bacigalupo, & Velarde, 2013). Likewise, in 2020, several higher education institutions closed due to the health restrictions of the pandemic (Vargas Bernuy et al., 2023). One may argue that the creation of the National Superintendence of Higher University Education (SUNEDU)

[8]This units are observed in Figure 5. Since neighborhoods of one university may intersect with those of another university, we stick with the neighborhoods associated with the oldest university campus following Dinerstein et al. (2023).

[9]Another example is in Figure 6.

in 2014 and its licensing policy to ensure the quality of higher education is another important event. Nonetheless, this does not pose a problem for our analysis because denials only started toward the end of 2018, and although our analysis includes 2019, these institutions had two years to cease operations.

Figure 3
Private Secondary Schools before and after a private college opening in 2007



Note: The following figure shows a treated neighborhood before and after the entry of a new university campus in 2007. Figure a) shows the number of schools according to quality in 2006 (before treatment), while figure b) shows it for 2010 (after treatment). A school is considered to be of bad quality if it is in the bottom fifth of the grades, while it is considered to be of good quality if it is in the top fifth. Schools that are neither good nor bad quality are not shown.
Source: School Census, DIGESU. Own elaboration.

Following Jagnani and Khanna (2020), we specify the two way fixed effects event study design for neighbourhood b in year t as follows:

$$y_{ibt} = \sum_{\tau=-k}^{-2} \beta_\tau \mathbf{1}(t - T_b^* = \tau) + \sum_{\tau=0}^{p} \beta_\tau \mathbf{1}(t - T_b^* = \tau) + \Psi_b + \Theta_t + \varepsilon_{ibt}$$

where y_{ibt} is the outcome for school i in neighbourhood b in year t. The effect of interest are the coefficients on the event year dummies $1(t - T_b^* = \tau)$, which become 1 when the year of observation is τ periods away from T_b^*. We decided to exclude $\tau = -1$ as the reference time. Additionally, to control for time-invariant unobservable variables that may affect both the presence of colleges and school markets composition, we introduce neighborhood fixed effects Ψ_b. We also include year fixed effects Θ_t to

control for time-specific events.

A recent concern when using an event study is the weakness of the Two Way Fixed Effects - TWFE estimator in the face of a staggered implementation of the treatment. Several authors have concluded that in the face of different treatment periods, the TWFE estimator might not provide a valid treatment effect average (Borusyak et al., 2024; Callaway & Sant'Anna, 2021; Miller, 2023). This is because it does not consider the heterogeneity of the effect where, for example, some neighborhoods might experience a greater increase in the share of good/bad quality schools. To deal with this problem, authors such as Callaway and Sant'Anna (2021) or Borusyak et al. (2024) have proposed estimators that deal with treatment heterogeneity. Since the best efficient and robust estimator is Borusyak's for the event study case, we stick with this specification for our results.

The causal interpretation of event studies relies on four critical assumptions. First, we require significant variability in the timing of when new private college campuses open. As highlighted by Miller (2023), the variation in event dates is crucial for proper identification of treatment effects. Second, the creation of new college campuses should not anticipate changes in the average quality or composition of nearby private secondary schools. Borusyak et al. (2024) explain that if anticipatory changes occur when there is not a control group, it may lead to under-identification issues. Third, the assumption of no pre-existing trends in the outcome variable is fundamental. Miller (2023) suggests that any pre-existing trends might confound the treatment effects. Finally, Borusyak et al. (2024) points out that it is possible to incorporate a control group that are not yet treated to emulate the inference that a diff in diff would have. In our identification strategy, these four assumptions are fulfilled. Our novel dataset contains a wide variety of private college campuses opening dates between 2000 and 2019 as shown in Figure 2. Additionally, our results show that there is no form of pre-existing trends[10]. Moreover, there is a statistically significant change that coincides with the creation of a new college $\tau = 0$. Also, treated and not yet neighborhoods are comparable and have similar characteristics as they will receive a new university campus at some point in time.

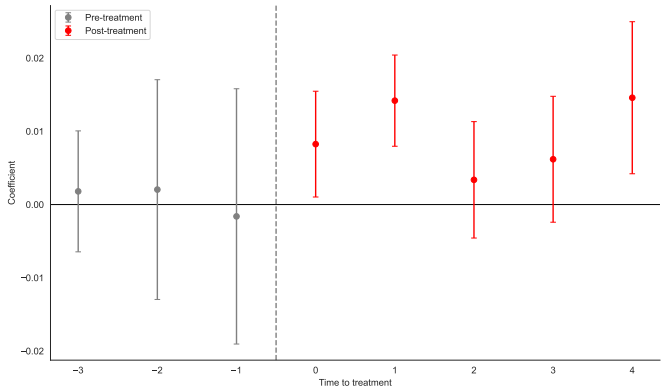
The main concern in the identification strategy is the possibility that the timing of

[10] See the Results section

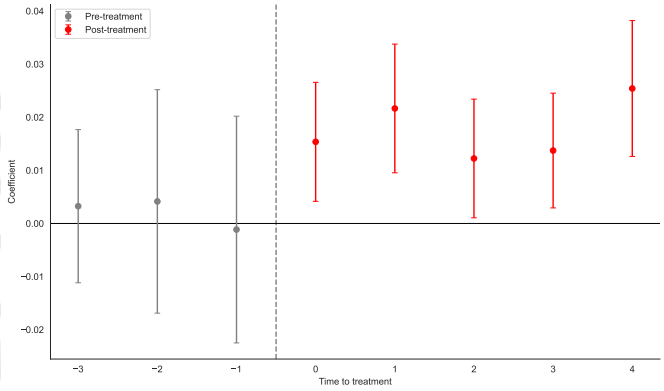
treatment is correlated with previous trends in the neighbourhood. We can think about the existence of unobserved variables that determine both the emergence of new private schools and the creation of new universities at the local level. The reasons behind this concern lie in the fact that a university seeks to locate where there is educational demand, therefore, it could tend to be located in neighbourhoods where there has been high population growth, sustained economic growth, among other factors that are also attractive for the creation of new private schools. Nonetheless, this possible existence of previous trends should be observed in the pre-trends test, which is not fulfilled in our case, so it can be stated that there were no previous trends before the event (arrival of the new campus).

Figure 4
Event study plot. Effect of private colleges opening on the share of bad private secondary schools (1.5km neighbourhood)

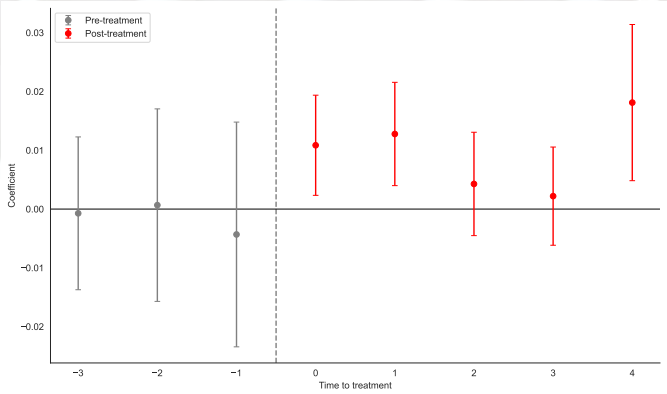
(a) Bottom 10% in academic performance



(b) Bottom 20% in academic performance



(c) Bottom 30% in academic performance



Note: The following figure shows the coefficients of the interaction for each event time according to Borusyak et al. (2024) event study. The confidence interval is at 90%. Dependent variable: An indicator that takes the value of one if the school is of bad quality. Schools are classified as bad quality if their zscore is in the bottom 10%, 20% or 30% in academic performance. We include neighbourhood and year fixed effects. Errors are clustered at neighbourhood level.
Source: School Census, DIGESU. Own elaboration.

6 Results

In this section, we present the effect of opening a new private college campus on the share of bad quality private secondary schools. Our main dependent variable is an indicator for each school that takes the value of 1 if the private secondary school is in the bottom 20% of academic performance (measure as the mean of reading and maths grades at school-level) and 0 otherwise. We also present the results using the bottom 10% and 30% to ensure the validness of our estimations.

In Figure 4 we present the results for the share of bad-quality private secondary schools using different measures of school bad quality (bottom 10%, 20% and 30% in academic performance). It is clearly observed that, after the opening of the new university campus, the share of low-quality schools increases by about 2.5 percentage points statistically significant independently of school quality measure which confirms the validness of our results.

The results imply that the arrival of a new campus is attracting mainly low-quality schools which is due to two main factors according to our theoretical framework. First, low-quality private schools with limited resources cannot compete on academic quality but can do so through location-based signaling—by situating themselves near a university, they benefit from a spatially distorted signal that increases their perceived legitimacy. Second, in a market characterized by imperfect information and high search costs, families rely on spatial cues and perceived educational clusters rather than objective quality indicators (e.g academic performance) when making school choices. As a result, the presence of a university amplifies the attractiveness of the area for low-quality schools seeking to leverage this informational asymmetry.

7 Robustness Checks

To validate the robustness of our results, we implement a pre-trends test and replicate the main results with different neighborhood sizes (1km and 2km radious). It is worth noting that the event study figures are different from traditional event study figures in Borusyak et al. (2024) model. This means that a non-statistically significant coefficient in a period prior to the event does not necessarily imply that there are no prior trends. We need to conduct pre-trend tests following Borusyak et al. (2024) procedure. The tests results are presented in Table 3 where we found no prior pretrends either anticipation effects given the non-statistically significant p-values.

We also examine whether the results are robust to the neighborhood size selection by using two different radious: 1km and 2km. In the main analysis, we use a 1.5km radious around the new private college campus. Therefore, we need to provide evidence that our results are not driven by neighborhood size. We present two different event study plots in Figure 7 (1km radious) and Figure 8 (2km radious). It is observed that the results remain consistently and statistically significant in most cases. The share of bad-quality private secondary schools increases after the opening of a new private college campus.

Conclusions

This study analyzes the impact of opening a new private college campus within a neighborhood on the composition and average quality of nearby private secondary schools. The results indicate that the introduction of a university does leads to a significant increase of 2.5pp in the share of bad-quality schools. This phenomenon occurs, according to our theoretical framework, due to what we have called the spatially distorted signaling effect. This effect arises from the limited information families have about the actual educational quality of secondary schools, leading them to rely on contextual cues, such as proximity to higher education institutions.

Consequently, a perverse incentive is created for bad-quality schools to locate strategically near universities, maximizing their attractiveness without actually improving their educational offerings. This dynamic creates a vicious cycle where the perception of quality replaces actual quality, perpetuating educational and economic inequalities. Our study is the first to provide quantitative evidence on the spatially distorted signaling phenomenon. Thus, we show that the expansion of private higher education (caused by Legislative Decree No. 882) can have negative effects not only on the quality of higher education itself but also on the quality of basic education.

Given this situation, it is urgent to implement policies that strengthen information transparency in the education market to address the problem of asymmetric information on educational quality between parents and schools. We recommend, first, the comprehensive dissemination of the Student Census Assessment results so that parents can access an objective measure of school educational quality, allowing them to make better-informed decisions when enrolling their children. Second, we suggest strengthening local regulatory mechanisms that oversee and limit the indiscriminate opening of low-quality private schools near universities, requiring minimum standards that ensure real, not merely perceived, educational quality. This will prevent potential spatial segregation in educational quality.

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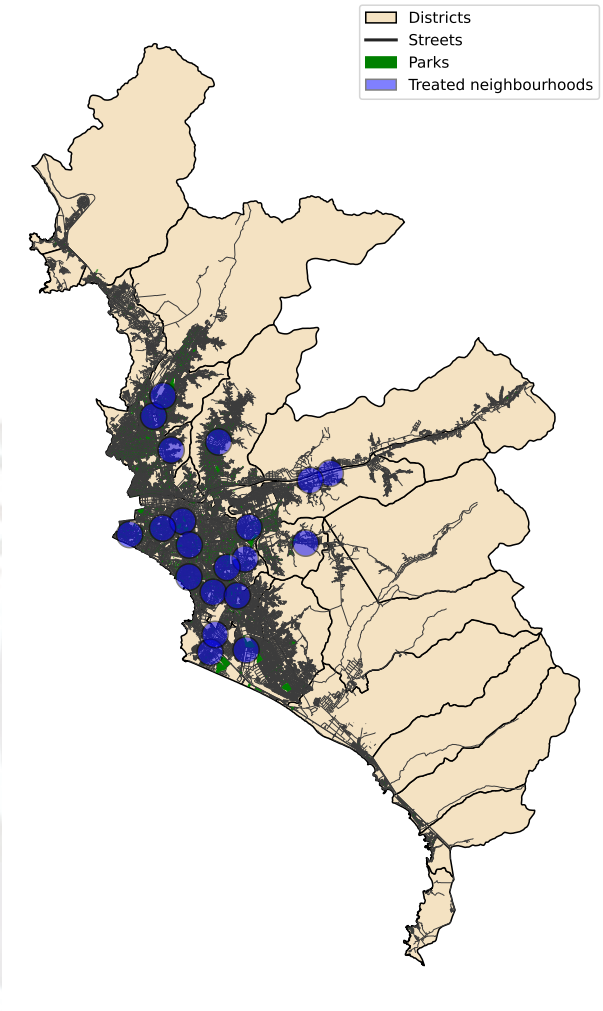
Appendix

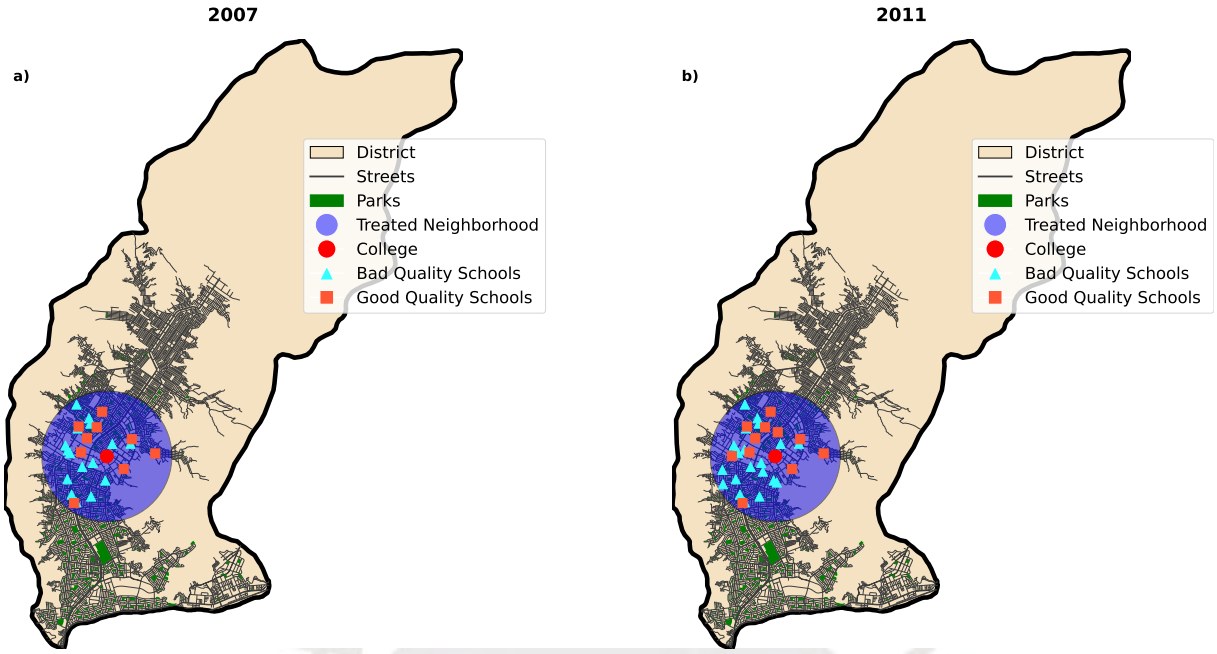
Appendix A

Figure 5
Treated Neighbourhoods in Lima (center=private college campus)



Note: We use a 1.5km radious.
Source: DIGESU, MINEDU, Google Maps API, University websites. Own elaboration.

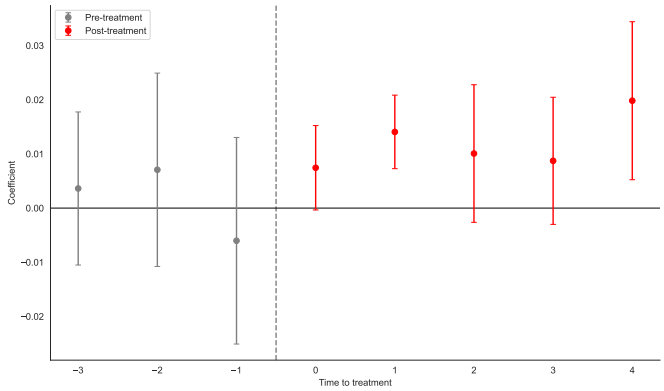
Figure 6
Private Secondary Schools before and after a private college opening in 2008



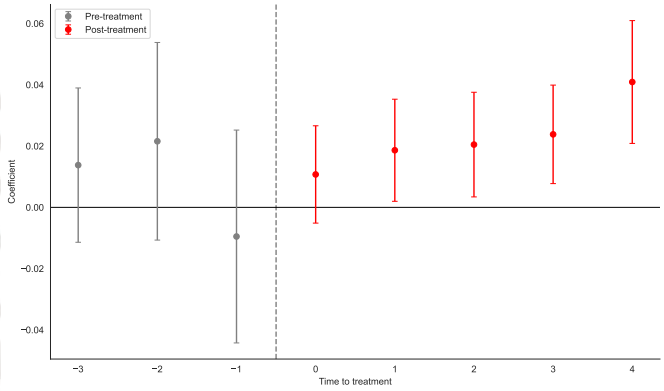
Note: The following figure shows a treated neighborhood before and after the entry of a new university campus in 2008. Figure a) shows the number of schools according to quality in 2007 (before treatment), while figure b) shows it for 2011 (after treatment). A school is considered to be of bad quality if it is in the bottom fifth of the grades, while it is considered to be of good quality if it is in the top fifth. Schools that are neither good nor bad quality are not shown.
Source: School Census, DIGESU. Own elaboration.

Figure 7
Event study plot. Effect of private colleges opening on the share of bad private secondary schools (1km neighbourhood)

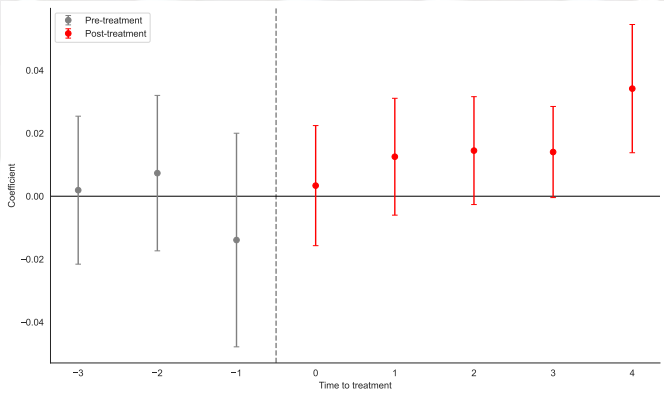
(a) Bottom 10% in academic performance



(b) Bottom 20% in academic performance



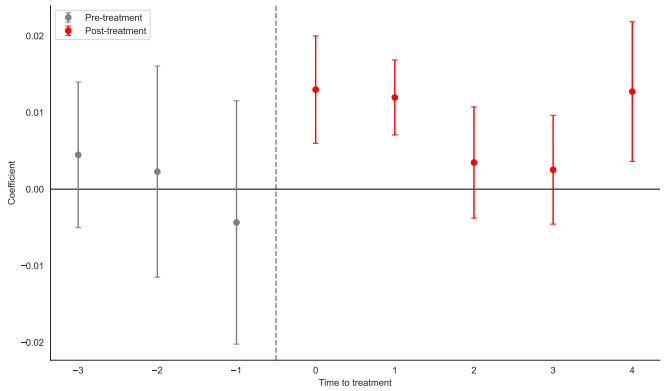
(c) Bottom 30% in academic performance



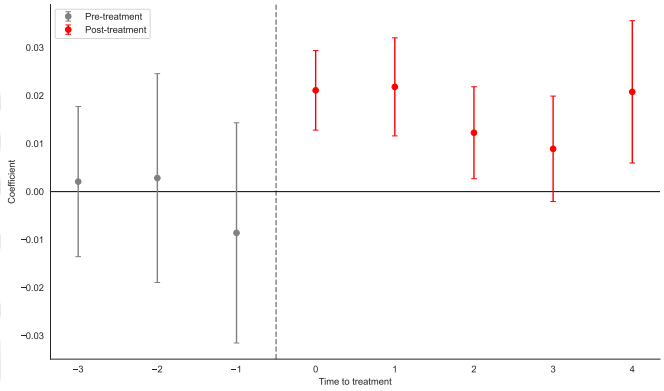
Note: The following figure shows the coefficients of the interaction for each event time according to Borusyak et al. (2024) event study. The confidence interval is at 90%. Dependent variable: An indicator that takes the value of one if the school is of bad quality. Schools are classified as bad quality if their zscore is in the bottom 10%, 20% or 30% in academic performance. We include neighbourhood and year fixed effects. Errors are clustered at neighbourhood level.
Source: School Census, DIGESU. Own elaboration.

Figure 8
Event study plot. Effect of private colleges opening on the share of bad private secondary schools (2km neighbourhood)

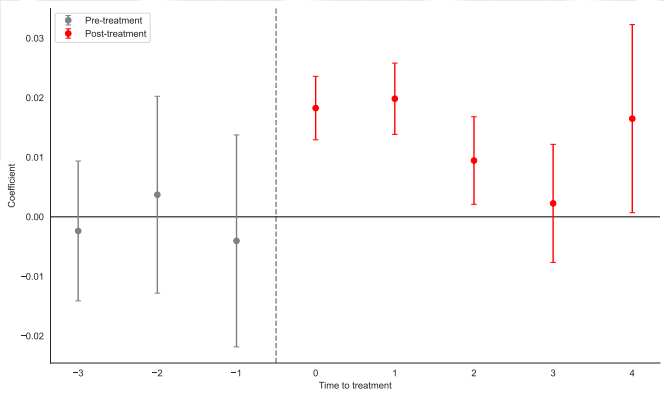
(a) Bottom 10% in academic performance



(b) Bottom 20% in academic performance



(c) Bottom 30% in academic performance



Note: The following figure shows the coefficients of the interaction for each event time according to Borusyak et al. (2024) event study. The confidence interval is at 90%. Dependent variable: An indicator that takes the value of one if the school is of bad quality. Schools are classified as bad quality if their zscore is in the bottom 10%, 20% or 30% in academic performance. We include neighbourhood and year fixed effects. Errors are clustered at neighbourhood level.
Source: School Census, DIGESU. Own elaboration.

Appendix B

Table 3
Event study regression. Effect of private colleges opening on the share of bad private secondary schools (1.5km neighbourhood)

	Bottom 10%		Bottom 20%		Bottom 30%	
	β	$s.e$	β	$s.e$	β	$s.e$
$t = 4$	0.0083*	0.0044	0.0154**	0.0068	0.0109**	0.0052
$t = 3$	0.0142***	0.0038	0.0217***	0.0074	0.0128**	0.0053
$t = 2$	0.0034	0.0048	0.0122*	0.0068	0.0043	0.0053
$t = 1$	0.0062	0.0052	0.0137**	0.0066	0.0022	0.0051
$t = 0$	0.0146**	0.0063	0.0254***	0.0078	0.0181**	0.0081
$t = -1$	-0.0016	0.0106	-0.0011	0.013	-0.0043	0.0116
$t = -2$	0.0020	0.0091	0.0042	0.0128	0.0007	0.01
$t = -3$	0.0018	0.005	0.0033	0.0088	-0.0007	0.0079
Observations	5128		5128		5128	
Pre-trends test (p-value)	0.61		0.82		0.85	

Note: Event study results. Dependent variable: An indicator that takes the value of one if the school is of bad quality. Schools are classified as bad quality if their zscore is in the bottom 10%, 20% or 30% in academic performance. We include neighbourhood and year fixed effects. Errors are clustered at neighbourhood level. On the bottom we include the p-value for the pre-trends test according to Borusyak et al. (2024).
Source: School Census, DIGESU. Own elaboration.

Appendix C

Recall from (5) that aggregate demand faced by a school at distance d can be written as

$$\begin{aligned} D(d;\delta) &= A + B\,\delta e^{-\lambda d} \\ A &= \frac{N_h}{W_{\text{max}} - W_{\text{min}}}\Big[\beta Q_0 - T - U_{\text{th}} + W_{\text{max}} - \tfrac{t\,X_{\text{max}}}{2}\Big], \qquad \text{(10a)} \\ B &= \frac{N_h\,\beta}{W_{\text{max}} - W_{\text{min}}}. \end{aligned}$$

Equilibrium school density is then

$$N_s(d;\delta) = \sqrt{\frac{C_q}{F}}\,\Big[A + B\,\delta e^{-\lambda d}\Big]. \qquad \text{(10b)}$$

Derivative with respect to δ.

$$\frac{\partial N_s(d;\delta)}{\partial \delta} = \sqrt{\frac{C_q}{F}}\,B\,e^{-\lambda d} > 0, \qquad \frac{\partial^2 N_s(d;\delta)}{\partial d\,\partial \delta} = -\sqrt{\frac{C_q}{F}}\,B\,\lambda\,e^{-\lambda d} < 0. \qquad \text{(10c–d)}$$

Limit as $\delta \to 0$ (no reputational signal).

$$\lim_{\delta \to 0} N_s(d;\delta) \;=\; \sqrt{\frac{C_q}{F}}\, A, \tag{10e}$$

so the spatial pattern of schools collapses to a flat profile driven only by baseline demand A.

Limit as $\delta \to \infty$ (dominant signal). For any fixed d,

$$\lim_{\delta \to \infty} N_s(d;\delta) \;=\; \infty, \tag{10f}$$

and the *relative* density between two locations $d_1 < d_2$ satisfies

$$\frac{N_s(d_1;\delta)}{N_s(d_2;\delta)} \;=\; \frac{A + B\delta e^{-\lambda d_1}}{A + B\delta e^{-\lambda d_2}} \;\xrightarrow[\delta \to \infty]{}\; e^{-\lambda(d_1 - d_2)}. \tag{10g}$$

Hence an arbitrarily large mass of schools clusters near the campus, and the spatial gradient approaches the exponential shape implied by the signal decay.

Interpretation.

- With $\delta = 0$ the model predicts modest, nearly uniform school density: reputational externalities are absent.
- As δ grows, both the *level* and the *slope* of $N_s(d)$ increase—see derivatives (10c–d). In the limit $\delta \to \infty$ the market becomes saturated near the campus, highlighting the pivotal role of spatially distorted signalling in driving agglomeration