Should states allow for-profit companies to train teachers? Evidence from Texas

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Abstract

Roughly half of all newly-certified Texas teachers receive their training from a for-profit company, and these companies are expanding their operations to other U.S. states. This paper uses administrative data from Texas to provide the first comprehensive analysis of the effectiveness of for-profit teacher training programs. Consistent with for-profits' business model of offering an easier path to a teaching career, we find that the growth of for-profit programs significantly increased the supply of certified teachers in Texas, which reduced school districts' reliance on uncertified teachers. Yet for-profit-trained teachers have higher turnover rates and slightly lower value-added than teachers from other certification routes, consistent with concerns about the quality of for-profit programs. To examine the net impact of these supply and quality mechanisms, we exploit variation in geographic concentration of for-profit openings and in the grade levels at which they produce certificates. On net, we find small and statistically insignificant impacts of for-profit exposure on the achievement of Texas students, suggesting that the supply benefits were offset by the negative quality effects.

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1 Introduction

U.S. school districts have struggled to hire full-time qualified teachers for decades (Aragon, 2016; García and Weiss, 2019). Teacher shortages can hinder student learning by forcing school districts to fill vacancies with teachers who have less experience or who are teaching subjects outside their expertise. Teacher shortages have even caused some districts to implement four day school weeks.[1]

To combat these shortages, one unique approach is to allow for-profit companies to fulfill the training portion of teacher certification requirements. In 2001, Texas became the first state to authorize for-profit educator preparation programs (EPPs), and these programs quickly grew to dominate the state's teacher training market. As of 2020, certifications through for-profit EPPs make up over half of all certifications in Texas (see Figure 1). Compared to standard and other alternative programs, which are typically affiliated with universities, for-profit teacher training programs tend to be much shorter in duration and have lower upfront costs. For these reasons, for-profit programs may make it easier for individuals to enter the teaching profession.[2]

However, for-profit teacher training programs are often perceived as offering low-quality training. For-profit EPPs are frequently criticized by education researchers and the media, and the State Board for Educator Certification has placed some for-profit programs on probation for violating state regulations.[3] Despite these concerns and a lack of rigorous empirical evidence on their overall effectiveness, ten states have followed Texas' lead in adopting for-profit alternative certification pathways as of 2022.[4]

This paper provides the first comprehensive analysis of the effectiveness of for-profit teacher training programs. Specifically, we ask: 1) whether for-profit teacher training programs have expanded access to the teaching profession; 2) whether there are quality differ-

[1] "Rural Texas districts struggling to attract teachers are switching to four-day school weeks," *The Texas Tribune*, July 19, 2022.

[2] For-profit EPPs often brand their programs as a fast and easy path into a teaching career. For example, as of November 2023, the website of iTeachTexas advertized: "Start your training and be qualified to teach in as few as six weeks."

[3] See, for example, "Too big to fail? Texas' largest teacher prep program riddled with problems, state finds," *The Dallas Morning News*, April 20, 2022.

[4] According to Title II data for 2021-22 from the Department of Education these include Arizona, Florida, Hawaii, Indiana, Louisiana, Massachusetts, Michigan, Nevada, North Carolina, and South Carolina

ences between for-profit-trained and other teachers; and 3) how, on net, these supply and quality mechanisms impact the achievement of Texas students. We answer these questions using rich administrative data from Texas, which allows us to track individuals along the path to teacher certification and employment, and, ultimately, to examine the performance of their students on standardized achievement tests.

We begin by showing that the growth of for-profit EPPs significantly increased the supply of certified teachers in Texas. The annual number of newly-certified teachers roughly doubled in the seven years following the 2001 policy that allowed for-profits to operate. Estimates from a simple cross-state difference-in-differences model show that for-profit EPPs increased the number of certified teachers in Texas by roughly 40 percent relative to other states—an effect that persisted up through 2019. This increase in the supply of certified teachers did not impact the number of *employed* teachers, but it did lead to a sharp decline in the fraction of teachers who were uncertified. Further, teachers who went through a for-profit EPP are more likely to be male and Black than teachers from the standard certification route. For-profit-trained teachers are also more diverse in terms of their college majors.

We next show that for-profit-trained teachers have higher turnover rates and slightly lower value-added than standard teachers but are significantly better on both of these metrics than uncertified teachers. Specifically, for-profit-trained teachers are 10 percentage points more likely to leave the profession within five years than standard-trained teachers. Further, for-profit-trained teachers' value-added for math and English language arts (ELA) tests scores is 0.01–0.03 standard deviations (SDs) lower than teachers from other certification routes. Put together, this suggests that for-profit-trained teachers are of a slightly lower quality than standard-trained teachers and are less committed to the profession. However, teachers who begin their careers without any certification have much higher turnover rates than for-profit-trained teachers, and their value-added is up to 0.08 SDs lower in math.

Our final analysis examines the net implications of these supply and quality effects for student achievement. While the supply results suggest that the growth of for-profit EPPs may have benefited Texas students by reducing school districts' reliance on uncertified teachers, our quality results imply these benefits may be offset by the fact that for-profit-trained teachers are slightly less effective than teachers from other certification routes. To examine the net impacts of these mechanisms, we utilize variation in the timing and geographic concentration of for-profit openings in a difference-in-differences analysis. To address concerns about endogeneity in the location choices of for-profit EPPs, we also use a triple-difference specification that exploits the fact that for-profit-trained teachers were more likely to earn certificates and teach at higher grade levels.

We find that, on net, the growth of for-profit EPPs neither helped nor hurt the achievement of Texas students. First, we show school districts that are located near the headquarters of for-profit EPPs were more likely to hire for-profit-trained teachers, and that these effects are larger at higher grade levels. Next, we show that greater exposure to for-profit EPPs reduced the fraction of teachers who were uncertified, but it also led to a decrease in average years of teaching experience, consistent with higher turnover rates for for-profit-trained teachers. Our main result is small and statistically insignificant impacts of for-profit exposure on students' performance on grade 3–8 math and ELA exams. These null effects are robust to a variety of specifications and to the inclusion of controls for student demographics and lagged achievement. Overall, these findings imply that supply side benefits of for-profit EPPs were offset by negative impacts on teacher quality. Thus, Texas' policy of allowing for-profit companies to train teachers was, on net, a wash as measured by student achievement.

Our paper presents novel estimates of the net effect of alternative certification, specifically for-profit provided training, on student outcomes accounting for both changes to supply and quality of the teaching workforce. Previous research has estimated the effects of certification status and license exams on student achievement (Aaronson et al., 2007; Kane et al., 2008a; Clotfelter et al., 2007; Goldhaber, 2007; Clotfelter et al., 2010; Chingos and Peterson, 2011; Shuls and Trivitt, 2015; Hendricks, 2016; Goldhaber et al., 2017; von Hippel and Bellows, 2018). This line of work finds a small difference between the average value-added between standard-trained teachers and alternatively-trained or uncertified teachers (Aaronson et al., 2007; Kane et al., 2008a; Clotfelter et al., 2007, 2010; von Hippel and Bellows, 2018). Many papers also find that there is a modest relationship between license exam scores and student achievement (Goldhaber, 2007; Clotfelter et al., 2010; Chingos and Peterson, 2011; Shuls and Trivitt, 2015; Hendricks, 2016; Goldhaber et al., 2017). This body of work concludes the differences across certification status and type are modest in relation to the variation of teaching ability within certification type. Our findings on teacher quality are similar to the findings in this literature.

However, existing research does not fully address how the *option* of alternative certification affects the overall supply of teachers. We consider how creating a new pathway to certification affects the supply of teachers, an outcome not considered in these papers. Understanding supply effects is crucial, as increased supply can alleviate student-teacher ratios, improve certification alignment, and mitigate teacher shortages. These effects could lead to positive outcomes for students even if for-profit-trained teachers are lower quality. In fact, we find the introduction of a for-profit training program has no overall harm on students in nearby schools despite the suggestion that students should on average be worse off.

Our work is also related to a burgeoning literature on teacher licensing that seeks to understand how certification acts as a screening device to the teaching profession (Angrist and Guryan, 2008; Larsen et al., 2020; Law et al., 2023; Orellana and Winters, 2023; Chung and Zou, 2024). The general findings from this literature indicate that increased difficulty of becoming certified or failing a license exam lowers the probability an individual chooses to become a teacher.

We explore how lowering the certification burden—without altering the difficulty of license exams—affects not only the decision to enter the profession, particularly for career-changers, but also the resultant outcomes for students. Prior work is limited in its ability to examine this latter question comprehensively. For example, some papers only have the college selectivity of newly hired teachers which is only weakly related to student achievement (Angrist and Guryan, 2008; Larsen et al., 2020). We add to this literature by considering both supply and quality effects jointly and by having improved measures of student achievement, including value-added of teachers and test scores of the students who are most affected by the certification changes.

Finally, we contribute to research on teacher labor supply and teacher quality. This includes work on teacher value-added (e.g., Rockoff, 2004; Rivkin et al., 2005; Kane and Staiger, 2008; Chetty et al., 2014b; Jackson, 2018), factors that affect the supply of teachers (e.g., Hoxby and Leigh, 2004; Bacolod, 2007; Nagler et al., 2020; Deneault, 2024), and policies to recruit and retain high-quality teachers (e.g., Guarino et al., 2006; Monk, 2007; Jackson et al., 2014; Rothstein, 2015; Neilson et al., 2019). Our contribution relative to this work is to examine the supply and quality effects of teacher certification requirements, which are an important and policy-relevant factor.

2 Texas Teacher Certification and Policy Background

2.1 Certification routes

To become a public school teacher in Texas, individuals must hold a bachelor's degree and be certified.[5] Like in many other states, the certification process in Texas requires that individuals complete an educator preparation program (EPP), which offers training on effective teaching practices, and pass both pedagogy and content-specific licensing exams.

In Texas, as in many states, there are two possible routes to earn a teaching certificate. In what is often called the *standard* certification route, prospective teachers fulfill the EPP training requirements at a university while completing a bachelor's degree (Agency, 2022a). The second route, known as *alternative* teacher certification, is designed for individuals who want a career change after they have already graduated from college. Alternative EPPs have existed in Texas since 1984, and until 2001, they were run by a variety of public and non-profit institutions, including universities, independent school districts, and state-legislated service organizations called Education Service Centers (Region 13 ESC, 2023). The content of standard and alternative programs is regulated by Texas state law, and the State Board for Educator Certification (SBEC) is in charge of EPP accreditation.

The timeline for coursework and requirements for completing the teacher training portion of certification differ across standard and alternative routes. In the standard route, students take a large number of courses on pedagogy while they are in college, as part of their major requirements, and they are usually required to complete unpaid student teaching positions. Individuals in the standard route typically take the content and pedagogy licensing exams before they begin teaching. If they pass these exams, they become eligible to teach under

[5] See sections TEC§21.003 and TEC§21.044. Since 2008, Texas also requires fingerprinting and background checks for the full certification (Agency, 2022d). See Appendix B for more details.

Texas' standard 5-year certificate. In alternative programs, individuals typically begin with a more abbreviated set of coursework and then take the content licensing exam. If they pass the content exam, individuals receive a 1-year probationary license and are eligible to become a full-time teacher of record with pay. During their first year as a teacher—which is often called the "internship" period—individuals take additional courses in their spare time to complete the EPP training requirements, and they must also pass the pedagogy licensing exam. If they fulfill all these requirements, individuals receive a standard 5-year certificate, typically in time for their second year as a teacher of record (Agency, 2022b).

Despite the regulatory certification requirements, there are instances when uncertified teachers fill classrooms. For example, school districts who have difficulty hiring can gain approval to issue emergency teaching permits from the Commissioner of Education (Templeton et al., 2022).[6] With state approval via this permit, school districts are legally allowed to hire a teacher who is not certified but who the district feels is nevertheless qualified to teach. There are also instances where a school district may hire an uncertified teacher and not get the appropriate approvals (Templeton et al., 2022).

2.2 The growth of for-profit EPPs

Motivated by growing teacher shortages, Texas enacted several unique policies around the turn of the millennium to expand pathways to certification. In 1999, the 76th state legislature passed House Bill 714, which modified the sections of the Texas Administrative Code that deal with educator preparation and certification (Templeton and Horn, 2020). The new law was "designed to promote flexibility and creativity in the design of programs, including ... alternative routes to certification."[7] Most significantly, the legislature gave SBEC the authority to approve new EPP programs, and it prescribed that educator preparation "shall be delivered by institutions of higher education, regional education service centers, public school districts, or *other entities*" (emphasis added).[8] Another influential change occurred in 2001 when the SBEC eliminated a requirement that preparation programs include "student

[6]See TEC§21.055 for legal code. It also stipulates that permit holders need to have a bachelor's degree.
[7]Texas Administrative Code Title 19, Part 7 §228.1(b) adopted to be effective July 11, 1999.
[8]Texas Administrative Code Title 19, Part 7 §228.20(b) adopted to be effective July 11, 1999.

contact hours" (May et al., 2003; Guthery and Bailes, 2023). This amendment meant that EPPs could offer programs that did not require any student teaching or other field experience prior to earning a certificate.

These policy changes opened the door for for-profit EPPs to enter the teacher certification market with a new business model.[9] Appendix Table A1 shows that 33 for-profit EPPs began operating between 2001 and 2011. Many of these programs are headquartered in major metropolitan areas, including Houston, Dallas, San Antonio, and Austin, but there is also a concentration of for-profit EPPs in the Rio Grande Valley. Since their inception, the largest for-profit EPP has been A+ Texas Teachers (now known as Teachers of Tomorrow), followed by iteachTexas and Education Career Alternatives Program.

For-profit EPPs have grown to dominate Texas' teacher certification market. Panel A of Figure 1 shows that the for-profit share of initial teacher certifications—i.e., individuals earning their first teaching certificate—grew from zero percent in 2000 to over 30 percent by 2010. In 2014, for-profit EPPs surpassed standard EPPs to become the most common initial certification route. As of 2019, for-profit EPPs account for roughly 50 percent of all newly-certified teachers in Texas.

What made for-profit EPPs successful? For-profits often market themselves as offering a fast and easy route to a teaching career. Historically, alternative EPPs required in-person coursework, which limited flexibility in when and where training occurred. In 2003, iteachTexas became the first EPP to offer fully-online training, and A+ Texas Teachers had a similar business model when it opened two years later (see Appendix Table A2).[10] Data from the Department of Education's Title II reports show that for-profit EPPs tend to require fewer hours of training than other EPPs (Appendix Table A3); often they require the bare minimum that is allowed by state regulation. For-profit EPPs also tend to have lower college GPA requirements for the students they admit (Appendix Table A3).[11]

The online training model also allowed for-profit EPPs to beat many of their competitors

[9] We note that for-profit EPPs are different from for-profit colleges (Deming et al., 2012), both in ownership and in kind. For-profit EPPs help individuals fulfill state teacher certification requirements; they do not offer associate's degrees, bachelor's degrees, or other occupational certificates.

[10] Other public and non-profit EPPs switched to online coursework models following the entry for-profits, likely in response to competitive pressure.

[11] Also see Appendix Table A4 for median length of time from admissions to classroom by EPP type.

on price. Figure 2 shows average fees charged by for-profit and other alternative EPPs using information that we collected from historical websites (see Appendix Table A2 for details). During the 1999–2007 period for which we could find data, for-profit EPPs charged roughly \$6,400 on average (in 2024 dollars), whereas the average cost at other alternative EPPs was roughly \$7,000. The share of the total fee that is due up-front (e.g., application and initial training fees) is also lower at for-profit EPPs; this may reduce credit constraints by allowing individuals to pay most of the program costs after they start earning a paycheck from the teaching internship. Notably, the average real fees at both for-profit and other alternative EPPs were roughly \$1,500 *lower* in 2024 than they were in the 2000s, and for-profits still offered lower average prices in this year. This decline in market prices likely reflects the competitive pressure from for-profit entry.

While for-profit EPPs have become the most popular certification route, there are significant concerns about the quality of their training. Many educators argue that online courses and pre-recorded videos are not an effective way to learn good teaching practices. For-profit EPPs have significantly higher faculty to student ratios than other EPPs (Appendix Table A3). Further, for-profit EPPs receive frequent scrutiny from regulators for failing to comply with accreditation standards. In 2022, for example, the Texas Education Agency recommended that the largest for-profit, Teachers for Tomorrow, be put on probation due to misleading marketing, insufficient mentorship, and unproven coursework.[12] These potential concerns about for-profit EPPs motivate our empirical analysis of their effectiveness.

3 Data

We use administrative datasets from Texas Education Agency (TEA), Texas Higher Education Coordinating Board (THECB), and Texas State Board for Educator Certification (SBEC) to construct two main samples: *teacher characteristics sample* and *student achievement sample*. We additionally use nationally representative datasets.

[12]See: "Texas' largest teacher prep program faces probation after state finds continued problems" *The Dallas Morning News*, April 25, 2022. Teachers for Tomorrow is currently operating under a monitoring agreement with the SBEC: "Texas' largest educator preparation program will be monitored" *The Dallas Morning News*, September 19, 2024.

3.1 Texas administrative data

Teacher panel: We create a teacher-level panel dataset for use in both of our main samples. Specifically, we start with course schedule data from the TEA. For teachers in this dataset, we observe the full-time-equivalent (FTE)[13] for each course taught and the corresponding subject, grade-level, and student population of the class (regular, special education, etc.) from academic years 1995-2019.

Using a unique personal identifier, we connect teachers' course schedules to their initial certification records available from 1995 to 2019. This contains their EPP route and the year they were first certified. We define certification status by year. A person is certified, with associated EPP route, if their first certification was effective by Nov. 1st of the school year in which they are teaching and any year thereafter. Most teachers are certified in their first year and consequently are always certified in our panel. Given that school districts can acquire a permit (see Section 2), some teachers may not be certified during the academic year in which they teach. We refer to this as being uncertified in a given year or not-yet-certified. About half of these teachers ultimately obtain certification at some point in their teaching career. Some teachers never become certified, which we refer to as uncertified.

There may be some measurement error in defining whether a teacher is certified in a given year. Since the SBEC was established in 1995, it should include a representative set of certifications valid from that year onward. However, individuals who were certified before 1995 might have valid certifications that are not recorded in this file. This could lead to an overcount of uncertified teachers in the early years of our sample (mid-1990s to early 2000s). We are also able to ascertain whether educators are teaching subjects and grades for which they are certified. We refer to this as certification alignment.

We connect these teachers to other employment data containing information on their experience, tenure (length of time at a specific school), demographics, and salary.[14] For a subset of teachers who also attended Texas public schools prior to becoming educators, we

[13]This is the percentage of full-time work for a given class for a given teacher. For example, a full-time person who spends half of their time teaching a class would receive a .5 or 50 percent for that class. All their classes would sum to 1 because they are full-time.

[14]We use experience-level defined by TEA. This variable has some measurement error. For samples in which we use descriptives only, we reduce our sample to only teachers for which we are sure of their start year and experience.

also observe their 8th grade math and English language arts standardized exams. We can also identify the college majors of teachers who obtained their bachelor's degrees from Texas public colleges or universities. Finally, for a subset of teachers, we calculate value-added at the teacher-year-level, described in Section 5.2.1.

We use this panel data set in both of our main samples. The *teacher characteristics sample* includes all teachers who were actively teaching between 2012-2019. We constrain this sample to these years so that we can have a better representation of value-added and other characteristics, such as such as 8th grade test scores and college major. Our *student achievement sample* collapses the teacher panel to the district-county-grade-year level to merge with other datasets described in this section.

Student outcomes: We have student test score data from 1995-2019 that includes demographic information on students including race/ethnicity, economic disadvantage, participation in special education or gifted programs, and at risk status.[15] We standardized test scores by subject-year for math and English language arts (ELA) subjects for grades 3-8.

We use the TEA-defined county associated with each district as our geographical area for teachers and students. For our *student achievement sample*, we collapse the average student standardized test score to the grade-district-county-year level. We additionally use standardized exams in the calculation of value-added for students years 2012-2019.

School and district: We restrict our analysis to Independent School Districts (ISDs) to focus on a stable set of schools during the period of for-profit EPP growth. The restriction to ISDs excludes charter districts, which comprise roughly 6 percent of total public school enrollment in the 2018–2019 academic year. Many Texas charter schools began operating after for-profit EPPs had already entered the market, and charters also have more flexibility in hiring teachers that do not meet the state certification requirements.

[15] This covers data during the TAAS, TAKS, and STAAR testing regimes.

3.2 National Data

In some analyses, we compare Texas to other U.S. states using a variety of state-level public data sources. Data from the Department of Education's Title II reports provide counts of the number of teacher preparation program completers and the number of initial certifications by state and year. Information on the number of employed teachers comes from the Department of Education's Common Core data, which we accessed through the National Center for Education Statistics (NCES). We also use state-level estimates from the NCES' Schools and Staffing Survey (SASS) and National Teacher and Principal Survey (NTPS) to measure teacher demographic characteristics, subjective measures of teacher preparation, and schools' assessment of the difficulty in filling teacher vacancies. Lastly, we use state average test scores from the National Assessment of Educational Progress (NAEP) to measure student achievement in math and English language arts.

4 Teacher supply

4.1 Empirical strategies

We begin our empirical analysis by examining how the growth of for-profit EPPs impacted the supply of teachers in Texas. This analysis uses two empirical approaches. Our first approach simply describes long-term trends in outcomes related to teacher supply. The landscape of Texas teacher preparation changed dramatically over the past several decades, with the for-profit share of initial teacher certifications growing from zero percent in 2000 to nearly 50 percent by 2019 (Figure 1, Panel A). It is important to document how this dramatic growth in for-profit EPPs relates to other long-term trends in teacher supply.

Our second empirical approach compares changes in teacher supply outcomes in Texas to those in other U.S. states using the national datasets described in Section 3.2. Texas is an outlier in its use of for-profit EPPs, making other states reasonable controls. King and Yin (2022) report that the for-profit share of total enrollment in teacher preparation programs was 63.9 percent in Texas for the 2018–2019 academic year. By contrast, the for-profit shares of total enrollment ranged from 1.0 percent (Massachusetts) to 9.9 percent (Louisiana) in the ten other states that allowed for-profit programs to operate in this year, and 39 states had no for-profit programs.[16]

We exploit this cross-state variation using a simple difference-in-differences (DiD) specification:

$$Y_{st} = \gamma_s + \gamma_t + \beta[\text{Texas}_s \times \text{Post2001}_t] + \epsilon_{st}, \tag{1}$$

where Y_{st} is a teacher supply outcome measured in state s and year t. The variable of interest is the interaction between an indicator for Texas (Texas_s) and an indicator for years in or after 2001 (Post2001_t), which is the year when Texas first allowed for-profit EPPs to operate. We include state and year fixed effects (γ_s and γ_t) and cluster standard errors at the state-level. We weight observations by population size using the U.S. Census' intercensal estimates of the number of 18–65 year olds in each state and year. Our sample includes outcomes measured from the 1990s up through 2019, with the range depending on the years in which each outcome is available. Thus the coefficient of interest, β, indicates how teacher supply outcomes changed in Texas between the pre- and post-2001 periods relative to the average change over the same period in other U.S. states.[17]

We complement our DiD regressions with synthetic control estimates following Abadie et al. (2010). For each outcome variable, we estimate synthetic control weights to match the pre-2001 levels of the outcome in Texas for each year of available data. We also follow Abadie et al. (2010) in performing permutation inference by computing placebo synthetic control estimates for each U.S. state because we have only one treated state but many control states. The placebo method assumes all other control states receive a placebo "treatment" and calculates the treatment effect accordingly. The p-value estimates from this method are based on the distribution of treatment effects from the placebo estimates and Texas' place within this distribution. Because there have been a large number of policies affecting the teaching landscape over such a long post-treatment period in the U.S., we believe some placebo treatment effects will be large enough to make Texas appear relatively less like an

[16] Appendix Table A5 shows that our cross-state results are similar if we exclude the 10 other states with any for-profit EPP enrollment.

[17] In many of our national datasets, the only pre-2001 year in which data is available is 2000. For each outcome, we restrict to states for which the outcome is measured in all years of the data.

outlier despite its uniqueness in allowing for-profit EPPs.[18] In other words, we believe that the standard errors produced by this method will be overly conservative in our case.

4.2 Effects on the quantity of teachers

As indication that for-profit EPPs increased the supply of teachers in Texas, the total number of newly-certified teachers increased dramatically following the 2001 policy that allowed for-profits to operate. Panel B of Figure 1 shows that the total number of initial teacher certifications—i.e., individuals who received their first teaching certificate—increased from roughly 12,000 in 2000 to nearly 27,000 by 2007. In the first few years after the policy change, the growth in initial certifications was driven primarily by other alternative programs, but for-profit EPPs grew rapidly over the 2000s and comprised a majority of the alternative certification market by the end of the decade.[19] By the end of the 2010s, the annual counts of newly-certified teachers from standard and other alternative programs were similar or slightly below their 2000 levels, but the *overall* number of certifications was significantly higher due to for-profit EPPs producing roughly 10,000 newly-certified teachers per year.

The number of potential teachers, measured by initial certifications, also increased significantly in Texas relative to other states over this two decade period. Panel A of Table 1 shows DiD estimates for the number of potential teachers per 10,000 residents using Title II data from the Department of Education. Estimates from our DiD specification (1) show that the number of EPP completers in Texas increased by 3.8 people per 10,000 residents relative to other states (column D). Our synthetic control specification gives a similar estimate of 4.02 EPP completers per 10,000 residents (column F). These coefficients represent a roughly 40 percent increase relative to the value of 9.49 EPP completers per 10,000 Texas residents in 2000 (column C). The increase in EPP completers was driven entirely by alternative programs (second row of Panel A), and we find a similar impact on the number of initial certifications per capita (third row of Panel A). These estimates are statistically

[18] For example, New York City created an alternative certification program called Teaching Fellows in 2000 that grew to represent a sizable share of the teacher certification market (Kane et al., 2008b).

[19] Other alternative programs are mostly run by colleges and independent schools districts (see Section 2). These institutions likely had an initial advantage in supplying the market because they could build on existing certification programs.

significant at $p < 0.01$ in our DiD specification, but they are mostly insignificant using permutation inference (column G). Figure 3 shows these results graphically by plotting trends in total EPP completers (Panel A) and alternative EPP completers (Panel B) for Texas and other states. In particular, Panel A shows that the number of EPP completers per capita in Texas was similar to that in other states in 2000, but it grew rapidly during the 2000s and remained roughly 40 percent higher throughout the 2010s. This matches the aggregate trends in initial certifications from Panel B of Figure 1.

Although these results suggest that for-profit EPPs helped to boost the supply of *certified* teachers in Texas, this did not increase the number of *employed* teachers. Panel B of Table 1 shows DiD and synthetic control estimates for the number of full-time teachers and the student/teacher ratio using data from the Common Core data and SASS/NTPS surveys. Estimates for the number of full-time teachers per 10,000 residents are small relative to the pre-policy level of 208.7, and they are not statistically significant in either specification. We also find no effect on the number of full-time teachers per school. If anything, our estimates suggest that the student/teacher ratio *increased* slightly in Texas relative to other states. Panel C of Figure 3 shows that there are no significant deviations between Texas and other states in the number of full-time teachers per capita. Panel D of Figure 3 shows that the student/teacher ratio fell slightly in other states between 2000 and 2018, while there was little change in this aggregate ratio in Texas.[20]

While the growth of for-profits did not impact the quantity of employed teachers, survey data from the SASS/NTPS suggest that for-profits made it significantly easier for Texas schools to fill teaching vacancies. In Panel C of Table 1, our outcome variables are the proportion of schools reporting that it was very difficult or that they were unable to fill vacancies in five teaching areas: elementary, math, English, English as a Second Language (ESL), and special education. In 2000, a large fraction of Texas schools reported difficulty hiring in these areas, especially in math (41 percent), ESL (50 percent), and special education (35 percent). Our DiD estimates in column (D) suggest that the growth of for-profits made it easier for schools to fill vacancies, with sizable and statistically significant coefficients in

[20]The slight relative increase in Texas' student/teacher ratio may be driven by demographic trends that have reduced the average age of the Texas population relative to other states.

all five areas ranging from −3pp to −18pp. (See also Panel E of Figure 3.) Our synthetic control estimates are mostly similar in magnitude (column F), though they are statistically insignificant using permutation inference (column G).

Our finding that for-profits increased the supply of certified teachers but not the number of employed teachers is consistent with anecdotal evidence on how school districts address teaching shortages. A 2004 report by the Texas SBEC states that "very few teaching positions have ever been found to be left unfilled" because "[d]istricts simply cannot and do not leave classes of students without teachers" (Herbert and Ramsay, 2004). Instead, the SBEC report notes that schools use a variety of approaches to fill hard-to-staff positions, including reassigning teachers to subjects in which they have not been trained.[21]

Consistent with this anecdotal evidence, the number of uncertified teachers in Texas ISDs declined substantially as the for-profit presence in the teacher certification market grew. Figure 4 displays estimates of the share of all teachers (Panel A) and first-year teachers (Panel B) who are uncertified in each year. We suspect that some observations are missing from SBEC's certification records for individuals who left teaching before 2011, so Figure 4 provides a range of estimates for the uncertified share using different methods. We think that the true uncertified share is somewhere between the solid red line—which counts individuals as uncertified if they do not appear in *either* the certification or certification exam datasets—and the short-dashed black line—which is an estimated lower bound on the uncertified share based on individuals who were still employed as teachers in 2011 (see the notes to Figure 4 for details).[22] Regardless of the method, we find that the uncertified share declined significantly during the 2000s as the for-profit market presence grew. Most strikingly, the share of first-year teachers who were uncertified dropped from above 30 percent in 2000 to around five

[21] Our results are also consistent with other research that finds that policies that impact teacher supply affect the number of licensed teachers but not student/teacher ratios (e.g., Kraft et al., 2020).

[22] Our conclusion that the true uncertified share is between the solid and short-dashed lines in Figure 4 is corroborated by several other published statistics. A 1999 SBEC report that found that 18 percent of employed teachers in the 1996–1997 academic year did not have the "target teaching certificate" (SBEC, 1999). A report from the Charles A. Dana Center at the University of Texas found that 20 percent of Texas students were in classes with uncertified teachers in the 1996–1997 academic year (*Abilene Reporter-News*, 1999). In the SASS/NTPS survey data, eight percent Texas public school teachers reported that they did not have a state teaching certificate in 2000 (Table 1, Panel D, column C). These statistics are not directly comparable to our estimate of the uncertified share, but each of them falls between the solid and short-dashed lines in Panel A of Figure 4.

percent by 2010, regardless of the method (Panel B). Using SASS/NTPS survey data, we find that the share of teachers who report that they are not currently certified in their state fell by 1–2pp in Texas relative to other states, which is a 12.5–25 percent reduction from the uncertfied share in 2000 (Table 1, Panel D). These long-term trends suggest that the primary benefit of for-profit EPPs may have been to reduce districts' reliance on uncertified teachers, as we investigate further in Section 6.

4.3 Characteristics of new teachers

What types of people were attracted to the teaching profession by the creation of a for-profit certification route? To answer this question, Table 2 displays summary statistics for first-year teachers in Texas public schools during 2012–2019.[23] For reference, column (A) shows averages for all individuals who graduated with a bachelor's degree in 2012–2019 from a Texas university in our data. Column (B) displays statistics for all first-year teachers during these years. Columns (C)–(E) present statistics separately based on individuals' certification route: standard, for-profit, and other alternative programs.

Teachers who attended a for-profit EPP are more likely to be male and non-white than teachers with a standard certification. Panel A of Table 2 shows that 33 percent of first-year teachers for for-profit EPPs were male as compared with 17 percent of teachers from standard EPPs. For-profit-trained teachers were also 8pp less likely to be white (53 percent vs. 61 percent), which is driven by a 12pp higher proportion of teachers who are Black (17 percent vs. 5 percent). Consistent with these descriptive statistics, Panel D of Table 1 shows that the proportion of male teachers increased by 2–4pp in Texas relative to other states in our DiD and synthetic control specifications. These specifications also show that the fraction of teachers who are racial/ethnic minorities increased by 4–5pp in Texas relative to other states.[24]

While for-profit-trained teachers are more racially diverse than standard teachers, indi-

[23]We define first-year teachers as individuals who have zero years of teaching experience and who do not appear in the data as a teacher in any prior year.

[24]Some of the growth of non-white teachers in Texas is likely to be driven by demographic and immigration trends, but Panel D of Table 1 shows that the increase in racial/ethnic minorities in Texas relative to other states was larger in the teaching population than it was in the student population.

viduals from the two certification routes have similar levels of academic achievement. Panel A of Table 2 shows that for-profit-trained teachers scored 0.57 SDs above the mean on 8th grade math exams, and 0.61 SDs above the mean on 8th grade ELA. This is comparable to the average achievement of teachers with standard certificates (column C) and to the achievement of the average college graduate in Texas (column A). Notably, teachers from other alternative programs scored roughly 0.12 SDs higher than for-profit-trained teachers on 8th grade math and ELA exams (column E).

For-profit-trained teachers are also much more diverse than standard teachers in terms of their college majors. Panel B of Table 2 shows that 85 percent of teachers with standard certifications come from two major categories: Interdisciplinary (69 percent) and Humanities (16 percent).[25] By contrast, only 34 percent of for-profit-trained teachers have degrees in these two major categories. Teachers from for-profit EPPs are much more likely to have degrees in Business, Communication, Social Sciences, and STEM, and thus they are more representative of the statewide distribution of college majors.

Lastly, teachers from for-profit EPPs relative to standard teachers are more likely to be employed at middle and high schools, the most difficult to staff grade-levels. Panel C of Table 2 shows that 53 percent of standard teachers teach grades K–5 as compared with 28 percent of for-profit-trained teachers. Teachers from for-profit EPPs are 8pp more likely to teach grades 6–8 and 17pp more likely to teach grades 9–12. For-profit and standard teachers do not differ significantly in the subjects they teach (Panel D of Table 2), with the exception that for-profit-trained teachers are more likely to teach career and technical education classes (7 percent vs. 2 percent).

Notably, our 2012–2019 sample of first-year teachers includes nearly 10,000 individuals without a teaching certificate, and these teachers tend to have significantly lower academic achievement. Column (F) of Table 2 shows statistics for individuals who did not have any teaching certification by November 1st of their first year of teaching. Uncertified teachers are similar to for-profit-trained teachers in terms of demographic and college major composition, but uncertified teachers scored approximately 0.3 SDs lower on eighth grade math and ELA

[25]Both education majors and other majors that lead to teacher certification are often classified as Interdisciplinary by two-digit Classification of Instructional Programs (CIP) codes.

exams (Panel A). Uncertified teachers are also 14pp more likely to be teaching high school than for-profit-trained teachers (Panel C).

Although for-profit and standard teachers had similar levels of average achievement at younger ages, there are significant concerns about the quality of training in for-profit programs. Panel E of Table 1 shows that the fraction of teachers with any student teaching experience declined by 10–12pp in Texas relative to other states, consistent with the limited-training business model of for-profits (first row of Panel E). Yet we find mixed evidence on how the growth of for-profit EPPs impacted the preparation of Texas teachers using self-reported measures from the SASS/NTPS surveys. We find mostly positive effects on five subjective measures of teacher preparation in our DiD specification (column D), but negative impacts in our synthetic control specification (column F). (See also Panel F of Figure 3.) We explore the relationship between certification route and teaching quality more comprehensively in the next section.

5 Teacher quality

5.1 Turnover

Alternative certification routes often target individuals transitioning from other careers, which may attract individuals who are less committed to the profession compared to those who initially chose teaching as a career. To explore this, we examine how turnover rates differ across training pathways. Figure 5 shows the average full-time equivalent for teachers who work in any public school in Texas each year after their first, categorized by certification pathway. A teacher who leaves our sample has a zero for their full-time equivalent in that year and the years following. We use the EPP of their first certification to categorize teachers, and we define the uncertified category as teachers who were not certified in their first year. This restricts movement across EPP types in this figure due to changes in certification status.

In general, we find that standard-trained teachers are more likely than any other type of teacher to be working in a Texas public school through the first five years of their career.

For-profit and other alternatively certified teachers are less likely to stay in the profession, relative to standard-trained, but they are nearly identical to each other. Moreover, certified teachers, regardless of certification pathway, are much more likely to stay in the profession than teachers who were not certified in their first year of teaching. By year five, more than half of certified teachers are still in the classroom but less than 40 percent of not-yet-certified-teachers are. Teachers uncertified in their first year are also less likely to be working full-time.

Figure 5 does not account for differential sorting of teachers across schools and subjects, which could influence turnover rates. To address this, Table 3 presents turnover by certification pathway conditional on several additional variables including teachers' first district and school, the first grade-level and subject they taught, and other demographic variables including race/ethnicity, sex, and their 8th grade test scores when available. School, grade-level, and subject are endogenous choices for teachers that could be related to turnover, so these regressions are descriptive and not causal.

Table 3 shows that while these factors do matter, they explain little of the overall turnover patterns across training type and certification status. The point estimate on the turnover in experience year five for other alternatively-trained and for-profit-trained teachers relative to standard-trained teachers is nearly identical across all empirical models which control for varying factors (10 percentage points lower relative to standard). The difference is slightly more attenuated for specifications with additional controls for teachers who were not certified in their first year. While the type of school and the grade-levels or subjects taught in the first year account for some variation in turnover, teachers who were not certified in their first year still remain significantly more likely to leave by their fifth year compared to certified teachers. Our preferred models (columns D-F) suggest they are about 23-26 percentage points less likely to still be teaching in year five relative to standard-trained teachers.[26] Finally, higher 8th grade standardized test scores are associated with an increased likelihood of leaving the profession, suggesting that individuals with higher ability levels might find outside opportunities more attractive.

[26] We are missing first grade and first subject for many teachers because they may teach multiple grades or subjects. We keep only the ones who have a distinct subject/grade.

5.2 Value-added

To evaluate whether there is a difference in raising student test scores across teachers trained through the different certification pathways, we estimate value-added models. Value-added is a useful method for assessing teacher productivity because it is predictive of student learning and long-run outcomes (Kane and Staiger, 2008; Chetty et al., 2014a,b; Koedel et al., 2015). However, test score value-added does not capture other ways in which teachers influence students, such as through soft skills (Jackson, 2018). Further, value-added cannot be calculated for teachers whose students do not take standardized exams, so our analysis is limited to teachers who teach grades 4-8 math or ELA.

5.2.1 Calculating value-added

Using data on more than 4 million students in grades 3-8 in math and ELA subjects, we link students and teachers via a classroom ID available for academic years 2012-2019. To obtain an estimate of the differences between certification pathways on student achievement, we estimate the following equation separately for each subject sub (math or ELA):

$$A^{sub}_{ijkgst} = \alpha_1 A^{sub}_{it-1} + \alpha_2 A^{-sub}_{it-1} + \gamma X_{it} + \lambda C_{kgst} + \nu_{gt} + \zeta S_{st} + \text{CertType}_{jt} + \epsilon_{ikgst} \tag{2}$$

where A^{sub}_{ijkgst} is student i's standardized math or ELA score in year t, grade g, classroom k, and taught by teacher j in school s. Student i's A^{sub}_{it-1} and A^{-sub}_{it-1} represent lagged standardized math and ELA scores and their squares and cubes, and X_{it} are student characteristics (economic disadvantage, ethnicity/race, sex, whether they are in special education, whether they are at risk, and whether they are gifted).[27] Classroom characteristics, C_{kgst}, and school characteristics, S_{st}, include the mean individual characteristics, mean lagged standardized test scores in math and ELA and their squares and cubes for all students in classroom k and school s, respectively. We interact all student, class, and school-level controls with grade-level to allow for differences in effect across grades (Chetty et al., 2014a). To control for grade-year specific factors affecting all students, we include ν_{gt}. The dummies for certification

[27] We also include fixed-effects for student population type defined at the classroom-level interacted with grade.

type, CertType$_{jt}$, estimate student achievement gains relative to standard-trained teachers. Specifically we include dummies for whether a person is first certified through a for-profit, other alternative, out-of-state, or was not certified in the current year t. Certification status can change over time for some teachers. In some models we explore alternative controls such as grade-school-year FEs or additionally control for experience-level of the teacher in a given year (Kane et al., 2008b). Finally, we cluster standard errors at the school-level.

To get teacher-year estimates of value-added, we make slight modifications. First we estimate equation 2 but replace CertType$_{jt}$ dummies with a fixed effect at the teacher-level, μ_j. Then we perform the following separately for each subject:

1. Obtain residuals by taking the difference between the student test score and the estimates from the previous regression with all controls except the teacher dummy:
   $a_{it} = A_{it} - [\hat{\alpha}_1 A^{sub}_{it-1} + \hat{\alpha}_2 A^{-sub}_{it-1} + \hat{\gamma} X_{it} + \hat{\lambda} C_{kgst} + \nu_{gt} + \hat{\zeta} S_{st}]$

2. Then average the residuals among teacher j's students at the teacher-year:
   $\bar{A}_{jt} = \text{Mean}[a_{it} | i \in \{i : j(i,t) = j\}]$

$\bar{A}_{jt}$ is our estimate of teacher-year value-added. It is essentially the classroom-year residual where $\hat{\beta}$ is estimated using within teacher variation. This follows Chetty et al. (2014a) by accounting for non-random sorting of students across teachers and its effect on the estimation of student, class, and school characteristics. We differ from Chetty et al. (2014a) by not completing their final step which calculates each $\bar{A}_{jt}$ as a function of other years' estimates (drift). We deviate because we prefer to have an estimate for teachers with only one year of teaching, which is not possible in their method. In practice, the estimates on value-added between the two approaches are highly correlated. See Table A6 for summary statistics.

5.2.2 Value-added findings

Descriptively, we find that math value-added for for-profit-trained teachers is lower than standard- or other alternatively-trained teachers. We additionally find that teachers not certified in their first year have substantially lower math value-added than certified teachers. Figure 6 presents the average student test score residuals per teacher for each year of experience by training pathway for both math and ELA subjects. Figure 6 demonstrates that teachers generally improve student test scores with experience, and this improvement is significant in the initial years. This pattern is identical across all training pathways, indicating substantial on-the-job learning for all teachers and is consistent with previous research (Wiswall, 2013; Papay and Kraft, 2015). Overall, alternatively-certified teachers and teachers not certified in their first year have approximately similar ELA value-added, but all have lower ELA value-added than standard-trained teachers.

To formalize the differences across teacher types, we estimate value-added regressions including training pathway dummies in our student-level regressions, as detailed in Section 5.2.1. Our preferred estimates in Table 4 do *not* control for experience level, though we present the same regressions controlling additionally for fully saturated experience levels in Appendix Table A7. Because experience is a strong predictor of value-added, leaving it out will downward bias training pathways which have higher levels of turnover, like for-profit-trained teachers. However, we think this is the relevant comparison. For example, hiring a for-profit teacher may lead to lower value-added relative to hiring a standard-trained teacher in the long-term given that the former is less likely to accumulate experience due to higher turnover rates.

Table 4 reveals three key findings. First, for-profit and uncertified teachers tend to work with students who show less potential for significant test score gains in either subject, as depicted in column A of Table 4, which does not control for lagged student achievement or other classroom or school-level characteristics. Controlling for the non-random sorting of teachers across students significantly lowers this differential, but there is still a small and statistically significant difference between for-profit-trained teachers relative to standard-trained teachers in both subjects. In our preferred models (column C-E), a student assigned to a for-profit-trained teacher learns about 0.02-0.03 standard deviations less in math compared to a student with a standard-trained teacher. By comparison, this student would learn about 0.06-0.1 standard deviations less in math with an uncertified teacher. This differential is smaller for ELA. A student assigned to a for-profit teacher learns 0.01 less compared to a standard-trained teacher while a student with an uncertified teacher learns 0.02-0.03 less.

How much of this is due to differences in experience? Controlling for experience-level erases some of the differences between training-pathways for math teachers and effectively eliminates the difference for ELA. For math value-added, controlling for experience cuts the difference between for-profit-trained teachers and standard-trained teachers by half - see Table A7. This is similarly true for uncertified teachers relative to standard-trained teachers.

While there are statistically significant differences between teachers from different certification routes, these magnitudes are small in comparison to the difference in teaching effectiveness within groups. The overall standard deviation of teacher-year math value-added is 0.27, which is nearly ten times the difference in the average for-profit-trained relative to the standard-trained teacher. We take this to mean that the approximate training differences across training programs, or lack thereof in the case of uncertified teachers, does not lead to appreciable differences in teaching effectiveness.[28]

Overall, we have potential benefits in terms of supply, and small potential downsides in terms of quality. In the next section, we estimate the net impacts on student achievement.

6 Student impacts

6.1 Empirical strategy

Our analysis of net impacts exploits two sources of variation in schools' exposure to for-profit EPPs. Our first source of variation is the timing and geographic concentration of for-profit openings. For-profit EPPs opened during 2001–2011 and were mostly located in large cities and in the Rio Grande Valley (see Appendix Table A1). Although most for-profits offered online training, the physical location of their headquarters nonetheless mattered for the enrollees they attracted due to advertising and some in-person training requirements.[29] This geographic concentration meant that school districts that were close to a for-profit EPP's headquarters were likely to have a larger pool of for-profit program completers to consider for teaching positions. We define a binary treatment variable that equals one for years in or

[28]This is consistent with previous literature which finds there is more heterogeneity within training backgrounds than across, for example Kane et al. (2008b).

[29]For example, many for-profit EPPs send employees to observe and provide feedback to the candidate during their first year of teaching.

after any for-profit EPP opened in a school district's county.[30] Appendix Table A8 shows that 12 counties had an initial for-profit opening between 2001 and 2009. The remaining 242 Texas counties serve as our control group of "never treated" counties.

Our second source of variation is the greater concentration of for-profit-trained teachers at higher grade levels. Appendix Table A9 shows that for-profit-trained teachers were disproportionately likely to earn certificates that allowed them to teach middle or high school. For example, the for-profit share of all initial certifications in 2010–2019 was 29 percent for grades K–5, 38 percent for grades 6–8, and 44 percent for grades 9–12. This allows us to compare lower and upper grade levels as an additional source of variation in for-profit exposure. As we show below, for-profits tended to open in areas with high population growth rates, and so within-district variation in for-profit exposure helps to alleviate concerns about differential county trends.

We use these two sources of variation in DiD and triple-differences (DDD) specifications:

$$Y_{dtgp} = \gamma_{dgp} + \gamma_{tgp} + \beta \mathrm{FP}_{c(d)t} + \epsilon_{dtgp} \tag{3}$$

$$Y_{dtgp} = \gamma_{dgp} + \gamma_{tgp} + \beta^E \mathrm{FP}_{c(d)t} + \theta[\mathrm{FP}_{c(d)t} \times \mathrm{Middle}_g] + \epsilon_{dtgp}. \tag{4}$$

In these regressions, Y_{dtgp} is an average or total outcome for school district d, year t, grade level g, and pairwise group p (discussed below). Our sample includes outcomes measured from 1996–2019 at districts that operated continuously over this entire period. We focus on elementary and middle school grades because our main outcome—student test scores—is measured consistently over this period only for grades 3–8.[31]

Equation (3) is our DiD specification that exploits only variation in the timing and geographic concentration of for-profit openings. This specification includes fixed effects for

[30] We use a binary county measure of for-profit exposure to simplify our analysis of pre-trends and to make it easier to interpret our regression estimates. Appendix Tables A10 and A11 show that our main results are similar using binary treatment measures based on distance to a for-profit EPP (rather than county). These tables show that our results are also similar if we exclude counties that border a county with a for-profit opening.

[31] Specifically, our sample includes teachers instructing grades K–8 (Table 5), but it only includes grade 3–8 for student achievement outcomes (Table 6). We include grades K–2 in our teacher regressions because we cannot always identify a teacher's exact grade in the early years of TEA data (although we can distinguish between elementary or middle school teachers). Texas also administered high school math and English exams during 1995–2019, but these were end-of-course exams in some years and end-of-grade exams in other years. Thus the test-taking populations and exam content are not consistent over our sample period.

district × grade level × pairwise group triplets (γ_{dgp}) and year × grade level × pairwise group triplets (γ_{tgp}). The variable of interest, $\text{FP}_{c(d)t}$, is a binary indicator for years t in or after any for-profit EPP opened in a school district's county $c(d)$. The DiD coefficient, β, indicates how educational outcomes changed in counties where a for-profit EPP opened relative to other counties. We separately estimate this equation for elementary, middle school, and both combined.

Our DDD specification, equation (4), additionally uses variation in for-profit exposure across grade levels. This specification is similar to equation (3), except we also include the interaction between $\text{FP}_{c(d)t}$ and an indicator for middle school grades (6–8), Middle_g. In equation (4), the β^E coefficient is identical to the DiD coefficient β that we get when we estimate equation (3) in a sample that includes only elementary school grades (K–5). The DDD coefficient from equation (4), θ, is equal to the *difference* between the DiD coefficients for middle and elementary school. We cluster standard errors at the county-level in both specifications.

The pairwise groups p in equations (3) and (4) address potential concerns about treatment effect heterogeneity in two-way fixed effects models (De Chaisemartin and d'Haultfoeuille, 2020). Each of our pairwise groups p contains a set of "treated" counties that experienced an initial for-profit opening in the same year and a set of "never treated" counties that did not have any for-profit opening.[32] We stack our dataset so that it contains all pairwise combinations of treated and never treated counties, and then interact our district × grade level (dg) and year × grade level (tg) fixed effects with dummies for these pairwise groups p. The resulting β and θ coefficients are regression-weighted averages of the pairwise treatment effects.[33] Appendix Tables A10 and A11 show that our stacked estimates from equations (3) and (4) are similar to those using a simple two-way fixed effects model, primarily because we have a large number of never treated counties.

Our identification strategy relies on the usual DiD assumption of parallel trends. For

[32]For example, one of our pairwise groups contains Tarrant and Hidalgo Counties, which experienced a for-profit opening in 2001 (Appendix Table A8), and the full set of 242 never treated counties.

[33]Equations (3) and (4) are consistent with Callaway and Sant'Anna (2021) in that they implicitly estimate treatment effects separately for each set of treated counties (using never treated counties as the control group) and then average these treatment effects to recover a single point estimate. The only difference between our approach and that in Callaway and Sant'Anna (2021) is that our pairwise treatment effects are averaged using regression weights because we estimate everything in a single regression.

our DiD coefficients, β, the parallel trends assumption requires that outcomes would have trended similarly in counties with and without for-profits in the absence of for-profit openings. For our DDD coefficients, θ, the key assumption is that the *difference* between middle and elementary school outcomes would have trended similarly across counties in the absence of for-profit openings. We present event study estimates for our β and θ coefficients to shed light on the plausibility of these assumptions.[34]

6.2 Effects on teacher composition

We begin our analysis of net impacts by showing that our DiD and DDD specifications capture variation in school districts' employment of for-profit-trained teachers, as intended. In the first row of Panel A of Table 5, the outcome variable is the fraction of all teachers who earned their initial certificate from a for-profit EPP. Column (A) of Table 5 shows the mean of this dependent variable in 1995–2000 (zero, by construction). Columns (B)–(D) show DiD coefficients β from equation (3) estimated separately for all grades (K–8), elementary school (grades K–5) and middle school (grades 6–8). Column (E) shows the DDD coefficient θ from equation (4), which is equal to the difference between the coefficients in columns (D) and (C). Across all grades, we find that the proportion of for-profit-trained teachers increased 4.1pp more in counties with a for-profit opening than in other counties. This increase was 5.8pp for middle school teachers as compared with 3.3pp for elementary teachers, and thus our DDD estimate is 2.5pp. Panel A of Figure 7 presents event study estimates of the β coefficients for elementary and middle schools, and Panel A of Figure 8 displays event study estimates for the θ coefficient. These figures show that the proportion of for-profit-trained

[34]Our event study specifications are:

$$Y_{dtgp} = \gamma_{dgp} + \gamma_{tgp} + \sum_{\tau=-13}^{18} \beta_\tau \mathbb{1}\{t - t^*_{c(d)} = \tau\} + \epsilon_{dtgp} \tag{5}$$

$$Y_{dtgp} = \gamma_{dgp} + \gamma_{tgp} + \sum_{\tau=-13}^{18} \beta^E_\tau \mathbb{1}\{t - t^*_{c(d)} = \tau\} + \sum_{\tau=-13}^{18} \theta_\tau [\mathbb{1}\{t - t^*_{c(d)} = \tau\} \times \text{Middle}_g] + \epsilon_{dtgp}, \tag{6}$$

where $t^*_{c(d)}$ denotes the first year that a for-profit EPP opened in county $c(d)$, and τ indicates years relative to the initial for-profit opening. We include dummies for all possible years τ except $\tau = -1$, but we restrict our graphs to $-8 \leq \tau \leq 15$ because estimates the composition of treatment counties changes significantly outside this range. Figures 7 and 9 display estimates of β_τ from equation (5) estimated separately for elementary and middle school. Figures 8 and 10 display estimates of θ_τ from equation (6).

teachers increased sharply at nearby school districts following a for-profit opening, but the increase was larger for middle schools.

For-profit EPPs reduced the share of teachers from other certification routes and the share of uncertified teachers. In Panel A of Table 5, our DDD specification shows that the increase in the for-profit share of employed teachers (2.5pp) came from a decline in the fraction of teachers from standard (−0.7pp) and other alternative programs (−1.0pp) as well as a decline in the fraction of teachers without certification (−1.2pp).[35] For-profit EPPs also improved the alignment between teachers' certificates and teaching assignments. In the last row of Panel A, we restrict the sample to certified teachers, and the outcome variable is an indicator for certificates that match both the grade and the subject (math or English) that the individual is teaching. Exposure to for-profit EPPs increased the share of appropriately-certified teachers by 1.6pp in grades K–5 and 3.7pp in grades 6–8, and our DDD estimate (2.0pp) is positive and significant at $p < 0.01$. Panel B of Figures 7 and 8 show that the timing of the increase in appropriate certification aligns with the timing of for-profit openings.

We do not find that for-profit EPPs increased the number of employed teachers. Panel B of Table 5 shows DiD and DDD estimates for the log number of teachers and the aggregate student/teacher ratio in each district × grade group. The β coefficients for the log number of teachers are positive and significant, but this appears to be the continuation of a pre-trend, which likely reflects for-profits choice to open in growing areas (see Panel C of Figure 7). The difference between the middle and elementary school coefficients for log number of teachers is close to zero and statistically insignificant (column E). We find a positive and significant DDD coefficient for the student/teacher ratio, but this also appears to be driven by pre-trends (see Panel D of Figure 8). These null effects on the number of employed teachers are consistent with our anecdotal and empirical evidence from Section 4. Consistent with the fact that for-profit EPPs attract a higher share of Black teaching candidates (Table 2), we find the the share of Black teachers increased 1.9pp more in middle schools than in

[35] Appendix Table A12 shows that our estimates for teachers without certification are robust to using our other measures of the uncertified share, as in Figure 4. This table also shows that our estimates for the for-profit, standard, and other alternative shares are similar if we restrict the sample to teachers who appear in the TEA certification data.

elementary schools following a for-profit opening (Panel C of Table 5), although this may also reflect differential pre-trends (Panel E of Figure 8).

Lastly, we find that exposure to for-profit EPPs reduced the average experience of teachers in nearby school districts. In Panel D of Table 5, our outcome variables include the proportion of teachers who are in their first year, years of teaching experience, and years of tenure at the school. In each case, our DDD estimates in column (E) show that the average level of teaching experience decreased more in middle schools than in elementary schools. For example, we find that average experience did not change significantly between treated and control counties among elementary teachers ($\beta = -0.09$), but it declined by -0.5 years more in treated counties than in control counties among middle school teachers. (See also Panel F in Figures 7 and 8.) These findings are consistent with the fact that for-profit-trained teachers have higher turnover rates (Section 5.1). Given their lower experience, our DDD estimate suggests that average annual salaries declined by -287 dollars more in middle schools than in elementary schools.[36]

6.3 Effects on student achievement

Finally, we explore how for-profit EPPs impacted student achievement on net. Panel A of Table 6 shows that the demographic characteristics of students who took grade 3–8 math and ELA tests are relatively balanced in our DiD and DDD specifications. Similar to our findings on the number of teachers (Panel B of Table 5), we find large positive DiD estimates for the log number of exam takers (columns B–D), suggesting that for-profits entered growing markets. Our DDD estimate for the log number of exam takers is also positive and significant, but the magnitude is relatively small at 1.4pp (column E). (See also Panel A of Figures 9 and 10.) The DiD and DDD coefficients are mostly insignificant using students' gender, race, socioeconomic status, and academic level as outcome variables. We find a small increase in the fraction of students who are economically disadvantaged in our DDD specification (1.0pp), but a small decrease in the fraction of students who are classified as being at risk of dropping out (-1.4pp). In the last two rows of Panel A, our dependent variables are indices that combine all demographic characteristics based on their predicted math and ELA scores.

[36]In Panel D of Table 5 (B)–(D) of Table

We do not find significant effects on these demographic indices in any specification, and our DDD event study shows no evidence of divergent trends between middle and elementary students (Panel B of Figure 10.)

Our main finding is that exposure to for-profit EPPs led to neither a significant increase nor a significant decrease in student achievement. Panel B of Table 6 shows impacts of for-profit EPP openings on grade 3–8 test scores in math and ELA, which we normalize to mean zero and standard deviation one for each grade and exam year. Our dependent variables also include residuals from a regression of these test scores on a large vector of individual-, grade-, and school-level controls that mirror our teacher value-added regressions (Section 5.2).[37] We find some evidence of *positive* impacts of for-profit exposure on math and ELA achievement; for example, column (B) shows that math scores increased by 0.065 SDs in counties with for-profit openings relative to other counties. But these impacts are significantly smaller using test score residuals as the outcome variable, and the effects are similar for elementary and middle school students. In our preferred DDD specification (column E), we find small and statistically insignificant effects of for-profit exposure on student achievement. Our event study graphs in Panels C–F of Figure 9 and 10 also show that for-profit openings did not have a significant impact on student test scores.

We do not find clear evidence of heterogeneous impacts on student achievement. Appendix Tables A13 and A14 present DiD and DDD coefficients for math and ELA test scores computed separately for subsamples defined by student demographics and school district characteristics. In our DiD specifications, we find that the effects of for-profit exposure on test scores were more positive for economically disadvantaged students and for students from lower-performing school districts. But these findings are not robust to our DDD specification, and so we prefer not to draw a strong conclusion from them.

Cross-state regressions using NAEP scores also suggest that for-profits EPPs did not have negative impacts on student achievement. In Appendix Table A15, we compare changes in NAEP scores between Texas and other states using our cross-state DiD specification (1).

[37] Specifically, the dependent variables in the second and fourth rows of Table 6 are residuals from regressing math/ELA scores on a vector of individual demographics and lagged test scores, plus means of these variables at the school and school $\times$ grade level. This is identical to our specification for teacher value-added except for the use of school $\times$ grade controls rather than classroom controls. Our data do not include classroom indicators prior to 2012.

These DiD estimates are unlikely to be solely driven by the growth of for-profit EPPs because there are many factors that could have altered the achievement of Texas students over this long time period (e.g., demographic changes). Thus we also show DDD estimates that combine this cross-state variation with changes in performance between 8th and 4th grade NAEP scores. In our DDD specification, we find that the difference between 8th and 4th grade NAEP math scores in Texas *increased* by 0.1–0.2 SDs relative to other states between 1990 to 2019. The math score effect is significant at $p < 0.01$ using a DDD specification with standard errors clustered at the state-level, but it is insignificant using synthetic control with permutation inference. We find small and insignificant effects on NAEP reading scores. While somewhat inconclusive, we find no evidence that the growth of for-profit EPPs significantly reduced the achievement of Texas students relative to students in other states.

The null impacts on student achievement are consistent with offsetting influences of the supply and quality effects documented in Sections 4 and 5. In particular, our findings suggest that for-profit EPPs reduced school districts' reliance on uncertified teachers (Panel A of Table 5) who tend to have lower value-added (Table 4) and higher turnover rates (Table 3). Yet for-profit-trained teachers also have somewhat lower value-added and higher turnover than teachers who were certified through other routes, and our analysis of net impacts found that for-profits reduced average teacher experience in nearby school districts (Panel D of Table 5). To quantify the potential impacts of these supply and quality effects, we perform a back-of-the-envelope calculation that combines the value-added estimates from Table 4 with the aggregate changes in the shares of teachers by certification route from Figure 1 and the uncertified share from Figure 4.[38] These back-of-the-envelope estimates suggest the growth of for-profit EPPs would predict a -0.0006 to 0.0145 SD difference in student achievement for

[38] We take the share of teachers for each certification route, including uncertified, in 2012-2019 and subtract the share of each category from 1995-2000 period to get a change in the distribution of certifications over time. This implicitly assumes the change in prevalence of certification pathways over the two time periods is due only to for-profit openings. We take the change in the share for uncertified, other alternative and for-profit and multiply it by their respective VA estimates in Column C of Table 4. Then we add them together for an overall change in value-added scores. For 1995-2000 distribution share, we first choose a representative uncertified (Figure 4) and then base the remaining teaching distribution on initial certification route shares as in Figure 1. For example, using our lower bound estimate of uncertified, we estimate uncertified total to be approximately 4 percent in 1995-2000. The the remaining 96 percent is allocated based on the shares of initial certifications for standard (61%*96 = 59%) and other alternative (39%*96 = 37%) from the same period.

math and a 0.0004 to 0.0050 SD different for ELA, depending on which estimate we use for the uncertified share. This small change in expected student outcomes confirms our triple differences estimates which find no significant effects on student achievement.

7 Discussion and conclusion

The introduction of for-profit EPPs positively impacted the labor market for prospective teachers, especially for career switchers. In Table A4, we show that the length of time between enrolling in an EPP to instructor of record is nearly a third of the time for for-profit and other alternative EPPs than it is for standard EPPs. This lowers the opportunity cost to become a teacher in terms of time and potential lost earnings. Moreover, alternative EPPs have a paid internship instead of unpaid student teaching required in standard EPPs. For career switchers, this further reduces the amount of time prospective teachers spend without earning income.[39] Potentially due to competition from for-profit EPPs, other alternative programs look similar to for-profit EPPs today and costs have declined in real terms for both - see Figure 2 and Appendix Table A2.[40] Additionally, for-profit EPPs attracted a more diverse group of candidates, which could also have broader positive impacts on students.

Not only was the introduction of for-profit EPPs beneficial for prospective teachers, but for-profit EPP openings alleviated supply constraints for school districts. The introduction of for-profits increased the number of certifications in Texas by about 40 percent and reduced school districts' reliance on uncertified teachers. We also found evidence that this led to better certification alignment whereby teachers were more likely to teach in subjects and grades in which they had appropriate training.

While these benefits to the supply of teachers had the potential for improving student outcomes, we find that for-profit-trained teachers had higher attrition rates and lower value-added scores relative to standard-trained teachers, suggesting that they might actually hurt

[39]For prospective teachers going through standard routes this may be less relevant because they are earning their bachelor's degree *while* completing their student EPP training.

[40]The tuition costs for career switchers are potentially cheaper among alternative programs than taking several credit hours at a college, and alternative EPPs reduce the need for credit (student loans). Completing just the education coursework portion of a bachelor's at Texas State University would be 78 credit hours for a total cost of $30,550 (University, 2024b,a).

student achievement. Further, for-profits diverted funding from public sources that could have supported beneficial initiatives like pedagogical research, a potential disadvantage for the state.

However, the difference in value-added test scores between standard-trained and alternative-trained teachers was minimal, and uncertified teachers were of lower quality than those trained through alternative pathways. Importantly, all certified teachers must pass licensing exams, which may prevent lower-quality candidates from entering the profession. Back-of-the-envelope and triple differences estimates both find essentially no effect on student achievement.

In all, there were benefits to prospective teachers in terms of easier access to the teaching profession. The positive supply outcomes were potentially offset by small differences in quality across teachers, resulting in little meaningful change for Texas students. While there are some potential drawbacks to the state, including lost revenue, the overall impact seems to have been positive.

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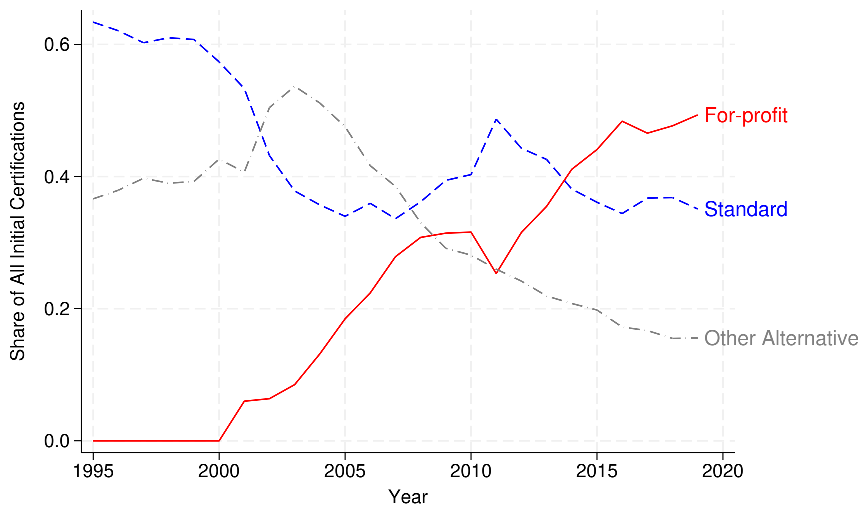
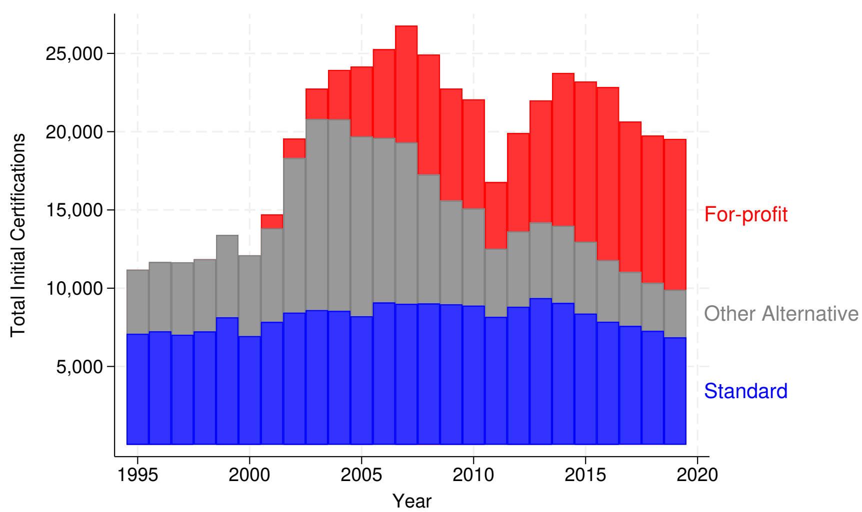
8 Figures



Panel A. Share of all initial teacher certifications



Panel B. Total initial teacher certifications

Figure 1: Growth of for-profit Educator Preparation Programs (EPPs)

Notes: Panel A shows the share of all initial teacher certifications by year and certification route. Panel B shows the total number of initial certifications by year and certification route. Data: SBEC.

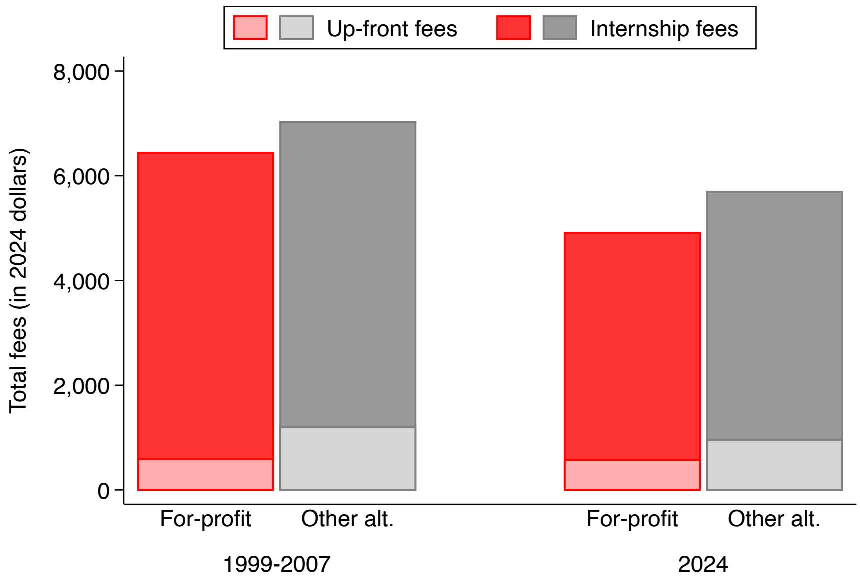
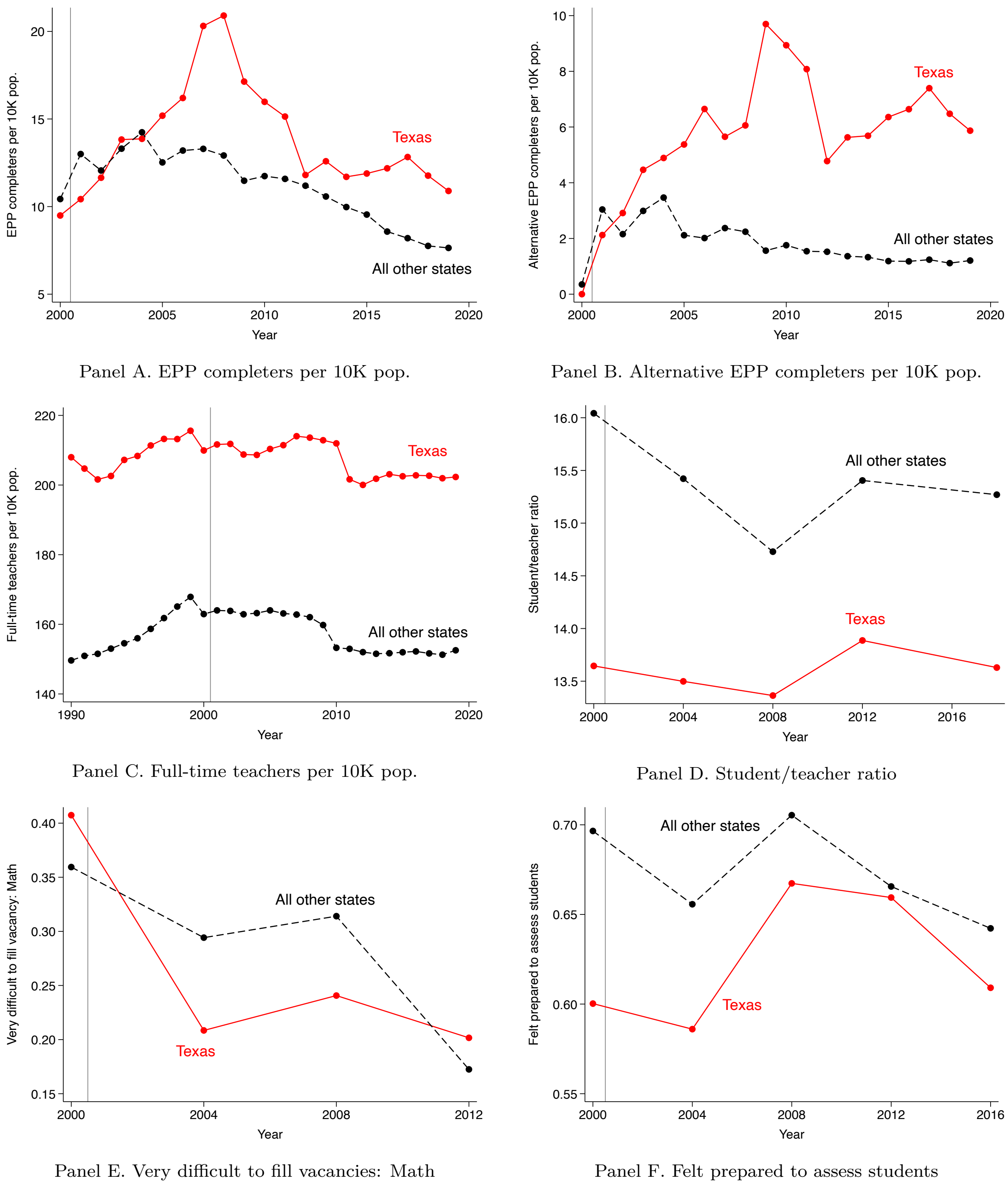


Figure 2: Pricing of for-profit and other alternative EPPs — Early 2000s vs. 2024

Notes: This figure displays average prices charged by for-profit and other alternative EPPs. The sample of for-profit companies includes the two largest EPPs (iteachTexas and A+ Texas Teachers) and the two earliest EPPs (ACT-Rio Grande Valley and Education Career Alternatives Porgram). The sample of other alternative programs includes the two largest EPPs operated by independent school districts (Dallas ISD and Houston ISD) and all EPPs run by Education Service Centers for which we could find historical information. These EPPs collectively represent the large majority of the alternative teacher certification market. The leftmost bars display pricing data obtained from historical versions of each EPP's website using archive.org; we use data from the earliest version of each website that we could find, which range from 1999–2007. The rightmost bars display information from each EPP's website obtained in October 2024. Light-shaded bars indicate up-front program fees, which typically include application fees and training fees. Dark-shaded bars include fees due during the internship period, which are typically paid out of the candidate's teaching paycheck. We convert 1999-2007 prices to 2024 dollars. See Appendix Table A2 for details on the data and sources.



Panel A. EPP completers per 10K pop.

Panel B. Alternative EPP completers per 10K pop.

Panel C. Full-time teachers per 10K pop.

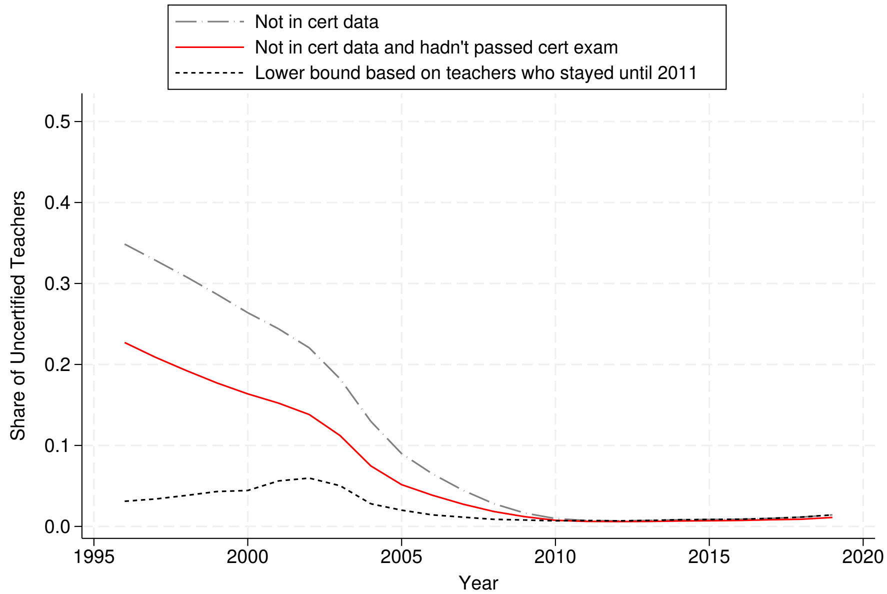
Panel D. Student/teacher ratio

Panel E. Very difficult to fill vacancies: Math

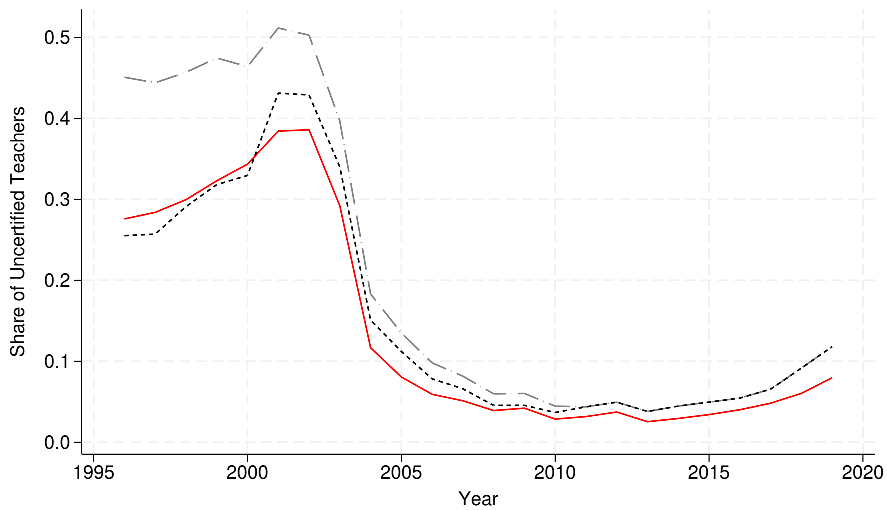
Panel F. Felt prepared to assess students

Figure 3: Changes in teacher supply — Texas vs. other states

Notes: This figure plots raw data for each outcome in Texas and all other states. The horizontal line represents the year in which Texas first allowed for-profits to operate (2001). Data: Title II, Common Core, and SASS/NTPS.



Panel A. All teachers



Panel B. First-year teachers

Figure 4: Estimates of the share of teachers who are uncertified

Notes: This figure plots estimates of the share of all teachers (Panel A) and first-year teachers (Panel B) who are uncertified in each year. We suspect that some observations are missing from SBEC's certification records for individuals who left teaching before 2011, and so we provide estimates of the uncertified share using several different methods. The long-dashed grey line shows the share of teachers who do not appear with a certificate in the teacher certification data. The solid red line shows the share of teachers who do not appear in the certification data with a certificate and who also do not appear in the certification exam data with any passed exam. The short-dashed black line displays an estimated lower bound on the uncertified share. To compute this lower bound, we compute the share of teachers who do not appear in the certification data separately for each year × experience level using only individuals who were still employed as teachers in 2011. We then assume that all teachers with a given year × experience level have the same uncertified share as those who were still employed in 2011. We compute the lower bound by averaging over these imputed values for each year prior to 2011; after 2011 we simply use the actual share of teachers who do not appear in the certification data. In all cases, we define uncertified as not meeting our criteria (having a certificate or passing a certification exam) by November 1st of the year in which the individual is teaching. Data: TEA and SBEC.

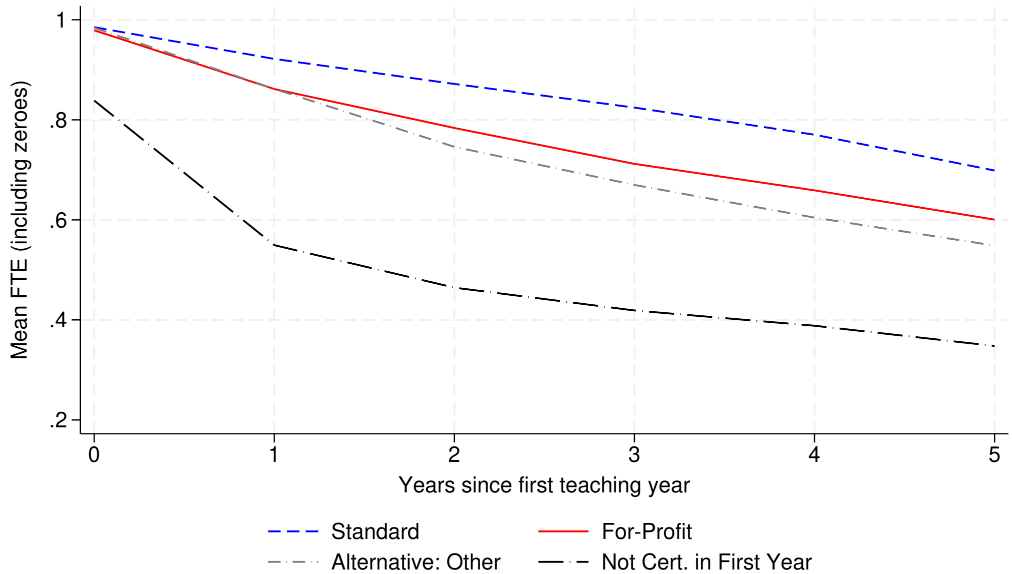
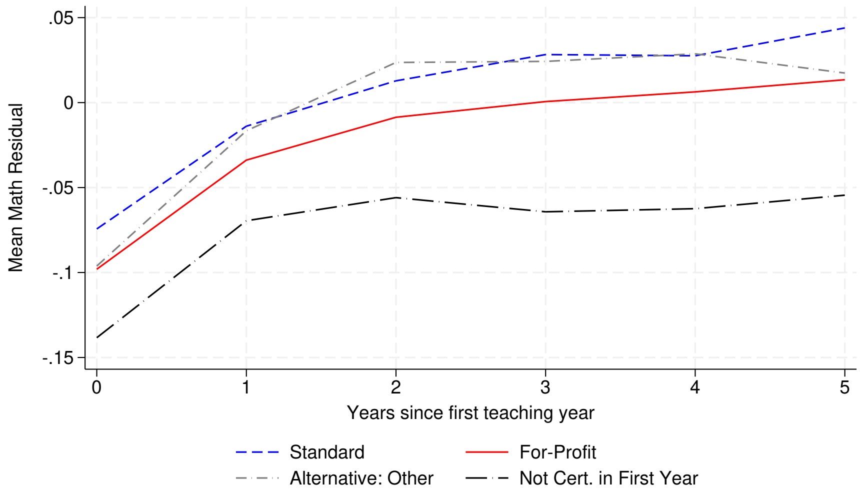
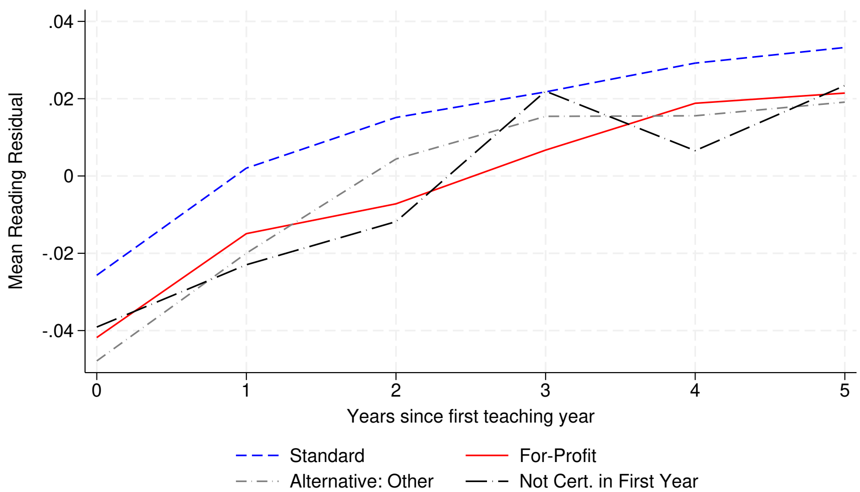


Figure 5: Teacher Turnover by Experience and Certification Route

Notes: The y-axis is the mean FTE for teachers in each category. We include only teachers who started in the 2012-2019 academic years. When a teacher leaves the dataset, we assign them a FTE equal to zero for that and all following experience years. See Figure A1 for the person-level (not FTE) version of this figure. Data: TEA and SBEC.



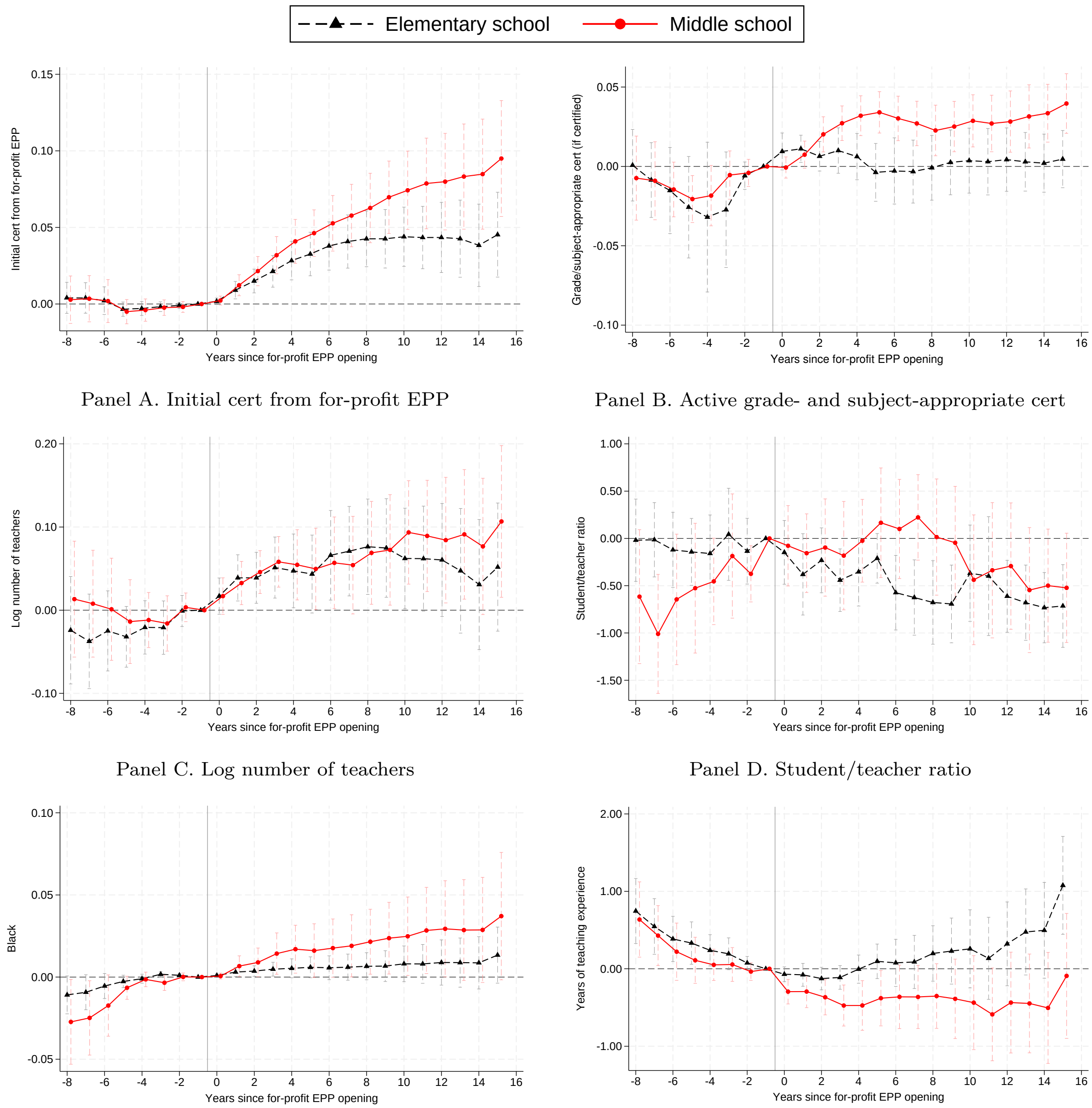
Panel A. Math VA



Panel B. ELA VA

Figure 6: Value-Added by Experience and Certification Route

Notes: The y-axis is the mean teacher-year value-added, calculated as described in Section 5.2.1, for teachers with a given experience-level. We include only teachers who started in the 2012-2019 academic years. See Figure A3 for the histogram of all value-added estimates. See Figure A2 for value-added calculated as in (Chetty et al., 2014a). Data: TEA and SBEC.



Panel A. Initial cert from for-profit EPP

Panel B. Active grade- and subject-appropriate cert

Panel C. Log number of teachers

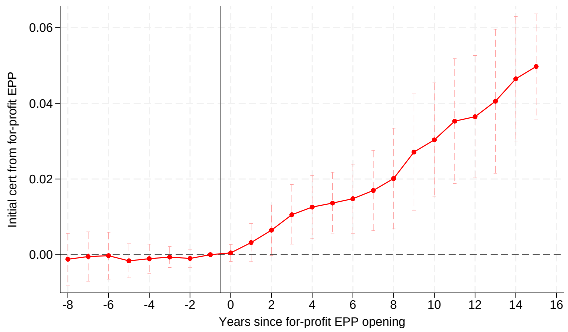
Panel D. Student/teacher ratio

Panel E. Black

Panel F. Years of teaching experience

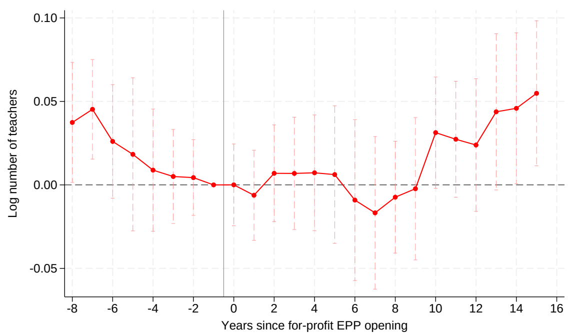
Figure 7: DiD event studies — Teacher composition

Notes: This figure plots DiD event study coefficients β_τ from equation (5) estimated separately for elementary school (grades K–5, black dashed line) and middle school (grades 6–8, red solid line). Horizontal dashed lines are 95 percent confidence intervals using standard errors clustered at the county-level. Data: TEA and SBEC.



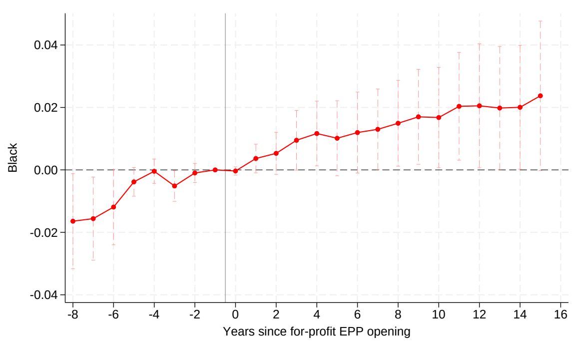
Panel A. Initial cert from for-profit EPP

Panel B. Active grade- and subject-appropriate cert



Panel C. Log number of teachers

Panel D. Student/teacher ratio

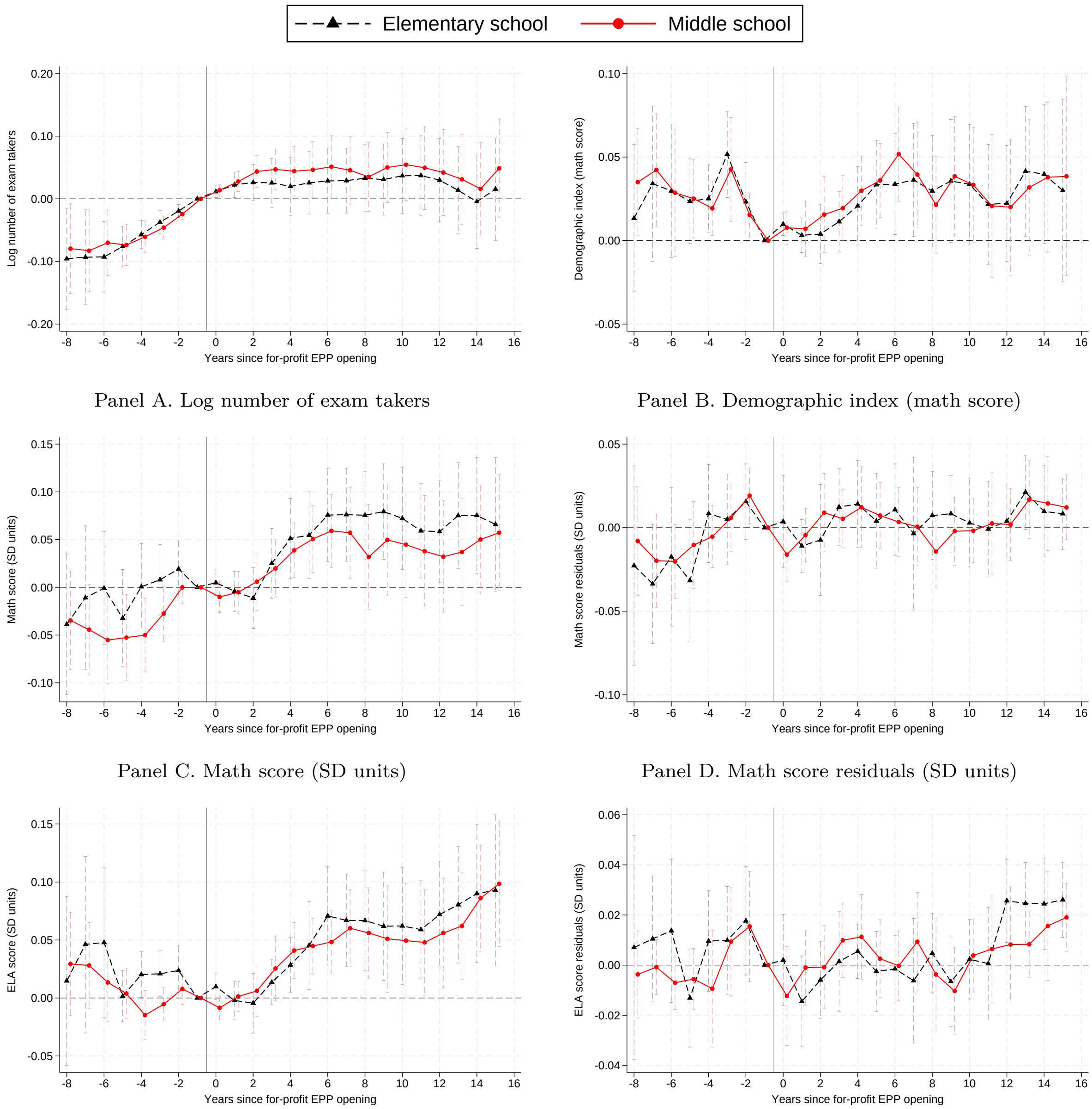


Panel E. Black

Panel F. Years of teaching experience

Figure 8: DDD event studies — Teacher composition

Notes: This figure plots DDD event study coefficients θ_τ from equation (6). Horizontal dashed lines are 95 percent confidence intervals using standard errors clustered at the county-level. Data: TEA and SBEC.



Panel A. Log number of exam takers

Panel B. Demographic index (math score)

Panel C. Math score (SD units)

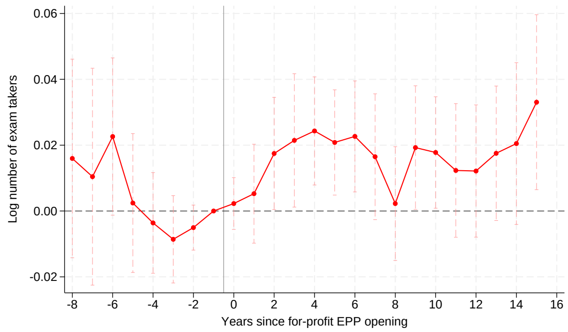
Panel D. Math score residuals (SD units)

Panel E. ELA score (SD units)

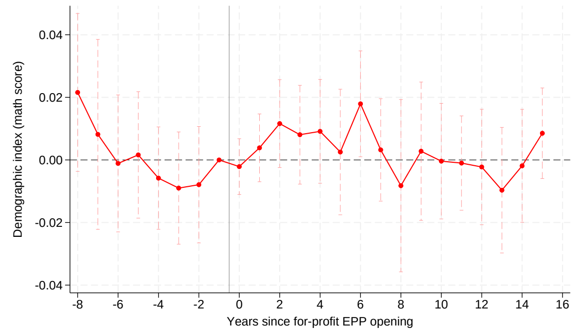
Panel F. ELA score residuals (SD units)

Figure 9: DiD event studies — Student achievement

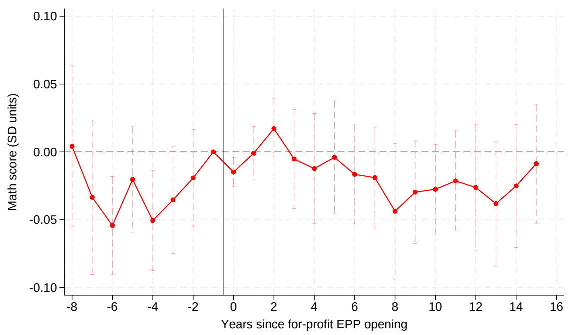
Notes: This figure plots DiD event study coefficients β_τ from equation (5) estimated separately for elementary school (grades 3–5, black dashed line) and middle school (grades 6–8, red solid line). Horizontal dashed lines are 95 percent confidence intervals using standard errors clustered at the county-level. Data: TEA and SBEC.



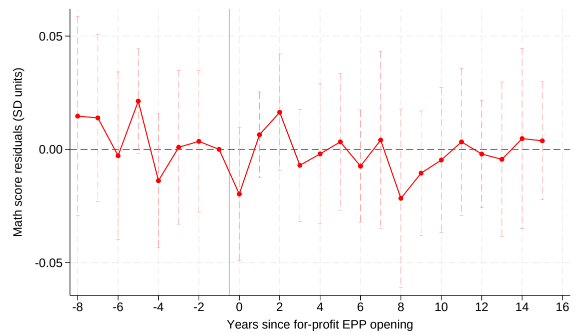
Panel A. Log number of exam takers



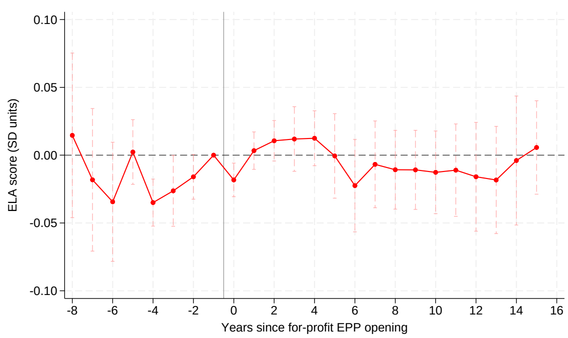
Panel B. Demographic index (math score)



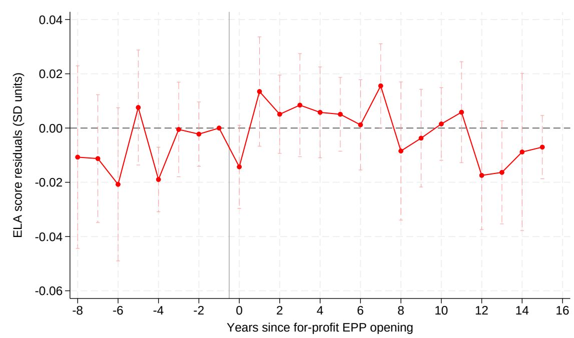
Panel C. Math score (SD units)



Panel D. Math score residuals (SD units)



Panel E. ELA score (SD units)



Panel F. ELA score residuals (SD units)

Figure 10: DDD event studies — Student achievement

Notes: This figure plots DDD event study coefficients θ_τ from equation (6). Horizontal dashed lines are 95 percent confidence intervals using standard errors clustered at the county-level. Data: TEA and SBEC.

9 Tables

Table 1: Changes in teacher supply and preparation — Texas vs. other states

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
			Standard DiD		Synth. control		
Dependent variable	Data source	Texas in 2000	Coef	SE	Coef	Perm. p val.	N
Panel A. Number of potential teachers							
EPP completers per 10K pop.	Title II	9.49	3.80***	(0.74)	4.02	0.17	480
Alternative EPP completers per 10K pop.	Title II	0.00	4.58***	(0.59)	4.17*	0.08	480
Initial certifications per 10K pop.	Title II	11.35	8.43***	(1.82)	3.36	0.35	420
Panel B. Number of employed teachers							
Full-time teachers per 10K pop.	Common Core	208.71	−1.75	(1.86)	5.57	0.57	1,530
Full-time teachers per school	SASS/NTPS	39.12	1.19	(0.84)	0.65	0.92	240
Student/teacher ratio	SASS/NTPS	13.64	0.84*	(0.42)	0.67	0.57	240
Panel C. Difficulty filling teacher vacancies							
Very difficult to fill vacancy: Elementary	SASS/NTPS	0.09	−0.03**	(0.01)	−0.02	0.43	132
Very difficult to fill vacancy: Math	SASS/NTPS	0.41	−0.09***	(0.02)	−0.05	0.41	196
Very difficult to fill vacancy: English	SASS/NTPS	0.14	−0.08***	(0.02)	−0.07	0.24	180
Very difficult to fill vacancy: ESL	SASS/NTPS	0.50	−0.18***	(0.03)	−0.05	0.58	84
Very difficult to fill vacancy: Special ed.	SASS/NTPS	0.35	−0.07**	(0.03)	−0.10	0.12	136
Panel D. Teacher characteristics							
Entered teaching through alternative EPP	SASS/NTPS	0.10	0.17***	(0.01)	0.12*	0.06	294
Not currently certified in state	SASS/NTPS	0.08	−0.02***	(0.01)	−0.01	0.55	174
Has taught 3 or fewer years	SASS/NTPS	0.18	0.03***	(0.01)	0.03	0.25	294
Years of teaching experience	SASS/NTPS	13.28	0.08	(0.29)	−0.97	0.31	294
Age when first started teaching	SASS/NTPS	27.30	0.34***	(0.09)	0.32	0.57	204
Male	SASS/NTPS	0.21	0.04***	(0.00)	0.02	0.25	294
Racial/ethnic minority (teachers)	SASS/NTPS	0.26	0.05***	(0.01)	0.04	0.20	196
Racial/ethnic minority (students)	SASS/NTPS	0.53	0.02*	(0.01)	0.03	0.43	240
Panel E. Teacher preparation							
Had any student teaching	SASS/NTPS	0.86	−0.10***	(0.02)	−0.12**	0.04	264
Felt prepared to assess students	SASS/NTPS	0.60	0.06**	(0.02)	−0.02	0.80	200
Felt prepared to differentiate instruction	SASS/NTPS	0.54	−0.00	(0.02)	−0.08	0.14	205
Felt prepared to manage classroom	SASS/NTPS	0.51	0.05***	(0.01)	−0.03	0.41	205
Felt prepared to teach subject matter	SASS/NTPS	0.72	0.03*	(0.02)	−0.05	0.25	205
Felt prepared to use variety of methods	SASS/NTPS	0.40	0.03**	(0.01)	−0.00	0.94	205

Notes: Column (A) lists the dependent variable for each regression, and column (B) lists the data source. Column (C) shows the value for Texas in the year 2000. Columns (D)–(E) show the DiD coefficient β from equation (1). Column (E) shows the standard error for β with clustering at the state-level. Column (F) shows our synthetic control estimate, and column (G) reports the permutation p -value. Column (H) shows the sample size for each regression (number of states × years). See Section 4.1 for details on the empirical specification. Data: Title II, Common Core, and SASS/NTPS.

Table 2: Characteristics of new teachers in 2012–2019

	(A)	(B)	(C)	(D)	(E)	(F)
	Texas BAs	First-year teachers by certification route				
	All	All	Standard	For-profit	Other alt.	No cert
Panel A. Demographics						
Male	0.42	0.25	0.17	0.33	0.28	0.33
White	0.48	0.58	0.61	0.53	0.58	0.51
Asian	0.07	0.02	0.02	0.02	0.03	0.01
Black	0.10	0.11	0.05	0.17	0.10	0.18
Hispanic	0.29	0.27	0.31	0.26	0.26	0.29
In grade 8 testing data	0.76	0.56	0.73	0.54	0.44	0.45
Grade 8 math score (SD units)	0.55	0.56	0.55	0.57	0.70	0.26
Grade 8 ELA score (SD units)	0.58	0.59	0.57	0.61	0.73	0.32
In college data	1.00	0.71	0.97	0.68	0.62	0.50
Age at certification		26.64	24.92	28.22	28.54	
N	946,378	136,363	49,708	44,180	22,452	9,993
Panel B. Distribution of college majors						
Business	0.19	0.05	0.00	0.11	0.10	0.07
Communication/Family Studies	0.08	0.06	0.02	0.10	0.10	0.07
Health	0.11	0.02	0.00	0.04	0.03	0.07
Humanities	0.11	0.21	0.16	0.26	0.27	0.20
Interdisciplinary	0.10	0.39	0.69	0.08	0.11	0.22
Parks/Leisure/Fitness	0.04	0.06	0.05	0.08	0.05	0.11
Social Sciences	0.11	0.07	0.01	0.14	0.15	0.08
STEM	0.18	0.07	0.05	0.10	0.11	0.07
Other	0.07	0.04	0.02	0.06	0.06	0.09
N	946,378	97,425	48,388	29,947	13,921	4,973
Panel C. Distribution of teaching grades						
Early childhood/Pre-kindergarten		0.03	0.03	0.02	0.03	0.04
Elementary school (grades K–5)		0.39	0.53	0.28	0.36	0.21
Middle school (grades 6-8)		0.22	0.19	0.27	0.23	0.17
High school (grades 9-12)		0.30	0.20	0.37	0.33	0.51
All grade levels		0.05	0.04	0.06	0.05	0.06
N		136,363	49,708	44,180	22,452	9,993
Panel D. Distribution of teaching fields						
Mathematics		0.16	0.18	0.15	0.17	0.09
English Language Arts (ELA)		0.22	0.23	0.22	0.23	0.14
Science		0.12	0.11	0.14	0.16	0.08
Social studies		0.11	0.11	0.11	0.12	0.07
Fine arts		0.07	0.09	0.06	0.04	0.04
Career & technical education		0.05	0.02	0.07	0.06	0.13
Special education		0.08	0.06	0.10	0.08	0.07
Bilingual students		0.04	0.05	0.03	0.04	0.03
English as a Second Language (ESL)		0.02	0.01	0.02	0.02	0.01
N		136,363	49,708	44,180	22,452	9,993

Notes: This table shows sumamry statistics for 2012–2019 Texas college graduates (column A) and 2012–2019 first-year teachers (columns B–F). Column B includes new out-of-state teachers, which are not included in columns C–F. Numbers are rounded to two decimals places, and thus values of 0.00 do not represent true zeroes. Data: TEA and THECB.

Table 3: Turnover in Experience Year Five by Certification Route

	(A)	(B)	(C)	(D)	(E)	(F)
For-profit	-0.108***	-0.092***	-0.108***	-0.111***	-0.102***	-0.118***
	(0.006)	(0.007)	(0.010)	(0.010)	(0.016)	(0.013)
Other alternative	-0.168***	-0.128***	-0.108***	-0.103***	-0.076***	-0.085***
	(0.006)	(0.008)	(0.012)	(0.012)	(0.018)	(0.015)
Not certified in first year	-0.389***	-0.342***	-0.231***	-0.255***	-0.265***	-0.265***
	(0.011)	(0.014)	(0.027)	(0.027)	(0.048)	(0.036)
8th grade math std				-0.026***	-0.023**	-0.026***
				(0.006)	(0.009)	(0.008)
8th grade ELA std				-0.031***	-0.023**	-0.033***
				(0.006)	(0.009)	(0.008)
N (# of teachers)	38,250	35,632	18,904	18,904	9,488	11,745
Start year FE	x					
Start year-start campus FE		x	x	x		
Non-missing covariates			x	x	x	x
Teacher demographics				x	x	x
Start year-start campus-start subject FE					x	
Start year-start campus-start grade FE						x

Notes: This table reports the regression output for turnover in experience year 5 (first year denoted 0). Regression coefficients for training type are interpreted relative to standard-trained teachers. Outcome is the FTE in experience year 5. Teachers not teaching in experience year 5 have 0 FTE. Regressions estimated on teachers who first started in years 2012-2014. Standard errors in parentheses are robust with * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data: TEA and SBEC.

Table 4: Math and ELA Value-Added by Certification Route

	(A)	(B)	(C)	(D)	(E)
Panel A - Math Standardized Exams					
For-profit	-0.140***	-0.028***	-0.020***	-0.021***	-0.017***
	(0.008)	(0.003)	(0.003)	(0.002)	(0.002)
Other alternative	-0.054***	-0.001	0.002	-0.000	0.001
	(0.007)	(0.003)	(0.002)	(0.002)	(0.002)
Out-of-state	0.079***	0.010***	0.001	-0.002	0.002
	(0.010)	(0.003)	(0.003)	(0.003)	(0.003)
Uncertified	-0.419***	-0.137***	-0.098***	-0.077***	-0.062***
	(0.034)	(0.013)	(0.012)	(0.011)	(0.013)
N (# of students)	8,891,069	8,891,069	8,891,069	8,891,069	8,891,069
Panel B - ELA Standardized Exams					
For-profit	-0.149***	-0.014***	-0.006***	-0.005***	-0.005***
	(0.007)	(0.002)	(0.001)	(0.001)	(0.001)
Other alternative	-0.066***	-0.008***	-0.005***	-0.004***	-0.004***
	(0.006)	(0.001)	(0.001)	(0.001)	(0.001)
Out-of-state	0.096***	0.009***	0.001	-0.001	0.000
	(0.010)	(0.002)	(0.001)	(0.001)	(0.001)
Uncertified	-0.393***	-0.061***	-0.032***	-0.019**	-0.018*
	(0.026)	(0.009)	(0.009)	(0.008)	(0.010)
N (# of students)	9,394,971	9,394,971	9,394,971	9,394,971	9,394,971
Grade-year FE	x	x	x	x	
Student Covariates		x	x	x	x
Class Covariates			x	x	x
School Covariates			x		
School FE				x	
School-grade-year FE					x

Notes: This table reports the regression output described in Section 5.2.1. Column C is our preferred model. The top panel presents value-added differences across teacher training type for math standardized exam scores, while the bottom panel reports them for ELA. Coefficients are interpreted in standardized test units relative to standard-trained teachers. Standard errors in parentheses are clustered at the school-level with * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data: TEA and SBEC.

Table 5: Effects of exposure to for-profit EPPs on teacher composition

	(A)	(B)	(C)	(D)	(E)
	Pre-2001 mean	DiD coefficients			DDD coef.
	All grades	All grades	Elem. school	Middle school	Middle – Elem.
Panel A. Certification route and status					
For-profit certification	0.000	0.041***	0.033***	0.058***	0.025***
		(0.009)	(0.008)	(0.011)	(0.006)
Standard certification	0.626	-0.040***	-0.038***	-0.045***	-0.007
		(0.014)	(0.014)	(0.014)	(0.005)
Other alternative certification	0.055	0.010	0.013	0.002	-0.010*
		(0.012)	(0.013)	(0.012)	(0.006)
Out of state certification	0.036	0.001	0.000	0.005	0.004
		(0.006)	(0.006)	(0.006)	(0.003)
No certification	0.283	-0.012	-0.009	-0.020**	-0.012***
		(0.008)	(0.007)	(0.009)	(0.004)
Grade/subject-appropriate cert (if certified)	0.927	0.030***	0.016***	0.037***	0.020***
		(0.006)	(0.005)	(0.007)	(0.006)
Panel B. Number of teachers					
Log number of teachers	4.876	0.071**	0.073**	0.068*	-0.005
		(0.036)	(0.036)	(0.035)	(0.012)
Student/teacher ratio	17.564	-0.206	-0.430**	0.335	0.765***
		(0.171)	(0.180)	(0.247)	(0.235)
Panel C. Teacher characteristics					
Male	0.128	0.013***	0.013**	0.015**	0.002
		(0.005)	(0.005)	(0.006)	(0.004)
White	0.827	-0.078***	-0.078***	-0.080***	-0.002
		(0.012)	(0.013)	(0.011)	(0.008)
Hispanic	0.112	0.059***	0.065***	0.044***	-0.021
		(0.009)	(0.009)	(0.015)	(0.016)
Black	0.056	0.015*	0.009	0.029**	0.019**
		(0.008)	(0.006)	(0.014)	(0.009)
Panel D. Teacher experience					
First-year teacher	0.063	-0.010***	-0.012***	-0.006	0.006**
		(0.003)	(0.003)	(0.004)	(0.002)
Years of teaching experience	11.690	-0.215	-0.088	-0.516*	-0.427***
		(0.211)	(0.198)	(0.269)	(0.151)
Years employed in position	8.077	0.185	0.265	-0.007	-0.273**
		(0.201)	(0.190)	(0.252)	(0.134)
Total annual salary	33,134	2,286***	2,371***	2,084***	-287*
		(423)	(443)	(393)	(161)
N (# districts/grade levels/years)	53,885	258,648	130,032	128,616	258,648

Notes: Column (A) shows the mean of each dependent variable in 1996–2000. Columns (B)–(D) present estimates of β from equation (3) estimated separately for all grades (K–8), elementary school (grades K–5), and middle school (grades 6–8). Column (E) presents estimates of θ from equation (4) estimated separately for all grades (K–8), elementary school (grades K–5), and middle school (grades 6–8). Standard errors in parentheses are clustered at the county level with * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data: TEA and SBEC.

Table 6: Effects of exposure to for-profit EPPs on student achievement

	(A)	(B)	(C)	(D)	(E)
	Pre-2001 mean	DiD coefficients			DDD coef.
	All grades	All grades	Elem. school	Middle school	Middle – Elem.
Panel A. Student characteristics					
Log number of exam takers	7.222	0.089***	0.082**	0.096***	0.014**
		(0.033)	(0.033)	(0.033)	(0.007)
Male	0.502	0.003**	0.002*	0.003**	0.001
		(0.001)	(0.001)	(0.001)	(0.001)
White	0.584	0.004	0.006	0.002	-0.004*
		(0.018)	(0.018)	(0.018)	(0.002)
Hispanic	0.277	0.019	0.019	0.020	0.001
		(0.018)	(0.018)	(0.017)	(0.002)
Black	0.117	-0.011*	-0.013*	-0.009	0.004
		(0.006)	(0.007)	(0.006)	(0.003)
Economically disadvantaged	0.422	0.017	0.012	0.023	0.010***
		(0.021)	(0.020)	(0.023)	(0.004)
At risk of dropping out	0.319	0.020	0.027*	0.013	-0.014**
		(0.015)	(0.016)	(0.015)	(0.007)
In special education	0.085	0.002	0.002	0.002	-0.000
		(0.004)	(0.004)	(0.004)	(0.001)
In gifted/talented program	0.109	0.000	0.006	-0.006	-0.012
		(0.006)	(0.005)	(0.009)	(0.009)
Demographic index (math score)	0.041	0.004	0.004	0.004	-0.000
		(0.015)	(0.014)	(0.018)	(0.008)
Demographic index (ELA score)	0.048	-0.004	-0.009	0.002	0.012
		(0.018)	(0.017)	(0.020)	(0.008)
Panel B. Student achievement					
Math score (SD units)	0.051	0.065***	0.062***	0.068***	0.006
		(0.021)	(0.022)	(0.024)	(0.020)
Math score residuals (SD units)	0.002	0.010*	0.015*	0.007	-0.007
		(0.005)	(0.008)	(0.006)	(0.008)
ELA score (SD units)	0.045	0.038**	0.034	0.041**	0.006
		(0.019)	(0.022)	(0.019)	(0.017)
ELA score residuals (SD units)	-0.003	0.002	-0.000	0.004	0.004
		(0.003)	(0.007)	(0.004)	(0.008)
N (# districts/grade levels/years)	53,885	258,648	130,032	128,616	258,648

Notes: Column (A) shows the mean of each dependent variable in 1996–2000. Columns (B)–(D) present estimates of β from equation (3) estimated separately for all grades (3–8), elementary school (grades 3–5), and middle school (grades 6–8). Column (E) presents estimates of θ from equation (4) estimated separately for all grades (K–8), elementary school (grades K–5), and middle school (grades 6–8). Standard errors in parentheses are clustered at the county level with * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data: TEA and SBEC.

Appendices

A Figures and Tables

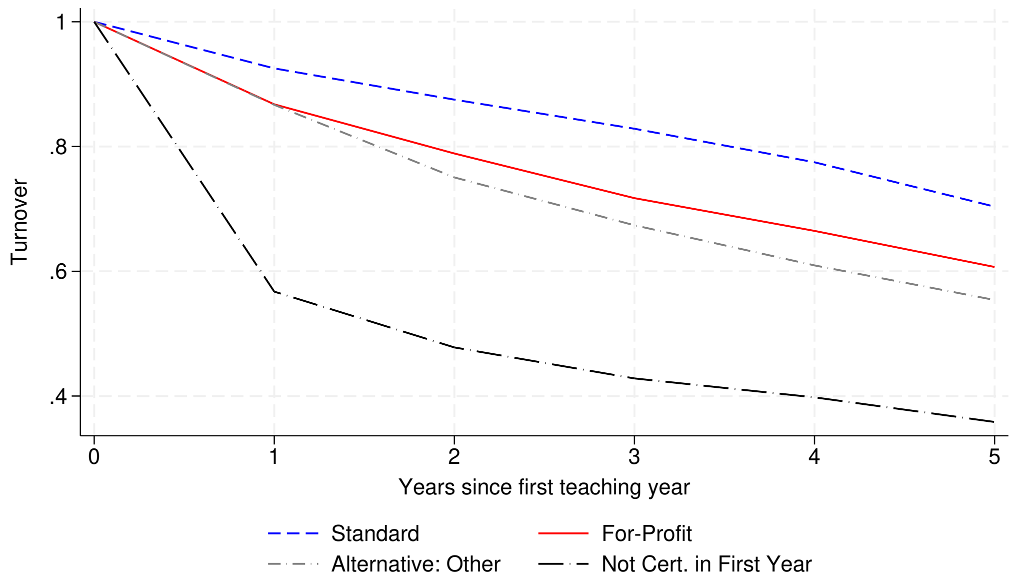
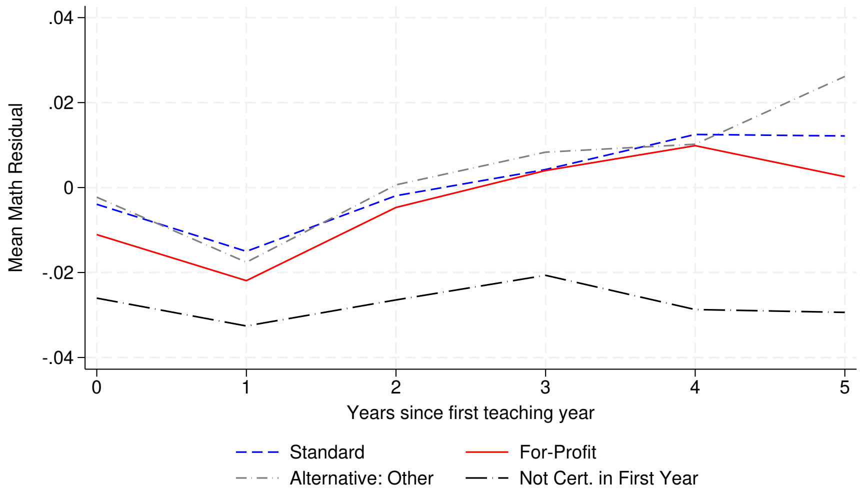
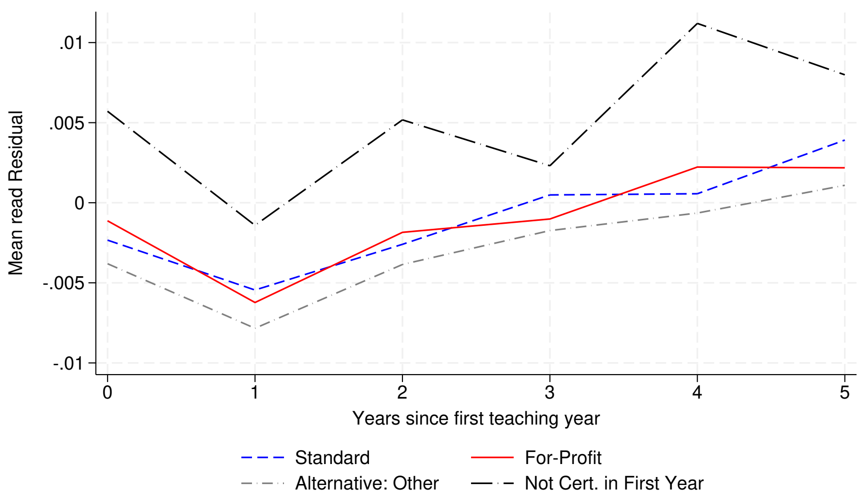


Figure A1: Teacher Turnover by Experience and Certification Route - Person-Level

Notes: The y-axis is the average number of teachers who are still teaching in a given experience year. This is turnover based on total number of teachers and not FTE. We include only teachers who started in the 2012-2019 academic years. Data: TEA and SBEC.



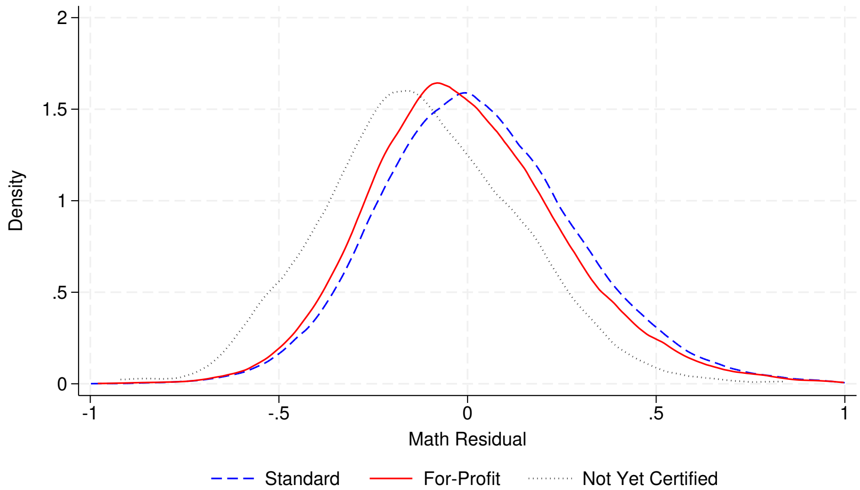
Panel A. Math VA



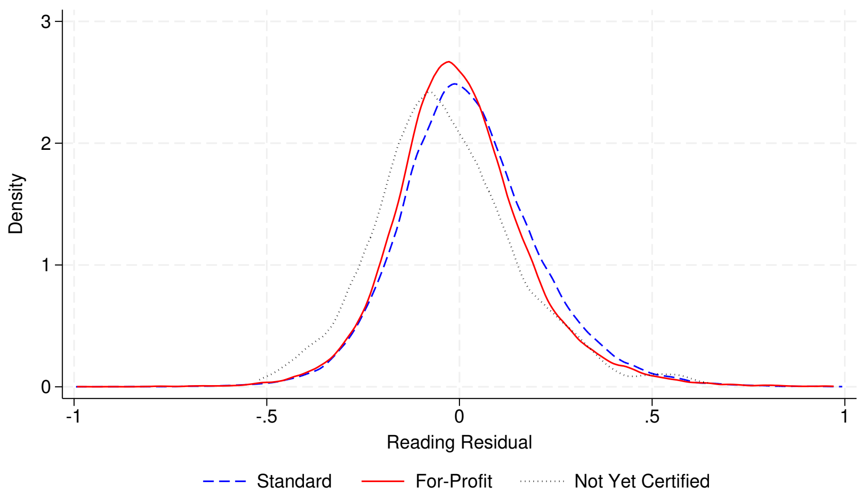
Panel B. ELA VA

Figure A2: Alternative Value-Added by Experience and Certification Route

Notes: The y-axis is the mean teacher-year value-added, calculated as described in (Chetty et al., 2014a), by experience-level. Data: TEA and SBEC.



Panel A. Math VA



Panel B. ELA VA

Figure A3: Teacher-Year Value-Added Histogram by Certification Route

Notes: These are the histograms by training pathway for all teacher-year value-added inclusive of all teachers and all years (2012-2019) available. Data: TEA and SBEC.

Table A1: List of for-profit EPPs by year of opening

#	(A) EPP name	(B) City	(C) County	(D) Year opened	(E) Total initial certs by 2019
1	Education Career Alternatives Program	N Richland Hills	**Tarrant County**	2001	10,270
2	ACT-Rio Grande Valley	Pharr	**Hidalgo County**	2001	4,725
3	Alternative-South Texas Educator Program	Brownsville	**Cameron County**	2002	2,696
4	iteachTexas	Denton	**Denton County**	2003	19,817
5	ACT-Houston	Houston	**Harris County**	2004	8,215
6	Steps to Teaching - ACP	Pharr	Hidalgo County	2004	433
7	Teachers for the 21st Century	El Paso	**El Paso County**	2004	286
8	A+ Texas Teachers	Houston	Harris County	2005	56,370
9	Web-Centric Alternative Cert Program	Cypress	Harris County	2005	4,449
10	Teachworthy	San Antonio	**Bexar County**	2005	3,333
11	Teacherbuilder.com	Edinburg	Hidalgo County	2005	2,614
12	Texas Alternative Certification Program	El Paso	El Paso County	2005	1,600
13	South Texas Transition to Teaching ACP	Edinburg	Hidalgo County	2005	1,423
14	A Career in Teaching-Epp (Corpus Christi)	Corpus Christi	**Nueces County**	2005	1,152
15	Quality ACT: Alternative Certified Tchrs	Irving	**Dallas County**	2005	988
16	Training Via E-Learning: An Alt Crt Hybr	Austin	**Travis County**	2005	425
17	ATC-East Houston	Houston	Harris County	2006	67
18	A Career in Education-ACP	Universal City	Bexar County	2008	147
19	ACT-Houston at Dallas	Dallas	Dallas County	2009	2,117
20	A Career in Teaching-Epp (Mcallen)	Mcallen	Hidalgo County	2009	538
21	A+ Texas Teachers (Dallas)	Dallas	Dallas County	2009	523
22	A+ Texas Teachers (San Antonio)	San Antonio	Bexar County	2009	417
23	ACT-Central Texas - Temple	Temple	**Bell County**	2009	382
24	A+ Texas Teachers (Austin)	Austin	Travis County	2009	354
25	Alternative-So Tx Ed Pgm-Laredo (A-Step)	Laredo	**Webb County**	2009	304
26	A+ Texas Teachers (Bedford/Fort Worth)	Bedford	Tarrant County	2009	256
27	EIT: Excellence in Teaching	Weslaco	Hidalgo County	2009	123
28	Texas Alternative Cert Pgm @ Austin	Leander	Travis County	2009	68
29	A Career in Teaching-Epp (Humble)	Humble	Harris County	2009	59
30	Texas Alternative Cert Pgm @ Brownsville	Brownsville	Cameron County	2010	470
31	Texas Alternative Cert Pgm @ Houston	Katy	Harris County	2010	25
32	ACT-Houston at Austin	Austin	Travis County	2010	5
33	Texas Alternative Cert Pgm @ San Antonio	San Antonio	Bexar County	2011	10

Notes: This table lists all the EPPs that we classify as for-profits with their year of opening (column D) and their total number of initial certifications through 2019 (column E). Bold text in column (C) indicates the first opening of a for-profit EPP in that county. Data: SBEC.

Table A2: Historical and modern EPP pricing and course requirements

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
	Historical data (1999–2007)						Modern data (2024)				
EPP name	Year of data	In-person courses	Up-front fees	Intern fee	Total cost	Total cost (2024 $)	Year of data	In-person courses	Up-front fees	Intern fees	Total cost
Panel A. For-profit programs											
ACT-Rio Grande Valley	2002	Yes	450	3,550	4,000	6,968	2024	Yes	900	4,700	5,600
A+ Texas Teachers							2024	No	299	4,700	4,999
Education Career Alternatives Program	2002	Yes	275	3,000	3,275	5,705	2024	Yes	990	3,500	4,490
iteachTexas	2004	No	300	3,700	4,000	6,641	2024	No	99	4,449	4,548
Average			342	3,417	3,758	6,438			572	4,337	4,909
Panel B. Other alternative programs											
Region 1 Education Service Center	2002	Yes	440	3,375	3,815	6,646	2024	Yes	350	6,245	6,595
Region 2 Education Service Center	1999	Yes	200	3,300	3,500	6,573	2024	Yes	1,150	4,700	5,850
Region 4 Education Service Center	2002	Yes	1,085	3,300	4,385	7,639	2024	No	100	5,484	5,584
Region 10 Education Service Center	2007	Yes	650	3,200	3,850	5,822	2024	No	699	4,550	5,249
Region 11 Education Service Center	2002	Yes	340	3,000	3,340	5,818	2024	No	2,975	2,975	5,950
Region 12 Education Service Center	2000	Yes	1,540	3,500	5,040	9,149					
Region 13 Education Service Center	2001	Yes	795	3,600	4,395	7,772	2024	Yes	1,900	4,475	6,375
Region 20 Education Service Center	2002	Yes	385	3,300	3,685	6,419	2024	Yes	311	5,284	5,595
Dallas ISD	2003	Yes	380	3,000	3,380	5,754	2024	Yes	890	4,165	5,055
Houston ISD	2000	Yes	1,040	3,750	4,790	8,695	2024	Yes	250	4,750	5,000
Average			686	3,333	4,018	7,029			958	4,736	5,695

Notes: This table displays information on the pricing and course requirements of for-profit (Panel A) and other alternative (Panel B) EPPs. The sample of EPPs includes the two largest for-profit EPPs (iteachTexas and A+ Texas Teachers), the two earliest for-profit EPPs (ACT-Rio Grande Valley and Education Career Alternatives Porgram), the two largest alternative EPPs operated by independent school districts (Dallas ISD and Houston ISD), and all EPPs run by Education Service Centers (ESCs) for which we could find historical information. These EPPs collectively represent the large majority of the alternative teacher certification market.

Columns (A)–(F) display information collected from historical versions of each EPP's website using archive.org; we use data from the earliest version of each website that we could find. Columns (G)–(K) display information from each EPP's website obtained in October 2024. We could not find a historical version of A+ Texas Teachers' website, and Region 12 ESC no longer offered an alternative certification program as of October 2024. Sources for all of this information are available from the authors upon request.

Columns (A) and (G) indicate the year for which we obtained data. Columns (B) and (H) indicate whether the EPP required some in-person courses prior to the teaching internship period; "No" indicates that all pre-internship training courses were online. Columns (C) and (I) indicate up-front program fees in nominal dollars, which typically include application fees and training fees. Columns (D) and (J) include fees due during the internship period in nominal dollars, which are typically paid out of the candidate's teaching paycheck. Some EPPs offer monthly payment plans; in this case we count the first month's payment as the up-front fee and all other monthly payments as the internship fee. If the EPP charges different prices for different teaching certificates, we report the cheapest option. We exclude other costs such as certification and testing fees. Columns (E) and (K) report the sum of the up-front and internship fees in nominal dollars. Column (F) converts the total cost in column (E) to 2024 dollars.

Table A3: Teacher training program requirements and characteristics

	(A)	(B)	(C)	(D)	(E)
	Texas			Other states	
	Standard	For-profit	Other alternative	Standard	Alternative
Panel A. Enrollment and completion					
Total enrollment	147,749	186,904	48,786	2,636,808	313,556
Total program completers	70,640	49,959	26,537	927,354	146,627
Share of state's enrollment	0.38	0.49	0.13	0.89	0.11
Share of state's completers	0.48	0.34	0.18	0.86	0.14
Program size (completers per program)	139.3	320.2	46.4	95.7	42.7
Panel B. Characteristics of enrollees					
Female	0.81	0.66	0.71	0.77	0.68
Male	0.19	0.34	0.29	0.23	0.32
White	0.52	0.46	0.51	0.74	0.63
Asian	0.02	0.03	0.04	0.03	0.03
Black	0.07	0.23	0.16	0.08	0.17
Hispanic	0.36	0.26	0.27	0.11	0.12
Panel C. Undergraduate grade point average (GPA)					
Minimum GPA required for admission	2.70	2.50	2.61	2.81	2.72
Median GPA of individuals accepted	3.23	3.03	3.14	3.38	3.23
Panel D. Number of faculty					
# full-time faculty supervising clinical experience	16.1	76.8	7.0	20.8	5.9
# adjunct faculty supervising clinical experience	93.3	83.2	19.8	168.1	34.8
Completer/faculty ratio	9.2	23.5	12.2	5.7	11.0
Panel E. Training requirements					
# students in supervised clinical experience (SCE)	433.1	165.5	137.6	489.1	126.5
# students in SCE / # completers	1.30	0.22	0.99	1.84	1.25
Hours of SCE required prior to student teaching	243.0	124.7	140.9	166.8	73.4
Hours required for student teaching	566.9	505.7	799.9	538.5	366.4
Hours required for mentoring/induction support	32.6	34.9	59.7	19.6	123.5
Hours of content training (ERC data)	46.5	25.4	36.8		

Notes: Data: Title II and TEA.

Table A4: Median Length of Time (in Days) from Admissions to Classroom by Certification Type

	For-Profit	Standard	Other Alternative
Admission to Content Exam	64	326	35
Content Exam to Certification	151	162	132
Certification to Classroom	22	146	29
Total	237	634	196

Notes: Median number of days for individuals from being admitted to an EPP, to taking their first content exam, to their certification effective date, to instructor of record by EPP type. Estimated on data between 2012-2019. Data: SBEC.

Table A5: Changes in teacher supply and preparation — Texas vs. states without for-profit EPPs

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
			Standard DiD		Synth. control		
Dependent variable	Data source	Texas in 2000	Coef	SE	Coef	Perm. p val.	N
Panel A. Number of potential teachers							
EPP completers per 10K pop.	Title II	9.49	3.77***	(0.87)	3.90	0.20	400
Alternative EPP completers per 10K pop.	Title II	0.00	4.64***	(0.70)	4.21	0.10	400
Initial certifications per 10K pop.	Title II	11.35	8.34***	(2.01)	3.26	0.37	360
Panel B. Number of employed teachers							
Full-time teachers per 10K pop.	Common Core	208.71	−2.21	(2.27)	5.57	0.68	1,230
Full-time teachers per school	SASS/NTPS	39.12	1.11	(1.10)	0.66	0.90	195
Student/teacher ratio	SASS/NTPS	13.64	0.91	(0.55)	0.78	0.59	195
Panel C. Difficulty filling teacher vacancies							
Very difficult to fill vacancy: Elementary	SASS/NTPS	0.09	−0.05***	(0.01)	−0.02	0.41	112
Very difficult to fill vacancy: Math	SASS/NTPS	0.41	−0.08**	(0.03)	−0.04	0.51	160
Very difficult to fill vacancy: English	SASS/NTPS	0.14	−0.10***	(0.01)	−0.07	0.20	144
Very difficult to fill vacancy: ESL	SASS/NTPS	0.50	−0.21***	(0.03)	−0.05	0.57	64
Very difficult to fill vacancy: Special ed.	SASS/NTPS	0.35	−0.07**	(0.03)	−0.10*	0.07	116
Panel D. Teacher characteristics							
Entered teaching through alternative EPP	SASS/NTPS	0.10	0.18***	(0.01)	0.21**	0.03	234
Not currently certified in state	SASS/NTPS	0.08	−0.03***	(0.01)	0.00	0.83	126
Has taught 3 or fewer years	SASS/NTPS	0.18	0.03***	(0.01)	0.04	0.17	234
Years of teaching experience	SASS/NTPS	13.28	−0.02	(0.37)	−1.04	0.27	234
Age when first started teaching	SASS/NTPS	27.30	0.39***	(0.09)	0.35	0.54	164
Male	SASS/NTPS	0.21	0.04***	(0.01)	0.03	0.22	234
Racial/ethnic minority (teachers)	SASS/NTPS	0.26	0.06***	(0.01)	0.04	0.12	160
Racial/ethnic minority (students)	SASS/NTPS	0.53	0.01	(0.01)	0.03	0.41	195
Panel E. Teacher preparation							
Had any student teaching	SASS/NTPS	0.86	−0.10***	(0.02)	−0.13*	0.06	204
Felt prepared to assess students	SASS/NTPS	0.60	0.05**	(0.02)	−0.02	0.71	160
Felt prepared to differentiate instruction	SASS/NTPS	0.54	−0.02	(0.01)	−0.08	0.12	165
Felt prepared to manage classroom	SASS/NTPS	0.51	0.05***	(0.01)	−0.04	0.34	165
Felt prepared to teach subject matter	SASS/NTPS	0.72	0.03	(0.02)	−0.04	0.24	165
Felt prepared to use variety of methods	SASS/NTPS	0.40	0.03**	(0.02)	−0.01	0.95	165

Notes: This table is identical to Table 1 except that our regression samples exclude states (other than Texas) that had any for-profit EPP enrollment in 2018–2019 (see Table 1 in King and Yin, 2022). These excluded states are AZ, FL, HI, IN, LA, MA, MI, NV, NC, and SC. Column (A) lists the dependent variable for each regression, and column (B) lists the data source. Column (C) shows the value for Texas in the year 2000. Columns (D)–(E) show the DiD coefficient β from equation (1). Column (E) shows the standard error for β with clustering at the state level. Column (F) shows our synthetic control estimate, and column (G) reports the permutation p value. Column (H) shows the sample size for each regression (number of states $\times$ years). See Section 4.1 for details on the empirical specification. Data: Title II, Common Core, and SASS/NTPS.

Table A6: Teacher-Year Value-Added Summary Statistics

	mean/(sd)	N (# of teacher-years)
Math VA	0.03	214,675
	(0.27)	
ELA VA	0.02	219,339
	(0.18)	

Notes: Mean and standard deviation of teacher-year value-added as calculated in part two of Section 5.2.1. N represents the total number of observations. Data: TEA and SBEC.

Table A7: Math and ELA Value-Added by Certification Route Controlling for Experience

	(A)	(B)	(C)	(D)	(E)
Panel A - Math Standardized Exams					
For-profit	-0.086***	-0.014***	-0.010***	-0.012***	-0.008***
	(0.008)	(0.003)	(0.003)	(0.002)	(0.002)
Other alternative	-0.059***	-0.004	-0.000	-0.002	-0.001
	(0.007)	(0.003)	(0.002)	(0.002)	(0.002)
Out-of-state	0.068***	0.007*	-0.002	-0.005	-0.002
	(0.010)	(0.003)	(0.003)	(0.003)	(0.003)
Uncertified	-0.263***	-0.078***	-0.049***	-0.031***	-0.016
	(0.033)	(0.013)	(0.012)	(0.011)	(0.012)
N (# of students)	8,891,069	8,891,069	8,891,069	8,891,069	8,891,069
Panel B - ELA Standardized Exams					
For-profit	-0.089***	-0.002	0.002*	0.002*	0.002
	(0.007)	(0.002)	(0.001)	(0.001)	(0.001)
Alternative, other	-0.058***	-0.006***	-0.003***	-0.002**	-0.003***
	(0.006)	(0.001)	(0.001)	(0.001)	(0.001)
Out-of-state	0.095***	0.010***	0.001	-0.001	0.001
	(0.009)	(0.002)	(0.001)	(0.001)	(0.001)
Uncertified	-0.238***	-0.026***	-0.005	0.004	0.004
	(0.026)	(0.009)	(0.009)	(0.008)	(0.010)
N (# of students)	9,394,971	9,394,971	9,394,971	9,394,971	9,394,971
Grade-year FE	x	x	x	x	
Student Covariates		x	x	x	x
Class Covariates			x	x	x
School Covariates			x		
School FE				x	
School-grade-year FE					x
Experience FE	x	x	x	x	x

Notes: This table reports the regression output described in Section 5.2.1. Column C is our preferred model. The top panel presents value-added differences across teacher training type for math standardized test scores, while the bottom panel reports them for ELA. Coefficients are interpreted in standardized test units relative to standard-trained teachers. All regressions control for experience level of the teacher in a given calendar year. Standard errors in parentheses are clustered at the school-level with * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data: TEA and SBEC.

Table A8: Opening of for-profit EPPs by county

(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
		Total initial certifications		For-profit (FP) share of initial certifications								
County where EPP is located	First FP year	2000	2019	2000	2001	2002	2003	2004	2005	2009	2014	2019
Tarrant County	2001	743	772		0.41	0.48	0.48	0.49	0.50	0.41	0.44	0.45
Hidalgo County	2001	536	727		0.29	0.36	0.42	0.36	0.36	0.46	0.59	0.54
Cameron County	2002	186	92			0.23	0.47	0.65	0.65	0.39	0.34	>0.94
Denton County	2003	611	2,293				0.13	0.45	0.61	0.59	0.59	0.72
Harris County	2004	1,814	8,287					0.16	0.25	0.63	0.74	0.80
El Paso County	2004	443	301					0.01	0.30	0.21	0.17	0.06
Bexar County	2005	695	927						0.10	0.21	0.18	0.36
Nueces County	2005	271	187						0.09	0.34	0.20	0.23
Dallas County	2005	760	671						0.01	0.10	0.27	0.17
Travis County	2005	3,598	4,015						<0.01	0.01	0.01	0.01
Bell County	2009	91	112							0.34	0.42	<0.05
Webb County	2009	169	83							<0.03	0.44	<0.07
All other counties		5,081	4,532									

Notes: This table shows the 12 Texas counties that experienced a for-profit EPP opening (column A). Column (B) shows the first year that a for-profit EPP opened in that county. Columns (C)–(D) report the total number of initial certifications by all (for-profit and not for-profit) EPPs located in that county in 2000 and 2019. Columns (E)–(M) report the share of all initial certifications that were produced by for-profit EPPs for each year listed in the column header. Data: SBEC.

Table A9: For-profit shares of initial certifications by grade level

(A)	(B)	(C)	(D)	(E)	(F)
		Total initial certifications		For-profit share of initial certifications	
Certificate grade range	Years offered	2000–2009	2010–2019	2000–2009	2010–2019
PK–KG	2000–2004	402		<0.02	
EC–4	2000–2016	65,726	7,788	0.13	0.17
PK–6	2000–2005	7,007		0.08	
EC–6	2009–2019	202	87,402	<0.03	0.24
1–6	2000–2007	4,351		0.07	
1–8	2000–2008	23,823		<0.01	
4–8	2000–2019	40,936	40,179	0.22	0.38
PK–12	2000–2017	16,820	8	0.06	*
EC–12	2001–2019	28,425	50,109	0.31	0.45
6–12	2000–2019	32,898	8,616	0.11	0.53
7–12	2010–2019		21,717		0.49
8–12	2001–2019	28,956	19,403	0.26	0.36
Elementary school (K–5)		128,079	121,907	0.14	0.29
Middle school (6–8)		65,582	62,971	0.16	0.38
High school (9–12)		55,885	50,344	0.20	0.44

Notes: This table shows the for-profit share of initial certifications by grade level of the certificate. Column (A) lists the certificate grade ranges, and column (B) lists the years in which at least one certificate with that grade range was offered. Columns (C)–(D) report the total number of initial certifications by all (for-profit and not for-profit) EPPs for each grade range in 2000–2009 and 2010–2019. Columns (E)–(F) report the share of all initial certifications that were produced by for-profit EPPs for each grade range in 2000–2009 and 2010–2019. The last three rows report weighted totals/averages based on the proportion of each certificate grade range (column A) that overlaps with elementary (K–5), middle (6–8), and high (9–12) school grades. Values of for-profit shares (columns E–F) that correspond to fewer than five observations are censored. The asterisk (*) denotes that no value can be reported due to the small sample size. Data: SBEC.

Table A10: Robustness tests for effects of exposure to for-profit EPPs on teacher composition

	(A)	(B)	(C)	(D)	(E)
	DDD coefficients				
	Bench-mark	No border counties	Standard TWFE	For-profit within 10 mi	For-profit within 50 mi
Panel A. Certification route and status					
For-profit certification	0.025***	0.036***	0.019***	0.014***	0.013***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.004)
Standard certification	-0.007	-0.009	-0.004	-0.004	-0.003
	(0.005)	(0.006)	(0.005)	(0.007)	(0.005)
Other alternative certification	-0.010*	-0.014**	-0.008	-0.008*	-0.005
	(0.006)	(0.006)	(0.005)	(0.004)	(0.004)
Out of state certification	0.004	0.001	0.005	0.004	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
No certification	-0.012***	-0.014***	-0.011***	-0.006**	-0.008**
	(0.004)	(0.005)	(0.003)	(0.003)	(0.003)
Grade/subject-appropriate cert (if certified)	0.020***	0.026***	0.014**	0.021**	0.010*
	(0.006)	(0.006)	(0.006)	(0.011)	(0.005)
Panel B. Number of teachers					
Log number of teachers	-0.005	-0.016	-0.009	-0.021	-0.019**
	(0.012)	(0.012)	(0.011)	(0.015)	(0.009)
Student/teacher ratio	0.765***	1.252***	0.682***	0.842***	0.920***
	(0.235)	(0.200)	(0.205)	(0.295)	(0.172)
Panel C. Teacher characteristics					
Male	0.002	0.006	0.001	-0.000	0.003
	(0.004)	(0.005)	(0.004)	(0.003)	(0.003)
White	-0.002	0.004	-0.000	0.007	0.002
	(0.008)	(0.008)	(0.008)	(0.008)	(0.004)
Hispanic	-0.021	-0.026	-0.021	-0.017	-0.009
	(0.016)	(0.016)	(0.016)	(0.011)	(0.008)
Black	0.019**	0.019**	0.018**	0.010	0.007
	(0.009)	(0.009)	(0.008)	(0.006)	(0.005)
Panel D. Teacher experience					
First-year teacher	0.006**	0.004*	0.006***	0.001	0.002
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Years of teaching experience	-0.427***	-0.433***	-0.377***	-0.323**	-0.211
	(0.151)	(0.166)	(0.143)	(0.134)	(0.133)
Years employed in position	-0.273**	-0.246*	-0.241*	-0.233*	-0.087
	(0.134)	(0.143)	(0.128)	(0.119)	(0.117)
Total annual salary	-287*	-443***	-245*	-317**	-210*
	(161)	(166)	(146)	(123)	(107)
Has master's degree	-0.010	-0.013*	-0.009	-0.009**	-0.008*
	(0.006)	(0.006)	(0.006)	(0.004)	(0.005)
N (# districts/grade levels/years)	258,648	189,816	48,648	48,648	48,648

Notes: Column (A) shows the mean of each dependent variable in 1996–2000. Columns (B)–(D) present estimates of β from equation (3) estimated separately for all grades (K–8), elementary school (grades K–5), and middle school (grades 6–8). Column (E) presents estimates of θ from equation (4) estimated separately for all grades (K–8), elementary school (grades K–5), and middle school (grades 6–8). Standard errors in parentheses are clustered at the county level with * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data: TEA and SBEC.

Table A11: Robustness tests for effects of exposure to for-profit EPPs on student achievement

	(A)	(B)	(C)	(D)	(E)
	DDD coefficients				
	Bench-mark	No border counties	Standard TWFE	For-profit within 10 mi	For-profit within 50 mi
Panel A. Student characteristics					
Log number of exam takers	0.014**	0.023***	0.012	-0.001	0.018***
	(0.007)	(0.007)	(0.008)	(0.006)	(0.007)
Male	0.001	0.001	0.001**	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
White	-0.004*	0.001	-0.004**	-0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Hispanic	0.001	0.001	0.002	0.004	-0.002
	(0.002)	(0.002)	(0.001)	(0.003)	(0.002)
Black	0.004	0.003	0.004	0.002	0.004*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
Economically disadvantaged	0.010***	0.006	0.011***	0.008*	0.002
	(0.004)	(0.004)	(0.004)	(0.005)	(0.002)
At risk of dropping out	-0.014**	-0.020***	-0.013**	-0.014**	-0.010*
	(0.007)	(0.007)	(0.006)	(0.007)	(0.006)
In special education	-0.000	-0.001	-0.000	-0.001	0.000
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
In gifted/talented program	-0.012	-0.013	-0.011	-0.014	-0.005
	(0.009)	(0.009)	(0.008)	(0.009)	(0.005)
Demographic index (math score)	-0.000	0.007	-0.000	-0.000	0.008
	(0.008)	(0.007)	(0.008)	(0.006)	(0.005)
Demographic index (ELA score)	0.012	0.021***	0.012	0.011	0.016***
	(0.008)	(0.007)	(0.009)	(0.008)	(0.006)
Panel B. Student achievement					
Math score (SD units)	0.006	0.019	0.001	0.017	0.025**
	(0.020)	(0.020)	(0.022)	(0.020)	(0.010)
Math score residuals (SD units)	-0.007	-0.018**	-0.011	-0.003	-0.016***
	(0.008)	(0.008)	(0.007)	(0.007)	(0.005)
ELA score (SD units)	0.006	0.015	0.006	0.012	0.023**
	(0.017)	(0.016)	(0.019)	(0.022)	(0.009)
ELA score residuals (SD units)	0.004	0.001	0.003	-0.003	0.002
	(0.008)	(0.008)	(0.008)	(0.011)	(0.005)
N (# districts/grade levels/years)	258,648	189,816	48,648	48,648	48,648

Notes: Column (A) shows the mean of each dependent variable in 1996–2000. Columns (B)–(D) present estimates of β from equation (3) estimated separately for all grades (3–8), elementary school (grades 3–5), and middle school (grades 6–8). Column (E) presents estimates of θ from equation (4) estimated separately for all grades (K–8), elementary school (grades K–5), and middle school (grades 6–8). Standard errors in parentheses are clustered at the county level with * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data: TEA and SBEC.

Table A12: Effects of exposure to for-profit EPPs on teacher composition — Robustness to definition of uncertified teachers

	(A)	(B)	(C)	(D)	(E)
	Pre-2001 mean	DiD coefficients			DDD coef.
	All grades	All grades	Elem. school	Middle school	Middle – Elem.
Panel A. Benchmark outcomes					
For-profit certification	0.000	0.041***	0.033***	0.058***	0.025***
		(0.009)	(0.008)	(0.011)	(0.006)
Standard certification	0.626	-0.040***	-0.038***	-0.045***	-0.007
		(0.014)	(0.014)	(0.014)	(0.005)
Other alternative certification	0.055	0.010	0.013	0.002	-0.010*
		(0.012)	(0.013)	(0.012)	(0.006)
Out of state certification	0.036	0.001	0.000	0.005	0.004
		(0.006)	(0.006)	(0.006)	(0.003)
Panel B. Conditional on appearing cert data					
For-profit certification (if certified)	0.000	0.040***	0.033***	0.057***	0.024***
		(0.009)	(0.008)	(0.011)	(0.006)
Standard certification (if certified)	0.873	-0.026*	-0.021	-0.041**	-0.020***
		(0.015)	(0.015)	(0.017)	(0.006)
Other alternative certification (if certified)	0.077	-0.009	-0.007	-0.015	-0.008
		(0.010)	(0.011)	(0.010)	(0.006)
Out of state certification (if certified)	0.050	-0.004	-0.005	-0.002	0.003
		(0.004)	(0.004)	(0.005)	(0.004)
Panel C. Different measures of uncertified					
No certification	0.283	-0.012	-0.009	-0.020**	-0.012***
		(0.008)	(0.007)	(0.009)	(0.004)
No certification and hadn't passed cert exam	0.182	0.007	0.012**	-0.005	-0.017***
		(0.006)	(0.005)	(0.009)	(0.006)
Lower bound on uncertified share	0.026	-0.015***	-0.016***	-0.012*	0.004
		(0.005)	(0.004)	(0.007)	(0.003)
N (# districts/grade levels/years)	53,885	258,648	130,032	128,616	258,648

Notes: Column (A) shows the mean of each dependent variable in 1996–2000. Columns (B)–(D) present estimates of β from equation (3) estimated separately for all grades (K–8), elementary school (grades K–5), and middle school (grades 6–8). Column (E) presents estimates of θ from equation (4) estimated separately for all grades (K–8), elementary school (grades K–5), and middle school (grades 6–8). Standard errors in parentheses are clustered at the county level with * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data: TEA and SBEC.

Table A13: Heterogeneity in the effects of exposure to for-profit EPPs on math scores

	(A)	(B)	(C)	(D)	(E)
	Pre-2001 mean	DiD coefficients			DDD coef.
	All grades	All grades	Elem. school	Middle school	Middle – Elem.
White	0.266	0.074***	0.070***	0.079***	0.009
		(0.024)	(0.021)	(0.028)	(0.011)
Hispanic	-0.235	0.075***	0.072***	0.079***	0.007
		(0.023)	(0.026)	(0.024)	(0.022)
Black	-0.463	0.026	0.038	0.013	-0.026
		(0.020)	(0.030)	(0.027)	(0.040)
Economically disadvantaged	-0.287	0.090***	0.094***	0.086***	-0.008
		(0.021)	(0.028)	(0.020)	(0.027)
Not economically disadvantaged	0.294	0.055*	0.048*	0.061*	0.013
		(0.029)	(0.027)	(0.032)	(0.014)
Male	0.038	0.066***	0.064***	0.069***	0.006
		(0.022)	(0.024)	(0.025)	(0.020)
Female	0.064	0.064***	0.061***	0.068***	0.007
		(0.020)	(0.021)	(0.024)	(0.020)
District average math score (bottom quartile)	-0.229	0.100***	0.101**	0.099***	-0.001
		(0.029)	(0.044)	(0.027)	(0.045)
District average math score (Q2)	-0.037	0.126***	0.109***	0.143***	0.035*
		(0.036)	(0.035)	(0.038)	(0.018)
District average math score (Q3)	0.080	0.014	0.013	0.015	0.002
		(0.027)	(0.025)	(0.038)	(0.034)
District average math score (top quartile)	0.264	-0.033	-0.033	-0.032	0.000
		(0.034)	(0.034)	(0.038)	(0.024)
District proportion white (bottom quartile)	-0.231	0.094**	0.099*	0.088	-0.011
		(0.043)	(0.049)	(0.052)	(0.054)
District proportion white (Q2)	-0.037	0.106**	0.090**	0.122**	0.032
		(0.043)	(0.039)	(0.053)	(0.035)
District proportion white (Q3)	0.078	-0.002	0.005	-0.010	-0.015
		(0.024)	(0.018)	(0.036)	(0.030)
District proportion white (top quartile)	0.182	0.004	-0.010	0.018	0.028*
		(0.027)	(0.027)	(0.030)	(0.016)
N (# districts/grade levels/years)	53,885	258,648	130,032	128,616	258,648

Notes: Column (A) shows the mean of each dependent variable in 1996–2000. Columns (B)–(D) present estimates of β from equation (3) estimated separately for all grades (3–8), elementary school (grades 3–5), and middle school (grades 6–8). Column (E) presents estimates of θ from equation (4) estimated separately for all grades (K–8), elementary school (grades K–5), and middle school (grades 6–8). Standard errors in parentheses are clustered at the county level with * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data: TEA and SBEC.

Table A14: Heterogeneity in the effects of exposure to for-profit EPPs on ELA scores

	(A)	(B)	(C)	(D)	(E)
	Pre-2001 mean	DiD coefficients			DDD coef.
	All grades	All grades	Elem. school	Middle school	Middle – Elem.
White	0.287	0.060***	0.057***	0.063***	0.006
		(0.020)	(0.019)	(0.022)	(0.009)
Hispanic	-0.322	0.031*	0.042*	0.020	-0.022
		(0.018)	(0.024)	(0.016)	(0.020)
Black	-0.397	-0.006	-0.003	-0.010	-0.007
		(0.019)	(0.026)	(0.020)	(0.026)
Economically disadvantaged	-0.342	0.052***	0.057**	0.046***	-0.011
		(0.017)	(0.025)	(0.013)	(0.022)
Not economically disadvantaged	0.320	0.043**	0.036*	0.050**	0.014
		(0.022)	(0.021)	(0.024)	(0.012)
Male	-0.037	0.038*	0.032	0.045**	0.013
		(0.020)	(0.023)	(0.020)	(0.018)
Female	0.127	0.038**	0.038*	0.037**	-0.000
		(0.018)	(0.021)	(0.019)	(0.017)
District average math score (bottom quartile)	-0.247	0.062**	0.059	0.065***	0.007
		(0.029)	(0.042)	(0.022)	(0.034)
District average math score (Q2)	-0.059	0.080**	0.072**	0.089***	0.017
		(0.032)	(0.035)	(0.030)	(0.015)
District average math score (Q3)	0.073	-0.009	-0.011	-0.008	0.003
		(0.030)	(0.027)	(0.038)	(0.027)
District average math score (top quartile)	0.278	-0.036	-0.041*	-0.031	0.010
		(0.022)	(0.021)	(0.026)	(0.017)
District proportion white (bottom quartile)	-0.290	0.042	0.045	0.039	-0.005
		(0.043)	(0.052)	(0.041)	(0.037)
District proportion white (Q2)	-0.054	0.061*	0.055*	0.067	0.012
		(0.035)	(0.031)	(0.040)	(0.020)
District proportion white (Q3)	0.067	-0.027	-0.030*	-0.023	0.007
		(0.021)	(0.016)	(0.029)	(0.021)
District proportion white (top quartile)	0.203	-0.009	-0.021	0.003	0.023**
		(0.022)	(0.021)	(0.024)	(0.011)
N (# districts/grade levels/years)	53,885	258,648	130,032	128,616	258,648

Notes: Column (A) shows the mean of each dependent variable in 1996–2000. Columns (B)–(D) present estimates of β from equation (3) estimated separately for all grades (3–8), elementary school (grades 3–5), and middle school (grades 6–8). Column (E) presents estimates of θ from equation (4) estimated separately for all grades (K–8), elementary school (grades K–5), and middle school (grades 6–8). Standard errors in parentheses are clustered at the county level with * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data: TEA and SBEC.

Table A15: Changes in NAEP scores — Texas vs. other states

	(A)	(B)	(C)	(D)	(E)
	Pre-2001 mean	DiD coefficients			DDD coef.
	All grades	All grades	Elem. school	Middle school	Middle – Elem.
Panel A. Standard DiD					
NAEP math scores (SD units)	0.011	0.016	-0.091***	0.106***	0.198***
		(0.021)	(0.031)	(0.022)	(0.031)
NAEP reading scores (SD units)	-0.062	-0.106***	-0.114***	-0.085***	0.028
		(0.024)	(0.026)	(0.025)	(0.020)
Panel B. Synthetic control					
NAEP math scores (SD units)	0.011	-0.033	-0.075	0.041	0.116
		[0.860]	[0.460]	[0.660]	[0.160]
NAEP reading scores (SD units)	-0.062	-0.110	-0.043	-0.067	-0.024
		[0.514]	[0.660]	[0.459]	[0.784]
N (# states/grade levels/years)	7	696	384	312	696

Notes: Column (A) shows the mean of each dependent variable for all available years in 1990–2000. Columns (B)–(D) present estimates of β from equation (3) estimated separately for all grades (3–8), elementary school (grades 3–5), and middle school (grades 6–8). Column (E) presents estimates of θ from equation (4) estimated separately for all grades (K–8), elementary school (grades K–5), and middle school (grades 6–8). Parentheses in Panel A contain standard errors clustered at the state level. Brackets in Panel B display permutation p values. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Data: NAEP.

B Steps to Becoming a Classroom Teacher in Texas

The basic requirements for becoming a teacher in Texas include (Agency, 2022c):

1. Obtain a Bachelor's Degree
2. Complete an Educator Preparation Program (EPP)
3. Become certified by passing appropriate license exams
4. As of January 1st, 2008, complete background check (Agency, 2022d)

There are two types of EPPs depending on whether the individual would like to obtain their bachelor's degree concurrently (University-based program - UBP, which we refer to as "standard"). TEA describes University-based programs as, "University programs offer a route to educator certification while earning a degree at the same time. These programs also allow a person with a bachelor's degree or higher to complete the requirements for an educator certificate with university coursework. In some cases, people with a bachelor's degree can earn an advanced degree in addition to completing the requirements for a certificate." TEA describes alternative programs as, "Alternative certification programs (ACP's) offer a nontraditional route to certification that may allow you to teach while completing the requirements. These programs are located in universities, school districts, education service centers, community colleges, and private entities."

Requirements for a UBP EPP (Agency, 2022a):

1. Select a Texas University that has an approved EPP program and meet the requirements for entry
2. Complete course work and secure student teaching placement
3. Complete examination requirements for a Standard Certification
    - Student must be recommended through program
4. Apply for a Standard Certificate

Requirements for a ACP EPP (Agency, 2022b):

1. Select an approved ACP and meet the requirements for entry
2. Obtain a Teaching Position
   - Depends on appropriate progress in ACP and program is required to provide an eligibility statement
   - A certified mentor is assigned to work along with the ACP student
3. Apply for a Probationary Certificate
4. Finalize any further requirements for ACP (coursework, exams, etc), then apply for a Standard Certificate

To become certified in Texas, teachers must pass both a content and a Pedagogy and Professional Responsibilities (PPR) exam (Templeton et al., 2020). The content exams test knowledge of subject material at relevant grade levels such as mathematics for grades 8-12 or art for grades EC-12. The PPR exam measures four dimensions: designing instruction and promoting student learning, creating a positive classroom environment, implementing effective instruction and assessment and fulfilling professional roles and responsibilities (Agency, 2018). The PPR exam changed in 2003 from Examination for the Certification of Educators in Texas (ExCET) to the Texas Examinations of Educator Standards (TExES) but they tested the similar material over the course of this change (Hendricks, 2016).