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Socioeconomic disparities in the reopening of schools during the pandemic in Chile

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ABSTRACT

The COVID-19 pandemic produced the most significant disruption in education in history. More than 190 countries suspended in-person instruction, affecting an estimated 1.6 billion students. The reopening of schools has been unequal. Schools in more affluent areas reopened sooner than poorer ones, exacerbating preexisting inequalities. There is limited research about the reopening processes in Latin America, where schools were closed for extended periods. Using a rich administrative dataset, we investigate the gaps in the resumption of in-person instruction in Chilean schools across socioeconomic groups in the fall of 2021. Schools with lower socioeconomic status were significantly less likely to offer in-person instruction. Disparities in reopening decisions were associated with administrative factors rather than economic or local epidemiological conditions.

1. Introduction

The COVID-19 pandemic has profoundly affected education across the globe. In March 2020, governments in more than 190 countries suspended in-person instruction in schools to mitigate the spread of the SARS-CoV-2, the virus that causes COVID-19. The decision to close schools affected an estimated 1.6 billion students and was the most significant disruption to formal education in modern history (UNESCO, 2020; Willyard, 2021). By the end of 2020, schools in 65 educational systems remained closed, and 129 were either partially or fully open (Azevedo et al., 2021). In June 2021, 770 million students were still not attending school, and more than 150 million children did not have in-person classes (Willyard, 2021). The United Nations Educational, Scientific and Cultural Organization estimated that 24 million students are likely to drop out of school due to the pandemic (UNESCO, 2020).

School closures and the loss of in-person instruction can severely affect the academic achievements, human capital, and well-being of students (Hanushek and Woessmann, 2020; Kuhfeld et al., 2020; Lewis et al., 2021; Van Lancker and Parolin, 2020). In-person education provides direct benefits beyond formal instruction, including the provision of essential food services, social interactions, access to information, and improvement of psychological well-being. In-person education also provides important indirect benefits, principally that parents, particularly mothers, can work without incurring childcare costs.

Growing evidence suggests that schools can safely open if they follow a framework of COVID-19 prevention protocols, such as indoor masking, physical distancing, adequate ventilation, handwashing, and encouraging vaccination among children (Ehrhardt et al., 2020; Ertem et al., 2021; Fukumoto et al., 2021; Hershow et al., 2021; Jara et al., 2022; Olson et al., 2022; Walter et al., 2022). The direct and indirect benefits of in-person education, the approval of COVID-19 vaccines for children, and the emerging evidence related to controlling the transmission of

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SARS-CoV-2 in educational settings have motivated countries and organizations to promote the resumption of in-person instruction (UNICEF, 2021a).

Globally, however, the reopening of schools has been unevenly distributed. Compared to those in more affluent global regions or countries, schools in poorer countries have remained closed for substantially longer periods, and students from poorer countries have missed more in-person instruction, despite having access to fewer resources and less support to facilitate remote learning on average (UNESCO, 2021). School reopening within countries has also been uneven. A body of research primarily focusing on high-income western countries has shown significant socioeconomic and racial disparities in access to in-person instruction, where disadvantaged students have been affected by school closures for more extended periods than students with higher socioeconomic status (Bacher-Hicks et al., 2021; Haderlein et al., 2021; Parolin and Lee, 2021). Furthermore, school closures are more detrimental for students from lower socioeconomic backgrounds. They are more likely to be disadvantaged by factors such as access to digital technology, home environment, and lower levels of support from parents and teachers (Andrew et al., 2020; Dietrich et al., 2021; Haderlein et al., 2021; Parolin and Lee, 2021; van de Werfhorst, 2021). These factors amplify the educational inequalities that existed before the COVID-19 pandemic (Bacher-Hicks et al., 2021; Belay, 2020; Cullinan et al., 2021; Maldonado and De Witte, 2020; Tiruneh, 2020).

Research suggests that the decision to reopen schools depends on several factors, including local health conditions, parental preferences, and the politics of the area where the school is located (Center on Reinventing Public Education, 2021). For example, a study from the United States, showed that reopening decisions made by school districts depended more on whether it was a Republican or Democratic district than on COVID-19 incidence rate (Hartney and Finger, 2020). However, little is known about differential access to in-person instruction in the Global South, particularly in Latin America, which has seen extensive delays in the education system reopening compared to the Global North (Insights for Education, 2020; UNICEF, 2021b). Digging into the gaps in the supply of in-person instruction between schools attending students of different socioeconomic backgrounds is essential; it will be a critical factor in designing and implementing policies or interventions to address widening gaps in development and learning.

Using a rich national data set that details school reopenings and administrative data from Chile, we examine the differences in the number of days with in-person instruction between schools of different socioeconomic status in the context of Chile's decentralized and voluntary school reopening process in the fall of 2021. We examine three potential factors that may shape these differences: local epidemiological conditions, measured as COVID-19 incidence and mortality rates; economic factors, using the student-teacher ratio and municipality income level as proxies for school resources and school district resources; and type of school administration. Heterogeneity within these factors enabled us to analyze how the reopening gap across socioeconomic groups changed as we progressively added these covariates as controls.

Our findings show that schools attended by students with lower socioeconomic status were significantly less likely to offer in-person instruction during the fall of 2021. These disparities were strongly associated with the type of school administration. Local epidemiological conditions (COVID-19 incidence rate) and economic characteristics (student-teacher ratio and municipality income level) were less relevant to schools' decision to reopen.

In Chile, it is possible to identify socioeconomic differences between the students who attend schools that depend on different types of administrative structures; thus, the differences in the probability of reopening due to type of school administration led to sharp socioeconomic inequalities in student access to in-person instruction during the pandemic. In light of evidence that school closures are detrimental to developmental and educational outcomes, particularly for students from disadvantaged backgrounds (Curriculum Associates, 2021), the vast socioeconomic disparities in access to in-person instruction suggest that the pandemic is likely to exacerbate educational inequalities in Chile.

2. Literature review

2.1. Remote teaching and learning loss in high-income countries

A growing body of research has examined the effects of the COVID-19 pandemic on education, including the impacts of school closures. However, most studies on learning losses during the pandemic come from high-income countries.The literature suggests that students suffer learning loss when taught remotely compared to in-person instruction. For example, a study from the Netherlands examined test scores before and after a short period of school closures in 2020 and found that students made little or no progress while learning remotely (Engzell et al., 2021). In a meta-analysis of the impact of COVID-19 on learning, Betthauser et al. (2023) estimated a 0.15 SD learning loss in high-income countries. Several studies show that the steepest drops in learning during school closures are suffered by the most vulnerable students (the poorest, those from minority groups, and low performers) and are concentrated in disadvantaged schools, expanding pre-pandemic learning gaps (Bacher-Hicks et al., 2021; Curriculum Associates, 2021; Kogan and Lavertu, 2021; Kuhfeld et al., 2020). A study from the United States showed that achievement gaps between students in low- and high-poverty elementary schools widened by 0.10 standard deviations (SD) during the 2020–2021 school year (Kuhfeld et al., 2022). A study in 12 states in the United States suggests that learning losses were more pronounced in school districts with a higher proportion of Black, Hispanic, and low-income students (Curriculum Associates, 2021; Halloran et al., 2021).

Multiple factors may explain the unequal impact of remote instruction on student learning. Low-income families have less access to the technology that enables online learning, such as electronic devices and good-quality internet (Haderlein et al., 2021; Stelitano et al., 2020). A 2020 Pew Research Center survey found differences of up to 10% in internet access between Black/Hispanic and White/Asian students in the United States and reported that about 40% of low-income parents said their children relied on public Wi-Fi to do their homework, compared to 6% of high-income parents (Vogels et al., 2020). Public Wi-Fi is generally more unstable and of inferior quality than privately contracted Wi-Fi. Other studies have shown that children from disadvantaged socioeconomic status receive less support from their parents and spend less time on educational activities at home than those from higher socioeconomic status (Bol, 2020; Dietrich et al., 2021; Jæger and Blaabæk, 2020; Reimer et al., 2021). Moreover, compared to parents of lower socioeconomic status, parents of higher socioeconomic status are more likely to support their children's learning processes and provide learning resources at home, such as computers (Bol, 2020).

The economic effects of the pandemic have also disproportionately affected low-income households. Many parents, particularly mothers, had to juggle with work, school support, and childcare during lockdowns (Harris, 2020). Pandemic-related unemployment has imposed a vast economic and socioemotional cost on households (Asahi et al., 2021; Baek et al., 2020; Gil et al., 2021; International Labour Organization, 2020; Lozano-Rojas et al., 2020; World Bank, 2020). Last, socioeconomic status has also impacted COVID-19 incidence and mortality (Bennett, 2021; Gozzi et al., 2021; Mena et al., 2021), imposing additional challenges to low-income households and reducing learning opportunities for children.

2.2. Determinants of the decision to reopen schools during the pandemic

2.2.1. Global North

As epidemiological conditions have improved, the transition to in-person activities has been heterogeneous among schools, states, and

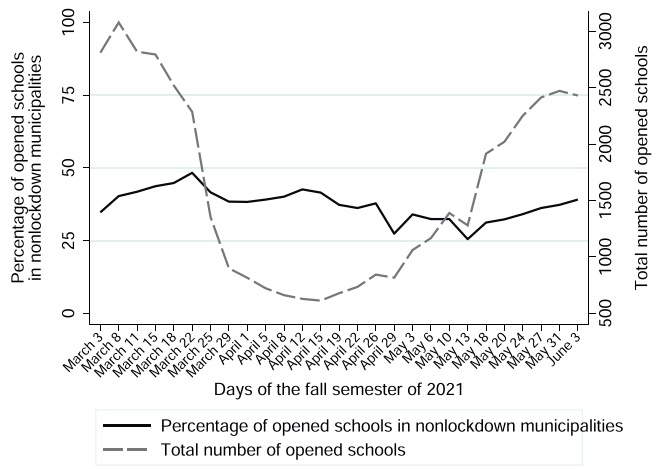

Fig. 1. Evolution of opening rates among schools in nonlockdown municipalities and total number of schools opened during the fall semester (N = 9450 schools). *Note:* This graph is based on data from the Ministry of Education (Ministerio de Educación, 2021c). Nonlockdown municipalities are those permitted by health authorities to resume in person instruction, given the epidemiological situation in their municipality.

countries. Schools and local governments have implemented various responses to the possibility of reopening. Some schools have offered hybrid (in-person and online) classes, in-person education or remote instruction for all students, or combined modes of education for specific subgroups. Research in the United States reported significant disparities in access to in-person instruction among groups with different social and racial or ethnic backgrounds (Haderlein et al., 2021; Parolin and Lee, 2021). Using data from the School Closure and Distance Learning Database, Parolin and Lee (2021) found substantial socioeconomic and racial gaps in access to in-person instruction. Their results showed that schools with lower third-grade mathematics scores and higher proportions of disadvantaged students—students who experience homelessness, are eligible for free or subsidized lunches, or are from racial and ethnic minorities—were more likely to be closed than schools serving non-disadvantaged students, which would exacerbate existing learning gaps. Parental and students's preferences for in-person instruction have further compounded these trends: Black and lower-income parents were more hesitant and uncertain about sending their children to school even when in-person education was available (Camp and Zamarro, 2021; Haderlein et al., 2021).

Studies have shown that decisions on when and how to reopen schools have not been directly related to epidemiological conditions but have instead been the result of political factors. These factors include the political affiliation of local authorities and the willingness of teacher unions to let their members return to the classroom (Henderson, Peterson, and West, 2021; Hartney and Finger, 2020; Parolin and Lee, 2021). Findings from the United States presented in Henderson et al. (2021), show that in-person instruction was unrelated to COVID-19 incidence in the 2020–21 academic year. Political factors have affected the likelihood of schools offering in-person instruction (DeAngelis and Makridis, 2021; Grossman et al., 2020; Hartney and Finger, 2020). Hartney and Finger (2020) found that areas with stronger teacher unions were less likely to resume full-time in-person education. Grossman et al. (2020) found that in-person instruction was strongly associated with political affiliation at the district level, suggesting that Republican districts favored in-person learning compared to Democratic districts during the Trump administration. The evidence in the United States suggests that reopening decisions have been more influenced by political factors than by COVID-19 incidence. When subordinated to the dispositions and inclinations of local governments, the duration of school closures has been more associated with political and institutional factors than epidemiological factors.

2.2.2. Global South

Evidence from the Global South on COVID-19 learning losses is limited to a few Latin American countries and South Africa. Studies suggest that learning deficits are prominent (mean - 0.50 SD, median −0.51) where in-person instruction was suspended for longer periods compared to high-income countries (Betthauser et al., 2023; Center on Reinventing Public Education, 2021). Hevia et al. (2022) found that learning losses ranged from 0.34 to 0.45 SD in reading and 0.62–0.82 SD in numeracy in Mexico. Lichand et al. (2022) found that test scores decreased by 0.32 SD in secondary education in Brazil under remote learning; this is equivalent to 27.5% of in-person learning. Those authors found that municipalities that authorized in-person instruction had a 20% increase in test scores relative to municipalities that did not reopen. Survey data from the Agencia de la Calidad de la Educación (ACE), Chile's state agency for education quality, suggest that 42% of Chilean secondary school students felt that the pandemic has had a large negative effect on learning (Agencia de la Calidad, 2021).

Despite the vast body of research documenting socioeconomic and racial disparities in school reopening, little is known about these gaps and their contributing factors in Latin America. Are the inequality patterns observed in developed economies comparable to those in Latin America? Which factors explain the slow in-person return to school in the region? These questions are key to policymakers in the region, and particularly in a socially stratified and segregated schooling system as the Chilean (Mizala and Torche, 2012, 2017).

2.3. The pandemic in Chile

Approximately 3.6 million COVID-19 cases and 58,000 deaths have been reported in Chile as of May 2022 in a population of 19.7 million (Ministerio de Salud de Chile, 2022). On March 3, 2020, the Ministry of Health reported the first case of COVID-19 in Chile (Ministerio de Salud de Chile, 2022), eight days before the World Health Organization (2020) declared a global pandemic. On March 16, 2020, the Chilean government announced the mandatory closure of all K–12 schools nationwide. The government also mandated several public health strategies to mitigate the pandemic ranging from individual behaviors, such as the use of masks and physical distancing, to regulations and actions at the population level, such as stay-at-home orders and curfews (Li et al., 2022; Tariq et al., 2021). Following the first major wave of COVID-19, the Chilean government implemented a five-tiered "*Paso a Paso*" strategy that adapted pandemic control strategies to local epidemiological conditions (Ministerio de Salud, 2021). The plan enables each municipality to be categorized into one of five tiers, called phases, based on specific indicators defined by the Ministry of Health. These include health care system capacity (occupation of intensive care unit beds), epidemiological indicators (COVID-19 incidence rate, reproduction number), test positivity rate, and contact tracing. Phase 1 is the most restrictive and imposes a municipality-level stay-at-home order (lockdown); Phase 5 does not impose any restrictions on the populous.

In August 2020, the Chilean government allowed schools located in municipalities in Phase 2 or higher to resume in-person education on a voluntary basis, dependent on following a strict COVID-19 protocol. This protocol required schools to have deferred schedules for student entry and exit and several other measures for preventing virus transmission, including the mandatory use of face masks, physical distancing, frequent handwashing, and adequate ventilation (Ministerio de Salud, 2021). Few schools, however, resumed in-person activities in 2020. And, because attendance was voluntary, schools had to provide remote learning and in-person instruction simultaneously. Maintaining educational continuity in the face of intermittent closures determined by the epidemiological situation was challenging and required substantial flexibility. Many schools could not concurrently comply with the sanitary protocols and host all the students in the space available; thus, a shift schedule was required that combined in-person and remote learning. As soon as a municipality was categorized as requiring Phase 1

Table 1
Description and socioeconomic composition of the types of school administration in Chile.

Type of administration	Description	Socioeconomic composition					N
		low	Medium-low	Medium	Medium-high	High	
Municipal	Public administered by municipalities	40.3%	42.9%	15.0%	1.8%	0.0%	3838
SLEP	Public administered by Government-dependent organization	32.6%	48.1%	18.0%	1.3%	0.0%	545
CAD	Public administered by private entities	47.1%	48.6%	4.3%	0.0%	0.0%	70
Private subsidized	Private entities	17.1%	28.7%	37.6%	16.5%	0.1%	3155
Private nonsubsidized	Private entities	0.0%	0.0%	0.0%	4.3%	95.7%	486
All		28.3%	35.1%	23.1%	7.7%	5.8%	8094

Note. We prepared this graph based on data from the Agencia de Calidad de la Educación (2019). The classification of schools in the different socioeconomic groups was completed by the Education Quality Agency based on the parents' schooling and the monthly household income of the students attending the school, among other characteristics. CAD = Corporación de Administración Delegada; SLEP = Servicios Locales de Educación Pública.

measures (i.e., lockdown), schools in the area were required to end in-person activities and return to remote learning. The mass vaccination campaign, which started on February 2, 2021, prioritized the vaccination of teachers and school workers so that schools could open more safely (Jara et al., 2021).

In January 2021, the Department of Education asked all schools to submit a plan for in-person instruction during the 2021 school year (March–December). Schools were required to plan in-person education under operational restrictions, including limited classroom capacity, limited in-person activities, and optional remote instructions, which led to full or partial school days and daily or weekly shifts (Ministerio de Educación, 2021a). The government established that in-person classes should be a voluntary, gradual, and flexible process, emphasizing COVID-19 safety protocols and active epidemiological surveillance.

At the beginning of the academic year, on March 3, 2021, only 2811 of 9450 schools offered in-person instruction (Fig. 1). A few weeks later, Phase 1 mandatory stay-at-home orders were imposed on almost the entire country (Taylor, 2021) and most schools had to close, as the Paso a Paso COVID-19 protocols stipulated. After this broad lockdown, the schools offering in-person instruction varied over time, primarily governed by Phase 1 stay-at-home orders at the municipal level and other challenges, such as the positions of teacher unions and school administrations. The issue of student internet connectivity, which was far from consistent across families and geographical locations, may have prompted some schools to return to in-person instruction. However, during the fall semester (March-June), the school reopening rate never surpassed 50% of schools permitted to resume in-person instruction. By the end of the fall semester, on June 3, only 26% (n = 2431) of 9450 schools had fully reopened. The percentage of schools that had not reopened during this period was 47% (n = 4412); 70% of the schools that had not reopened were public and administered by municipalities.

All restrictions on school reopening were fully lifted during the first two months of the spring semester (August-September), when no municipalities were in Phase 1, and the resumption of in-person education became mandatory. However, the drastic disparities in school reopening rates depending on the type of school administration in the fall semester raised concerns about how reopening decisions were made. In Section 2.4, Chile's school system and the five types of school administration are described.

2.4. The administration of Chilean schools

Chilean schools are dependent on different types of administrative structures. These types of school administration are classified into five main groups. Table 1 describes the five types and shows their socioeconomic composition.

The first two groups are fully public schools, representing 35.5% of student enrollment. They are administered and owned by the municipality or Servicios Locales de Educacion Pública (SLEP), which are state-run local education services (Ministerio de Educación, 2021b). The majority of public schools are municipal schools, not SLEP schools. In 2021, 30.7% of Chilean students were enrolled in municipal schools and 4.8% in SLEP schools. Municipal schools depend on municipal authorities (led by mayors), which are democratically elected every four years and can be reelected. During the period on which this study focuses, a municipal election took place (May 2021), and the newly elected mayors (including those reelected) started their terms in June 2021.

SLEPs were created by the New Public Education Law, enacted in 2017. The law requires municipalities to transfer school administration to these newly created governmental organizations gradually. In 2017, 14 municipalities transferred school administrations to the first four SLEP. There are currently 11 SLEP, each administering between 35 and 91 schools. The main differences between SLEPs and municipal schools are that political or administrative authorities from the central government coordinate and support SLEP through a government agency, the Dirección de Educación Pública. Municipal authorities designate principals for municipal schools. They are chosen through a public appointment application process, and they directly manage the administrative, financial, pedagogical, and human resources affairs at the schools.

The "Corporación de Administración Delegada" (CAD) group are state-owned public vocational high schools administered by private organizations. Only 1.3% of students in Chile attend these schools. They are free and are attended primarily by students from low-income families.

The "private subsidized" group are schools owned and administered by independent religious and nonprofit organizations. They receive government subsidies per student, which depend on attendance. Most of these schools are not allowed to charge tuition fees, with a few temporal exceptions. Enrollment in this type of school represents 54.5% of Chilean students, the largest proportion by some margin.

Finally, the "private nonsubsidized" group are private schools entirely funded by tuition fees and do not receive government subsidies. Enrollment in this type of school represents 8.6% of Chilean students, primarily from high-income families (Ministerio de Educación, 2021b).

As reflected by their socioeconomic composition shown in Table 1, types of school administration highly correlate with socioeconomic status (SES). This high correlation between the type of school and children's socioeconomic status has also been highlighted in previous empirical research in Chile (Mizala and Torche, 2012, 2017; Salgado and Castillo, 2018). Whilst public and CAD schools' enrollment (municipal and SLEP) concentrates on low- and medium-low-SES students, private subsidized schools encompass larger shares of medium and medium-high-SES students. This segregation is extreme in the private nonsubsidized sector, which comprises only high-SES schools. However, heterogeneous socioeconomic realities prevail within types of administration, and between-types sorting is far from explaining all socioeconomic distribution between schools (Elacqua, 2012; Paredes et al., 2013). This socioeconomic overlapping across types of administration is more evident between municipal and SLEP schools, which used to be under the same administrative regime as far as five years ago. Therefore, despite being unevenly distributed, schools in the same

Table 2
Description of the variables included in the model.

Variable	Definition	*Mean*	*SD*
School level variables (N = 7613):			
School SES			
Low	= 1 if a low SES school	0.27	0.44
Middle–low	= 1 if a middle-low SES school	0.35	0.48
Middle	= 1 if a middle SES school	0.23	0.42
Middle–high	= 1 if a middle-high SES school	0.08	0.27
High	= 1 if a high SES school	0.06	0.24
Rural zone	= 1 if a located in a rural zone	0.32	0.46
High school	= 1 if a high school education	0.38	0.49
TP school	= 1 if a technical school	0.12	0.33
Bicentennial	= 1 if a bicentennial school	0.04	0.20
Enrollment	Number of students enrolled in the school	429	430
Teachers over 60 years old	Percentage of teachers over 60 years of age	0.15	0.12
Students-teacher ratio	Number of students per teacher in the school	14.48	6.98
School administration:			
Municipal	= 1 if municipal	0.46	0.50
SLEP	= 1 if SLEP	0.07	0.25
CAD	= 1 if CAD	0.01	0.10
Private subsidized	= 1 if private subsidized	0.40	0.49
Private nonsubsidized	= 1 if private nonsubsidized	0.06	0.24
Municipal level variables (N = 320):			
Nonlockdown days	Total number of nonlockdown days in the school's municipality between March 1 and June 3, 2021	32.20	15.87
COVID-19 incidence rate	Cumulative incidence rate of the school's municipality	9.02	0.26
COVID-19 mortality rate	Cumulative mortality rate of the school's municipality	5.01	0.40
District mean income	Mean income of the school's municipality (in Chilean pesos)	323,067	174,243

Note. SLEP = Servicios Locales de Educación Pública; CAD = Corporación de Administración Delegada; TP = technical school.

socioeconomic group are subject to different types of administration, leading to heterogeneous behaviors within groups during the pandemic. The same happens when considering teacher endowments and the income level of their municipalities (proxy of resources available for schools). According to an ANOVA analysis of these variables, nearly 70% of their variance occurs within socioeconomic groups.

These within-group heterogeneities enabled us to compare the reopening behavior of similar-SES schools subject to different restrictions and decision-making processes. Specifically, we used this to test three hypotheses that could explain socioeconomic differences in schools reopening in Chile.

1) Socioeconomic differences in epidemiological conditions and associated restrictions to curb viral transmission will generate uneven opportunities for schools to reopen.
2) Controlling for epidemiological conditions and associated restrictions, lower-SES schools reopened less because they have fewer resources and poorer municipalities, which implies greater difficulty complying with COVID-19 sanitary protocols and potentially being subject to higher risks if they reopen.
3) Because of the socioeconomic segregation between types of school administrations, heterogeneous behavior between them will lead to socioeconomic inequalities in school reopening, conditional on local epidemiology, local restrictions, and the resources to which schools have access.

3. Methods

3.1. Data collection

We combined data from five sources to examine the socioeconomic gap in schools reopening and test our hypotheses. First, we obtained data on school opening status (open, mandatory lockdown, or closed) from administrative records kept by the Ministry of Education. This data records whether a particular school was open on Mondays and Thursdays throughout the fall semester (Ministerio de Educación, 2021c). It only covers the period between March 1 and June 3, 2021, when schools could voluntarily offer in-person instruction conditional on not being in Phase 1. The data also include school characteristics, such as type of administration, number of students enrolled, student–teacher ratio (a proxy for school resources), school region, rural or urban, whether the school offers vocational education, whether the school has been selected for additional state funding, and the proportion of teachers older than 60 years.

Second, we used data from the ACE, the state agency for education quality, to retrieve the socioeconomic statuses of schools (Agencia de Calidad de la Educación, 2019). The ACE divides schools into five socioeconomic categories (low, medium-low, medium, medium-high, and high) based on parental schooling, household income, and other socioeconomic characteristics related to the students.

Third, we estimated the average household income at the municipal level using Chile's national household survey (CASEN) from 2017. Fourth, we obtained epidemiological data relating to the pandemic at the municipal level (daily *Paso a Paso* phase, COVID-19 incidence rate, and COVID-19 mortality rate) from the Ministry of Health (Ministerio de Salud de Chile, 2022). And, fifth, using data from the Chilean Electoral Service, we characterized the political affiliations of all the municipal authorities in Chile (Servicio Electoral de Chile, 2016).

We excluded 1837 schools that did not have data available. Most of these schools do not participate in the standardized evaluations from which the SES information is obtained. Generally, their enrollments are smaller than 20 students, and two-thirds impart adult education or consist of schools with composite classes and only 1–3 teachers. As a result, although they represent 20% of schools, they comprise less than 5% of students in the system. The final sample consisted of 7613 K–12 schools with complete information, encompassing schools in 320 out of the 345 municipalities in Chile. Table 2 shows the definitions and descriptions of the variables used.

3.2. Analytical strategy

The first step of our analytical strategy was to conduct a descriptive analysis of the distribution of days that the schools in the sample spent in lockdown between March 1 and June 3, 2021, distinguishing by school socioeconomic status, municipality income level, student-teacher ratio, and type of school administration. Recall that the number of days of in-person instruction depended on several factors, including the decision of the school administration and the municipality not being in Phase 1 (a mandatory stay-at-home order). When a municipality was not in Phase 1, the school administration and the principal decided on whether to permit in-person instruction.

The second step was to model reopening decisions throughout the fall semester using a hurdle model (Cragg, 1971) with two stages. Accordingly, we first modeled whether the school opened or not, and then we modeled how many days it was open, conditional on being open at least one day. The first stage used a probit model, as shown in Eq. 1, to estimate the probability of a school being open for at least one day. Thus,

$$\Pr(A_i = 1) = \Phi(\beta' x_i), \tag{1}$$

where A_i is a dichotomous variable equal to 1 if the school was open at least one day, $\Phi(\bullet)$ represents the standard cumulative normal distri-

Table 3
Average fraction of school days in lockdown, according to socioeconomic status, average income of the municipality, student-teacher ratio, and type of school administration.

Variable	*Mean*	*SD*	*N*
School SES:			
Low	0.53	0.26	2066
Middle–low	0.54	0.23	2697
Middle	0.55	0.20	1784
Middle–high	0.53	0.20	601
High	0.47	0.19	465
Municipality mean income (quintiles):			
Q1	0.54	0.26	946
Q2	0.51	0.27	1045
Q3	0.59	0.22	1439
Q4	0.54	0.25	1727
Q5	0.51	0.18	2456
Student-teacher ratio (quintiles):			
Q1	0.47	0.27	1529
Q2	0.53	0.23	1519
Q3	0.54	0.23	1520
Q4	0.55	0.21	1523
Q5	0.58	0.20	1522
School administration:			
Municipal	0.49	0.25	3531
SLEP	0.52	0.23	512
CAD	0.59	0.15	70
Private subsidized	0.59	0.20	3017
Private nonsubsidized	0.47	0.18	483
Total	0.53	0.23	7613

Note. SLEP = Servicios Locales de Educación Pública; CAD = Corporación de Administración.

bution, and x_i is the vector of variables linked to the school (socioeconomic status, the student-teacher ratio, number of students enrolled, school region, rural or urban, whether the school offers vocational education, whether the school has been selected for additional funding, the proportion of teachers older than 60 years, and the total number of nonlockdown days in the fall semester). By controlling for these factors, we are taking into account the unequal impacts and urgencies that arose during the pandemic in the different regions, zones, and types of schools.

The second stage consisted of estimating the number of days the school was open (n_i), conditional on being open for at least one day, using the maximum likelihood method. At this stage, we are interested only in the subsample that opened at some moment during the semester. Because the dependent variable is truncated at 0, we considered the density function as shown in the following equation:

$$f(n_i|n_i>0)=\frac{f(n_i)}{P(n_i>0)}=\frac{\frac{1}{\sigma}\phi\left(\frac{n_i-\gamma' x_i}{\sigma}\right)}{\Phi\left(\frac{\gamma' x_i}{\sigma}\right)}, \quad (2)$$

where $\phi(\bullet)$ corresponds to the standard normal density function. Because of differences in the number of days in lockdown, not all schools could open for the same number of days. Thus, n_i was calculated as the percentage of the maximum number of days that a school could have opened. The main advantage of this model over other censored variable models, such as the Tobit model, is that it allows the coefficients associated with the probit model—used to estimate the probability of a school opening at least one day—to differ from those of the truncated regression—used to estimate how many days a school was open, conditional on opening at least one day (Katchova and Miranda, 2004). There are no restrictions on the control variables between the first and second stages of our analysis (as in Heckman's two-step sample selection model) because our goal was to examine the differences that emerge once schools decide to reopen (truncated sample), not to estimate system-unbiased parameters in the second stage.

In both stages, our primary focus is on the marginal effect associated with each socioeconomic group: it represents the difference in the probability of reopening and the number of days with in-person learning between low-SES schools (reference group) and the others. To analyze the extent to which these differences can be attributed to the epidemiological conditions, the school resources, and the type of administration, we estimated nested models, including each of these factors sequentially. The epidemiological conditions considered were the COVID-19 incidence rate and mortality rate at the municipal level throughout the fall semester. School resources were represented by the student-teacher ratio and the income level of the municipality in which the school was located, which serve as a proxy for the resources of the school and the municipality to comply with COVID-19 sanitary protocols. Finally, the type of administration contains the five categories of administration on which Chilean schools are dependent (municipal, SLEP, private subsidized, CAD, and private nonsubsidized). By gradually adding these variables into the model, we can analyze how they influence the partial correlations between SES and reopening processes, i.e., how the reopening gaps between socioeconomic groups change when we control by the differences in these aspects.

Table 4
Marginal effects on the probability of opening at least one day during March–June 2021 (probit model estimation).

Variable	(1)	(2)	(3)	(4)	(5)
School SES:					
Low	ref.	ref.	ref.	ref.	ref.
Middle–low	0.07***	0.02	0.02	0.01	0.00
	(4.56)	(1.47)	(1.50)	(1.00)	(0.24)
Middle	0.24***	0.15***	0.14***	0.13***	0.02
	(15.43)	(7.78)	(7.69)	(6.86)	(1.26)
Middle–high	0.35***	0.21***	0.20***	0.19***	0.00
	(16.75)	(7.74)	(7.54)	(7.08)	(0.10)
High	0.52***	0.39***	0.38***	0.40***	0.14
	(31.28)	(15.43)	(14.87)	(15.80)	(1.75)
COVID-19 case rate at municipal level:					
COVID-19 incidence rate (log)			-0.19***	-0.20***	-0.25***
			(−4.97)	(−5.36)	(−7.51)
COVID-19 mortality rate (log)			0.07***	0.07***	0.04*
			(3.87)	(3.94)	(2.29)
Municipality mean income (log)				-0.00	0.02
				(−0.24)	(1.00)
Student-teacher ratio (log)				0.08***	-0.02
				(6.51)	(−1.64)
School administration:					
Municipal					ref.
SLEP					0.51***
					(27.21)
CAD					0.61***
					(14.44)
Private subsidized					0.51***
					(42.26)
Private nonsubsidized					0.48***
					(5.77)
Covariates	No	Yes	Yes	Yes	Yes
FE region	No	Yes	Yes	Yes	Yes
Observations	7613	7613	7613	7613	7613
Pseudo R^2	0.07	0.20	0.20	0.20	0.37

Note. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$. Marginal effects; t statistics in parentheses. The covariates include the number of days without lockdown, whether the school is in a rural area, whether it has secondary education, type of secondary education provided, whether it is a bicentennial school, number of children enrolled in 2021, and the percentage of teachers over 60 years of age. SLEP = Servicios Locales de Educación Pública; CAD = Corporación de Administración Delegada; FE = Fixed Effects.

4. Results

First, we examined how the possibility of opening (*Paso a Paso* Phase >1) was distributed among the different schools. Table 3 shows the

Table 5
Marginal effects on the percentage of days open, conditional on having opened at least one day (truncated regression model estimation).

Variable	(1)	(2)	(3)	(4)	(5)
School SES:					
Low	ref.	ref.	ref.	ref.	ref.
Middle–low	3.93*	0.08	0.10	-0.15	-2.23
	(2.29)	(0.04)	(0.06)	(−0.08)	(−1.34)
Middle	8.40***	2.85	3.00	2.65	-3.12
	(4.85)	(1.39)	(1.46)	(1.28)	(−1.55)
Middle–high	7.12**	2.27	2.75	3.78	-2.60
	(3.22)	(0.85)	(1.03)	(1.40)	(−0.99)
High	23.16***	16.97***	17.90***	22.93***	19.05*
	(10.60)	(6.26)	(6.54)	(8.02)	(2.39)
COVID-19 case rate at municipal level:					
COVID-19 incidence rate (log)			9.76*	3.32	-1.58
			(2.42)	(0.80)	(−0.40)
COVID-19 mortality rate (log)			-0.95	-0.78	0.34
			(−0.46)	(−0.38)	(0.18)
Municipality mean income (log)				-9.61***	-8.92***
				(−4.95)	(−4.79)
Student-teacher ratio (log)				4.14**	-2.04
				(3.06)	(−1.54)
School administration:					
Municipal					ref.
SLEP					22.56***
					(9.72)
CAD					35.09***
					(7.72)
Private subsidized					32.65***
					(18.16)
Private nonsubsidized					24.67**
					(3.24)
Covariates	No	Yes	Yes	Yes	Yes
FE region	No	Yes	Yes	Yes	Yes
Observations	4085	4085	4085	4085	4085
Wald χ^2	124.9	568.8	574.6	612.1	945.2

Note. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$. Marginal effects; t statistics in parentheses. The dependent variable corresponds to the percentage of non-lockdown days that the school opened. The covariates include the number of days without lockdown, whether the school is in a rural area, whether it has secondary education, type of secondary education provided, whether it is a bicentennial school, number of children enrolled in 2021, and the percentage of teachers over 60 years of age. SLEP = Servicios Locales de Educación Pública; CAD = Corporación de Administración Delegada; FE = Fixed Effects.

average percentage of school days the schools in our sample were in lockdown during the period under study, displayed by socioeconomic group, average municipality income, student-teacher ratio, and type of administration. The average municipality income and the student-teacher ratio are expressed in quintiles of their distribution. The first quintile represents the schools with the lowest municipal income or student-teacher ratio. On average, schools were permitted to offer in-person classes on 53% of the school days between March and June 2021. We found no significant differences in the possibility of opening in three of the four variables analyzed. We found that high-SES schools and private nonsubsidized schools had statistically fewer days under Phase 1 restrictions (0.47). Moreover, schools with lower student-teacher ratios had fewer days in lockdown, with the difference between the first and fifth quintiles being statistically significant.

Table 3 shows that the possibility of having in-person instruction during the first half of 2021 was strongly determined by the epidemiological conditions and the restrictions associated with the pandemic (the *Paso a Paso* plan), independent of the socioeconomic status of the school. However, in-person instruction was offered on only 34% of the non-lockdown days at each school, with high heterogeneity ($SD = 0.39$). This heterogeneity is primarily explained by the fact that, even when not in Phase 1, 46% of the schools did not reopen for at least one day during the fall semester. The average percentage of days without lockdown on which in-person instruction was offered was 63.6% ($SD = 31.7$) among schools that opened at least one day.

Table 4 presents the average marginal effects of a school's socioeconomic status on the probability of opening at least one day (probit model) conditional on not being in Phase 1. Without any control (column 1), these marginal effects depict the raw gap between the low-SES schools (reference group) and the rest. COVID-19 incidence rate and mortality rate, student-teacher ratio, income level of the municipality in which the school is located, and type of administration are included sequentially in the model to analyze the impact of each of these factors on the coefficients associated with each socioeconomic group. Because of the correlation between these variables, these estimations could be affected by a multicollinearity problem. However, the VIF measures extracted from a Linear Probability Model's estimation do not support this idea (see Table A1 in the Appendix). Most of the VIF statistics, one for each variable, are around 1–2, much lower than the threshold of 10 proposed in the literature to identify colinear variables (Marquardt, 1980). The only exception is the high correlation between high-SES and private nonsubsidized schools. However, the general trends of our results do not vary when omitting this last group of schools (see Table A2 in the Appendix).

Before adjusting for observable characteristics, the results in Table 4 show strong differences in the probability of offering in-person instruction between socioeconomic groups. For example, the difference in the likelihood of offering in-person instruction between low and high-SES schools was 52% points (Column 1). However, the school's socioeconomic status was no longer significant as we added more controls (Column 5).

The reopening gaps between socioeconomic groups are not strongly related to school-level covariates, the number of non-lockdown days, or COVID-19 incidence rate and mortality rate at the municipality level because the differences remained significant after controlling for these variables, except between schools with low and medium-low socioeconomic status (Columns 2 and 3). Similarly, when controlling for the student-teacher ratio and the income level of the municipality, the gaps in the probability of reopening remained unchanged (Column 4). Therefore, when comparing similar schools regarding these covariates, those of lower SES showed significantly lower probabilities of reopening. This result goes against this study's first two hypotheses, i.e., the differences in the probabilities of schools reopening between socioeconomic groups were not due to the particular municipality's epidemiological conditions, unequal income among municipalities, or the student-teacher ratio at the school.

When we included the school administration types, the coefficients associated with socioeconomic status were reduced to close to zero and ceased to be statistically significant, which implies there are no reopening gaps between socioeconomic groups when comparing within the same type of administration. Furthermore, the low reopening rate of municipal schools explains all the observed socioeconomic disparities in the school reopening probabilities (Column 5). These differences could be driven by additional reopening restrictions faced by public school administrators compared to private administrators. However, the probability of SLEP schools reopening—fully public schools—was very similar to those with private administrators. Thus, only schools administered by municipalities remained in the group with the lowest rates of in-person instruction, even after controlling for the complete set of covariates and independent of the SES of schools, which supports hypothesis 3.

When considering schools that opened at least one day (N = 4085; 53% of the sample), we found that schools with low socioeconomic

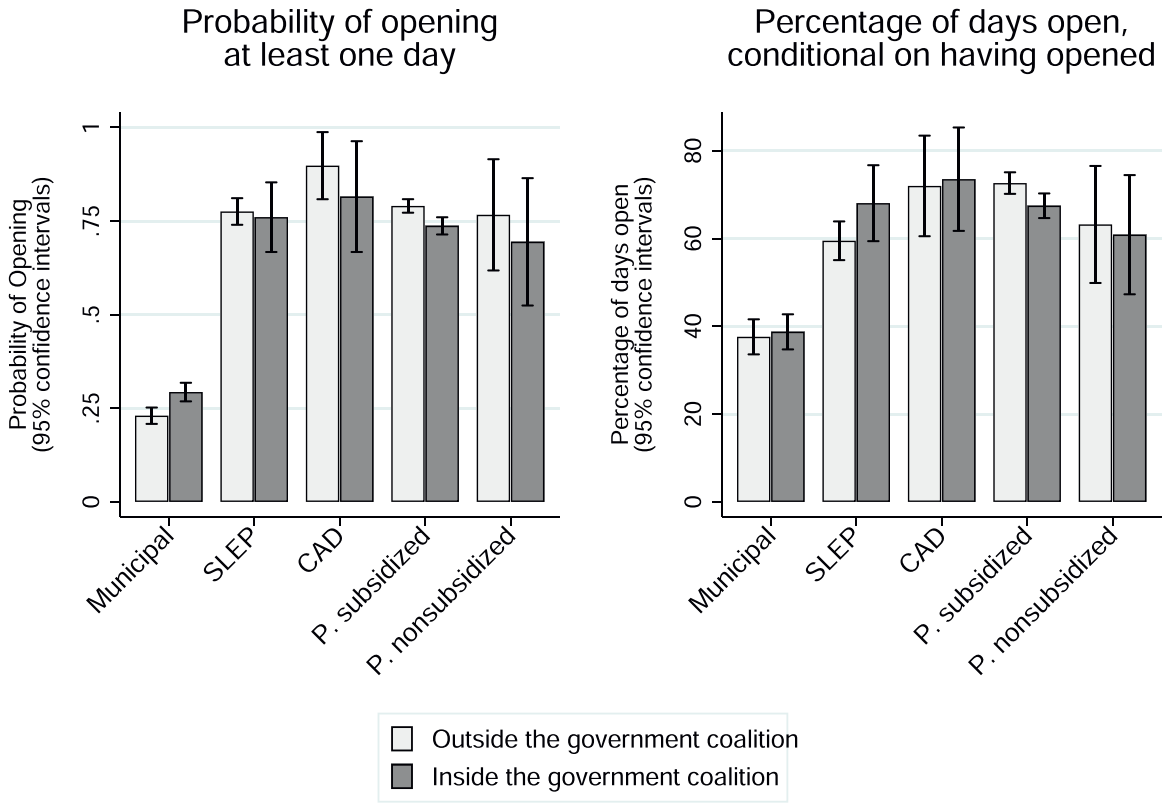

Fig. 2. Predicted probability of opening and predicted percentage of days open by school, according to the mayor's affiliation with the government coalition. *Note*. SLEP = Servicios Locales de Educación Pública; CAD = Corporación de Administración Delegada.

Table A1
Marginal effects on the probability of opening at least one day during March–June 2021 and VIF statistics (Linear Probability Model).

Variable	Coef.	VIF
School SES:		
Low	ref.	ref.
Middle–low	0.00	1.67
Middle	0.05	2.02
Middle–high	0.05	1.67
High	0.12	20.51
COVID-19 case rate at municipal level:		
COVID-19 incidence rate (log)	-0.37	1.32
COVID-19 mortality rate (log)	0.05	1.32
Municipality mean income (log)	0.06	1.51
Student-teacher ratio (log)	-0.03	1.52
School administration:		
Municipal	ref.	ref.
SLEP	0.48	1.07
CAD	0.47	1.54
Private subsidized	0.65	1.04
Private nonsubsidized	0.45	19.80
Observations	7613	

Note. Marginal effects and VIF statistics. This model does not include other covariates. VIF = Variance Inflation Factor; SLEP = Servicios Locales de Educación Pública; CAD = Corporación de Administración Delegada; FE = Fixed Effects.

status opened on fewer days than those with higher socioeconomic status (Table 5). These differences disappeared, however, when we adjusted for other school characteristics (Column 2). Schools with the highest socioeconomic status reopened on a significantly higher percentage of days than the rest (19% points higher than low socioeconomic status schools, as displayed in Column 5). These results are robust to any model specification. Hence, the inequalities between schools with distinct socioeconomic statuses, adjusted for school characteristics, resources, and type of administration, were mainly expressed by the greater number of days that the highest socioeconomic status schools offered in-person instruction rather than by the decision whether or not to open.

We found a substantial variation in reopening decisions by type of school administration. Municipal schools opened on fewer days than schools with other administration types. Specifically, municipal schools reopened 22% points less than SLEP schools. There was a similar reopening gap between municipal schools and private nonsubsidized schools (23% points less), which was even more pronounced compared to private subsidized schools (34% points less). Contrary to our expectations, the income level of the municipality was negatively related to the percentage of days a school reopened, even after controlling for administration type. And we found no significant differences in the number of days that schools reopened according to student-teacher ratio or COVID-19 incidence rate. Furthermore, the accumulated COVID-19 incidence rate in the municipality affected the decision to reopen schools but not the number of days that schools remained open.

One plausible explanation for the observed differences in offering in-person instruction according to school administration type is the political affiliation of the municipal mayor. As described previously, municipal schools depend on municipal authorities (mayors), who are elected every four years and whose potential political discrepancies with the central government and vested interests may have influenced their decisions on school reopening. To explore this further, we included a dummy variable in the model indicating whether the mayor of the municipality in which the school was located belonged to a political party from the same political coalition as the central government (2018–2022) and an interaction of this variable with the five types of school administration. Using the estimates given by this model, Fig. 2 shows the predicted probabilities of reopening and the predicted percentages of days open for each unit, separated by the mayor's political affiliation.

Table A2
Marginal effects on the probability of opening at least one day during March–June 2021 without high-SES/private nonsubsidized schools (probit model estimation).

Variable	(1)	(2)	(3)	(4)	(5)
School SES:					
Low	ref.	ref.	ref.	ref.	ref.
Middle–low	0.07***	0.02	0.02	0.02	0.00
	(4.56)	(1.50)	(1.54)	(1.10)	(0.34)
Middle	0.24***	0.15***	0.15***	0.13***	0.02
	(15.43)	(7.83)	(7.75)	(6.99)	(1.44)
Middle–high	0.35***	0.20***	0.20***	0.19***	0.01
	(16.39)	(7.48)	(7.28)	(6.89)	(0.23)
COVID-19 case rate at municipal level:					
COVID-19 incidence rate (log)			-0.19***	-0.21***	-0.26***
			(−4.88)	(−5.23)	(−7.68)
COVID-19 mortality rate (log)			0.08***	0.08***	0.04**
			(4.12)	(4.10)	(2.59)
Municipality mean income (log)				-0.02	0.02
				(−0.92)	(0.86)
Student-teacher ratio (log)				0.08***	-0.04**
				(6.09)	(−3.08)
School administration:					
Municipal					ref.
SLEP					0.52***
					(27.53)
CAD					0.62***
					(14.32)
Private subsidized					0.52***
					(46.90)
Covariates	No	Yes	Yes	Yes	Yes
FE region	No	Yes	Yes	Yes	Yes
Observations	7127	7127	7127	7127	7127
Pseudo R^2	0.04	0.17	0.17	0.18	0.35

Note. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$. Marginal effects; t statistics in parentheses. The covariates include the number of days without lockdown, whether the school is in a rural area, whether it has secondary education, type of secondary education provided, whether it is a bicentennial school, number of children enrolled in 2021, and the percentage of teachers over 60 years of age. SLEP = Servicios Locales de Educación Pública; CAD = Corporación de Administración Delegada; FE = Fixed Effects.

Although the municipalities with mayors from the same political coalition as the central government tended to open schools on a greater number of days than municipalities led by mayors from outside the ruling coalition, the difference was small, about 6%. Municipal schools were reopened on considerably fewer days than schools with other types of administration, independent of the mayor's political affiliation. Among public schools located in municipalities with mayors from the government coalition, we found that the probability of municipal schools being reopened for at least one day was less than half that of SLEP schools (0.29 in municipal schools versus 0.77 in the SLEP schools). We found no statistically significant differences in the percentage of days a school reopened by mayoral political affiliation among municipal schools that reopened for at least one day (right panel). Thus, although schools were more likely to be open in municipalities with mayors favorable to the central government, most differences in offering in-person instruction between schools remain unexplained. Aside from a small statistically significant difference for private subsidized schools, there were no other significant differences in the probability of a school reopening according to the mayor's political affiliation in the other types of administration.

Our main results hold once we included municipal fixed effects. Results from the municipality fixed effects model are presented in Table A3 in the Appendix.

5. Discussion

The challenges remote education has presented for schools, students, and families during the COVID-19 pandemic have been immense. Evidence suggests that differences in exposure to in-person instruction may exacerbate existing learning gaps and that, given the inequalities that have characterized school closures, socially vulnerable students have been most affected by pandemic-related changes to the educational format. These students have faced greater difficulties utilizing remote education due to limited connectivity, equipment, materials, and family support. Accordingly, numerous organizations have advocated for an expedited return to in-person instruction to restore the right to education, particularly among low-income and vulnerable populations.

Our study shows that the pandemic heavily restricted the opening of schools in Chile in the fall of 2021. On average, schools were not permitted to reopen on about half of the school days in the 2021 fall semester because the municipality in which the school was located was in lockdown. We found no differences in the distribution of lockdowns across socioeconomic sectors. However, the effective reopening of schools was highly uneven across schools of different SES: schools that served the most socially vulnerable students offered significantly fewer in-person classes. These differences remained when we compared schools exposed to similar COVID-19 incidence rates, with similar student-teacher ratios, and located in municipalities with similar income levels. However, reopening gaps between socioeconomic groups disappeared when comparing within types of administration; the non-reopening of municipal schools fully explained them. This last type of school took significantly longer to reopen, even if they were exposed to conditions and resources similar to those of other types of administration.

Our study illuminates the prominent role that municipal mayors played in the decisions to reopen the schools in their municipality. Compared to schools that were administered by a SLEP, Municipal schools had a 50% lower probability of being reopened for at least one day. These two types of schools are very similar in terms of the socioeconomic status of their students, administrative regulations, and infrastructure. Indeed, SLEP schools were under municipal administration as little as four years ago.

Notably, however, the decision not to open schools in most municipal authorities was largely unrelated to a political affiliation with the governing coalition in Chile. Although government-aligned municipalities opened more schools than municipalities that were not aligned with the central government, they did so at considerably lower rates than schools administered by the state or private institutions. Our findings differ from research focused on the US, which showed that the differences in decisions to reopen schools between districts could largely be explained by whether a particular school district had a stronger relationship with the Democratic party or the Republican party during the Trump administration (Grossman et al., 2021).

As the low reopening rates of municipal schools in Chile became apparent during the fall semester of 2021, a sustained discussion on this issue between the central government and municipal authorities played out in the media. The central government blamed the lack of mayoral leadership in acknowledging the rights of families to send their children to school (Gálvez, 2021). In response, representatives of municipal mayors argued that it was not sensible to reopen because the pandemic was not under control and that reopening would put families at risk (Veloso, 2021). For similar reasons, Chile's teacher association's members, the majority of whom work in public education, argued against the return to in-person instruction throughout the fall semester (Colegio de Profesoras y Profesores de Chile, 2021).

In this regard, the mayoral elections held during the fall semester in May 2021—the winners taking office at the end of June 2021—may have played a crucial role in municipal decisions not to reopen schools. After these elections, and in parallel with a continuous decrease in COVID-19 incidence rate, the arguments for not reopening schools from

Table A3
Marginal effects on the probability of opening at least one day (probit model estimation) and on the percentage of days open, conditional on having opened at least one day (truncated regression model estimation).

	Probit model			Truncated regression model		
Variable	(1)	(2)	(3)	(1)	(2)	(3)
School SES:						
Low	ref.	ref.	ref.	ref.	ref.	ref.
Middle–low	0.03	0.00	-0.01	1.54	0.24	-1.90
	(1.56)	(0.21)	(−0.77)	(0.84)	(0.18)	(−1.46)
Middle	0.17***	0.14***	0.02	4.34*	3.37*	-1.25
	(7.90)	(6.62)	(1.14)	(2.03)	(2.03)	(−0.78)
Middle–high	0.24***	0.22***	0.01	3.25	5.10*	-0.29
	(7.86)	(7.87)	(0.43)	(1.17)	(2.37)	(−0.14)
High	0.46***	0.40***	0.11	22.98***	19.85***	8.16
	(16.46)	(13.81)	(1.78)	(8.29)	(8.77)	(1.33)
Student-teacher ratio (log)	0.11***	0.15***	0.02	7.86***	5.41***	0.88
	(7.94)	(10.75)	(1.40)	(5.57)	(4.71)	(0.80)
School administration:						
Municipal			ref.			ref.
SLEP			0.61***			19.74***
			(24.57)			(7.93)
CAD			0.61***			32.83***
			(50.06)			(20.49)
Private subsidized			0.69***			37.13***
			(14.22)			(10.30)
Private nonsubsidized			0.56***			34.28***
			(6.62)			(5.77)
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
FE municipality	No	Yes	Yes	No	Yes	Yes
Observations	6050	6050	6050	4085	4085	4085

Note. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$. Marginal effects; *t* statistics in parentheses. The covariates include whether the school is in a rural area, whether it has secondary education, type of secondary education provided, whether it is a bicentennial school, number of children enrolled in 2021, and the percentage of teachers over 60 years of age. SLEP = Servicios Locales de Educación Pública; CAD = Corporación de Administración Delegada; FE = Fixed Effects. 1563 observations from 119 municipalities are missing from the probit model estimation due to perfect predictions within those municipalities.

the municipal authorities have become less strident, and school reopening has increased. Opposition to the reopening of schools by Chile's teacher association was maintained for a more prolonged period. Although far from representing a causal effect, the prominent role municipal mayors played in reopening schools found in this study supports the growing influence of vested interests on educational policy during the COVID-19 pandemic, shifting conflicts between central governments and municipal authorities to the educational arena (Hartney and Finger, 2020).

The leadership of political authorities, both at the national and municipal levels, was crucial to the school reopening decision-making process and the effective reopening of the school system. For example, the collaboration between local and national political leaders to define the conditions that would allow more students to attend schools, when reopening schools should be mandatory, and when mandatory in-person instruction should resume emerged as an urgent challenge. The lack of political coordination on school reopenings affects the most socially vulnerable students and schools, accentuating the socioeconomic gaps in educational opportunities and learning. Which factors hinder the reopening of municipal schools is a topic that needs further research to design political devices capable of coordinating municipalities and the central government in contexts of crises.

6. Conclusions

Growing evidence has revealed that the pandemic increased the existing inequalities in countries across the globe. In Chile, the pandemic has put an enormous burden on low-income groups (Bennett, 2021; Gil et al., 2021; Gozzi et al., 2021; Mena et al., 2021). Our analysis shows that schools attended by students of lower socioeconomic status were significantly less likely to hold in-person instruction during the pandemic, attributable mainly to the low reopening rate among schools administered by the municipalities. Although the political affiliations of municipal authorities did affect the likelihood of reopening schools to some degree, we found that belonging to the municipal school administration meant a school was less likely to reopen compared to all other school administration types. To close the gaps widened by the COVID-19 pandemic, policymakers should urgently focus on educational recovery, identifying and prioritizing the most severely affected groups. We hope the results presented in this paper help to inform this urgent work.

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Declarations of interest

none.

Human subjects protection

No human being participated directly as the subject of this research.

Author statement

The study team was entirely responsible for study design, data

collection, and data analysis. All authors vouch for the accuracy and completeness of the data and accept responsibility for publication. DK, and JPV directly accessed and verified the underlying data. DK, JPV, SC, AC, and EAU wrote the first draft of the manuscript and contributed equally to this Article. All authors critically reviewed and edited the manuscript.

Appendix

See Tables A1-A3.

References

Agencia de Calidad de la Educación, 2019. Formulario de Solicitud Bases de Datos [PDF document]. Retrieved from https://s3.amazonaws.com/archivos.agenciaeducacion.cl/documentos-web/Formulario_de_Solicitud_Bases_de_Datos.pdf.

Agencia de la Calidad, 2021. *Resultados Diagnóstico Integral de Aprendizaje*.

Andrew, A., Cattan, S., Costa Dias, M., Farquharson, C., Kraftman, L., Krutikova, S., Sevilla, A., 2020. Inequalities in Children's Experiences of Home Learning during the COVID-19 Lockdown in England*. Fiscal Studies 41 (3), 653–683. https://doi.org/10.1111/1475-5890.12240.

Asahi, K., Undurraga, E.A., Valdes, R., Wagner, R., 2021. The effect of COVID-19 on the economy: evidence from an early adopter of localized lockdowns. Journal of Global Health 11, 05002.

Azevedo, J.P., Hasan, A., Goldemberg, D., Geven, K., Iqbal, S.A., 2021. Simulating the potential impacts of COVID-19 school closures on schooling and learning outcomes: a set of global estimates. World Bank Res. Obs. 36 (1), 1–40.

Bacher-Hicks, A., Goodman, J., Mulhern, C., 2021. Inequality in household adaptation to schooling shocks: covid-induced online learning engagement in real time. J. Public Econ. 193, 104345.

Baek, C., McCrory, P.B., Messer, T., Mui, P., 2020. Unemployment effects of stay-at-home orders: Evidence from high frequency claims data. Review of Economics and Statistics 30, 1–72.

Belay, D.G., 2020. COVID-19, Distance learning and educational inequality in rural ethiopia. Pedagog. Res. 5 (4).

Bennett, M., 2021. All things equal? Heterogeneity in policy effectiveness against COVID-19 spread in Chile. World Dev. 137, 105208 https://doi.org/10.1016/j.worlddev.2020.105208.

Betthäuser, B.A., Bach-Mortensen, A.M., Engzell, P., 2023. A systematic review and meta-analysis of the evidence on learning during the COVID-19 pandemic. Nature Human Behaviour 7 (3), 375–385. https://doi.org/10.1038/s41562-022-01506-4.

Bol, T. , 2020). Inequality in homeschooling during the Corona crisis in the Netherlands. First results from the LISS Panel.

Camp, A., Zamarro, G. , 2021. Determinants of Ethnic Differences in School Modality Choices during the COVID-19 Crisis.

Center on Reinventing Public Education, 2021. Tracking district actions to address the COVID-19 pandemic. Retrieved from https://crpe.org/pandemic-learning/tracking-district-actions/.

Colegio de Profesoras y Profesores de Chile. , 2021. *Declaración del directorio nacional sobre materia pedagógica, 2 de julio de 2021* . Retrieved November 11 from ⟨https://www.colegiodeprofesores.cl/2021/07/06/acuerdos-de-la-asamblea-nacional-del-colegio-de-profesoras-y-profesores-del-2-de-julio-de-2021/⟩.

Cragg, J.G., 1971. Some statistical models for limited dependent variables with application to the demand for durable goods. Econometrica 829–844.

Cullinan, J., Flannery, D., Harold, J., Lyons, S., Palcic, D., 2021. The disconnected: COVID-19 and disparities in access to quality broadband for higher education students. Int. J. Educ. Technol. High. Educ. 18 (1), 1–21.

Curriculum Associates. , 2021. *Understanding Student Learning*.

van de Werfhorst, 2021. Inequality in learning is a major concern after school closures. Proceedings of the National Academy of Sciences 118 (20), e2105243118.

DeAngelis, C., Makridis, C., 2021. Are school reopening decisions related to funding? evidence from over 12,000 districts during the COVID-19 pandemic. Evidence *12*.

Dietrich, H., Patzina, A., Lerche, A., 2021. Social inequality in the homeschooling efforts of German high school students during a school closing period. *Eur. Soc.*, *23*(sup1) S348–S369.

E. Vogels A. Perrin L. Rainie M. Anderson 53% of Americans Say the Internet Has Been Essential during the COVID-19 Outbreak: Americans with Lower Incomes Are Particularly Likely to Have Concerns Related to the Digital Divide and the Digital 2020 Homework Gap". Pew Research Center.

Ehrhardt, J., Ekinci, A., Krehl, H., Meincke, M., Finci, I., Klein, J., Brockmann, S., 2020. Transmission of SARS-CoV-2 in children aged 0 to 19 years in childcare facilities and schools after their reopening in May 2020, Baden-Württemberg, Germany. Eurosurveillance 25 (36), 2001587.

Elacqua, G., 2012. The impact of school choice and public policy on segregation: evidence from Chile. Int. J. Educ. Dev. 32 (3), 444–453.

Engzell, P., Frey, A., Verhagen, M.D., 2021. Learning loss due to school closures during the COVID-19 pandemic. Proc. Natl. Acad. Sci. 118 (17), e2022376118.

Ertem, Z., Schechter-Perkins, E.M., Oster, E., van den Berg, P., Epshtein, I., Chaiyakunapruk, N., Nelson, R.E., 2021. The impact of school opening model on SARS-CoV-2 community incidence and mortality. Nat. Med. 27, 2120–2126. https://doi.org/10.1038/s41591-021-01563-8.

Fukumoto, K., McClean, C.T., Nakagawa, K., 2021. No causal effect of school closures in Japan on the spread of COVID-19 in spring 2020. Nat. Med. https://doi.org/10.1038/s41591-021-01571-8.

Gálvez, R., 2021. Gobierno empuja el retorno a clases en julio tras desastrosos resultados en diagnóstico de aprendizajes. La Tercerca 27. https://bit.ly/3kwweD5.

Gil, D., Domínguez, P., Undurraga, E.A., Valenzuela, E., 2021. Employment Loss in Informal Settlements during the Covid-19 Pandemic: Evidence from Chile. J Urban Health 98, 622–634. https://doi.org/10.1007/s11524-021-00575-6.

Gozzi, N., Tizzoni, M., Chinazzi, M., Ferres, L., Vespignani, A., Perra, N., 2021. Estimating the effect of social inequalities on the mitigation of COVID-19 across communities in Santiago de Chile. Nat. Commun. 12 (1), 2429. https://doi.org/10.1038/s41467-021-22601-6.

Grossman, G., Kim, S., Rexer, J.M., Thirumurthy, H., 2020. Political partisanship influences behavioral responses to governors' recommendations for COVID-19 prevention in the United States. Proc. Natl. Acad. Sci. 117 (39), 24144–24153. https://doi.org/10.1073/pnas.2007835117.

Haderlein, S.K., Saavedra, A.R., Polikoff, M.S., Silver, D., Rapaport, A., Garland, M., 2021. Disparities in educational access in the time of COVID: evidence from a nationally representative panel of American families. Aera Open 7, 23328584211041350. https://doi.org/10.1177/23328584211041350.

Halloran, C., Jack, R., Okun, J. C., & Oster, E., 2021. Pandemic schooling mode and student test scores: Evidence from US states. *NBER Working Papers, 29497*.

Hanushek, E.A., Woessmann, L., 2020. The economic impacts of learning losses. OECD Educ. Work. Pap. *225*. https://doi.org/10.1787/21908d74-en.

Harris, N., 2020. Children's Education and the Legal Response to COVID-19 in England. Int'l J. Educ. L. & Pol'y 16, 139.

Hartney, M.T., Finger, L.K., 2020. Politics, markets, and pandemics: Public education's response to COVID-19. Perspect. Polit. 1–17.

Henderson, M.B., Peterson, P.E., West, M.R., 2021. Pandemic Parent Survey Finds Perverse Pattern: Students Are More Likely to Be Attending School in Person Where Covid Is Spreading More Rapidly: Majority of students receiving fully remote instruction; private-school students more likely to be in person full time. Education Next 21 (2), 34–48.

Hershow, R.B., Wu, K., Lewis, N.M., Milne, A.T., Currie, D., Smith, A.R., Freeman, B., 2021. Low SARS-CoV-2 transmission in elementary schools—Salt Lake County, Utah, December 3, 2020–January 31, 2021. Morb. Mortal. Wkly. Rep. 70 (12), 442.

Hevia, F.J., Vergara-Lope, S., Velásquez-Durán, A., Calderón, D., 2022. Estimation of the fundamental learning loss and learning poverty related to COVID-19 pandemic in Mexico. Int J Educ Dev 88, 102515.

Insights for Education. , 2020. *COVID-19 and School responses: Tracking and Analysis* Retrieved July 15 from ⟨https://education.org/covid-19/⟩.

International Labour Organization, 2020. *ILO Monitor: COVID-19 and the World of Work. Seventh edition. Updated estimates and analysis.* Retrieved from https://www.ilo.org/global/topics/coronavirus/impacts-and-responses/WCMS_767028/lang–en/index.htm.

Jæger, M.M., Blaabæk, E.H., 2020. Inequality in learning opportunities during Covid-19: evidence from library takeout. Res. Soc. Stratif. Mobil. 68, 100524.

Jara, A., Undurraga, E.A., González, C., Paredes, F., Fontecilla, T., Jara, G., Araos, R., 2021. Effectiveness of an Inactivated SARS-CoV-2 vaccine in Chile. N. Engl. J. Med. 385, 875–884. https://doi.org/10.1056/NEJMoa2107715.

Jara, A., Undurraga, E.A., Zubizarreta, J.R., González, C., Acevedo, J., Pizarro, A., Araos, R., 2022. Effectiveness of coronavac in children 3 to 5 years during the SARS-CoV-2 omicron outbreak in Chile. Nat. Med. 28, 1377–1380. https://doi.org/10.1038/s41591-022-01874-4.

Katchova, A.L., Miranda, M.J., 2004. Two-step econometric estimation of farm characteristics affecting marketing contract decisions. Am. J. Agric. Econ. 88–102.

Kogan, V., Lavertu, S., 2021. The COVID-19 pandemic and student achievement on Ohio's third-grade English language arts assessment. Ohio State University,, p. *27*.

Kuhfeld, M., Soland, J., Lewis, K., 2022. Test score patterns across three COVID-19-impacted school years. Educational Researcher 51 (7), 500–506.

Kuhfeld, M., Soland, J., Tarasawa, B., Johnson, A., Ruzek, E., Liu, J., 2020. Projecting the potential impact of COVID-19 school closures on academic achievement. Educ. Res. 49 (8), 549–565.

Lewis, S.J., Munro, A.P.S., Smith, G.D., Pollock, A.M., 2021. Closing schools is not evidence based and harms children. bmj 372, n521. https://doi.org/10.1136/bmj.n521.

Li, Y., Undurraga, E.A., Zubizarreta, J.R., 2022. Effectiveness of Localized Lockdowns in the Covid-19 Pandemic. Am. J. Epidemiol. 191 (5), 812–824.

Lichand, G., Doria, C.A., Leal-Neto, O., Fernandes, J.P.C., 2022. The impacts of remote learning in secondary education during the pandemic in Brazil. Nature Human Behaviour 6 (8), 1079–1086. https://doi.org/10.1038/s41562-022-01350-6.

Lozano-Rojas, F., Jiang, X., Montenovo, L., Simon, K.I., Weinberg, B.A., Wing, C., 2020. Is the cure worse than the problem itself? immediate labor market effects of covid-19 case rates and school closures in the US. National Bureau of Economic Research WP 27172, 1–17.

Maldonado, J.E., De Witte, K., 2020. The effect of school closures on standardised student test outcomes. Br. Educ. Res. J. 48 (1), 49–94. https://doi.org/10.1002/berj.3754.

Marquardt, D., 1980. You should standardize the predictor variables in your regression models. Discussion of: a critique of some ridge regression methods. J. Am. Stat. Assoc. 75 (369), 87–91.

Mena, G.E., Martinez, P.P., Mahmud, A.S., Marquet, P.A., Buckee, C.O., Santillana, M., 2021. Socioeconomic status determines COVID-19 incidence and related mortality in Santiago, Chile. Science 372 (6545), eabg5298. https://doi.org/10.1126/science.abg5298.

Ministerio de Educación. (2021a). *Protocolo de alerta temprana en contexto de COVID-19 para establecimientos educacionales*. Mineduc. Retrieved July 15 from ⟨https://bit.ly/3y0T1vL⟩.
Ministerio de Educación. (2021b). *Variación de la matrícula preliminar 2021, Apuntes 16* .
Ministerio de Educación. (2021c). Estado apertura de establecimientos. Datos Abiertos. [Data set]. Retrieved from https://datosabiertos.mineduc.cl/estado-apertura-de-establecimientos/.
Ministerio de Salud de Chile. , 2022. *Cifras Oficiales COVID-19*. Ministerio de Salud, Plan de Acción Coronavirus COVID-19. Retrieved December 10, from ⟨https://www.gob.cl/coronavirus/cifrasoficiales/⟩.
Ministerio de Salud. , 2021. *Plan de Acción Coronavirus Covid-19*. Retrieved July 1 from ⟨https://www.minsal.cl/nuevo-coronavirus-2019-ncov/material-de-descarga/⟩.
Mizala, A., Torche, F., 2012. Bringing the schools back in: the stratification of educational achievement in the Chilean voucher system. Int. J. Educ. Dev. 32 (1), 132–144.
Mizala, A., Torche, F., 2017. Means-tested school vouchers and educational achievement: evidence from Chile's universal voucher system. Ann. Am. Acad. Political Soc. Sci. 674 (1), 163–183.
Olson, S.M., Newhams, M.M., Halasa, N.B., Price, A.M., Boom, J.A., Sahni, L.C., Randolph, A.G., 2022. Effectiveness of BNT162b2 vaccine against critical covid-19 in adolescents. N. Engl. J. Med. 386, 713–723. https://doi.org/10.1056/NEJMoa2117995.
Paredes, R., Volante, P., Zubizarreta, J., Opazo, M.2013. Financiamiento compartido en la educación subvencionada chilena. In I. Irarrázaval, M. Morandé, & M. Letelier (Eds.), *Propuestas para Chile* (pp. 51–84). Pontificia Universidad Católica de Chile.
Parolin, Z., Lee, E.K., 2021. Large socio-economic, geographic and demographic disparities exist in exposure to school closures. Nat. Hum. Behav. 5 (4), 522–528.
Reimer, D., Smith, E., Andersen, I.G., Sortkær, B., 2021. What happens when schools shut down? Investigating inequality in students' reading behavior during Covid-19 in Denmark. Res. Soc. Stratif. Mobil. 71, 100568.
Salgado, M., Castillo, J., 2018. Differential status evaluations and racial bias in the Chilean segregated school system. Sociol. Forum.
Servicio Electoral de Chile, 2016. Elecciones generales - Detalles de las elecciones [Data set]. Retrieved from https://historico.servel.cl/servel/app/index.php?r=EleccionesGenerico&id=165.
Stelitano, L., Doan, S., Woo, A., Diliberti, M., Kaufman, J.H., Henry, D. , 2020. The Digital Divide and COVID-19: Teachers' Perceptions of Inequities in Students' Internet Access and Participation in Remote Learning. Data Note: Insights from the American Educator Panels. Research Report. RR-A134–3. *RAND Corporation*.
Tariq, A., Undurraga, E.A., Laborde, C.C., Vogt-Geisse, K., Luo, R., Rothenberg, R., Chowell, G., 2021. Transmission dynamics and control of COVID-19 in Chile, March-October, 2020. PLOS Negl. Trop. Dis. 15 (1), e0009070.
Taylor, L.2021. Reckless Rush to Reopen Threatens Chile's Exemplary Vaccination Strategy. *Scientific American*. ⟨https://www.scientificamerican.com/article/reckless-rush-to-reopen-threatens-chiles-exemplary-vaccination-strategy/⟩.
Tiruneh, D.T. , 2020. COVID-19 school closures may further widen the inequality gaps between the advantaged and the disadvantaged in Ethiopia. *Education in Emergencies, April* .
UNESCO. , 2021. *COVID-19 Education Response*. Retrieved November 15 from ⟨http://covid19.uis.unesco.org/disruptions-due-to-school-closures/⟩.
UNESCO. , 2020. *Covid-19 education response. How many students are at risk of not returning to school?*
UNICEF , 2021b. *Tres de cada cinco niños y niñas que perdieron un año escolar en el mundo durante la pandemia, viven en América Latina y el Caribe*. Retrieved November 10 from ⟨https://uni.cf/3osHJg5⟩.
UNICEF. , 2021a. *#ReopenSchools. There's no time to lose*. UNICEF. Retrieved November 15 from ⟨https://www.unicef.org/coronavirus/reopen-schools⟩.
Van Lancker, W., Parolin, Z., 2020. COVID-19, school closures, and child poverty: a social crisis in the making. Lancet Public Health 5 (5), e243–e244.
Veloso, L. , 2021. *Asociación de Municipios asegura que no más del 10% de comunas abrirá sus escuelas en fase 2*. BioBio Chile. Retrieved November 11 from ⟨https://bit.ly/30dwgbU⟩.
Walter, E.B., Talaat, K.R., Sabharwal, C., Gurtman, A., Lockhart, S., Paulsen, G.C., Pahud, B.A., 2022. Evaluation of the BNT162b2 Covid-19 vaccine in children 5 to 11 years of age. N. Engl. J. Med. 386 (1), 35–46.
Willyard, C., 2021. COVID and schools: the evidence for reopening safely. Nature 595 (7866), 164–167.
World Bank. (2020). The Economy in the Time of CoVID-19. *Semiannual Report of the Latin America and Caribbean Region.* Retrieved from https://bit.ly/35B2r3y.