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Full-time schools and educational trajectories: Evidence from high-stakes exams☆

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ABSTRACT

This paper estimates the effects of extending the school day during elementary school on students' educational outcomes later in life. The analysis takes place in the context of a large-scale program introduced in 2007 that extended the school day from 4.5 to 8 h in Mexico City's metropolitan area. The identification strategy leverages cohort-by-cohort variation in full-time enrollment in elementary schools. The results indicate that full-time elementary schools have positive and long-lasting effects on students' performance, increasing high-stakes high school admission test scores by 4.8 percent of a standard deviation. The effects are larger for females than for males. The difference in the effects between males and females of 2.1 percent of a standard deviation represents 16% of the gender gap in the high school admission exam. Moreover, full-time schooling decreases the probability of delays in schooling completion.

1. Introduction

Implementing effective education policies to improve academic outcomes and productivity is central to fostering economic development. Yet, implementation, scalability, and potential diminishing effects across time are challenges that often plague education interventions (Agüero & Beleche, 2013; Bailey et al., 2020). Full-time schools (FTS) have shown promising results in improving education quality and promoting equity in the short term and at a large scale.[1] Still, less is known about the persistence of their effects. This paper provides new evidence on the effects of extensions in the school day on individual educational achievement beyond immediate outcomes. Understanding these impacts is imperative for a complete assessment of the potential benefits of FTS.

Our analysis takes place in the context of a large-scale program that extended the school day by three-and-a-half hours in public elementary schools in Mexico. Due to data restrictions or lack of exogenous variation in education policies, evaluating the dynamic effects of educational investments is typically challenging. We overcome identification challenges by combining a large-scale policy change with rich individual-level data on students' educational trajectories, including measures of academic performance, non-cognitive outcomes, and student preferences over schools. We leverage quasi-experimental variation in the staggered rollout of Mexico's FTS program and linked administrative records on low-stakes and high-stakes test scores in Mexico City's metropolitan area to identify causal effects of exposure to FTS during elementary school on high-stakes test scores, high school placement, and preferences over highly-selective high schools later in life.

To recover the causal effects of interest, our identification strategy exploits the variation in exposure to FTS across schools and over time. Because elementary schools were incorporated into the FTS program in different academic years, two-way-fixed effects (TWFE) regressions are potentially biased (e.g., de Chaisemartin & D'Haultfœuille, 2020; Goodman-Bacon, 2021; Sun & Abraham, 2021).[2] We implement the diagnostic test proposed by Goodman-Bacon (2021) to evaluate the

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[1] For the case of Mexico, Cabrera-Hernández (2020) and Padilla-Romo (2022) find an average effect close to 10 percent of a standard deviation after FTS implementation on standardized test scores. Similar effects have been found for Chile (Bellei, 2009) and Peru (Agüero et al., 2021).

[2] The FTS was first introduced in the academic year 2007/08, covering 500 schools in 15 states. Over time, it was gradually extended to other schools and states. By 2018, more than 25,000 schools distributed across all states in Mexico had implemented the program (see Cabrera-Hernández, 2020; Padilla-Romo, 2022).

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extent to which the staggered implementation of the FTS program is likely to bias the TWFE estimates in our setting. Furthermore, we present our main results using the Interaction-Weighted (IW) estimator proposed by Sun and Abraham (2021), which produces robust estimates for both dynamic effects and heterogeneous treatments across schools adopting the FTS program at different time periods.

Our data come from the Mexican Secretariat of Public Education. The data contain information from *ENLACE* (National Assessment of Academic Achievement in Schools), a low-stakes standardized exam administered annually to elementary school students to evaluate their general performance in mathematics and language. This information allows us to determine if students were exposed to FTS in elementary school and the degree of exposure in years. We also use information from *COMIPEMS* (Metropolitan Commission of Public Institutions of Higher Secondary Education), a high-stakes high school admission exam, and its context questionnaire. Our analytical sample contains information on the elementary schools where students were enrolled between 2007 and 2013, the middle schools they attended, high school admission exam scores, self-reported non-cognitive outcomes, and information on family background and demographics. In addition, we observe the students' reported complete ranking of preferences over high school options.

We examine the effects of the extension in FTS availability on a set of complementary outcomes. Our main analysis focuses on high-stakes test scores, which are strong predictors for long-term academic achievement and labor force outcomes (Ebenstein et al., 2016; Machin et al., 2020). We find that being enrolled in an FTS for all six years of elementary school education increases high school placement test scores by between 5.1 and 13.8 percent of a standard deviation. As a consequence, full-time schooling increases the probability that students attend more selective high schools. Moreover, we find that FTS increases students' probability of taking a high school admission exam and on-time graduation from middle school, reducing potential delays in educational completion.

A threat to our estimations is the chance of students' endogenous school switching as a response to the implementation of the FTS program. We address this concern with three different strategies: (i) we study individuals by their first elementary school of enrollment, recovering intent-to-treat estimates; (ii) given the higher probability of COMIPEMS test-taking for students in FTS, we follow the approach developed by Lee (2009) and provide bounds on the estimated effects under extreme assumptions about a possible endogenous sample selection process;[3] and (iii) we reproduce our estimates using a restricted sample consisting of individuals with at most one other school within half a kilometer of their school to reduce endogenous shifting concerns. Even under these restrictions, our estimates show that exposure to FTS in elementary school significantly increases performance in the high-stakes high school admission exam, and thus, our main conclusions are robust to the non-random selection of students taking the high school admission exam.

While a large fraction of literature has focused on the importance of cognitive skills, non-cognitive skills are also strong determinants for long-term success in economic and behavioral outcomes (Heckman, 2006; Heckman et al., 2013, 2006).[4] Using data on self-reported non-cognitive outcomes, we provide evidence of the effects of FTS on non-cognitive skills, which may mediate the effects on test scores. Our estimates suggest that exposure to FTS improved oral communication, the ability to learn independently, and the ability to plan school activities for girls. The results also suggest that FTS improved self-reported work ethic skills for girls and for students from lower socioeconomic backgrounds.

This paper contributes to the literature on the effects of FTS on academic achievement and non-cognitive outcomes. Existing studies on the effects of FTS concentrate on short-term low-stakes test scores (Agüero et al., 2021; Almeida et al., 2016; Bellei, 2009; Cabrera-Hernández, 2020; Cerdan-Infantes & Vermeersch, 2007; Dias Mendes, 2011; Hincapie, 2016; Llambí, 2013; Orkin, 2013; Padilla-Romo, 2022; Xerxenevsky, 2012), mothers and grandmothers' labor supply (Berthelon et al., 2022; Cabrera-Hernández & Padilla-Romo, 2020; Contreras & Sepúlveda, 2017; Garganta & Zentner, 2020; Nemitz, 2016; Padilla-Romo & Cabrera-Hernández, 2019), child labor (Kozhaya & Flores, 2022), divorce (Padilla-Romo et al., 2022), teen pregnancy, and youth crime (Berthelon & Kruger, 2011). This study is particularly close to Padilla-Romo (2022) in that both papers exploit the same variation to analyze the effects of FTS in Mexico on students' academic achievement. Differently from (Padilla-Romo, 2022) – that examines the short-run impacts of FTS on diagnostic tests scores in elementary school – we evaluate how FTS affect students' performance on high-stakes exams, student preferences, and high school placement. These outcomes are realized at least three years after exposure to the program.

The effects of FTS, in the long run, have received less attention in the literature. In the case of Chile, it has been shown that FTS delays childbearing and increases years of schooling (Dominguez & Ruffini, 2021). Similarly, Pires and Urzua (2010) uses retrospective surveys and propensity score matching methods to show that FTS improve performance on test scores taken during adulthood by 10 percent of a standard deviation but does not significantly affect labor market outcomes. For the city of Buenos Aires (Argentina), Llach et al. (2009) document a positive association between extension in the school day in primary school and high school completion and no effects on labor market outcomes using a retrospective survey on 380 individuals. We add to this literature by providing results on the unexplored causal link between exposure to FTS in elementary school and students' achievement later in life using administrative records. Moreover, we provide evidence suggesting that improvements in performance in high-stakes exams in addition to reductions in delays in schooling completion are potential mechanisms that can mediate the longer-term positive impacts identified in the literature.

The analysis proceeds as follows. Section 2 provides background information on the structure of Mexico's education system, the FTS program, and the centralized high school admission process in Mexico City's metropolitan area. Section 3 describes the data used for our analysis. Section 4 presents the identification strategy. Section 5 presents the main results, and Section 6 concludes.

2. Background

2.1. The full-time schools program

Mexico's education system comprises preschool (ages 3–5 years), elementary school (grades 1–6), middle school (grades 7–9), high school (grades 10–12), and higher education. Elementary school enrollment is nearly universal, achieving over 99% since the 2000/01 academic year. Moreover, net enrollment rates have been increasing sharply over the last two decades for higher levels of education. High school net education enrollment went through a remarkable increasing trend at the national level; it grew from 34.1% in 2000/01 to 60.2% in 2015/16.[5]

Approximately 92% of elementary school students attend a public school. The typical school day is of four-and-a-half hours, either in the morning (8:00 am–12:30 pm) or in the afternoon shift (2:00 pm–6:30 pm). Starting in the 2007/08 academic year, the government created an

[3] That is, we assume that the students entering the sample are either at the top or the bottom of the COMIPEMS' test score distribution.

[4] Hanushek and Woessmann (2008) provide a review of the role of cognitive skills in determining economic outcomes.

[5] For middle school education, the national net enrollment rate increased by 21.4 percentage points, which was 66.5% in 2000/01 and grew to 87.9% in 2015/16.

FTS program aiming to improve the quality of education and promote equity, which increased the length of the school day in public elementary schools that adopted the program. Participating schools extended their school day from four-and-a-half to eight hours.[6] During its first academic year of implementation (2007/08), the program was introduced in 500 elementary schools, and by 2018 it had been implemented in more than 25,000 schools, reaching more than three million students all over Mexico and nearly 80% of all Mexican municipalities. Due to its reach and resources, the FTS has been one of Mexico's most important educational interventions in recent decades (CONEVAL, 2018).

Every academic year, the Secretariat of Public Education provided the states with the program's operation rules denoting its goals and the characteristics of the schools to be targeted, including a list of potential schools to be treated. The rules also denote how the additional funding due to the program could be allocated. Ultimately, each state chooses the schools that enter the program—based on the rules of operation and school characteristics. While there is always the chance that more motivated school principals may lobby the state authorities for their school to receive the program, schools did not opt in, and the assignation process was systematically based on a set of school characteristics. Yet, students can freely move between FTS and non-FTS schools. We discuss how we address this potential selection bias in Section 4. Over time, the FTS rules of operation have targeted urban and rural schools with one teacher per class, operated in either a morning or an afternoon shift but not both, those with low academic achievement in the ENLACE exam and those in high-poverty areas.[7] FTS funds could be used to supplement teachers' salaries, acquire teaching materials, equip schools for the extended schedule, and provide school lunches. While these changes could have induced endogenous changes in teachers' composition, existing evidence suggests that the program did not significantly affect teachers' formal education (measured by the share of teachers with some graduate education) and only had a small negative effect on the percentage of female teachers (Padilla-Romo, 2022).

2.2. Mexico City's high school admissions: COMIPEMS exam

Our analysis takes place in Mexico City's metropolitan area, which has the highest middle-school and high-school net enrollment rates across all Mexican states. In Mexico City, enrollment has expanded considerably since the early 2000s, reaching universal enrollment in middle school in 2015/16 and increasing from 51.4% in 2000/01 to 83.9% in 2015/16 in high school. Public education covers most students, with roughly 91% and 83% of middle and high school students in Mexico City enrolled in public schools.

Nine different school subsystems offer public high school education in Mexico City's metropolitan area.[8] Before 1996, each subsystem had its own admission process. This meant that students had to take different admission exams for each subsystem. In 1996, all nine subsystems agreed to form the *Metropolitan Commission of Public Institutions of Higher Secondary Education* (COMIPEMS) to achieve inter-institutional coordination and jointly meet the demand for high school education in Mexico City's metropolitan area. In practice, this implies the existence of a single application process and the offering of the same high school admission exam (COMIPEMS exam) to all students. All students that aim to attend a public high school in the Mexico City's Metropolitan area must take the COMIPEMS exam. This high-stakes test is the sole determinant of high school admission.[9]

Students may take the COMIPEMS exam during their last year of middle school (grade 9) or later. Every year, in February and March, students respond to a context questionnaire and a preference ranking with up to twenty high schools. In June, aspiring students take the COMIPEMS exam and are assigned to a high school using a *serial* dictatorship algorithm (Abdulkadiroğlu & Sönmez, 1998). That is, all applicants are ranked from the highest to the lowest test score. Then, the applicant at the top of the performance distribution is assigned to her most preferred high school with open spots (the applicant is assigned to her next preferred school if the most preferred high school is full). Only one spot at a particular high school is offered; thus, the lower the result on the test, the higher the chance of being placed in a less-preferred option. This process is carried on until all applicants have been assigned to a high school. In Mexico City's metropolitan area, there are more spots at high schools than applicants. Thus, the sorting process and the exam stakes are about high-school preferences and not access.

3. Data

We use individual-level and school-level data from the Mexican Secretariat of Public Education. The individual-level data consist of linked information on low-stakes test scores in elementary school and high-stakes test scores for a high-school admission exam. In addition, our dataset incorporates individual-level preferences over high schools, demographic information, and self-reported non-cognitive outcomes for students taking a high-school admission exam. In terms of school-level data, we use the information on elementary schools' participation in the FTS Program and the share of Progresa beneficiaries in 2007.[10]

Information on high-stakes test scores, students' preferences over high schools, demographics, and self-reported non-cognitive outcomes come from COMIPEMS and its context questionnaire. As described in Section 2.2, the COMIPEMS exam is taken by students applying to public high schools in Mexico City's metropolitan area. To determine exposure to FTS in elementary school, we use linked data from ENLACE, a diagnostic test offered to elementary school students in grades three to six in public and private schools in all states in Mexico.[11] Exposure to the program is determined considering the elementary school in which the applicants were enrolled the first time they took the ENLACE test. This information on both exams, combined with data on elementary schools' participation in the FTS program, provides a measure of exposure to the program in elementary school. By using initial school enrollment to determine exposure to the program, we avoid having non-monotonic changes in treatment status and shield our estimates against endogenous school switching during elementary school.

Our sample covers the universe of students who attended an elementary school in Mexico City's metropolitan area, took the ENLACE exam at least once between 2007 and 2013, and applied to a public high school between 2010 and 2019.[12] We drop students enrolled in

[6] The typical school day in schools adopting the FTS program starts at 8:00 am and ends at 4:00 pm.

[7] Table A.1 in the Appendix presents information on the probability of becoming an FTS. The results show general compliance with the rules of operation. Schools with one teacher per class, smaller and in rural areas have a higher probability of being treated. Yet poorer schools seem to have a lower chance of participating in the program.

[8] For example, one subsystem is run by the National Autonomous University of Mexico (UNAM), and another one is organized by the National Polytechnic Institute (IPN), offering a more vocational-oriented high school education.

[9] The COMIPEMS exam contains 128 multiple-choice questions on ten subjects: math, math ability, reading, verbal ability, biology, physics, chemistry, geography, civics and ethics, and history. The composite score is the sum of all ten sections and ranges between 0 and 128. We normalize test scores for each academic year to have a mean of zero and a standard deviation of one.

[10] Progresa is a conditional cash transfer targeted at poor households.

[11] Note that the ENLACE test was given to 93.9%, 95.3%, 95%, 94.3%, and 96.1% of the universe of students in each of the academic years between 2007/08 and 2012/13, respectively. Moreover, Padilla-Romo (2022) shows that attrition in the ENLACE exam is not correlated with the implementation of the FTS program.

[12] Fig. A.1, in the Appendix, shows the dynamics of the testing for four of our cohorts. For example, the cohorts that are first evaluated by ENLACE are formed by students in grades three to six in the academic year 2006/07, who then take the COMIPEMS exam when they are to start high school. In

elementary schools that adopted the program in 2007/08 because many of these schools were in a pilot run and already full-time before their incorporation into the program.[13] We further restrict our sample to students taking the COMIPEMS exam for the first time to avoid practice effects and give re-takers a larger weight in the estimation.[14]

In our preferred specification, we also control for whether and when elementary schools adopted the Quality Schools program and the Secure School program. The Quality Schools program was launched in the academic year 2001/02 to improve the quality of education by enhancing infrastructure and decentralizing schools' decision-making processes. The Secure School program, introduced in the 2007/08 academic year, aims to prevent violence and drug addiction in schools by providing participant schools with technical and financial support. The information on when and whether schools adopted these programs comes from Mexico's Secretariat of Public Education.

To estimate how FTS affects high school placement, we rely on information from the Secretariat of Public Education on each high school's admission cutoff. This information, combined with students' priority lists, allows us to make a counterfactual analysis to quantify the share of students placed in schools ranked above the schools they would have been otherwise assigned in the absence of the FTS program.

Table 1 shows summary statistics, separately for students enrolled in elementary schools that adopted the program between 2008/09 and 2012/13 (ever FTS), for those enrolled in non-adopting schools (never FTS), and for the overall sample. The underlying differences between ever-treated and never-treated students shown in Table 1 highlight the importance of controlling for observed and unobserved students' characteristics that might be correlated with program adoption.[15]

Table 2 presents descriptive statistics for non-cognitive outcomes. This information comes from COMIPEMS' context questionnaire. We define a set of indicator variables related to self-reported abilities to plan school activities, express ideas in writing, express ideas orally, and learn independently. These variables are equal to one for students reporting that they consider themselves very skillful in a particular task and zero otherwise. The table also shows measures of self-reported abilities related to work ethic, such as class participation, on-time completion of homework, and fulfilling assigned tasks when working on teams. We define indicators equal to one when students report performing these always or almost always and zero otherwise.

Given that the questions on self-reported non-cognitive outcomes vary by year, we focus on a subset of questions and years in which the subset of variables we analyze remain unchanged.[16] On average, the share of students reporting being very skillful in planning school activities and expressing their ideas orally and in writing are 0.211,

Table 1
Summary statistics by full-time schooling.

	(1) Ever FTS	(2) Never FTS	(3) Total
ENLACE Test Score (SD)	−0.020	0.002	0.000
	(0.979)	(1.002)	(1.000)
Ever Took COMIPEMS	0.558	0.521	0.525
	(0.497)	(0.500)	(0.499)
COMIPEMS Test Score (SD)	0.096	0.002	0.012
	(0.994)	(1.001)	(1.000)
Age at Test	15.227	15.164	15.170
	(0.560)	(0.544)	(0.546)
Graduated on Time	0.874	0.893	0.891
	(0.331)	(0.309)	(0.311)
Top Choice in the Top 5	0.378	0.267	0.278
	(0.485)	(0.442)	(0.448)
Top Choice in the Top 10	0.509	0.366	0.380
	(0.500)	(0.482)	(0.485)
Female	0.506	0.506	0.506
	(0.500)	(0.500)	(0.500)
Mother Middle School Education or Lower	0.473	0.559	0.550
	(0.499)	(0.496)	(0.497)
Ever Full Time School	1.000	0.000	0.102
	(0.000)	(0.000)	(0.303)
Ever Quality School	0.959	0.636	0.669
	(0.199)	(0.481)	(0.471)
Ever Secure School	0.957	0.761	0.781
	(0.203)	(0.427)	(0.414)
Above Median Progresa	0.268	0.525	0.499
	(0.443)	(0.499)	(0.500)

Notes: The ENLACE sample consists of 4,604,135 students observed over time between 2007 and 2013 and totaling 11,866,301 observations. The COMIPEMS sample consists of 2,415,382 students that took the COMIPEMS exam for the first time between 2010 and 2019. Each cell shows the mean and standard deviation (in parentheses) of the listed variable for ever-treated and never-treated FTS. Never-treated schools are schools that had not adopted the program between 2007/08 and 2012/13.

Table 2
Summary statistics of self-reported noncognitive skills by full-time schooling.

	(1) Ever FTS	(2) Never FTS	(3) Total
Plan School Activities	0.210	0.211	0.211
	(0.407)	(0.408)	(0.408)
Express Ideas in Writing	0.245	0.239	0.240
	(0.430)	(0.427)	(0.427)
Express Ideas Orally	0.271	0.262	0.263
	(0.444)	(0.440)	(0.440)
Learn for Themselves	0.315	0.310	0.310
	(0.464)	(0.462)	(0.463)
Class Participation	0.295	0.296	0.296
	(0.456)	(0.456)	(0.456)
Homework on Time	0.484	0.487	0.487
	(0.500)	(0.500)	(0.500)
Fulfillment of Assigned Tasks	0.591	0.591	0.591
	(0.492)	(0.492)	(0.492)

Notes: The sample consists of 1,003,844 students that took the COMIPEMS exam for the first time between 2016 and 2019. Each cell shows the mean and standard deviation (in parentheses) of the listed variable for ever-treated and never-treated FTS. Never-treated schools are schools that had not adopted the program between 2007/08 and 2012/13.

this case, most of those who were in the cohort of sixth grade in 2006/07 faced the COMIPEMS test at the beginning of the academic year 2010/11. Note that students who took the exam for the first time in 2006/07 are no longer "evaluated for the first time" in the next academic years. For which, most of the pool of first-time evaluated students in the cohorts from 2007/08 to 2012/13 (98% of students in our sample) are enrolled in third grade.

[13] 173 schools adopted the program in 2007/08, representing 109,153 students. This is 17% of the 847 schools treated by 2012/13 in Mexico City's Metropolitan Area. Fig. A.2, in the Appendix, shows the number of schools incorporated into the FTS program in each academic year between 2008 and 2012 out of the total of schools in Mexico City's metropolitan area. On average, 11% of the schools were ever treated.

[14] In our sample, 87.88% of students take the COMIPEMS exam once, 11.25% twice, and 0.87% three or more times. Importantly, we are able to identify past enrollment for the large majority of students taking the COMIPEMS exam because 96.67% of the students who took COMIPEMS in our sample also took the ENLACE exam at least once.

[15] Table A.1, in the Appendix, complements this information showing the correlation between school characteristics and treatment rollout. On average, schools that ever adopt the program are more likely to have one teacher per class, participate in the quality schools program and the secure school program, be located in rural areas, and be located in Mexico City. Ever-FTS have lower enrollment and larger classes, and a lower share of Progresa beneficiaries in their school.

[16] For the variables on Table 2 we use the information from 2016 to 2019.

0.263, and 0.240, respectively. The shares of students reporting participating in class, completing homework on time, and fulfilling assigned group tasks always or almost always are 0.296, 0.487, and 0.591, respectively. The differences in these outcomes across students in ever and never-adopting schools are relatively small.

4. Identification strategy

To identify the longer-term effects of FTS on students' performance in high-stakes exams, we exploit cohort-by-cohort variation in students' FTS enrollment during elementary school. We estimate the following fixed effects regression:

$$HS_{iect} = \nu_e + \theta_c + \delta FTS_{iec} + X_{iect}\beta + u_{iect} \quad (1)$$

where HS_{iect} is the composite test score for student i, first enrolled in elementary school e in cohort c, and taking the COMIPEMS exam in academic year t. The cohorts are defined as the students' grade and academic year the first time they took the ENLACE exam. ν_e are elementary-school fixed effects; θ_c are cohort fixed effects; FTS_{iec} is an indicator variable that equals one if student i was ever exposed to full-time schooling; X_{iect} are time-varying characteristics, including student's gender, mothers' education, indicators for implementation of the Quality Schools and Secure Schools programs at the school level, and a state-specific post-2012 Education Reform indicator;[17] and u_{iect} is an error term that we allow to be correlated within elementary schools. Our coefficient of interest, δ, measures the average effect of exposure to full-time schooling during elementary school on high-stakes test scores in the longer run.[18]

We further allow our model to capture dynamic effects before and after the first exposure to FTS with the following event-study specification:

$$HS_{iect} = \nu_e + \theta_c + \sum_{k \neq -1} \delta_k FTS_{ieckt} + X_{iect}\beta + u_{iect} \quad (2)$$

Our variable of interest, FTS_{ieckt}, indicates the degree of exposure to full-time schooling in elementary school for student i, first enrolled elementary school e in cohort c who takes the COMIPEMS exam in year t. For $k \geq 0$, this variable is equal to one if the student was enrolled in a full-time elementary school for $k+1$ years. δ_k are our parameters of interest and measure the effects of $k+1$ years of exposure to FTS.

Given the staggered implementation of the FTS program and the possibility of heterogeneous treatment effects across schools and over time, we estimate Eq. (2) using the Interaction-Weighted (IW) estimator proposed by Sun and Abraham (2021), which estimates the effects of being in an elementary school that has implemented the FTS program for $k+1$ years as compared to schools that never adopted the program between the academic years 2008/09 and 2012/13. These estimates are robust to both dynamic effects and heterogeneous treatments across groups of schools that adopted the FTS program at different time periods.

The δ_k coefficients are identified under the standard common trends assumption: absent the FTS program in elementary school, students' COMIPEMS scores would have followed the same trends in adopting and non-adopting elementary schools. The pre-treatment estimates ($k < -1$) allow us to empirically test for divergent trends between treated and never-treated schools prior to the adoption of the program. Fig. 2 shows that treated and never-treated schools followed the same trajectory prior to program adoption, which provides support to our identification strategy.

Dynamic difference-in-differences specifications with staggered treatment timing, such as ours, become unbalanced in time relative to treatment. There are more lag periods (and fewer lead periods) for elementary schools treated earlier than for those treated later, and vice-versa. In fact, we have an unbalanced time to event panel that goes from $k = -6$ to $k = 5$, which is balanced only for event time $k \in \{-2, -1, 0, 1, 2, 3\}$. Therefore, the estimated coefficients outside this time window must be interpreted with caution as they only rely on variation across earlier (lags) or later (leads) treated cohorts.

Furthermore, a threat to our estimators is the possibility of students' endogenous school switching as a response to the implementation of the FTS program. We address this issue by relying on the first elementary school of enrollment, as reported by ENLACE, which implies that we recover intent-to-treat estimates. In addition, in our baseline specification, we control for students' gender and mothers' level of education. Considering that more than 65% of students in Mexico City's metro area walk to school, we also show that our results are robust to restricting our sample to students that have few options available in their neighborhood (i.e., less likely to have switched schools due to the FTS program).

Finally, we only observe the outcomes of those students who apply to high school using the centralized admission system managed by COMIPEMS. That is, we do not observe outcomes of students who migrated out of the Mexico City Metropolitan Area, dropped out of school, or enrolled in private high schools. Each of these actions may be affected by the degree of students' exposure to full-time schooling. Consequently, sample selection bias may hinder our ability to causally identify longer-term effects on students' outcomes. We address the potential selection bias by computing the probability of ever taking the COMIPEMS exam using the dynamic specification in Eq. (2). We then compute (Lee, 2009) bounds to account for potential endogenous selection problems.

5. Main results

5.1. Test-taking behavior

To examine how sample selection can affect the interpretation of our results, we begin by estimating the effects of full-time schooling on the probability of ever taking the COMIPEMS exam. In Fig. 1 and Column 1 of Table 3, we show the estimated results for our preferred dynamic specification in Eq. (2) but where the outcome is an indicator of whether the student ever took the COMIPEMS exam. Overall, students' probability of taking the COMIPEMS exam increases with every year of exposure to the FTS program; the point estimates increase from being non-statistically different from zero for students exposed for less than three years to 2.4 percentage points (or 4.3% of the mean in ever-FTS) for students exposed during all six years of elementary school education. These increases in test-taking behavior can be interpreted as FTS reducing the probability of students dropping out of school or FTS inducing students from the private high school system to enter the public system.

To get a sense of which type of students are entering the sample, in Column 3 of Table 3, we further interact our treatment variables with the pre-intervention (fixed at 2007) normalized school-level average ENLACE score.[19] The probability of taking the exam decreases as school-level pre-intervention test scores increase, which indicates that exposure to FTS has a differential positive effect on the probability of

[17] In 2012, Mexico passed an education reform that made high school education compulsory. Due to heterogeneous high school capacity constraints, the reform is likely to affect each state differently.

[18] Note that, to avoid non-monotonic changes in treatment status, our analysis assumes that once a school adopts the program for the first time, the school continues to be treated, regardless of whether they leave the program later on. In this scenario the estimates are likely to provide lower bounds for the true effects.

[19] In Column 2 of Table 3, we re-estimate our model in Column 1 using the OLS estimator. Our results are robust to using this alternative estimator, which is more flexible and allows us to include the interactions of our years from treatment indicators with pre-intervention test scores in Column 3.

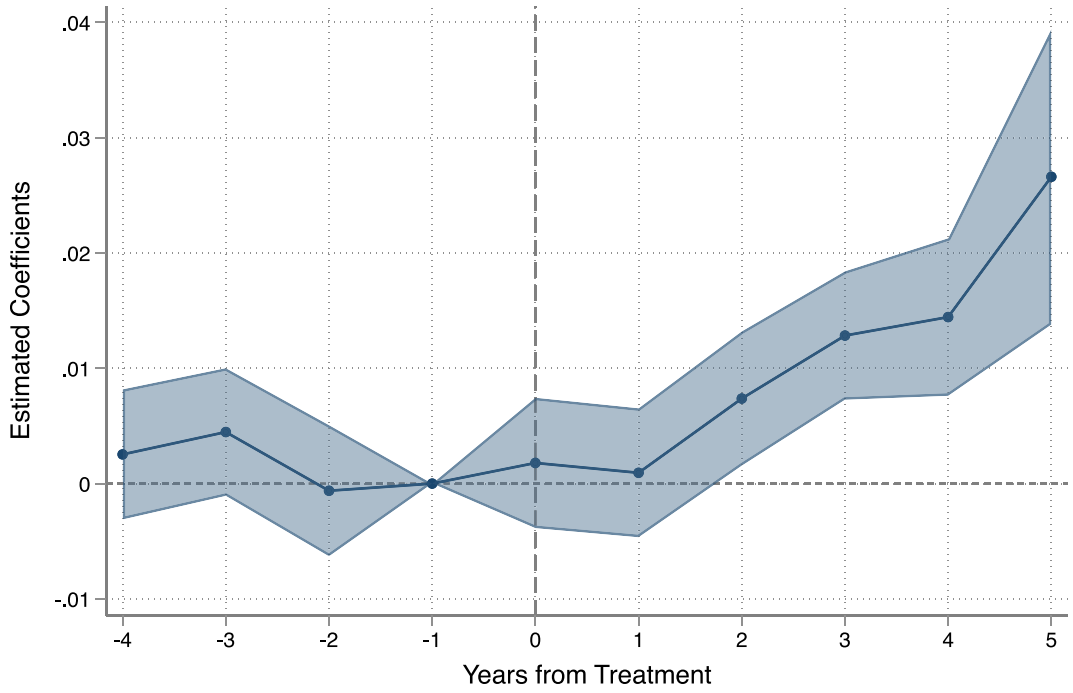

Fig. 1. Persistent Effects of Full-Time Schools on the Probability of Ever Taking the COMIPEMS Exam.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for indicators for the years prior to and after an elementary school adopted the FTS program. All estimates come from a single regression that controls for elementary school fixed effects, cohort fixed effects, gender, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. On the horizontal axis, "−4" indicates four or more years prior to treatment, and "5" indicates five or more years from treatment. The pre-treatment mean of the outcome for students ever exposed to FTS is 0.567. Standard errors are clustered at the elementary school level. Our regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

taking the COMIPEMS exam among students who are more likely to be low-achievers (i.e., enrolled in schools with low average ENLACE score at baseline) relative to students who are more likely to be high achievers.

5.2. High-stakes test scores

Table 4 shows the estimated effects of full-time schooling during elementary school on the COMIPEMS exam standardized test scores based on Eq. (1) without time-varying controls. Column 1 presents the TWFE estimates controlling for elementary school fixed effects and cohort fixed effects.[20] In the second panel of Column 1, we perform the decomposition proposed by Goodman-Bacon (2021). The TWFE estimator attaches more than 99% of weight to non-problematic comparisons (i.e., those that use never-treated or later-treated students as controls), which suggests that the bias in the TWFE estimator is likely to be small.

Columns 2 through 5 report estimated results using the IW estimator. Column 2 includes the same controls as in Column 1 and shows that the point estimate is close to the TWFE estimate in Column 1. In Column 3, we additionally control for students' gender and mothers' education. In Column 4, we also control for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and Column 5 presents our preferred specification that also controls for a state-specific post-2012 Education Reform.[21] For all specifications, the estimated effects indicate that full-time schooling during elementary school has long-lasting effects on students' cognitive outcomes, increasing their performance in the COMIPEMS high-school admission exam. The estimated effects in Column 5 indicate that the FTS program increases high-stakes test scores by 4.8 percent of a standard deviation for students ever enrolled in an FTS during elementary school.

Next, we evaluate how the effects vary with the time of exposure. Fig. 2 shows the evolution of the estimated effects of full-time schools on high-stakes test scores for the years prior to and after an elementary school first adopted the FTS program based on Eq. (2). All estimates are relative to the year prior to the adoption of the FTS program. The estimated coefficients for the years prior to program adoption are close to zero and statistically insignificant, providing support for the common trends assumption. The estimated effects of full-time schooling on high-stakes test scores increase with each year of students' exposure to the FTS program in elementary school. The estimated effects grow from 0.2 percent of a standard deviation for students exposed to FTS for one year to 9.5 percent of a standard deviation for students exposed all six years of elementary school education.[22] Given the timing of the program rollout and the first time we observe students taking

[20] For this specification, we use all variables aggregated at the elementary school and cohort level, keep a balanced panel of schools, and weigh observations by the average number of students in the elementary school-cohort cells.

[21] As discussed in Section 3, Quality Schools and Secure School programs are public initiatives with the objective of improving academic achievement and safety in schools, respectively.

[22] Given that students are enrolled in elementary school for six years, the endpoints in this design are binned at −4 and 5. This specification implies assuming that the effect of FTS on high-stakes scores is constant prior to and after the endpoints of the window. This limited effect window is equivalent to

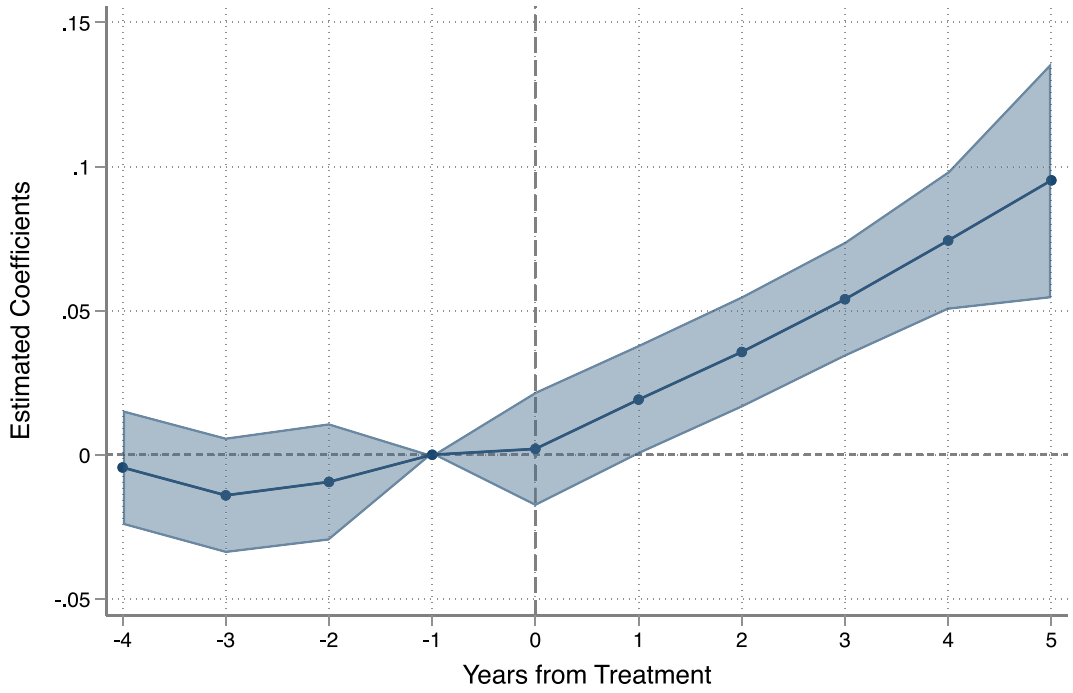

Fig. 2. Persistent Effects of Full-Time Schools on High-Stakes Test Scores.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for indicators for the years prior to and after an elementary school adopted the FTS program. All estimates come from a single regression that controls for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. On the horizontal axis, "−4" indicates four or more years prior to treatment, and "5" indicates five or more years from treatment. Standard errors are clustered at the elementary school level. Our regression model is estimated using the *eventstudyinteract* package developed by Sun (2021).

the COMIPEMS exam, we cannot disentangle the effects of years of exposure to the program from the effects of being first exposed at younger ages. However, Padilla-Romo (2022) shows that the effects of full-time schooling increased low-stakes test scores with every year of exposure to the FTS program for students first exposed to the program in grades first through sixth: the effects are larger for students first exposed at younger ages but they also increase with years of exposure for all students, regardless of when they were first exposed.

Considering the possibility of endogenous school switching prior to the first observed enrollment, in Appendix Fig. A.3 and Table A.2, we show that the estimated effects are similar in magnitude and statistical significance to our main results when we restrict our sample to students that have few options available in their neighborhood (i.e., less likely to have switched schools due to the FTS program). Specifically, in this analysis, we restrict our sample to students enrolled in elementary schools with at most another elementary school within half a kilometer of their school.[23]

Since students from elementary schools with lower average baseline achievement are more likely to take the high school admission exam when they are exposed to longer school days, our estimates are likely to be downward biased.[24] To further examine how endogenous nonrandom selection can affect our results, we evaluate the robustness of our main estimates by making extreme assumptions about sample selection and using the method proposed by Lee (2009). That is, we assume that students entering the sample each year (relative to treatment) are either the lowest or highest-performing students in the COMIPEMS exam. Then, we drop the set of treated students at the top and the bottom of the treated students' COMIPEMS test score distribution, considering the effect on the probability of taking the exam for each treatment window.[25] Using these restricted samples, we estimate the lower and upper bounds for the effects on COMIPEMS test scores. The results, in panels (a) and (b) of Fig. 3, indicate that even under these extreme assumptions, FTS have positive and statistically significant effects on high-stakes test scores and that our main conclusions are robust to endogenous effects of FTS on test-taking behavior.

To put the estimated effects on test scores in context, we perform a counterfactual analysis to show how these increases in high school admission exam scores affect the quality of schools that students attend. We start by computing counterfactual test scores using the estimated coefficient from our preferred specification in Column 5 of Table 4 and the COMIPEMS standard deviation for every year. That is, for students exposed to FTS, we subtract 4.8 percent of a standard deviation from the observed COMIPEMS scores in each year to simulate the distribution of test scores in the absence of exposure to FTS. Next, we compare each high school's cutoff score in students' priority lists in a given year to the observed and counterfactual test scores. The results of this analysis indicate that out of the 130,239 students ever enrolled in a full-time elementary school, 17,146 students are placed in higher-ranked

an infinite event window for which $\delta_k = \delta_{\underline{k}}$ for all $k < \underline{k}$ and $\delta_k = \delta_{\overline{k}}$ for all $k > \overline{k}$ (Schmidheiny & Siegloch, 2019).

[23] According to the 2015 *Encuesta Intercensal*, 65.01% (78.46%) of elementary-school-age students in Mexico City (Estado de México) walk to school. One-fourth of students in our sample are enrolled in a school with at most another elementary school within half a kilometer.

[24] The increase in the probability of on-time graduation and the reduction in age at test are compatible with improvements in educational trajectories that are likely to reduce drop-out rates.

[25] Specifically, we drop 0.5, 1.1, 1.0, and 2.4 percent of students in the upper and lower tails of the COMIPEMS test score distribution of students exposed to treatment for 3, 4, 5, or 6 years, respectively.

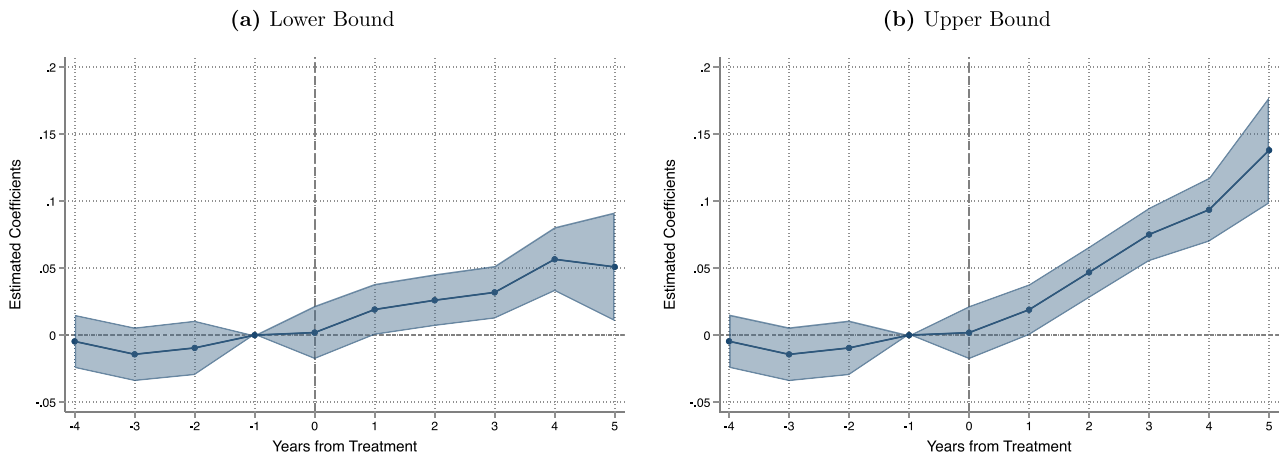

Fig. 3. Lee (2009)'s Bounds of the Persistent Effects of Full-Time Schools on High-Stakes Test Scores.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for indicators for the years prior to and after an elementary school adopted the FTS program. All estimates for each panel come from a single regression that controls for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. On the horizontal axis, "−4" indicates four or more years prior to treatment, and "5" indicates five or more years from treatment. Standard errors are clustered at the elementary school level. Our regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

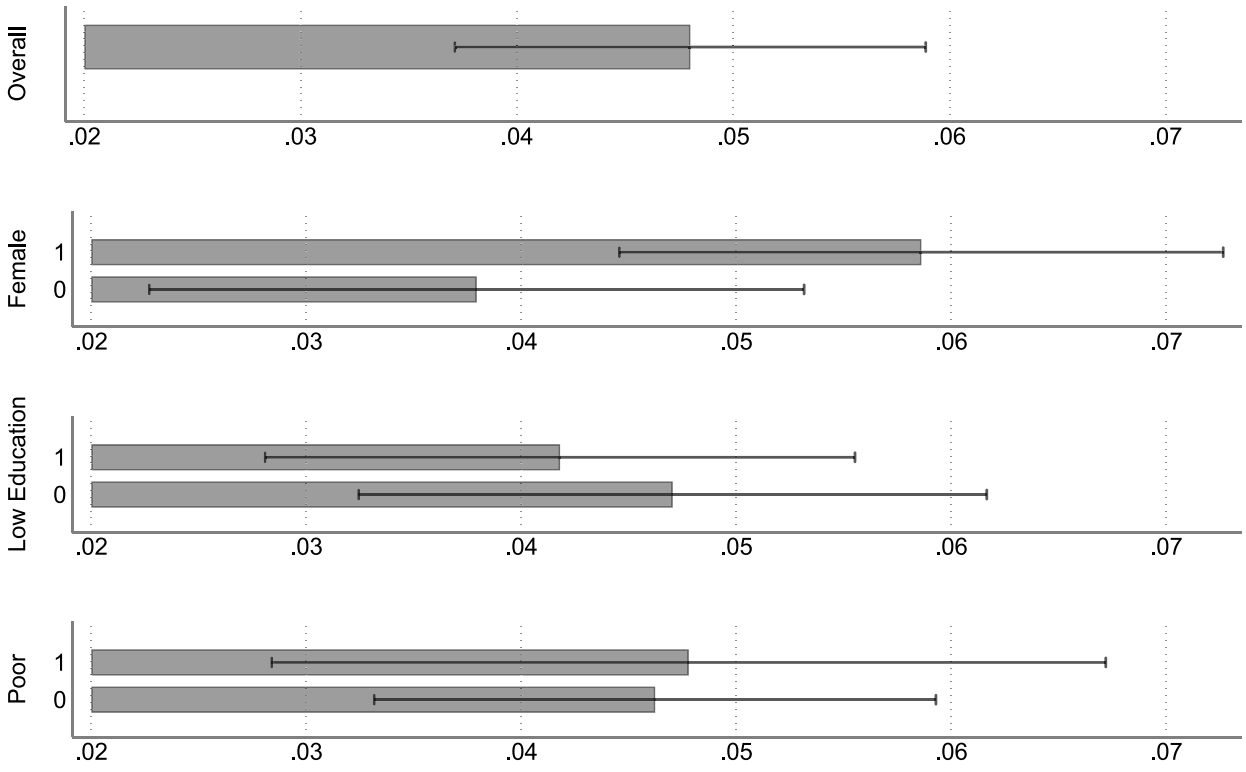

Fig. 4. Persistent Effects of Full-Time Schools on High-Stakes Test Scores by Gender, Mothers' Education Level, and Socioeconomic Status.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

schools in their priority list compared to the ones they would have been assigned in the absence of the FTS program. On average, roughly 13 out of 100 students exposed to full-time schooling are placed in more-preferred high schools, which is likely to affect the composition of high school peers, the probability of graduating from high school, and college enrollment (e.g., Dustan et al., 2017; Estrada & Gignoux, 2017; Jackson, 2010; Pop-Eleches & Urquiola, 2013).

In Fig. 4, we allow for heterogeneous effects for different types of students. We estimate our preferred specification separately for males and females, students whose mothers' education level is low or high, and students enrolled in schools with a low and high share of low-SES students (proxied with the pre-intervention share of Progresa beneficiaries in their school). The results indicate that all groups benefit from FTS, with point estimates that range from 3.8 to 5.9 percent of a

Table 3
Persistent effects of full-time schools on the probability of ever taking the COMIPEMS exam.

	IW (1)	TWFE (2)	TWFE (3)
Exposed 1 Year	−0.000	0.000	−0.000
	(0.002)	(0.002)	(0.002)
Exposed 2 Years	−0.001	−0.001	−0.001
	(0.002)	(0.002)	(0.002)
Exposed 3 Years	0.005*	0.005**	0.005*
	(0.003)	(0.003)	(0.003)
Exposed 4 Years	0.011***	0.011***	0.010***
	(0.002)	(0.002)	(0.002)
Exposed 5 Years	0.010***	0.011***	0.012***
	(0.003)	(0.003)	(0.003)
Exposed 6 Years	0.024***	0.026***	0.028***
	(0.005)	(0.005)	(0.005)
Exposed 1 Year $\times ENLACE_{2007}$			−0.007***
			(0.003)
Exposed 2 Years $\times ENLACE_{2007}$			−0.006**
			(0.003)
Exposed 3 Years $\times ENLACE_{2007}$			−0.007***
			(0.003)
Exposed 4 Years $\times ENLACE_{2007}$			−0.005*
			(0.003)
Exposed 5 Years $\times ENLACE_{2007}$			−0.008***
			(0.003)
Exposed 6 Years $\times ENLACE_{2007}$			0.002
			(0.004)
N	4,603,510	4,603,510	4,495,296
Pre-treatment mean (Ever FTS)	0.567	0.567	0.567

Notes: Each column represents a different regression. All estimates control for elementary school fixed effects, cohort fixed effects, gender, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. Standard errors are clustered at the elementary school level. Estimates in Column 1 are calculated using the *eventstudyinteract* package developed by Sun (2021). *, **, *** Significant at the 10%, 5%, and 1% levels, respectively.

standard deviation. Female students experience the largest increases in test scores. On average, COMIPEMS' test scores are 12.6 percent of a standard deviation lower for girls than for boys. The difference in the effects between males and females of 2.1 percent of a standard deviation is statistically significant at conventional levels and represents 16% of the gender gap in the COMIPEMS exam.[26]

5.3. On-time graduation

By improving short-term cognitive outcomes, full-time schooling has the potential to increase the probability of graduating on time. For example, in the context of Mexico and using within twins variation in ENLACE test scores, de Hoyos et al. (2021) show that higher sixth-grade ENLACE scores are associated with a positive probability of on-time graduation from middle school and high school.

For every student in the COMIPEMS sample, we observe whether and when students received their middle school diplomas.[27] We use this information to generate an on-time graduation indicator that equals one if students receive their middle school diploma the year their cohort graduated and zero otherwise.[28] We also observe the student's age when they took the test and whether or not students retake the high stakes exam.

Using our preferred specification and the IW estimator, columns 1 and 2 of Table 5 show the estimated effects of FTS on the probability of on-time graduation and students' age when taking the test, respectively. The point estimates indicate that exposure to full-time schooling during elementary school increases the probability of graduating on time by 1.6 percentage points and decreases the age at which the test was taken by 0.04 years (or 15 days). In panels (a) and (b) of Fig. 5, we further show heterogeneous effects by the student's gender, mother's level of education, and socioeconomic status. The estimated increases in the probability of on-time graduation and decreases in age at test are of similar magnitude and statistical significance across different types of students, which indicate that FTS resulted in general improvements in educational trajectories.[29]

As mentioned in Section 3, 12.12% of students in our sample took the COMIPEMS exam more than once. By improving short-term academic performance (Cabrera-Hernández, 2020; Padilla-Romo, 2022), the FTS program might drive students to get admitted into their preferred high schools at higher rates than students not exposed to full-time schooling, making them less likely to retake the exam. In Fig. 6, we analyze how exposure to the FTS program affects students' probability of retaking the exam for different types of students. The results indicate that the probability of retaking the exam decreases for all students, the estimates are statistically significant for students exposed to FTS and range between 1 and 1.5 percentage points.[30] Since retaking the exam requires a waiting time of at least one year, the reduction in the probability of exam retaking is expected to affect high-school graduation timing as well.

The results in this section suggest that exposure to FTS improves educational trajectories and allow students to finish their education earlier. Since delays in education completion (because of late graduation or because of exam retaking) are likely to result in delays in entering the job market, FTS can impact lifetime earnings by affecting the chances of entering selective schools and increasing the length of time individuals are able to participate in the labor market.[31]

[26] Figs. A.4 and A.5, in the Appendix, show (Lee, 2009)'s lower and upper bounds for the estimated effects for each sub-sample of students. The estimates are robust to extreme assumptions on sample selection.

[27] The student's middle-school diploma is a requirement for high school admission. In the COMIPEMS sample, 5.48% of students were not assigned to a high school because they did not present a middle-school diploma.

[28] For example, a student enrolled in third grade in the 2010 ENLACE exam should have graduated from middle school in 2016. Then, our outcome is equal to one if students received their middle school diploma in 2016 and zero if they did not receive a diploma or did so after 2016.

[29] The estimated effects on on-time graduation and age at test are robust to extreme assumptions on sample selection. Figs. A.6 and A.7 show lower and upper bounds for the estimates presented in Fig. 5 following the method proposed by Lee (2009) and described in Section 5.2. Since on-time graduation is defined as a dichotomous variable, we randomly drop 0.5, 1.1, 1.0, and 2.4 percent of students among students that graduated on time and did not graduate on time, respectively.

[30] Appendix Figs. A.8 and A.9 show (Lee, 2009)'s lower and upper bounds for the estimated effects on students' probability of retaking the COMIPEMS exam. The estimated effects for the different subgroups of students are statistically significant and follow the same patterns as those in Fig. 6.

[31] Deming and Dynarski (2008) provide an excellent discussion on the cost and benefits of late entrance to elementary school. Delays in education completion can result in higher dropout rates and delays in entering the labor market. As explained by the authors, delaying the entrance into the labor market can imply costs in terms of lost earnings and the returns to the experience in the job that are lost. While our results imply reductions in potential delays in education completion that happen later in life, similar mechanisms in terms of potential financial costs can apply.

Table 4
Persistent effects of full-time schools on high-stakes test scores.

	TWFE (1)	IW (2)	IW (3)	IW (4)	IW (5)
FTS	0.047***	0.048***	0.044***	0.049***	0.048***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
N	61,750	2,204,018	2,204,018	2,204,018	2,204,018
	Decomposition				
Never vs. timing	0.047 [0.983]				
Early vs. late	0.000 [0.008]				
Late vs. early	−0.000 [0.010]				
Gender and mothers' education	no	no	yes	yes	yes
Quality Schools Program	no	no	no	yes	yes
Secure School Program	no	no	no	yes	yes
Education Reform	no	no	no	no	yes

Notes: Each column represents a different regression. Estimates in Column 1 use a balanced panel of schools and are weighted using the average number of students in the school. All estimates in columns 3 through 5 control for gender and mothers' education. In column 4, we further control for whether and when elementary schools adopted the Quality Schools Program and the Secure School Program. In Column 5, we additionally control for state-specific post-2012 Education Reform indicators. Standard errors are clustered at the elementary school level. Estimates in columns 2 through 5 are estimated using the *eventstudyinteract* package developed by Sun (2021). *, **, *** Significant at the 10%, 5%, and 1% levels, respectively.

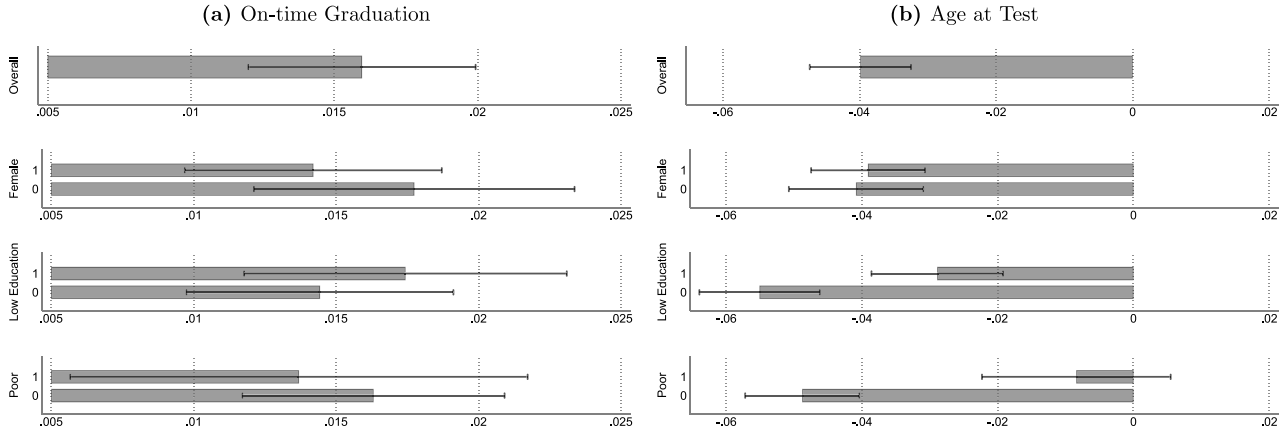

Fig. 5. Persistent Effects of Full-Time Schools on On-time Graduation and Age at Test by Gender, Mothers' Education Level, and Socioeconomic Status.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment means for students ever exposed to FTS are 0.824 (on-time graduation) and 15.359 (age at test). Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

Table 5
Persistent effects of full-time schools on on-time graduation and age at test.

	Graduate on time (1)	Age at test (2)
FTS	0.016***	−0.040***
	(0.002)	(0.004)
N	2,265,610	2,265,610
Pre-treatment mean (Ever FTS)	0.824	15.359

Notes: Each column represents a different regression. All estimates control for elementary school fixed effects, cohort fixed effects, gender, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. Standard errors are clustered at the elementary school level. Estimates in columns 1 and 2 are calculated using the *eventstudyinteract* package developed by Sun (2021). *, **, *** Significant at the 10%, 5%, and 1% levels, respectively.

5.4. Non-cognitive outcomes

Both cognitive and non-cognitive skills have been found to be relevant determinants of schooling and socioeconomic success (Carneiro & Heckman, 2003; Heckman, 2000). Because investment in education has the potential of generating returns in dimensions other than academic achievement measured by test scores gains, we examine the link between FTS and non-cognitive outcomes, focusing on measures of self-reported abilities and school work ethic and participation. The context questionnaire section on self-reported non-cognitive skills changes over time. Consequently, our estimates on non-cognitive outcomes rely on a small sub-sample of years, using homogeneous questions.[32] Considering this data restriction, the results in this section should be interpreted with caution and as suggestive evidence of the potential effects of FTS on non-cognitive skills.

We allow the effects to vary by gender, school's socioeconomic status (proxied by the pre-intervention share of students receiving Progresa in their school), and maternal education. The evidence suggests that exposure to FTS improved girls' self-reported oral communication abilities, learning independently, and planning school activities (Fig. 7), which might explain the larger effects for girls' test scores. Self-learning also improved for students in schools with larger shares of low-SES populations. The estimates also suggest gains in skills related to work

[32] For the variables considered in this section, we use the information for the period 2016–2019.

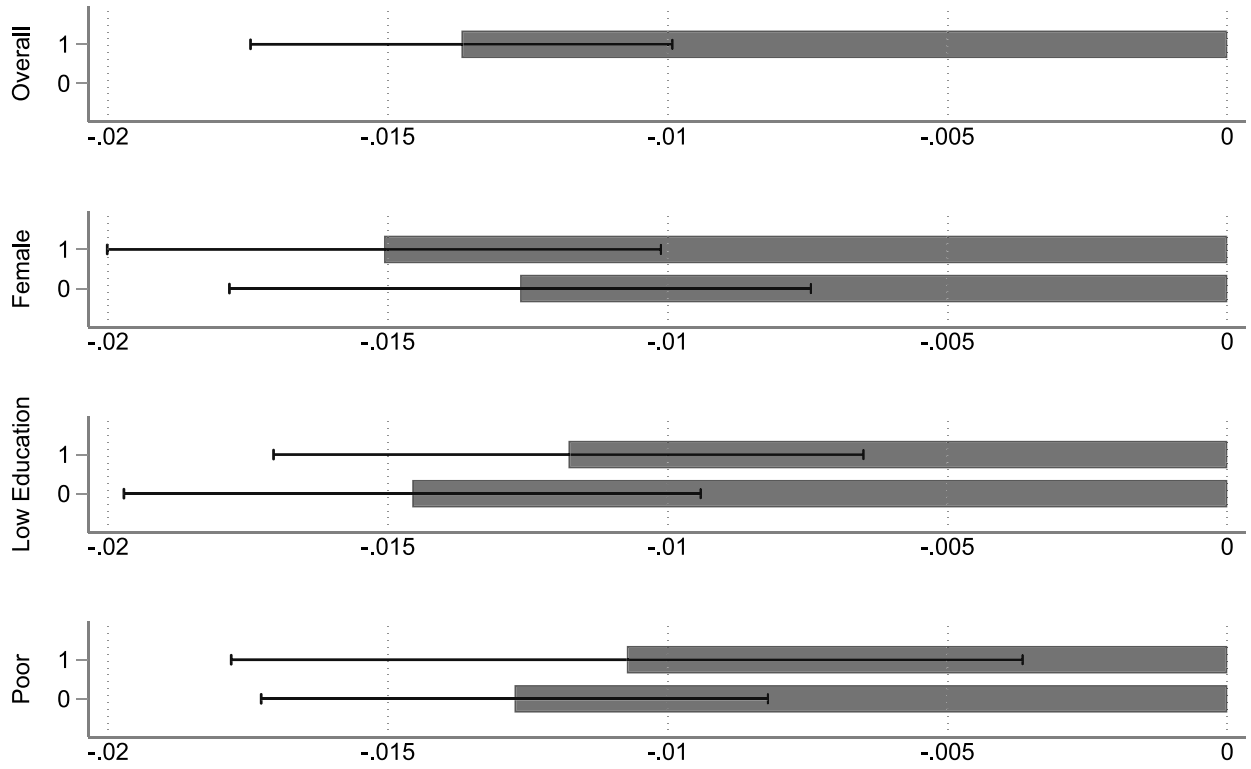

Fig. 6. Persistent Effects of Full-Time Schools on the Probability of Retaking the Exam by Gender, Mothers' Education Level, and Socioeconomic Status.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment mean for students ever exposed to FTS is 0.192. Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

ethic for girls and for students whose mothers have relatively lower levels of formal education. These gains reflect improvements in class participation and timely completion of homework. We also find an increased probability of fulfilling assigned tasks when working on teams for students whose mother has middle-school or lower formal education (Fig. 8).[33]

5.5. Students' preferences

There are several potential mechanisms through which full-time schooling can shape individual preferences for high schools, including information, beliefs, and peer exposure.[34] Moreover, by generating short-term academic gains and improving non-cognitive skills, FTS have the potential to improve self-esteem, motivation, and academic ambition.

To shed light on these issues, we explore how full-time schooling affects the quality of the high school students choose as their first choice. Our measures of high school quality are calculated using the standardized high schools' 2010–2019 average cutoff scores. Specifically, we examine the effects of full-time schooling on the probability that a student's first choice is ranked in the first five or the first ten high schools, ordered in terms of their average cutoff scores. These results are shown in Fig. 9. Panels (a) and (b) present the estimated effects of FTS on the probability that a student's first choice is in the top 5 and in the top 10 most selective public high schools in the Mexico City metropolitan area, respectively. Each panel shows point estimates and 95% confidence intervals for the overall sample and separately by students' gender, mother's education level, and socioeconomic status. Overall, our estimates of the effect of FTS on students' preferences for high schools are noisily estimated. Students are 0.4 percentage points more likely to choose one of the high schools in the top ten ($p-value = 0.055$). Next, we estimate the effects for different subsamples of students. With longer school days, students and their parents may receive more and better information about school quality and its long-term benefits, which can be particularly important for low-SES families that may face higher costs of collecting and interpreting information (Hastings & Weinstein, 2008).[35] When separating the effects on school choices by gender, mother's education, and SES, we find noisy point estimates that are larger for males and for students likely to be low SES.[36]

[33] Following the method proposed by Lee (2009) and described in Section 5.2, Figs. A.10, A.11, A.12, and A.13 present lower and upper bounds for the estimates presented in Figs. 7 and 8, respectively. Even when making extreme assumptions on sample selection, the main conclusions of this subsection hold. Since non-cognitive outcomes are defined as dichotomous variables, we randomly drop 0.5, 1.1, 1.0, and 2.4 percent of students among students with indicators equal to 1 and 0, respectively.

[34] Throughout the paper, we refer to students' expressed ranking of high schools as students' preferences, which assumes that the 20-school constraint is not binding. It is worth noting that 94.95% of students in our sample choose less than 20 high schools in their priority list.

[35] Hastings and Weinstein (2008) show that receiving information on the academic quality of schools increased the share of parents choosing higher-performing schools. Moreover, Hastings et al. (2015) show that providing information on degree-specific earnings decreases the demand for the lowest earning programs, even more so among low-SES students.

[36] Appendix Figs. A.14 and A.15 show (Lee, 2009)'s lower and upper bounds for the estimated effects on students preferences. The estimated effects for the different subgroups of students follow the same patterns as those in Fig. 9.

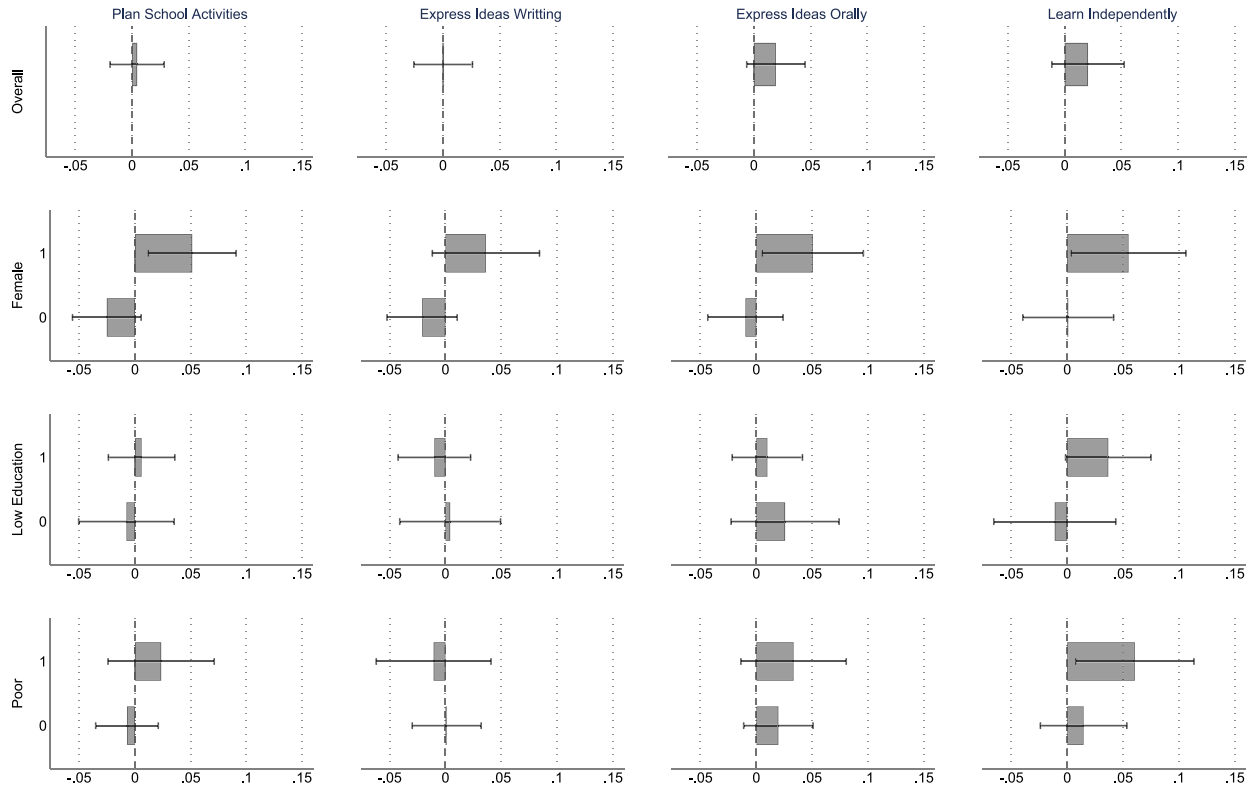

Fig. 7. Persistent Effects of Full-Time Schools on Non-Cognitive Self-Reported Abilities.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment means for students ever exposed to FTS are 0.128 (plan school activities), 0.180 (express ideas in writing), 0.185 (express ideas orally), and 0.248 (learn independently). Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

6. Conclusion

This paper provides new evidence on the persistence of the effects of full-time schooling on high-stakes test scores, subsequent placement, on-time graduation, and preferences over high schools. We use linked administrative data on elementary school enrollment and a high-school admission exam in Mexico City's metropolitan area. We focus on elementary school students exposed to full-time schooling (grades 1–6). The results indicate that full-time schools have long-lasting benefits for children. Full-time schooling positively affects children's probability of graduating from middle school on time, high school admission test scores, and subsequent placement. The effects are heterogeneous by gender, with girls experiencing significantly larger gains in high-stakes test scores later in life. The differences in the estimated effects by gender are equivalent to 16% of the gender gap in test scores.

In terms of costs of the FTS program, the extra spending per school amounts to 281.20 thousand pesos on average for the period 2009–2013, or approximately 110 dollars of 2012 per student per academic year (Padilla-Romo, 2022). Considering the gain reported by our lower Lee bound estimation, of 5.1% of a standard deviation after six academic years of exposure to full-time schooling, the additional gain in high-stakes exams is of 0.77% of a standard deviation per every 100 USD. Although not fully comparable because of the high-stakes of the COMIPEMS exam, the reported cost of an FTS program implemented in Uruguay was 2,300 dollars of 2012 per student per academic year, with gains of 4% of a standard deviation in sixth-grade Spanish low-stake exams (Cerdan-Infantes & Vermeersch, 2007). This represents a short-term gain of 0.2% of a standard deviation for every 100 USD spent. Finally, considering a different type of intervention in a low-stakes setting in Mexico, ten additional school-days increase test scores between 4 and 7% of a standard deviation, which implies short-term gains of 3.8% and 6.7% of a standard deviation per 100 USD spent (Agüero & Beleche, 2013).

A back-of-the-envelope calculation implies that 13 out of 100 students exposed to the FTS program during elementary school are placed in higher-ranked high schools on their priority list. Moreover, FTS exposure may have long-lasting consequences on overall students' success beyond high school, as elite public high schools in Mexico City increase future academic performance in low-stakes tests (Dustan et al., 2017), and offer better quality education in terms of smaller class sizes, fewer students per computer, better peers, and more college-educated teachers (Estrada & Gignoux, 2017).

Our findings indicate that full-time schooling is an effective policy to improve educational trajectories for all students and to close the gender gap in high-stakes test scores.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

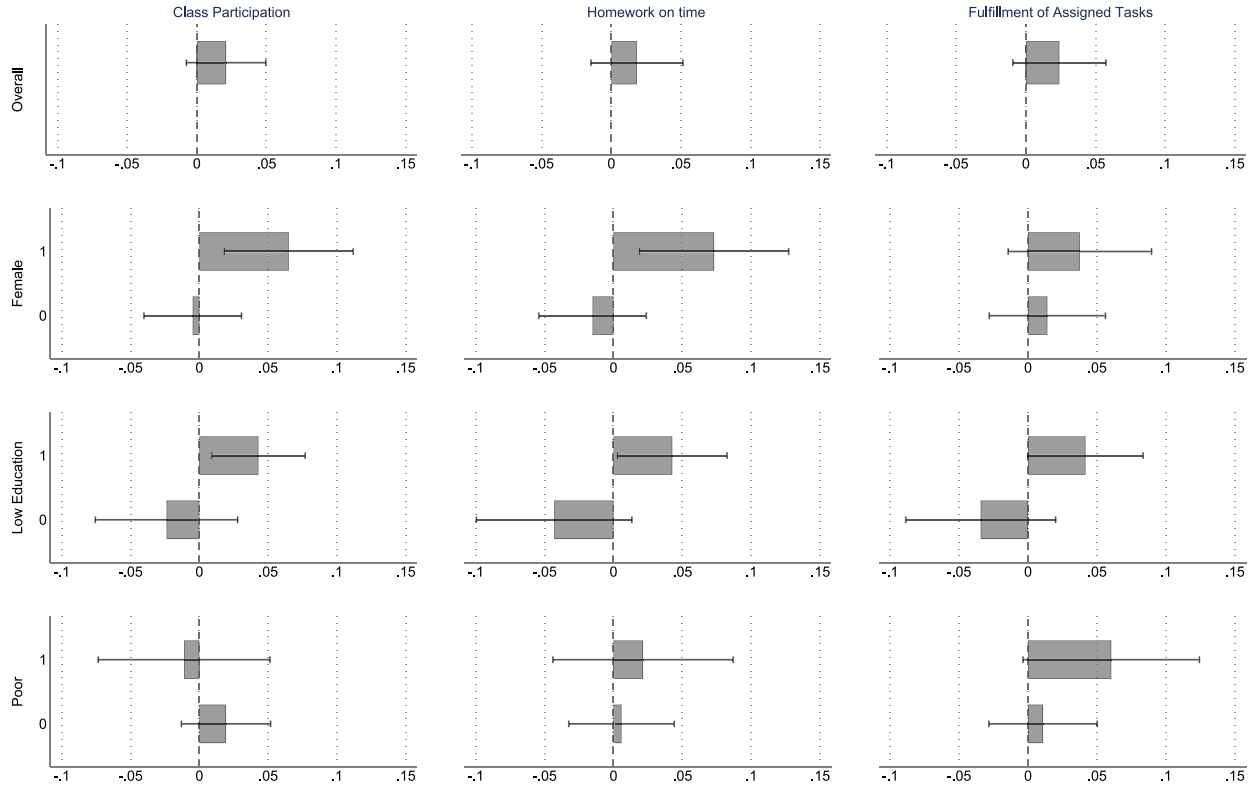

Fig. 8. Persistent Effects of Full-Time Schools on Self-Reported Work Ethic.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment means for students ever exposed to FTS are 0.206 (class participation), 0.338 (homework on time), and 0.445 (fulfillment of assigned task). Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

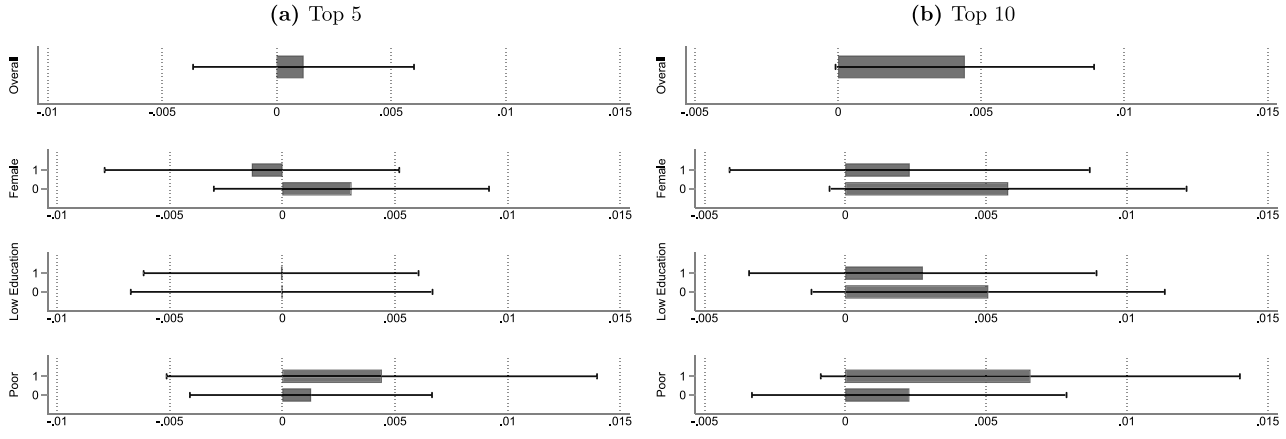

Fig. 9. Persistent Effects of Full-Time Schools on Students' Preferences for High Schools.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment means for students ever exposed to FTS are 0.345 (top 5) and 0.479 (top 10). Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

Appendix. Additional results

See Figs. A.1–A.15 and Tables A.1 and A.2.

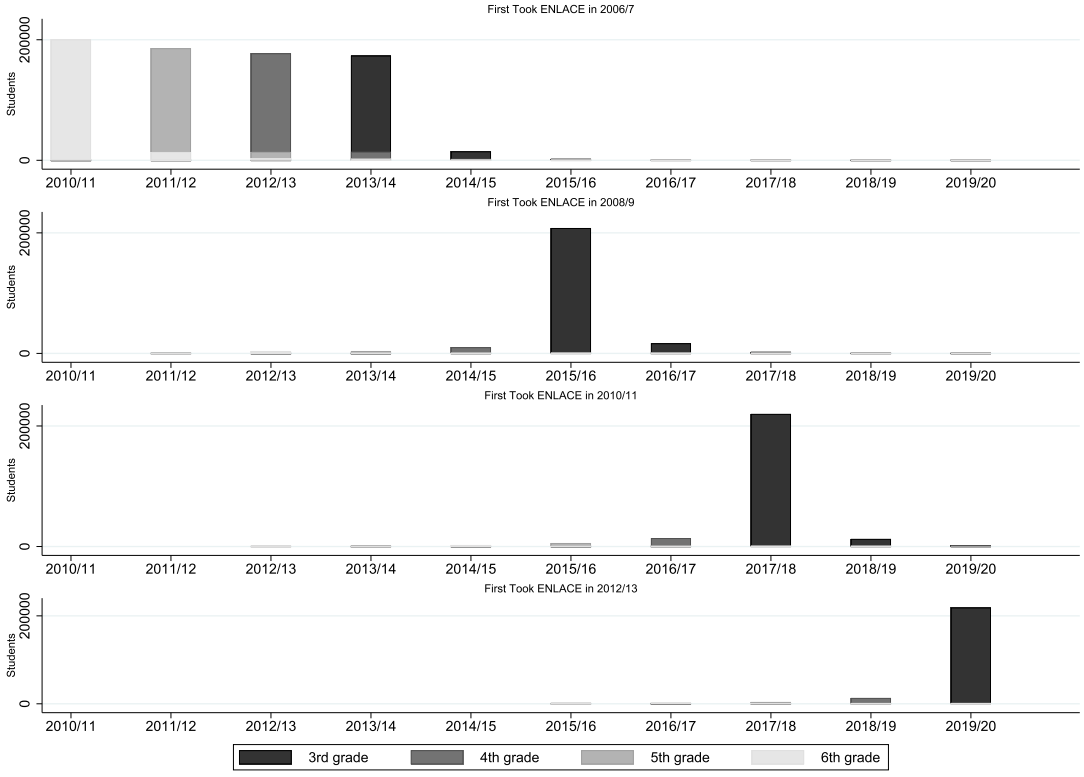

Fig. A.1. Dynamics of ENLACE and COMIPEMS Testing for Selected Cohorts of Students by Elementary School Grade.
Notes: The graph shows the academic year and grade in which each cohort of students is evaluated by ENLACE, and the academic year in which these take the COMIPEMS test. We do this for four representative cohorts of students. The first time the ENLACE test is applied is in the academic year 2006/07 to students in grades three to six. Most of these students face the COMIPEMS test when they finish grade nine, and are to start high school, four academic years later. Note that students who are evaluated for the first time in 2006/07 do not appear as "evaluated for the first time" in the subsequent years, and thus, most of the students tested for the first time in the academic years 2007-2013—this is 98% of students in our sample, are in grade three.

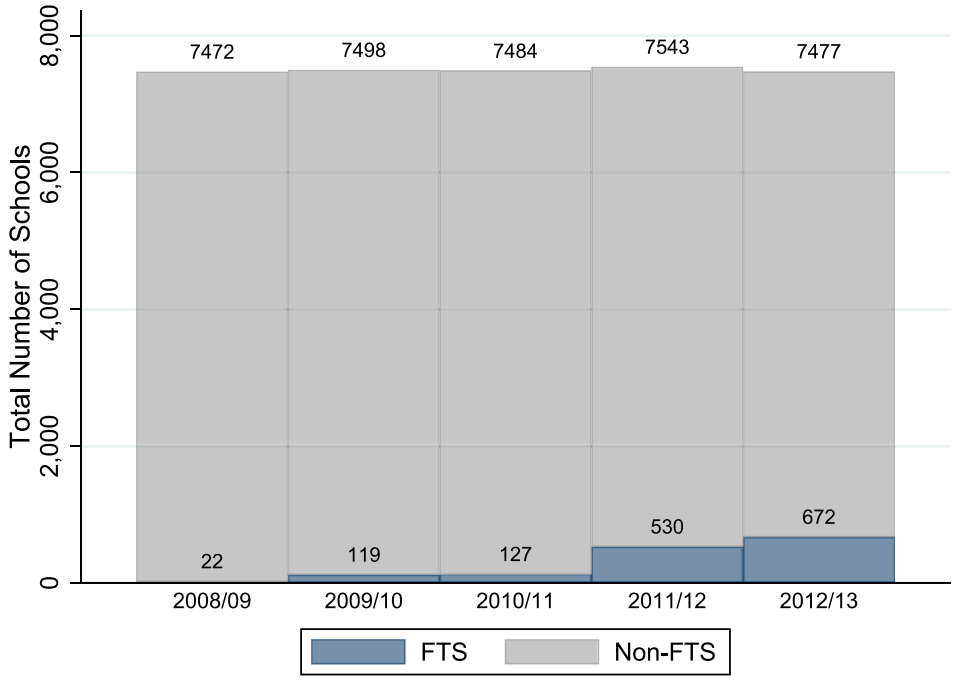

Fig. A.2. Number of FTS out of Total Schools in Mexico City's Metropolitan Area.
Notes: The graph shows the staggered implementation of the FTS program across academic years. In total 11% of the schools were ever treated.

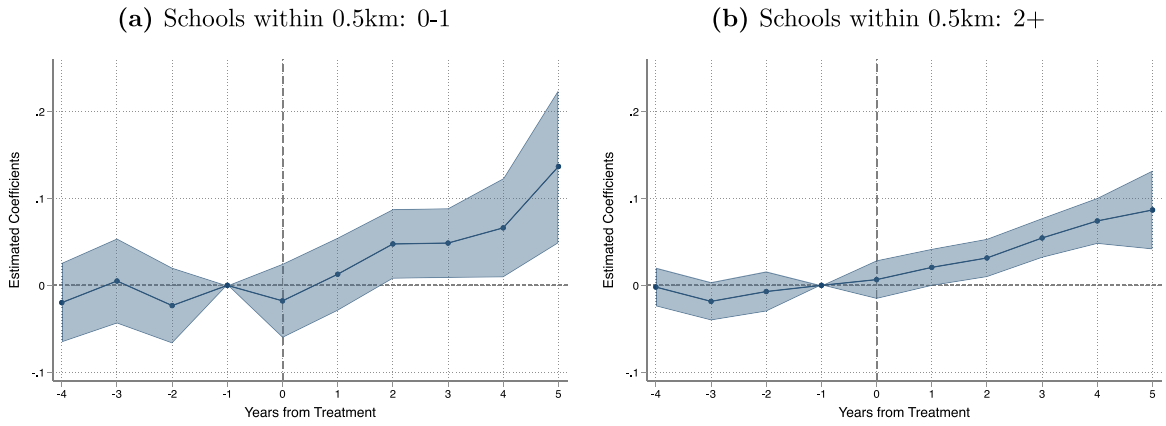

Fig. A.3. Persistent Effects of Full-Time Schools on High-Stakes Test Scores by Number of Schools within 0.5 km.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for indicators for the years prior to and after an elementary school adopted the FTS program. All estimates come from a single regression that controls for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. On the horizontal axis, "−4" indicates four or more years prior to treatment, and "5" indicates five or more years from treatment. Standard errors are clustered at the elementary school level. Our regression model is estimated using the *eventstudyinteract* package developed by Sun (2021).

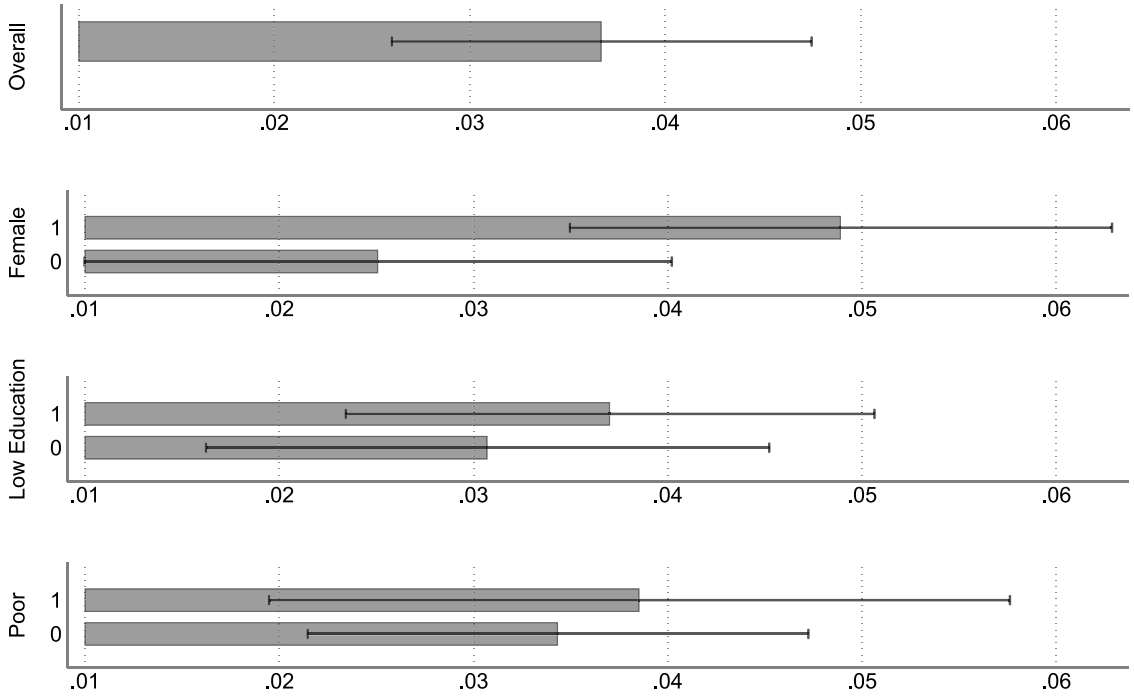

Fig. A.4. Lower Bound of the Persistent Effects of Full-Time Schools on High-Stakes Test Scores by Gender, Mothers' Education Level, and Socioeconomic Status.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

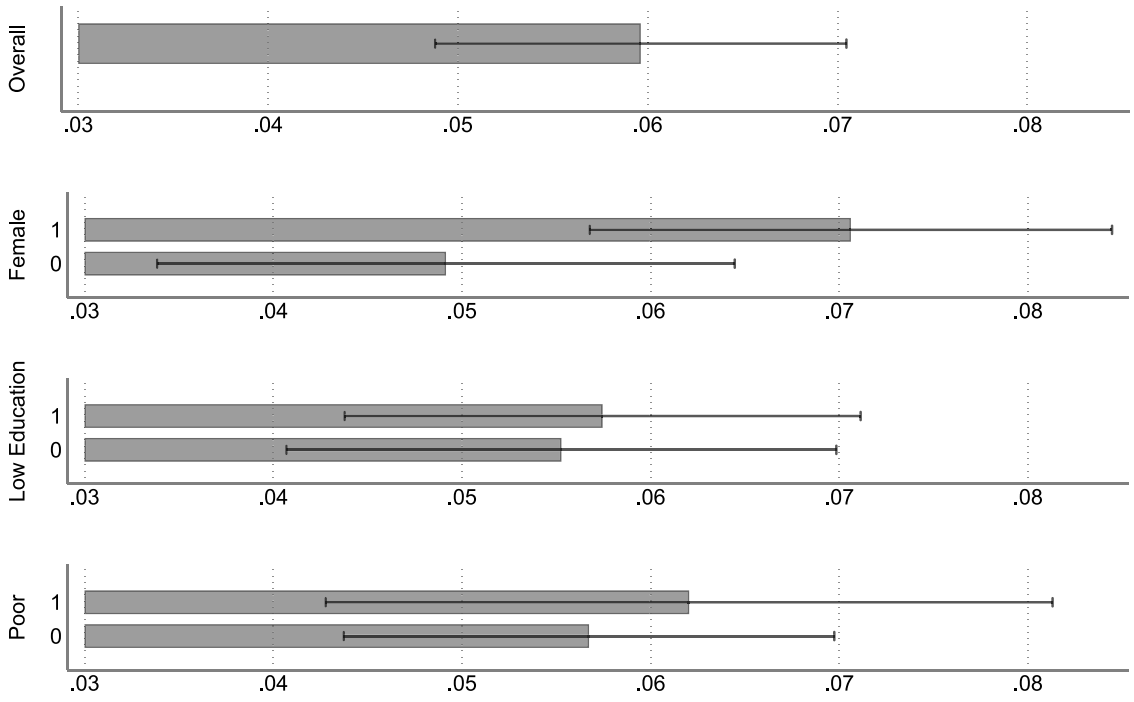

Fig. A.5. Upper Bound of the Persistent Effects of Full-Time Schools on High-Stakes Test Scores by Gender, Mothers' Education Level, and Socioeconomic Status.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

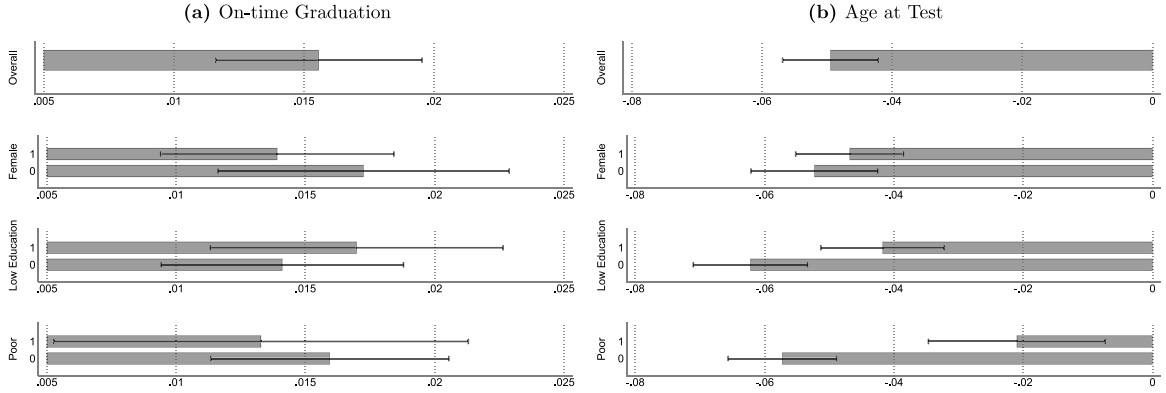

Fig. A.6. Lower Bound of the Persistent Effects of Full-Time Schools on On-time Graduation and Age at Test by Gender, Mothers' Education Level, and Socioeconomic Status.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment means for students ever exposed to FTS are 0.824 (on-time graduation) and 15.359 (age at test). Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

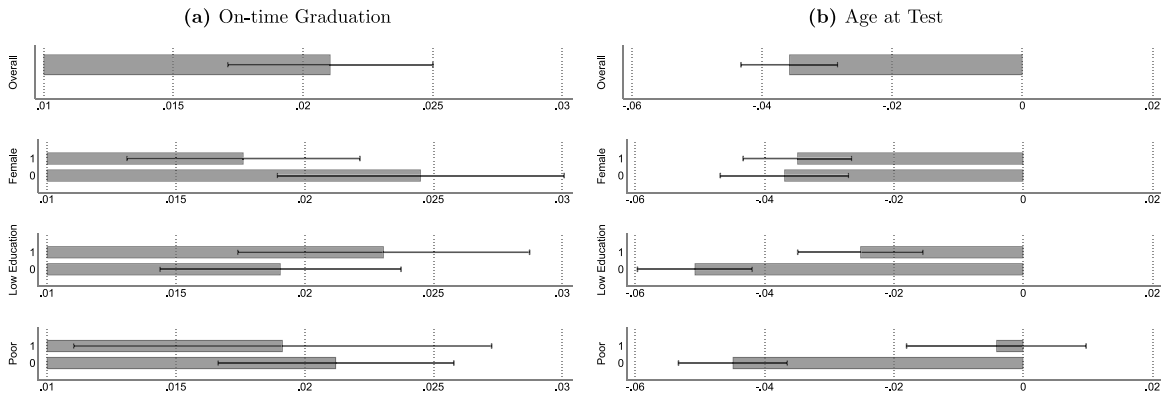

Fig. A.7. Upper Bound of the Persistent Effects of Full-Time Schools on On-time Graduation and Age at Test by Gender, Mothers' Education Level, and Socioeconomic Status. Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment means for students ever exposed to FTS are 0.824 (on-time graduation) and 15.359 (age at test). Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

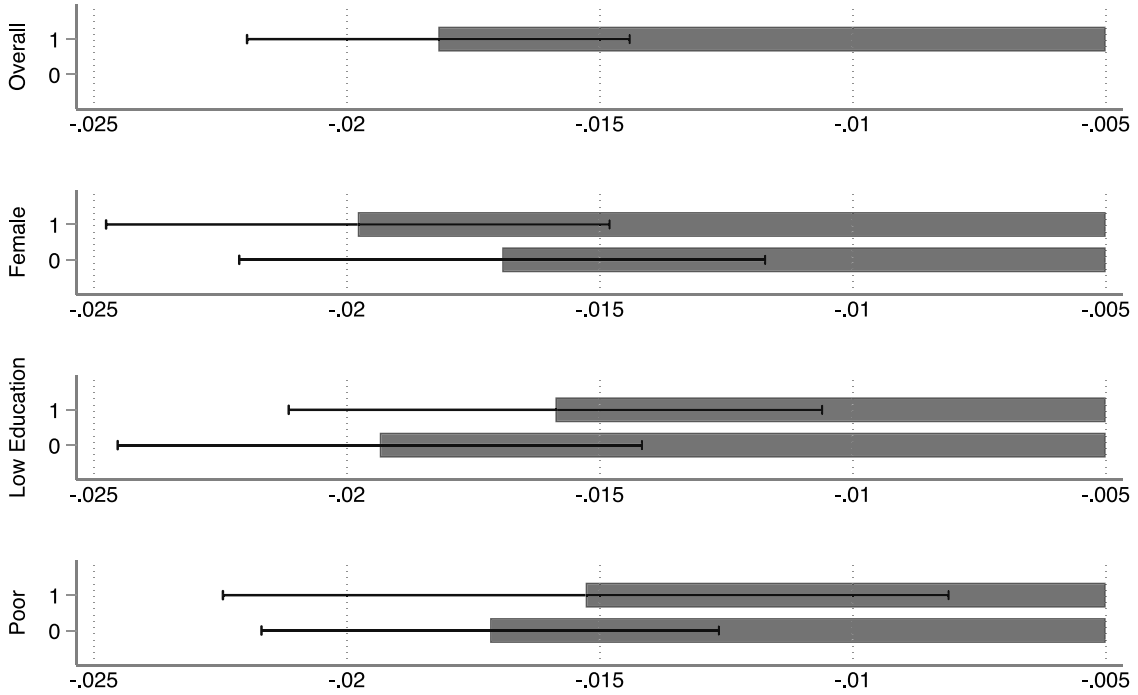

Fig. A.8. Lower Bound of the Persistent Effects of Full-Time Schools on the Probability of Retaking the Exam by Gender, Mothers' Education Level, and Socioeconomic Status. Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment mean for the outcome students ever exposed to FTS is 0.192. Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

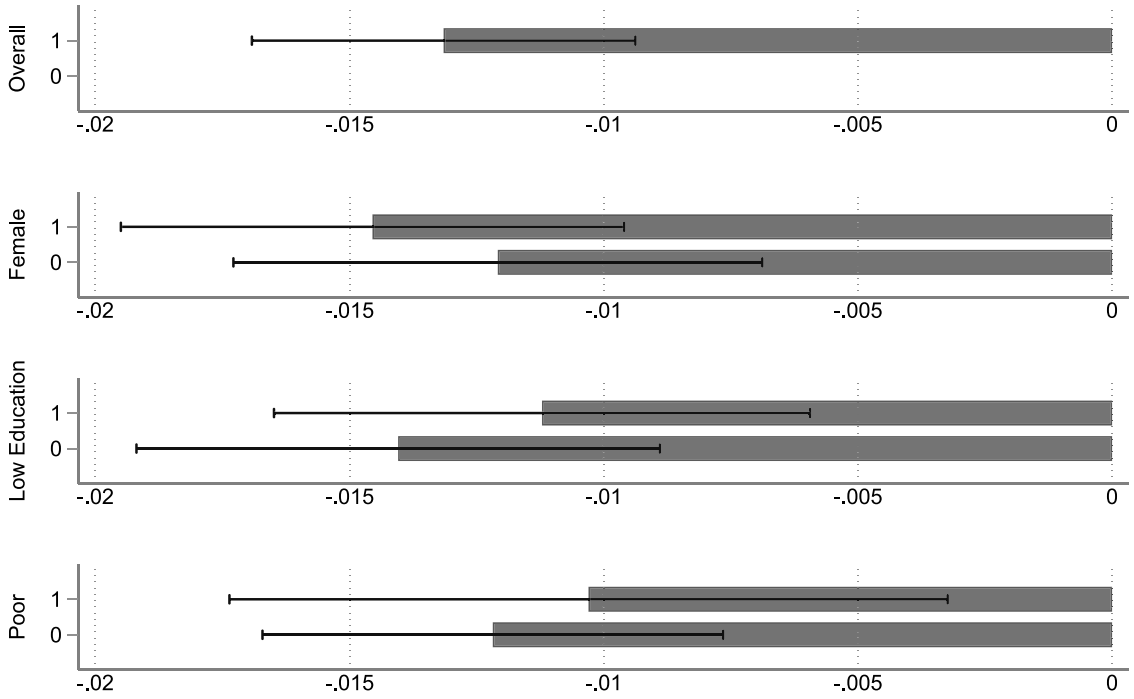

Fig. A.9. Upper Bound of the Persistent Effects of Full-Time Schools on the Probability of Retaking the Exam by Gender, Mothers' Education Level, and Socioeconomic Status.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment mean for the outcome students ever exposed to FTS is 0.192. Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

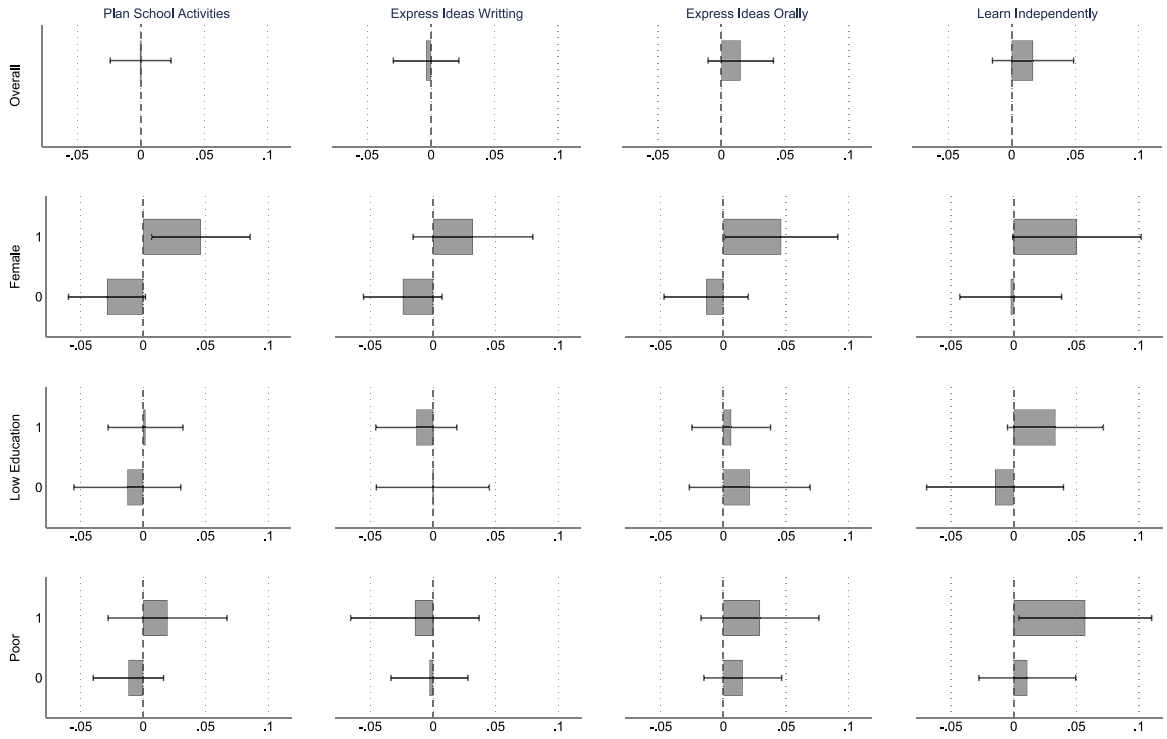

Fig. A.10. Lower Bound of the Persistent Effects of Full-Time Schools on Non-Cognitive Self-Reported Abilities.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment means for students ever exposed to FTS are 0.128 (plan school activities), 0.180 (express ideas in writing), 0.185 (express ideas orally), and 0.248 (learn independently). Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

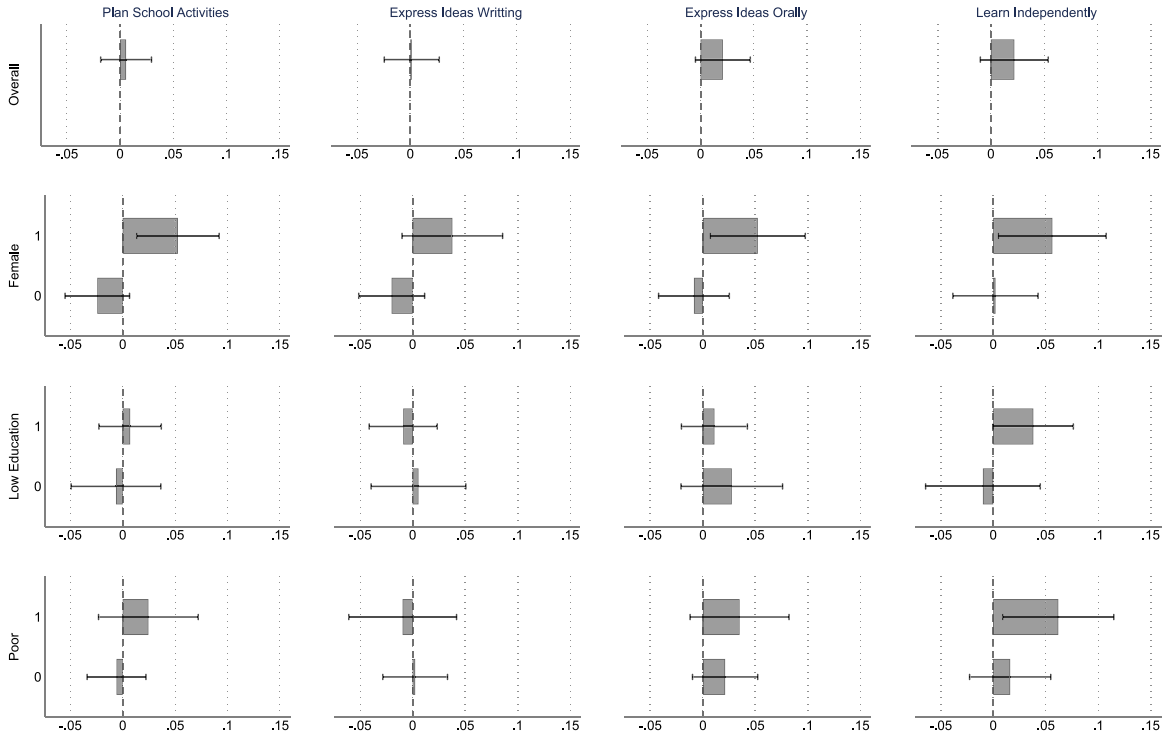

Fig. A.11. Upper Bound of the Persistent Effects of Full-Time Schools on Non-Cognitive Self-Reported Abilities.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment means for students ever exposed to FTS are 0.128 (plan school activities), 0.180 (express ideas in writing), 0.185 (express ideas orally), and 0.248 (learn independently). Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

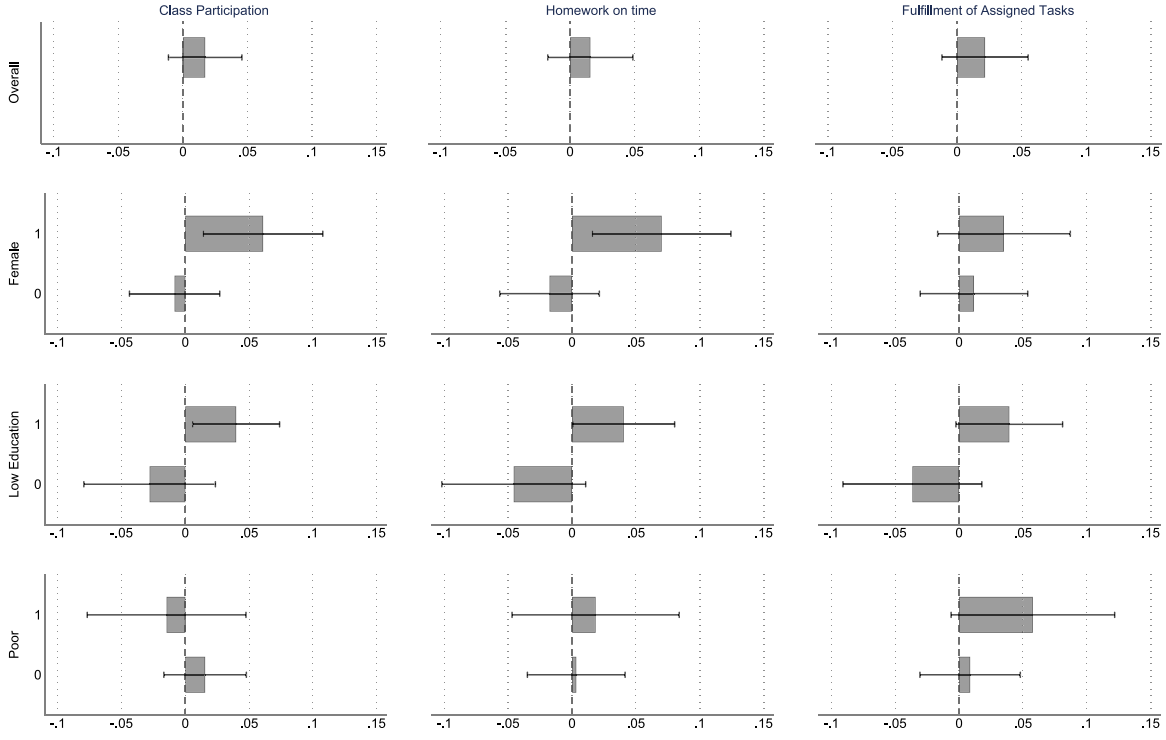

Fig. A.12. Lower Bound of the Persistent Effects of Full-Time Schools on Self-Reported Work Ethic.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment means for students ever exposed to FTS are 0.206 (class participation), 0.338 (homework on time), and 0.445 (fulfillment of assigned task). Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

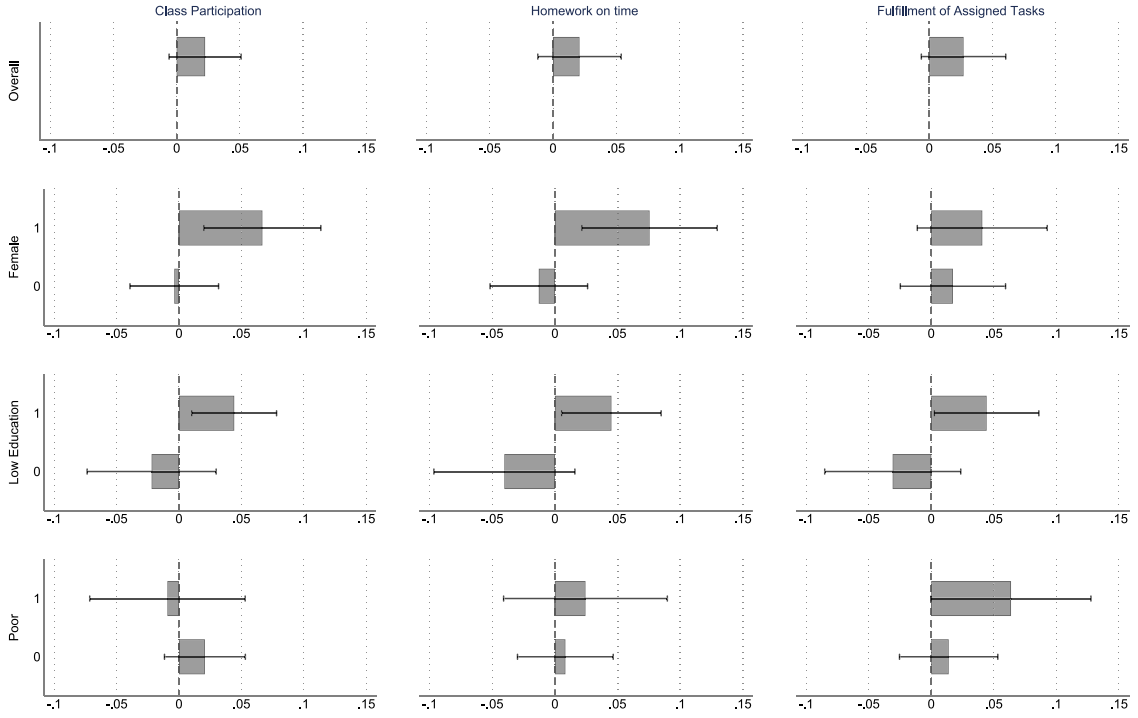

Fig. A.13. Upper Bound of the Persistent Effects of Full-Time Schools on Self-Reported Work Ethic.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment means for students ever exposed to FTS are 0.206 (class participation), 0.338 (homework on time), and 0.445 (fulfillment of assigned task). Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

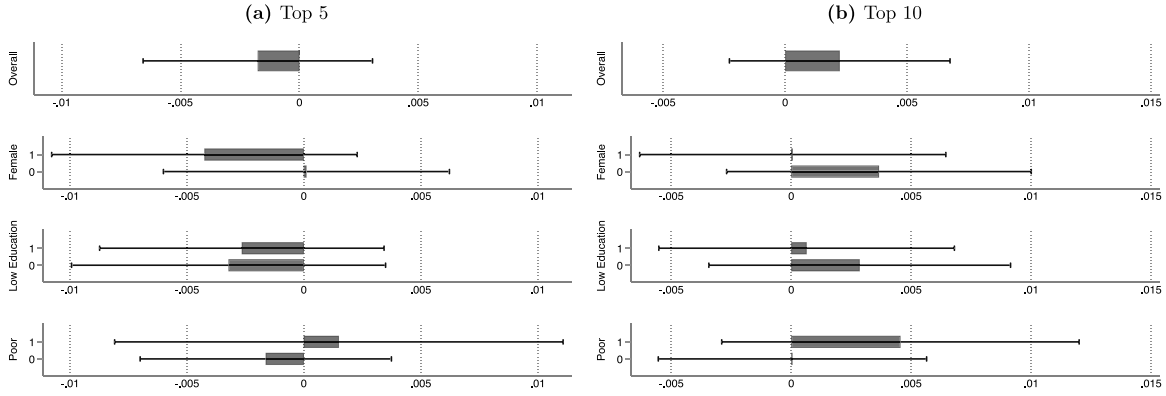

Fig. A.14. Lower Bound of the Persistent Effects of Full-Time Schools on Students' Preferences for High Schools.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment means for students ever exposed to FTS are 0.345 (top 5) and 0.479 (top 10). Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

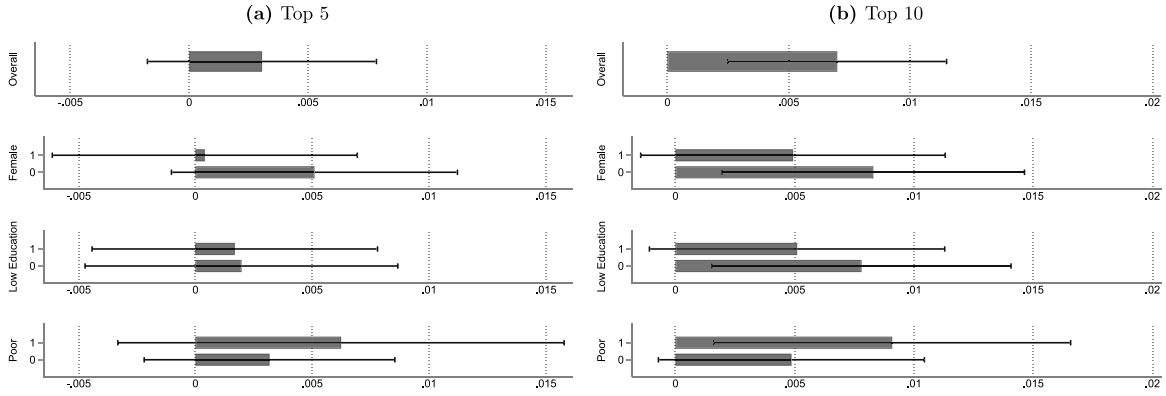

Fig. A.15. Upper Bound of the Persistent Effects of Full-Time Schools on Students' Preferences for High Schools.
Notes: This figure shows estimated IW coefficients and their 95% confidence intervals for a post-adoption of the FTS program indicator. All estimates come from different regressions that (when possible) control for elementary school fixed effects, cohort fixed effects, gender, mothers' education, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. The pre-treatment means for students ever exposed to FTS are 0.345 (top 5) and 0.479 (top 10). Standard errors are clustered at the elementary school level. The regression models are estimated using the *eventstudyinteract* package developed by Sun (2021).

Table A.1
School characteristics and probability of becoming an FTS.

	Ever-FTS	2008/09	2009/10	2010/11	2011/12	2012/13
	(1)	(2)	(3)	(4)	(5)	(6)
One teacher per class	0.018**	−0.000	−0.003	0.000	0.022***	0.000
	(0.008)	(0.001)	(0.004)	(0.000)	(0.006)	(0.005)
Log. Enrollment	−0.033***	−0.005**	−0.013***	−0.002*	−0.013**	−0.001
	(0.007)	(0.002)	(0.003)	(0.001)	(0.006)	(0.003)
Class size	0.003***	0.000*	0.001***	0.000	0.001**	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Share of teachers w/graduate education	0.039	0.006	0.024	−0.002	0.009	0.003
	(0.045)	(0.016)	(0.026)	(0.006)	(0.031)	(0.016)
Share of teachers in *Carrera Magisterial*	−0.023	−0.004	−0.004	−0.001	−0.004	−0.010
	(0.022)	(0.006)	(0.010)	(0.001)	(0.017)	(0.010)
Secure school program	0.063***	0.000	0.008***	0.000	0.040***	0.014***
	(0.007)	(0.002)	(0.003)	(0.001)	(0.006)	(0.003)
Quality schools program	0.091***	0.006***	0.018***	0.001	0.047***	0.019***
	(0.007)	(0.002)	(0.003)	(0.001)	(0.006)	(0.003)
Share of *Progresa* beneficiaries	−0.110**	−0.011	−0.001	−0.005	−0.074*	−0.018
	(0.055)	(0.016)	(0.023)	(0.005)	(0.044)	(0.020)
Rural	0.116***	0.004	0.020**	−0.002*	0.070***	0.024**
	(0.022)	(0.006)	(0.009)	(0.001)	(0.017)	(0.010)
Mexico City	0.099***	−0.005***	0.015***	−0.002**	0.066***	0.026***
	(0.007)	(0.001)	(0.003)	(0.001)	(0.005)	(0.004)
N	7,372	7,372	7,372	7,372	7,372	7,372
Share of FTS	0.090	0.003	0.013	0.001	0.054	0.019

Notes: Heteroskedasticity robust standard errors in parentheses.

Table A.2
Persistent effects of full-time schools on test scores by number of schools within 0.5 kilometers.

Schools within 0.5 km:	0–1	2+
	(1)	(2)
FTS	0.051***	0.048***
	(0.012)	(0.006)
N	567916	1614078

Notes: Each column represents a different regression. All estimates control for elementary school fixed effects, cohort fixed effects, gender, indicators for whether and when elementary schools adopted the Quality Schools program and the Secure School program, and state-specific post-2012 Education Reform indicators. Standard errors are clustered at the elementary school level. Estimates in columns 1 and 2 are calculated using the *eventstudyinteract* package developed by Sun (2021). *, **, *** Significant at the 10%, 5%, and 1% levels, respectively.

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