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The evolution of charter school quality

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Abstract

Studies of the charter sector typically compare charters and traditional public schools at a point in time. These comparisons are potentially misleading because many charter-related reforms require time to generate results. We study quality dynamics among Texas charter schools from 2001-2011. School quality in the charter sector was initially highly variable and on average lower than traditional public schools. However, exits, improvement of existing charter schools, and higher quality of new entrants increased charter effectiveness relative to traditional public schools despite an acceleration in the rate of sector expansion in the latter half of the decade. We present evidence that reduced student mobility and an increased share of charters adhering to No Excuses- style curricula contribute to these improvements. Although student selection into charter schools becomes more favorable over time in terms of prior achievement and behavior, such compositional improvements appear to contribute little to the charter sector gains. Moreover, accounting for student composition in terms of prior achievement and behavior has only a small effect on estimates of the higher average quality of No Excuses schools.

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1. Introduction

Charter schools have become increasingly popular alternatives to traditional public schools. Since the mid 1990's when many of the state laws establishing charters were passed, the number of campuses has grown exponentially; charter schools now operate in nearly every large US city and educate an increasing share of students enrolled in public schools. Many proponents have hailed the introduction of these schools as key contributors to unlocking the operation of market forces in educational markets. In particular, these schools facilitate increased greater school choice for parents and their children as well as serving as potential centers for innovation in educational practices. The policy question is whether these market forces will lead to emergence of higher quality schools and better student outcomes.

The rapid expansion of the charter school sector, however, remains controversial in part because of mixed evidence on its effectiveness in improving achievement. While lottery studies focusing on oversubscribed urban charter schools have generally found positive impacts,[1] observational studies focusing on all charter schools in a geographic area, not just those that are over-subscribed, have tended to find much smaller or even negative impacts.[2] Reconciling this conflicting evidence has proven difficult, in part because it interacts with methodological issues. Minimal attention has been paid, however, to the cross-sectional nature of many of the existing analyses. Charter schools are relatively new, and deeper understanding of this market-oriented reform requires examination of the longer-term dynamics.

Although little comprehensive research exists on the role of market forces driving the evolution of charter school quality, two studies provide evidence consistent with potentially effective market forces pushing schools to improve.[3] First, Hanushek et al. (2007) shows that higher school value-added increases the probability of student reenrollment in charter schools, suggesting that households respond to quality.

[1]Abdulkadiroğlu et al. (2011), Angrist et al. (2012), and Angrist, Pathak, and Walters (2013) report results for charter schools in and around Boston, and Dobbie and Fryer (2011) and Hoxby, Murarka, and Kang (2009) report results for New York City.

[2] See, for example, evidence from statewide studies in Bifulco and Ladd (2006), Sass (2006), Booker et al. (2007), and Hanushek et al. (2007). See also the multiple state comparisons in CREDO (2009, 2013).

[3] Ladd, Clotfelter, and Holbein (forthcoming) find that charter schools in North Carolina improve on average relative to traditional public schools on average following the approach used in an earlier version of this paper.

Second, CREDO (2013) finds that although the mean effectiveness of Texas open-enrollment charters relative to the traditional public school comparison (TPS) group still lags the nation as a whole, charter school effectiveness has improved relative to TPS in a number of other states. Importantly, CREDO (2013) highlights the contribution of the closure of poorly performing charter schools to these gains.

This paper contributes new evidence to this debate by capitalizing on detailed longitudinal data for students and schools in Texas, one of the largest charter school states. It has two principal aims. First, it describes how the distribution of charter school quality has evolved between 2001 and 2011 through entry, improvement, voluntary closures, and authorizer intervention. Second, it investigates the extent to which more fundamental factors–student mobility, student selection into and out of charters, and the share of schools that adhere to a "No Excuses" philosophy – contribute to the observed changes in quality.

The descriptive analysis provides strong evidence that Texas charter school quality has increased over time. Specifically, we find that school-level value added estimates based on comparisons with a statewide sample of traditional public schools and with a locally-matched sample generated by an approach similar in spirit to Angrist, Pathak, and Walters (2013) reveal similar improvements in mathematics and reading attributable to charter schools despite different control group structures. To better understand these improvements, we consider how the dynamics of school entry and exit affect the distribution of school quality. We find that the voluntary and involuntary closure of underperforming schools, the increase in the quality of new entrants, and the improvement of existing schools combine to increase the mean and to reduce the variance of charter school value-added relative to traditional public schools. First, similar to the findings in CREDO (2013), schools that close prior to 2011, either voluntarily or following state authorizer intervention, come disproportionately from the lower end of the quality distribution and strongly relate to the observed overall improvement. Second, charter schools that open after 2001 and are still operating in 2011 have an average value-added that far exceeds those that closed. Third, average value added increases for charter schools that remain open throughout the decade.

We then study both the distribution of quality across charter schools and the selectivity-driven enrollment patterns. On first glance, improvements in the distribution of achievement for charter-sector

students failed to keep pace with the rightward shifts in the distribution of charter-school value-added. However, focusing on charter schools after their first year of operation reveals a close tracking of the distributions of school value-added unweighted by enrollment and the corresponding enrollment-weighted value-added distributions. These results are consistent with a rapid expansion of the sector, including the opening of many new schools with unknown quality, that weakens the short run association between school quality and enrollment.

Next, we study several school-specific factors and present evidence that the increase in the share of charter schools adhering to a No Excuses philosophy and the market-driven decline in student mobility contribute to observed improvements in the sector. Even though inclusion of the mobility and selection variables leads to a small reduction in the magnitude of the estimated No Excuses effect, its impact remains highly significant in all mathematics specifications and almost all reading specifications. Reduced student mobility, largely unstudied in this context, appears to contribute substantially to the improvement of the sector. This finding highlights the importance of patience in understanding the effects of a large-scale reform that opens the education sector to many new entrants of variable quality and that precipitates extensive switching among schools. Finally, although selection into charter schools on the basis of prior achievement and behavior becomes, on average, more positive over time, there is little evidence that selection is a primary force behind the improvement in charter school value-added.

We begin with a brief overview of the charter school market in Texas, followed by a description of the Texas Schools Project microdata used in the study. Then we discuss the various approaches used to measure school quality and describe the relative improvement of the charter sector and the divergence between that improvement and the stagnation of charter school quality post-2006 for the typical charter school student. The final two sections examine the contributions of specific factors to the observed improvements and discuss policy implications and directions for future study.

2. The Texas Charter School Program

Since enacting charter school legislation in 1995, the Texas charter sector has grown into one of the largest in the nation. It ranks second nationally in both the number of charters operating and the number of students served by charters in 2010-11.[4] We first discuss relevant legislation and then describe the growth of the Texas charter sector.

2.1. Institutional Structure

The Texas Education Code establishes four types of charters: home-rule school district charters, independent school district charters, university/college campus or program charters, and open enrollment charters. Open-enrollment charters, which are the focus of this study, constitute the majority of charter schools in the state. As shown in Figure 1, since 2001 open-enrollment charters consistently educate well over 80 percent of the students enrolled in the sector. Open-enrollment charters are awarded under the auspices of the Texas State Board of Education, which acts as the primary authorizer for these schools. These schools are independent public educational entities, and the state designates a unique county-district identifier for schools operating under each open enrollment charter. District charters, by contrast, are established by and accountable to the school districts in which they reside. These charters constitute a relatively small fraction of charter schools and educate less than 20 percent of students enrolled in the charter sector. University charters make up the remainder of the state's charters. Their establishment and operation, however, is similar in character to open-enrollment charters. Thus, we make no distinction between these and open enrollment charters. No home-rule district charters have been established as of this writing.[5]

The defining feature of open-enrollment charter schools is their receipt of public funding without many of the regulatory restrictions, chiefly in the realm of personnel, inherent to the operation of

[4]U.S. Department of Education (2014), Table 216.90 [http://nces.ed.gov/programs/digest/d13/tables/dt13_216.90.asp, accessed June 30, 2014].

[5] Home rule charter districts offer the possibility of increased flexibility for the entire district, but they also have a number of procedural requirements including approval by local voters. The Dallas Independent School District had met the initial requirements and had a charter commission that was developing a charter for the voters, but the commission voted to stop the process in January 2015. See http://www.homerulecommission.com/ [accessed October 31, 2015].

traditional public schools. They primarily fund their operations from state funds distributed according to a formula based on average daily attendance with adjustments by student participation in special education, bilingual education, or gifted and talented programs.[6] In contrast to their traditional public school counterparts, they receive no local tax revenue nor any funds earmarked for buildings from the state facilities fund. In general, these charters are required to finance all school activities and infrastructure requirements from student attendance and any additional funds contributed from non-state sources.

Outside of the requirements imposed by No Child Left Behind legislation for teachers in core areas in any open-enrollment charter receiving federal funds, these charter schools have almost no restrictions on hiring and firing. They may hire teachers who currently lack certification or bring skills and experiences that may not be rewarded in conventional public schools. In addition, open-enrollment charters are allowed to set salary and benefit schedules freely. By contrast, district charters maintain the hiring and salary rules of their home districts. This distinction leads to some differences in the characteristics of staff: open-enrollment charters tend to employ less-experienced teachers who are less likely to have a post-graduate degree. Open enrollment charters also pay, on average, lower salaries.

Although district charters offer a degree of parental choice, they have a much weaker effect on traditional public school district enrollment and revenue relative to open-enrollment charters, as most students in district charters would alternatively have attended a traditional public school in the same district. Thus, the district charter schools put little enrollment pressure on districts. Additionally, because they typically involve existing personnel, support structures, and general institutional framework, the dynamics of start-up for district charters are quite different from those for new open enrollment charters. In some cases, it becomes difficult to distinguish the characteristics of a district charter from those of other district schools. Therefore, because of the very different incentives, particularly as generated by any market forces, we focus on open-enrollment charters.

Despite differences in hiring and staffing, all charters in Texas are similar in their stated goals to implement new curricular and disciplinary practices that improve the educational outcomes of their

[6] See tea.texas.gov for more information on state funding of charter schools.

students. The path to achieving these goals differs, however, as both the public mission statements and operational choices of charters vary widely across the sector. For example, many combine standard skills enrichment with an emphasis on discipline; others center the curriculum on more specialized interests such as athletics, the sciences, or music and the arts. Regardless of curriculum, all charters are subject to the same accountability and student testing requirements as traditional public schools. Achievement is the quality dimension central to the enabling legislation and the heart of our evaluation of performance.

Institutionally, a charter is a contract that enables outside entities to operate schools, and there is not a one-to-one match between each charter granted and a specific school (called a campus in Texas). A charter school management organization (CMO) can hold more than one charter, and each charter can include multiple campuses in the same manner that a traditional public school district can include multiple campuses. As a general rule, each charter applies to one geographic market, and a CMO entering multiple markets will have multiple charters.

From 1997 to 2000, there was no statutory limit on the number of open-enrollment charters granted to management organizations that committed to operate schools that served at least 75 percent "at-risk" students, although the number of unrestricted open-enrollment charters was limited to 100. Two changes were made in 2001. In response to reports of poor performance and mismanagement at some schools, the legislature relaxed the at-risk student composition constraint.[7] At the same time, a strict limit of 215 was imposed on the total number of charters awarded under the open-enrollment program. This limit implicitly advantages existing charter holders by restricting entry.

2.2. Open-Enrollment Charter School Growth

Figure 2 illustrates the growth of open enrollment charter CMOs, districts, and campuses between 1996 and 2011. Prior to 2001, entry of charter school operators and the establishment of new districts constituted the bulk of expansion in the charter sector, as both the number of charter holders and districts

[7] Even though the at-risk requirements were modified, the charter sector has continued to enroll an increasingly larger share of poor students compared to the traditional public school sector.

increased. After 2001, however, the numbers of CMOs and charter districts remained roughly - stable (around 150 holders and 200 charter districts), while the number of schools roughly doubled.

Figure 3 shows the stock and flow of charters by type. It includes the number of charter districts by active status relative to the state limit as well as the number of annual charter authorizations and discontinuations. The number of charters increased through 2001 partly due to the elimination of the separate "at-risk" charter category and the more than doubling of the cap on unrestricted open enrollment charters. The annual increase in the number of new charter districts, however, declined steadily between 1999 and 2002. Exits among charter school operators who either had their charters revoked or who voluntarily surrendered them during the period spanning 2000 – 2011 contributed to these changes. Most of the increase in charter schools, however, can be attributed to expansion of campuses among existing charter districts.

Figure 4 illustrates a typical example of CMO expansion its operations using *America Can!*'s entry and growth through 2011 as an example. *America Can!,* a 501(c)(3) non-profit organization, successfully applied for a charter in Dallas and operated one of the first charter schools in Texas in 1997. This CMO subsequently expanded along two dimensions. First, it received an additional four open enrollment charters (covering Houston, San Antonio, Ft. Worth, and Austin) between 1999 and 2005 for a total of five charter districts; and second, it increased the number of campuses operated in three of these charter districts. This pattern highlights a key aspect of the regulatory structure of charter schools in Texas: the approval process charter districts in good standing face when seeking to expand the number of schools is far less involved than applying for a new charter. This observation also suggests that the cost of procuring approval for an additional school is likely to be modest relative to other costs associated with adding a school.

3. The UTD Texas Schools Microdata Panel

The cornerstone of this research is the microdata constructed by the Texas Schools Project at the University of Texas at Dallas. These data include test scores, demographic characteristics, and

information on school attendance and academic programs for a stacked panel of students and schools.[8] Our analysis focuses on the over 366 separate charter school campuses and their enrollees operating over the period spanning 2001 to 2011. School information includes charter school type, state accountability rating, and information on all staff. Student information includes demographics, mathematics and reading test results, school attended, grade, and academic program. Students who switch schools, including between traditional public and charter schools, can be followed as long as they remain within the Texas public school system.[9]

Mathematics and reading assessments come from statewide criterion-referenced achievement tests administered during our period of study. From 1993-2003, the Texas Assessment of Academic Skills (TAAS) was administered each spring to students enrolled in grades three through eight. In 2003, Texas introduced the Texas Assessment of Knowledge and Skills (TAKS).[10] TAKS expanded the number of subjects for which students were required to demonstrate proficiency and elevated the difficulty of the tests. Because the tests are not vertically aligned, they cannot be used to measure absolute changes over time in charter school quality; rather they provide information on performance relative to other students and schools in the same grade and year. Because the test structure, number of questions, and average percent correct vary across time and grades, we standardize all test scores to have a mean of zero and a variance equal to one for each grade and year. Backes et al. (2016) find that measures of teacher value added tend to be stable across and within test regimes. Nonetheless, to address potential concerns associated with imposing a new testing regime, we examine the sensitivity of the results to changes from TAAS to TAKS.

Any school without students in the TAAS/TAKS data is excluded from the sample; therefore, our

[8]A more detailed description of the underlying database can be found in Kain (2001) and other publications on the website for the Texas Schools Project: http://www.utdallas.edu/research/tsp-erc/.
[9] Private school enrollment in Texas remains relatively small at less than six percent in 2011 (U.S. Department of Education (2014)). Moreover, in 2010 only 23 percent of people born in Texas had migrated to another state, making it the state with the lowest out-migration rate in the nation (Hanushek, Ruhose, and Woessmann (2017)).
[10] The TAKS exam was recently repealed by the Texas legislature and schools will now transition to End of Course Exams.

number of charters will differ from public records of the number of authorized charter schools.[11] Also omitted are those charter schools exclusively serving children with special needs, residents in treatment programs, or students with diagnosed behavioral problems.

For the subsequent analysis of charter sector improvement, we construct a database that incorporates the operational focus of each charter school. Using information gathered through interviews and records investigations, we classified each CMO on the basis of whether or not it adheres to a No Excuses philosophy as defined below in Section 6 and in Appendix B. We also use the components of the "No Excuses" taxonomy in separate analyses.

4. Measuring Charter School Quality

The primary concern in measuring charter school performance is that unobserved differences between charter school and traditional public school attendees contaminate comparisons of achievement in the two sectors. This is particularly salient in this analysis, as evidence below illustrates the increasingly positive selection of charter school entrants in terms of prior achievement. Although random assignment methods that make use of lottery data can be used to estimate the effectiveness of oversubscribed charter schools, such approaches cannot be used to study an entire market in which the majority of schools are not oversubscribed. Nonetheless, comparisons of lottery-based and selection on observables estimates based on the same data provide information on the implications of alternative approaches when lottery data are not available. Importantly, the most commonly used value-added and matching models based on prior traditional public school attended differ not only in their treatment of unobserved heterogeneity but also in the composition of the comparison set of traditional public schools.

We begin with a school-level value-added model (which becomes the base specification in our subsequent statewide estimation). In the context of this model, we highlight potential problems introduced by purposeful sorting of students into schools. From that, we consider matching estimators

[11]Note, however, that students do not have to complete the tests to be included in the TAAS/TAKS file.

that also estimate value-added models but employ different estimation samples, here focusing on the approach proposed and implemented by Angrist, Pathak, and Walters (2013). Throughout, we highlight additional considerations related to our focus on the estimation of changes over time in charter school effectiveness.

4.1 Alternative Empirical Models

Our baseline specification is a school-level value added model that we estimate separately for each year. Achievement A for student i in grade g and school s is modeled as a function of prior achievement, prior behavioral infractions (D), contemporaneous student and family factors (X), a school fixed effect that measures school quality (δ_s), and a random error:

$$A_{igs} = f(A_{i,g-1}) + 1[D_{i,g-1}] + X_{igs}\beta + \delta_s + \epsilon_{igs} \qquad (1)$$

Following the literature, we control for prior achievement with cubic functions in both mathematics and reading scores. We also include an indicator for the receipt of any disciplinary infractions in the prior year.[12] The vector X includes a broad set of demographic characteristics: indicators for race, ethnicity, gender, low income household, prior grade retention, and whether the student was enrolled in a special education program. We also include indicators for whether the student switched schools prior to taking their exams within the school year and control for the grade structure of the school. Note that for expositional ease we suppress grade fixed effects.

In practice, we construct our school-level value added estimates from separate regressions for each year and test subject; the included grade fixed effect is a year-by-grade component intended to capture grade-specific changes over time in the test instruments and state policies. Using this approach, we estimate the full distribution of school quality across both traditional and charter schools. Further, and key to this study, we trace the evolution of this quality distribution over time and then consider how market dynamics affect both the location and scale of the charter quality distribution relative to its traditional public school counterpart.

[12] Estimates are virtually identical without this variable.

The validity of the school fixed effects as measures of productivity depends upon the assumption that the prior test scores, disciplinary infraction measures, mobility controls, and other included variables account for confounding factors related to school quality. Although a vigorous debate continues about the estimation and use of teacher value-added measures, much less attention has gone into such estimation at the school level. Two concerns that dominate the discourse around teacher value-added are less important here. First, researchers often disagree about the extent to which systematic student sorting, both within and between schools, contaminates estimates of teacher value-added. Rothstein (2010) provides evidence of bias introduced by endogenous sorting into classrooms, but Chetty, Friedman, and Rockoff (2014) find that including one-year lagged achievement in cubic form along with common demographic characteristics effectively eliminates bias.[13] Our focus on average school quality rather than the effectiveness of individual teachers, however, reduces the relevance of issues related to classroom placement.[14] Second, concerns about the variance of estimation error and the instability of teacher effects, particularly in proposed uses for personnel decisions, have been extensively discussed. These problems are, however, largely related to small samples for classroom teachers (McCaffrey et al. (2009) and are less important at the school level.

Nevertheless, the possibility that the included variables fail to account fully for sorting among schools remains. Research on charter schools has adopted a variety of approaches to account for unobserved heterogeneity, and the merits of each have now been examined extensively. We focus primarily on school value-added measures within the context of alternative approaches.

In terms of internal validity, admissions lotteries constitute the gold standard, as they effectively randomize assignment to charters and in the absence of nonrandom attrition produce consistent estimates of charter school effects. However, only oversubscribed schools conduct admissions lotteries, and an

[13]In follow-on papers, Rothstein (2017) asserts that bias in estimation remains, while in response Chetty, Friedman, and Rockoff (2017) reject his test.

[14] It may be that classroom placement of students is productive, i.e., average student gains are higher in schools where student groupings and matches with teachers are optimal. For our analysis this is simply reflected in the overall school value-added, and we make no attempt to disentangle such sources of any differences in school value-added.

analysis of sector dynamics must cover all charter schools. Although comparisons between lottery and observational estimates of charter school quality employing value-added approaches do not exist for Texas, Abdulkadiroğlu et al. (2011), Dobbie and Fryer (2013), and Deming (2014) present evidence that lottery approaches and alternative observational identification strategies generate broadly similar estimates in their work on Massachusetts, New York, and North Carolina, respectively.

Matching of charter school students with observationally equivalent students in the traditional public schools from which new charter entrants originate has been used in several recent studies; e.g., see CREDO (2013) and Angrist, Pathak, and Walters (2013) along with studies investigating the correspondence of lottery and observational estimates. Although these matching approaches do not address selection on unobserved differences among students attending the same traditional public schools, they do account for systematic differences in observed characteristics and the composition of traditional public schools previously attended by charter school students.[15]

Our alternative specification is similar in spirit to the model presented in Angrist, Pathak, and Walters (2013). Specifically, our model compares charter school students who transition from a traditional public to a charter school with same-grade, same-demographic group students attending the traditional public school from which the charter school entrant transitioned.[16] Equation (2) models achievement A for student i in grade g and school s as a function of prior achievement, prior behavior (D), a charter-school fixed effect that measures school quality (δ_s), and a full set of race/ethnicity-gender-traditional public school dummy variables (θ) that indicate the traditional public school by race-

[15] Student fixed effects provides another alternative approach to the identification of charter and traditional public school quality, as each student acts as his or her own control; see Bifulco and Ladd (2006), Sass (2006), Booker et al. (2007), and Hanushek et al. (2007). However, in models with student fixed effect only students who attended schools in both sectors contribute to identification. Estimates based just on switchers may be particularly prone to biases introduced by time-varying student shocks. Moreover, in their study of variation in teacher value-added estimates, Guarino, Reckase, and Wooldridge (2015) find that the types of shocks typically considered problematic in this context appear to introduce less bias into value-added estimates produced by the lagged-achievement model than those produced by other models, including those with student fixed effects.

[16] Note that Angrist, Pathak, and Walters (2013) control for achievement in the year prior to charter-school entry and estimate the effect of an additional year in a charter school on achievement. By comparison, we estimate separate specifications for each year and therefore use prior year test scores to account for underlying achievement differences regardless of how long a student has been attending a charter school.

ethnicity-gender attended prior to entry into a charter school by the student or a classmate (in the case of students remaining in the traditional public sector):

$$A_{igs} = f\left(A_{i,g-1}\right) + 1\left[D_{i,g-1}\right] + X_{igs}\beta + \delta_s + \theta_{rgs} + \epsilon_{igs} \qquad (2)$$

where θ is defined as follows: $\theta_{rgs} = 1$ if race/ethnicity = r, gender = g, traditional public school = s, and the student transitioned to a charter school from traditional public school s, was a classmate in the same demographic cell and grade in the given charter school, or was a student in the demographic cell and grade in traditional public school s; otherwise $\theta_{rgs} = 0$. Consistent with the statewide estimator, we estimate the value-added model separately by year, controlling for prior achievement with cubic functions in both mathematics and reading. The vector X includes the same set of controls as the statewide estimator other than the characteristics used for matching.

4.2 Differences in Empirical Applications

In an evaluation of alternative approaches, Fortson et al. (2012) finds that such matching methods produce estimates that are not significantly different from lottery-based estimates over the same sample of schools; estimates produced by regression adjustments without matching of students tend to be fairly close in magnitude though statistically different.

Although prior discussions have emphasized the degree to which the estimator accounts for unobserved student heterogeneity, sample differences among the methods alter the distributions of estimates for both charter and traditional public schools. This complicates the interpretation of any observed differences among lottery-based, matching, and simple regression-adjusted value-added models. A measure of the mean sector difference based on value-added estimates would weight each school by its sector enrollment share. By comparison, the corresponding measure based on a matching model of the type used in Angrist, Pathak, and Walters (2013) would weight each school by its sector sample share, where sample inclusion requires finding an appropriate match by grade, year, and demographic cell. Specifically, including any students from a grade and demographic cell for a school in a given year such as 2001 requires at least one student in that cell to have previously transitioned from the traditional sector

and remained in the charter sector in 2001.[17]

Differences between the samples for the two estimation approaches highlight both the separate appeal of the estimators and the pronounced difference in the traditional public school enrollment distributions used to construct the comparison. In the case of the matching model, there is common support across sectors in terms of demographic characteristics and prior traditional public school attended, implying that the traditional public school comparison group invariably reflects a geographic distribution similar to that of the charter schools. The statewide estimator includes all traditional public schools in Texas, even if some were not previously feeder schools for the charter sector, thereby reflecting the full range of educational opportunities. This contrast may contribute to the finding in Fortson et al. (2012) of a greater similarity between lottery-based and matching estimators than between lottery-based and value-added estimators. Of course, the greater similarity may also result from the matching-model sample restrictions mitigating selection bias.

In our context of a rapidly growing charter sector, matching model estimates of changes over time in the charter-traditional public school quality differential will partially reflect any changes over time in the quality of the traditional public schools previously attended by charter-sector entrants.[18] Consider both the response to a change in the quality of a charter school and the expansion of the charter sector. If a charter school improves, it is likely to appeal to students from higher-quality traditional public schools. In addition, because a CMO is likely to consider the local demand for charter schools in the determination of where to open a school, a decline in the quality of traditional public schools in a community may elevate the probability that a charter school opens. Each of these processes could lead estimates of changes in mean sector differences based on matching methods to diverge from those produced by a statewide value-added model, because changes in the pattern of charter school entry would have a negligible effect on

[17] The measure of the mean difference based on lottery data would weight each school based on its sector enrollment share of compliers with the lottery results.

[18] Variation over time in the composition of schools that hold lotteries also changes the control group of traditional public schools.

traditional public school enrollment shares in the latter.[19]

Relatedly, any competitive effects of charter schools on the quality of instruction in the traditional sector are likely to be strongest in schools directly affected by charter school competition. Therefore, matching models might be more sensitive to general equilibrium effects that dampen estimates of charter sector improvement. In a preliminary analysis not reported, we found a strong positive relationship between charter school quality and the quality of the origin schools in the traditional sector after controlling for school fixed effects. Although this association does not provide causal evidence of a competitive effect, it is consistent with such an effect.

All in all, differences between the estimators in both the distributions of students among charter and traditional public schools and the treatment of unobserved heterogeneity lead us to provide estimates for both statewide and matched samples. These will illuminate the sensitivity of the findings to the empirical specification and comparison group.

5. Evolution of the Charter School Quality Distribution

We begin with a description of changes over time in charter school mathematics and reading value-added between 2001 and 2011 relative to traditional public schools. We then examine the contributions of school improvement, school closures, and the entry of new schools to these changes. We provide parallel estimates for a statewide comparison group used in the value-added model and for the more localized comparison group used in the matching estimator.

5.1. Trends in Charter-School Effectiveness

In what follows, we first illustrate changes over time in relative charter school effectiveness based

[19]The findings in Gleason et al. (2010) illustrate the possibility that changes over time in the distribution of traditional public schools can alter estimates of charter school effects. First, the lottery-based method generates substantial heterogeneity in estimated charter school effects. Second, the estimated effect of charter school attendance is much higher for low-income students. This finding is consistent with the possibility that the gains from charter school attendance are likely higher in areas with lower-quality traditional public schools (assuming that school quality tends to be lower as poverty increases). Some of the observed variation almost certainly reflects heterogeneity in charter school effects, but the pattern is consistent with the existence of heterogeneity in traditional public school quality as well.

on unweighted school value-added estimates and then show figures based on enrollment-weighted versions of these estimates. The distribution of school value-added unweighted by enrollment highlights the evolution of the school quality distribution, while comparisons with trends in enrollment-weighted estimates illustrate how sorting across schools affects the evolution of school quality experienced by charter-school students relative to that experienced by students in traditional public schools.

Figure 5 illustrates changes over time in the 25th, 50th, and 75th percentiles of charter school value-added in mathematics and reading relative to the corresponding percentiles of the traditional public school mathematics and reading statewide distributions. Over the decade, relative improvements in charter school mathematics value-added (Panel A) occurred throughout the distribution following a small decline between 2001 and 2003 when the state test was changed. The gaps at the 25th and 50th percentiles fell from roughly 0.4 to less than 0.2 standard deviations, while the difference at the 75th percentile declined from roughly 0.2 to 0.05 standard deviations.

Panel B illustrates smaller initial deficits and smaller charter sector improvement in reading value-added, though gains are similarly more pronounced at the lower percentiles. Across the full period, the gain at the 25th percentile was over 0.2 standard deviations, the gain at the 50th percentile equaled 0.15 standard deviations, and the gain at the 75th percentile was roughly 0.05 standard deviations. By comparison to mathematics, the improvements in reading value-added come much closer to eliminating sector gaps throughout the distribution by 2011.

The trends in the matching estimates presented in Figures 6A and 6B show similar overall improvement of charter relative to traditional public schools, but the patterns also reflect differences in the underlying structure of the models. In contrast to the statewide comparison trends composed of differences at comparable percentiles in the charter and traditional public school value-added distributions, the matching trends reflect the ordering of charter schools on the basis of performance relative to their unique and changing sets of traditional public school controls.

5.2. Entry, Exit and Improvement

It is informative to disaggregate the trends in relative charter school effectiveness between 2001

and 2011 into performance changes associated with entry, market (i.e., voluntary) closures, authorizer closures, and school improvement. Tables 1 and 2 illustrate the contributions of these components to the changes in charter-school performance between 2001 and 2011 using the statewide and matching estimates, respectively.

The average improvement of charter school value-added based on the statewide comparison model equals 0.25 and 0.22 standard deviations in mathematics and reading, respectively, and Table 1 shows that these performance gains are attributable to a combination of: (1) improvement in charter schools that persist throughout the period (Panel A); (2) the disproportionate closure of lower value-added schools (Panels B and C); and (3) an average value-added of new schools that far exceeds that of the schools that closed (Panel D). Value-added improved by 0.14 standard deviations in math and 0.12 standard deviations in reading for schools that remained open throughout the entire period. The average value-added of both voluntary and authorizer closures exceeded -0.5 and -0.6 standard deviations for both math and reading, far below the sector averages. Finally, the significantly higher average value-added of schools that entered post-2001 compared to those operating at the beginning of the period illuminates the importance of compositional changes to charter school gains.[20] Notice also that the contribution of entrants is amplified by their large market share.[21]

The somewhat larger average changes produced by the matching estimators are 0.28 and 0.23 standard deviations in mathematics and reading, respectively, and Table 2 disaggregates these changes into the contributions of school entry, closures and improvement. The patterns in the table are qualitatively similar to those for the statewide comparison, but there are some quantitative differences. Specifically, the matching model estimates show much larger improvements for schools open throughout

[20] A concern here is that differences in the number of years schools had been in operation may also contribute to the observed changes in value added, we investigated differences by years of operation using a school fixed effect estimator. The results (not reported) revealed little evidence of systematic differences in average VA by years of operation, among schools not in their first year of operation.

[21] Preliminary analysis that examined the association between CMO quality is measured by prior average value-added found only weak evidence of a negative relationship between CMO quality and the probability reducing the number of schools operated and little or no evidence of a positive relationship between CMO quality the probability of expansion.

the period, and state-authorizer closures are even more negatively selected, particularly in reading. This suggests that the quality of the alternative traditional public schools (which is localized with the matching estimator) is associated with charter-school closure decisions.

All in all, the similarity between the estimators in the overall patterns of relative quality changes for charter schools including the importance of compositional changes strengthens the case that charter schools improved relative to traditional public schools between 2001 and 2011. Even accounting for any changes over time in the observable characteristics of and prior schools attended by charter school entrants using the matching model does not reduce the estimates of relative improvement over the decade.

5.3 Enrollment and School Effectiveness

Enrollment decisions determine the extent to which the rightward shift in the school quality distribution translates to improvements in school effectiveness for students. Enrollment growth in more effective charter schools would amplify the improvements in the school quality distribution, while a weakening of the association between enrollment and charter-school effectiveness would attenuate the gains to students.

Figure 7 illustrates changes over time in the 25th, 50th, and 75th percentiles of the distributions of school quality for charter school students relative to those in the traditional public schools in mathematics and reading using both the statewide comparisons and matching estimates. A comparison of each to the corresponding distribution of school quality shown in Figures 5 and 6 shows two patterns that span subject and method: first, students are concentrated in higher value-added charter schools throughout the period, such that value-added in the distribution of school quality for students exceeds that in the distribution of schools at the 25^{th}, 50^{th} and 75^{th} percentiles for both subjects and methods in all years.

Second, in contrast to steady charter school gains in mathematics value-added throughout the distribution and in reading value-added at the 25^{th} percentile illustrated in Figures 5 and 6, the enrollment weighted distributions shown in Figure 6 flatten out around the middle of the ten-year period. This indicates a weakening of the association between enrollment and school quality, because the improvement in the quality distribution of charter schools does not translate into corresponding improvements in the

distribution of school quality for students.

This weakening might suggest that market pressures for higher-value added schooling lose strength as the sector matures. A simpler explanation, however, comes directly from the expansion of the charter sector. The entry of many new schools each year without any performance record would naturally dampen the association between enrollment and quality. As Figure 8 shows, the entry of charter schools and the share of students in new charter schools accelerated after 2004 and jumped precipitously in 2007.

Now we consider just schools for which there is some history of performance. Figure 9 presents trends in unweighted and enrollment-weighted median reading and mathematics charter school value-added for campuses not in the initial year of operations based on both statewide comparisons and the matching model. In all four figures the trends in median school quality and median school quality for students move much more closely together than those shown in Figures 5, 6 and 7. In fact, there is virtually no difference between the rightward shifts in the unweighted and enrollment-weighted distributions of mathematics and reading value-added between 2001 and 2011 regardless of the estimation method. These are not consistent with a weakening of the association between enrollment and quality.

5.4 Placing relative improvements in context

Importantly, interpretation of these findings in terms of the absolute level of charter school quality depends in part upon changes in the traditional public school sector. If, for example, the quality of traditional public schools in Texas fell during this period due to the expansion of the charter sector or other factors, the catch-up of charter schools may not indicate much if any quality improvement. Alternatively, if traditional public schools improved – either in response to competition from the charter sector or for other reasons – the observed increase in charter school quality would actually understate the increase in charter school effectiveness. Imberman (2011) highlights the difficulty of identifying the causal effect of competition on traditional schools. Therefore, we simply describe changes over time in state average achievement to provide a context for the relative improvement of the charter sector.

During the sample period, the general increase in scores on the National Assessment of Educational Progress (NAEP) suggests a positive change over time in the quality of public education in

Texas. The average NAEP score improved from 2000-2011 in fourth and eighth grade mathematics and from 1998-2011 in fourth grade reading; the average NAEP score remained roughly constant in 8th grade reading during this period.[22] Given the increase over time in the minority enrollment share and the lower average scores of blacks and Hispanics than of whites, the improvements in the overall average NAEP scores may well underestimate the gains in school quality. Looking at subgroups, whites, blacks, and Hispanics each improved over this period on all NAEP tests including eighth grade reading.[23] Thus, the relative improvement of charter schools is not driven by a decline in the average quality of traditional public schools; rather our estimates likely understate the gains in absolute performance.

6. Exploratory Analysis of the Sources of Improvement

Existing research on the determinants of charter school effectiveness focuses on school culture and operations, and there is less focus on student composition. Although the absence of experimental variation precludes strong causal inferences, evidence reported in Furgeson et al. (2012), Angrist, Pathak, and Walters (2013), and Dobbie and Fryer (2013) highlights the particularly strong performance of charter schools that set high expectations, require uniforms, or more broadly adopt a No Excuses philosophy. At the same time, questions have emerged about the contribution of student composition and whether unobserved heterogeneity contributes to the advantages observed for schools that adhere to a No Excuses philosophy.[24] In this section we examine the association between various dimensions of student composition and school quality and the sensitivity of estimates of the higher effectiveness of No Excuses schools to the inclusion of the student composition variables.

The belief that students are inputs into education production in addition to being consumers of its

[22] NAEP is a national test, often called the "Nation's Report Card," given to representative samples of students in all states. It has reported state performance in math and reading at grades 4 and 8 every two to four years since 1992. Eighth grade reading tests were not available until1998. See https://nces.ed.gov/nationsreportcard/.
[23] Note that schools across the country also tended to improve on these tests over the period, perhaps indicating the impact of federal accountability legislation (No Child Left Behind, or NCLB). Nonetheless, Texas students as a whole and across the racial/ethnic subgroups generally improved more than the national average over this period.
[24]Nichols-Barrer et al. (2014) consider the conjecture that student attrition from KIPP schools might explain their success but reject it.

output guides the model of schooling demand in the seminal work by Epple and Romano (1998). It has been reinforced by extensive work on peer effects in schools.[25] Informal conversations with CMO executives indicate that many share this belief. These executives, however, tend to emphasize behavior rather than achievement. The No Excuses philosophy encapsulates this theory, often featuring a number of rules or policies including strict discipline, contracts that require parental commitment, and uniforms aimed at creating a positive environment for learning (See Thernstrom and Thernstrom (2003), Mathews (2009)). These rules may contribute to a positive environment both through their direct effects on behavior and through their influence on enrollment and re-enrollment decisions.

We begin by describing trends in the share of schools that adhere to a No Excuses philosophy, student mobility, and selection on the basis of prior achievement and behavior. Next, we report estimates of the relationship between charter school value-added and adherence to a No Excuses philosophy for a series of models that progressively add controls for mobility and selection.

Importantly, the designation of a CMO as adhering to a No Excuses philosophy is not straightforward, as many that appear to operate with rules and practices that correspond to the No Excuses philosophy do not designate themselves in this way. We classified all charter schools according to the elements of a No Excuses approach as opposed to their self-identification. Appendix A describes the extensive information and decision-rules that we use to determine whether a CMO should be classified as following a No Excuses philosophy.

6.1. Variable trends over time

Figure 10 shows that, by our measures, the share of students attending Texas charter schools classified as adhering to a No Excuses philosophy increases from roughly 36 to 52 percent between 2001 and 2011. But that was not the only change going on over this period.

The next two figures reveal trends over time that are also consistent with selection and mobility accounting for a portion of charter school gains, and potentially, some of the association between value-added and a No Excuses philosophy. Figure 11 traces the proportion of charter and traditional public

[25] See the review in Sacerdote (2011).

school students that are new to their school. For this we exclude students for whom the previous grade was not offered in the previous year, meaning that the sample excludes students in brand new schools or the lowest grade offered in a school. In 2001, roughly half of the charter school students in this restricted sample were new to the school as compared with 18 percent of students in traditional public schools. The sector differential declined steadily throughout the period, falling below 10 percentage points in 2011.

To illustrate the changes in composition of the students in charter schools, Figure 12 plots the mean differences in math and reading achievement and the probability of committing a disciplinary infraction between traditional public school students who transition to a charter school in the subsequent year and their schoolmates who remain in the traditional sector. Importantly, all comparisons of achievement and behavior are based on the year prior to charter school entry and thus rule out any influences of the charter school. Moreover, disciplinary infraction comparisons within a traditional public school at a point in time hold constant infraction policies and procedures and isolate differences in behavior. For these measures, we first compute the differences between each charter school entrant and her schoolmates who remain in the traditional public sector and then average over the sample of entrants.

The high rate of charter school mobility shown previously, however, also means that the characteristics of new entrants may not accurately capture the overall degree of selection relevant for on-going operations. Therefore, while the top panel compares all charter school entrants to schoolmates who remain in the traditional public sector, the bottom panel compares only charter entrants who remain in the charter school into the second year with the same set of schoolmates.

Following a dip between 2001 and 2002, average achievement of charter school entrants increased steadily relative to schoolmates who remained in the traditional public sector (Figure 12A). The average difference in mathematics achievement between students who entered a charter school and schoolmates who remained in the traditional sector rose from -0.20 standard deviations in 2002 to 0.12 standard deviations in 2011; the corresponding rise for reading achievement is -0.11 to 0.17 standard deviations.

Selection on achievement of entrants who remained in their charter schools into the second year

following the transition shows slightly smaller improvement in mathematics but even larger improvement in reading (Figure 12B). The similarity of the changes, however, indicates that it is selection for new entrants as a whole rather than differential persistence that drives the changes in composition by prior achievement.

Charter school entrants also become more positively selected in terms of the probability of having committed a disciplinary infraction. Again, it is the composition of new entrants that drives the change, as the relative rate of prior disciplinary infractions for students who persist in charter school remains stable during the period.

6.2 Regression results

A pressing question for policymakers is the extent to which increasingly positive selection accounts for the higher performance of charter schools overall and for schools that adhere to a No Excuses philosophy. To understand better the interrelationships among mobility, selection, and adherence to a No Excuses philosophy, we estimate a series of models that regress mathematics or reading value-added on various combinations of these variables.[26] Separate columns present estimates based on quality measures produced by both the statewide estimates and the matching models.

The top panel of Table 3 reports estimated effects on charter-school effectiveness at raising mathematics achievement based on statewide (left panel) and matching (right panel) estimates of quality. The patterns are quite similar in each. Although the matching model coefficients are more than 50 percent larger than the corresponding statewide coefficients, all No Excuses coefficients are highly significant. Inclusion of the student turnover variable, also highly significant in all specifications, reduces the

[26]For this analysis, the selection at the time of entry and reenrollment variables are computed as follows: first, each charter school entrant is assigned the difference between their prior achievement (or receipt of a disciplinary infraction) and the average among their traditional public school peers that remain in the traditional public sector. Next, these differences are averaged over all students that enter each school. The reenrollment selection variables are computed similarly with the exception that the differences are averaged over only those students who remain in the same charter into their second year. For students who enter a charter school in year t, the degree of selection upon entry is related to value-added in year t, while the degree of selection at the time of reenrollment for the second year is related to value-added in year t+1. Standard errors are clustered at the school level; clustering at the CMO level has little effect on the standard errors.

magnitude of the No Excuses estimate by roughly 20 percent. The addition of the selection variables leads to a further reduction of roughly 5 percent. In the full models (Columns 4 and 8), the No Excuses coefficient equals 0.075 in the statewide specifications and 0.12 in the matching specifications. Although the pattern is consistent with the possibility that lower turnover and more positively selected students account for a portion of the No Excuses effect, that portion appears to be relatively small.

Estimates for reading presented in the bottom panel of Table 3 follow a similar pattern, though the inclusion of the selection variables leads to a somewhat larger decline in the No Excuses coefficient. In the statewide specifications, the coefficient declines from 0.047 to 0.031 while remaining significant at the 5 percent level; in the matching models the coefficient declines from 0.050 to 0.029 and becomes insignificant. The larger and more significant effects for mathematics are consistent with the broader literature on school effects.

Although the specifications do not produce compelling estimates of the causal effects of the student composition variables, the findings illustrate the associations with school value-added. The coefficient on the turnover variable is highly significant in all subjects and specifications, while those on the prior achievement variables for entrants and persisters are all positive but only significant in some specifications. This is not surprising given the multicollinearity introduced by including measures for both all entrants and those that remain at least two years. We are particularly interested in the sensitivity of the No Excuses coefficients to changes in the controls, and therefore we control comprehensively for student characteristics. Finally, there is little or no evidence that selection on prior disciplinary infractions inflates the No Excuses coefficients.

The large and significant mobility estimates, the sensitivity of the No Excuses coefficients to the inclusion of mobility, and the dramatic decline in the average share of students who are new to the school (Figure 11) suggest an important role for mobility in the improvement of the charter sector. One approach to quantifying that contribution is to use the causal estimate of mobility externalities from Hanushek, Kain, and Rivkin (2004), also based on Texas data, to estimate the contribution of mobility to the increase

in charter school mathematics value-added.[27] The estimate suggests that the approximately 20 percentage point decline in the charter-traditional public school differential in the share of students that are new to the schools contributes roughly 0.04 standard deviations to the improvement of charter school math performance between 2001 and 2011.[28] Thus the greater sector stability *per se* accounts for over 17 percent of the decrease in the average mathematics value-added gap between charter and traditional public schools. Note, this is an estimate of the externality of high student mobility as the value-added regressions account for the direct effects of moving.

6.3 Other Contributing Factors

Classification as a No Excuses school is, of course, not the sole dimension of school operations, and there are certainly others, most notably the quality of leadership and instruction, that vary among schools regardless of their philosophy. In fact, conversations with executives employed by some of the largest CMOs operating in Texas reveal a strong emphasis on the hiring and development of effective school leaders. Some CMOs devote substantial resources to the identification and training of school leaders including year-long apprenticeships. These preparation programs differ considerably from the traditional public school job ladder of teacher to assistant principal to principal combined with some formal education in leadership. Other CMOs bemoaned the inability to afford such programs. Importantly, this commitment to leadership did not seem to depend on the degree of authority granted over personnel or programmatic decisions. Impediments to the measurement of leadership performance complicate the identification of its contribution to charter school quality and improvement, and this is a prime area for further investigation.[29]

[27]Note that estimates of the impact of mobility externalities are not available for reading.

[28]Hanushek, Kain, and Rivkin (2004) find that the added disruption of high mobility creates an externality. That analysis is based on value-added models of achievement in Texas that include student, school-by-year, and school-by-grade fixed effects to account for confounding factors including perceived school quality and neighborhood shocks. A ten percentage point higher level of mobility reduces mathematics achievement by approximately 0.02 standard deviations in Texas public schools (independent of any impact on the individuals who move).

[29] See Branch, Hanushek, and Rivkin (2012) and Laing et al. (2016) on both the potential importance of principals and the difficulty of measuring differences among principals. Bloom et al. (2014) also point to the importance of management in schools, relying on surveys of specific management practices. England has introduced Academy Schools which call for conversion of traditional public schools into institutions very similar to charter schools, and this has led to positive but heterogeneous impacts on student performance. When surveyed, a majority of the

7. Conclusions

This paper uses administrative microdata on schools and students to trace the evolution of charter school quality in Texas between 2001 and 2011 as measured by contributions to mathematics and reading achievement. The results are based on quality measures generated by flexible value-added specifications that control for prior achievement and discipline. Regardless of whether students in all traditional public schools in the state or only those from traditional public schools once attended by a charter school student provide the comparison group, the analysis finds that charter-school mathematics and reading value-added increased substantially relative to traditional public schools, driven strongly by authorizer and voluntary closures. This improvement is notable because there is evidence that traditional public schools were also improving on average. The overall pattern of improvement is not a function of sampling or estimation methodology but appears to reflect market dynamics and effective regulation.

Two potential sources of these improvements stand out: an increasing share of schools that adhere to a No Excuses philosophy and a reduction in student mobility as the sector matures, although substantial portions of the improvement remains unexplained by these factors. The pattern of estimates suggests that student selection and lower student turnover account for some portion of the No Excuses premium, but the contribution is relatively small.

The substantial decline in student mobility and the contribution of closures to charter sector gains highlight the importance of patience in an evaluation of a large-scale educational reform, particularly one that relies on parental choices and market forces. The relaxation of constraints on school management induced many with little prior experience to apply for a charter, and the large variation in school quality observed during the early years is consistent with growing pains associated with a new market. These factors likely contribute to the high mobility and the unwillingness of many students making adequate progress in a traditional public school to consider a switch to a charter school.

Academy Schools indicated that change in leadership was the most important element of their conversion; see Eyles and Machin (2014).

Over time, many low-performing schools closed, and the average effectiveness of new market entrants and schools remaining open throughout the decade rose. As might be expected, students and families appear to have responded favorably to these improvements, as selection into the charter sector became more positive. Thus, the families of higher-achieving students appear to have elevated their opinion of a charter school as a viable alternative. Importantly, these responses likely amplified the improvements in the sector by raising the quality of the classroom environment through greater stability and increased academic skills of peers.

The juxtaposition of these dynamic changes with cross-sectional comparisons of sector differences highlights the value of a focus on the trajectory of school quality as opposed to effectiveness at a point in time in the evaluation of a major educational reform. Much more can be learned about the behaviors of both families and education providers and the aspects of school operations that contributed to the improvement. Although the identification of the contributions of specific school factors including the quality of teachers, principals, and CMO executives may be difficult, this is a prime area for additional research.

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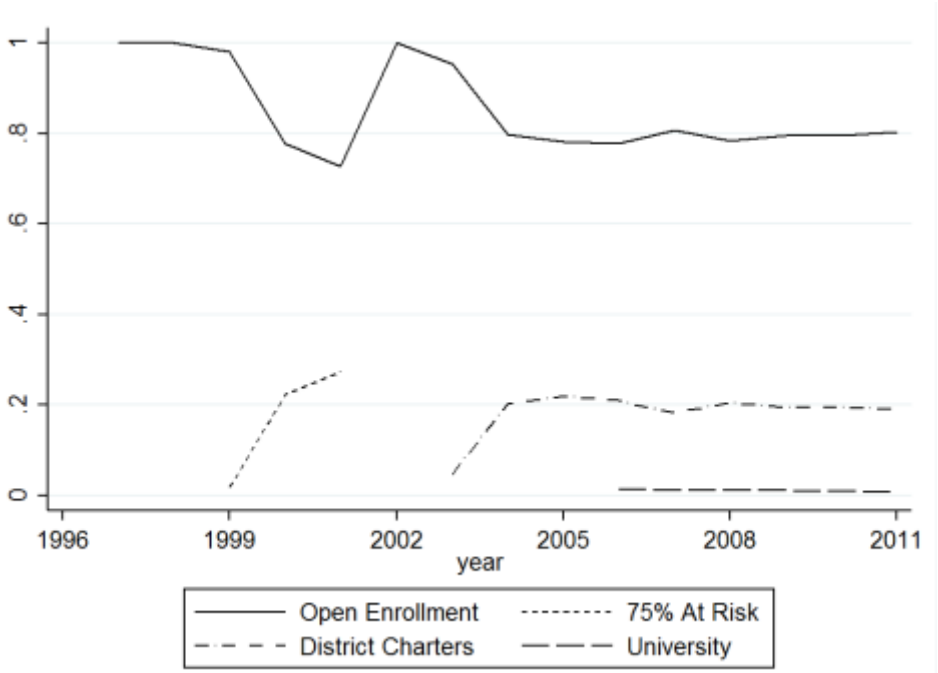
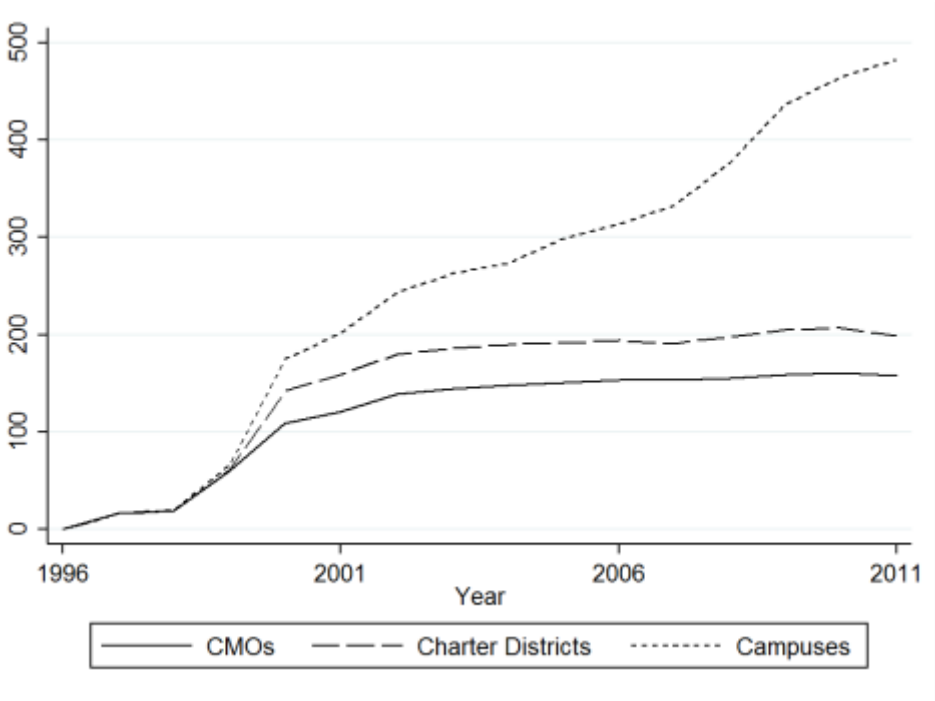
Figure 1: Charter Sector Enrollment Shares by Charter School Type



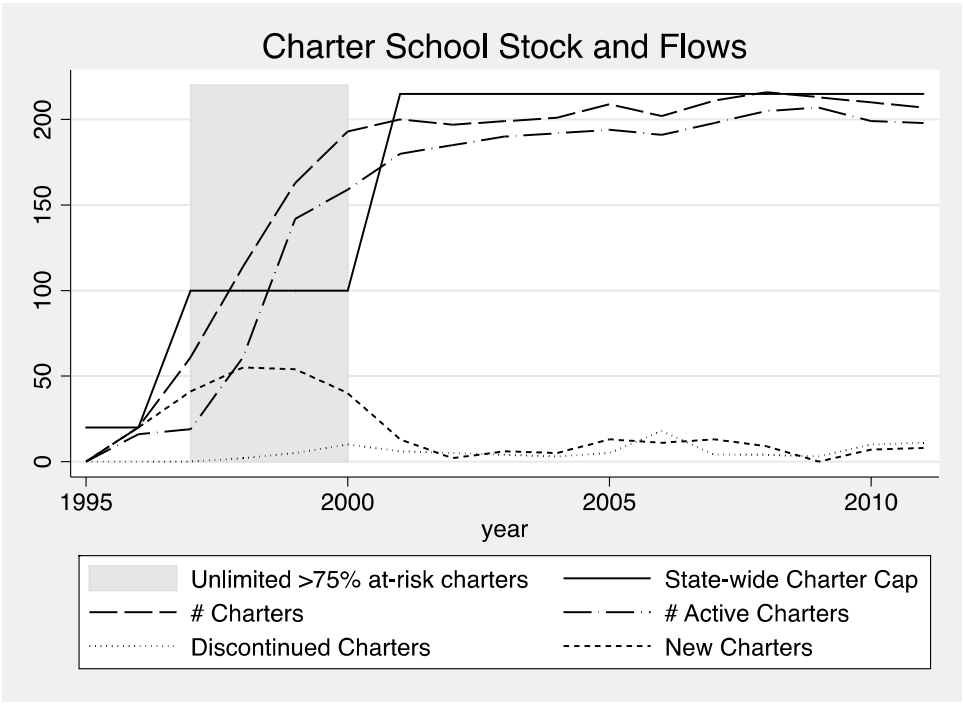
Note: Figure shows the share of charter sector enrollment in each school type over time.

Figure 2: The Growth in Open-Enrollment Charter Schools, 1995-2011



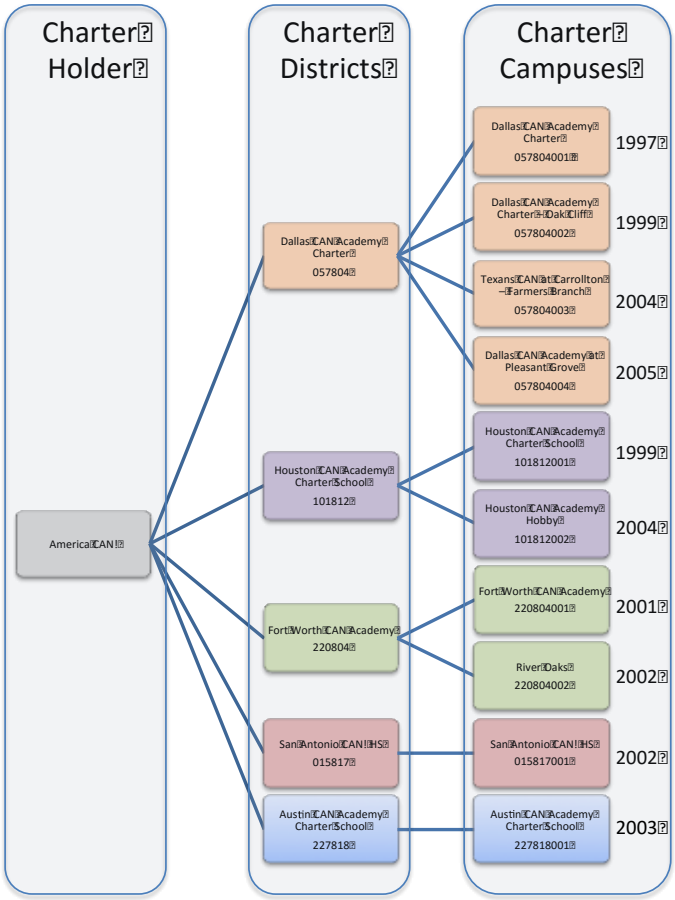
Note: Figure shows the number of Charter Management Organizations (CMOs), Charter Districts, and Charter Campuses operating in Texas over time.

Figure 3. Stock and Flows of State Charters by Type, 1995-2011



Note: Data drawn from Texas Schools Project data on schools.

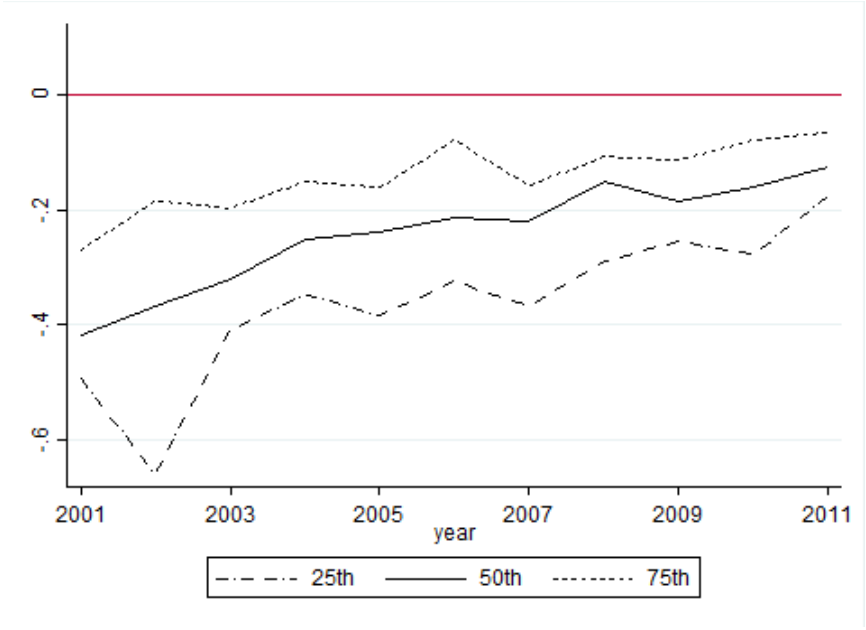
Figure 5: An example of the charter sector organizational structure: the expansion of the America Can! CMO from 1997-2011



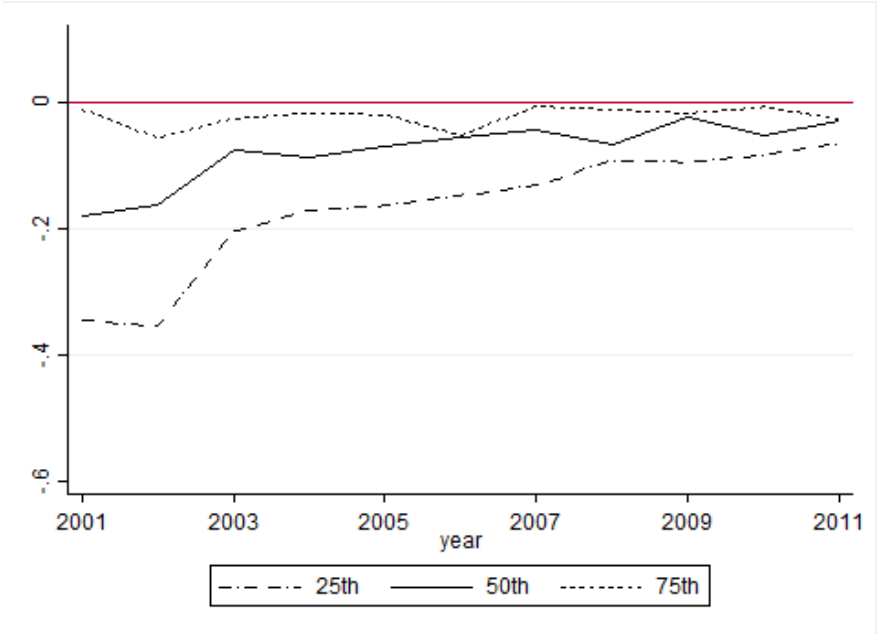
Note: The number in each district and campus block refers to the relevant state ID code.

Figure 5: Charter School Quality Quartiles Over Time Relative to Traditional Public Schools (Statewide Comparisons)

Panel A: Mathematics



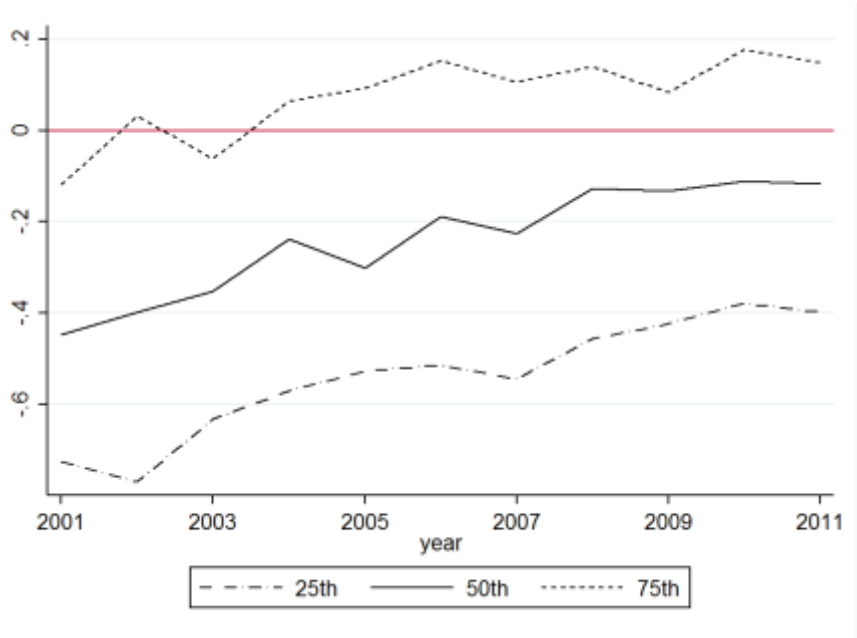
Panel B: Reading



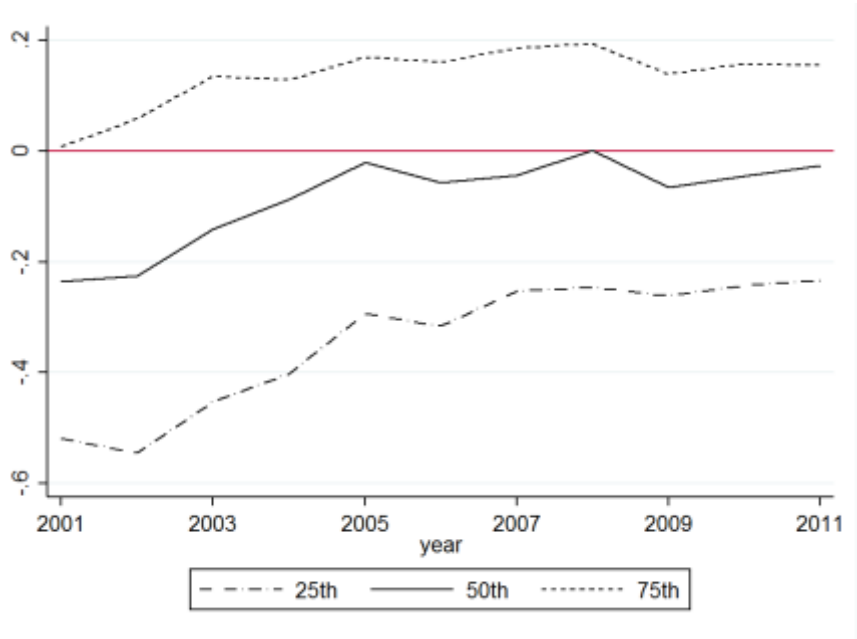
Note: Figures show the difference between the 25th, 50th, and 75th percentiles of the charter and traditional public school quality distributions based on statewide value-added models.

Figure 6: Charter School Quality Quartiles Over Time Relative to Traditional Public Schools (Matching Procedure)

Panel A: Mathematics



Panel B: Reading

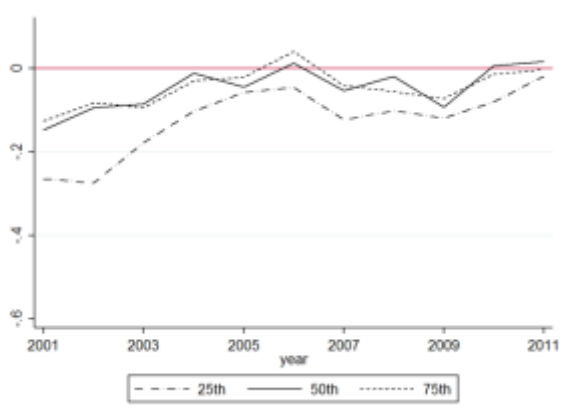


Note: Figures show estimates at the 25th, 50th, and 75th percentiles of charter school quality distributions relative to traditional public schools based on matching models.

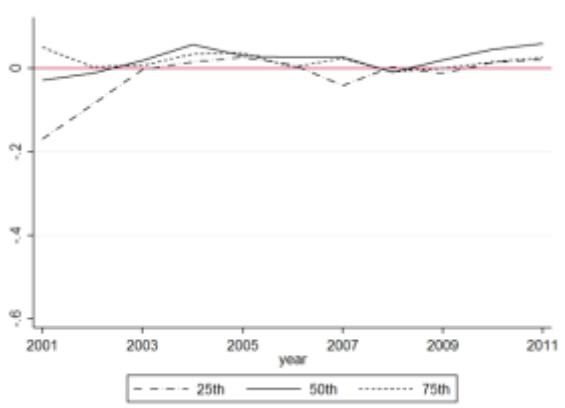
Figure 7: Enrollment Weighted Quartiles of Value-added Relative to Tradition Public Schools.

Panel A: Statewide Comparisons

Math

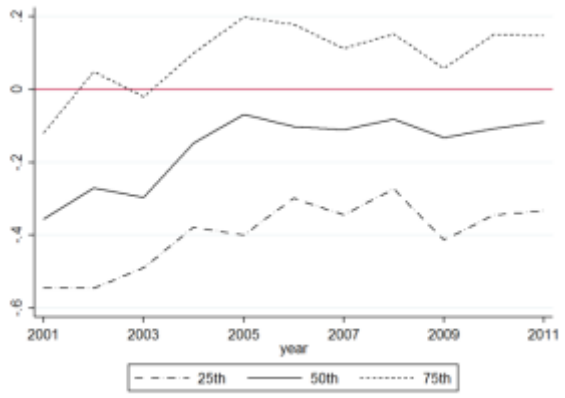


Reading

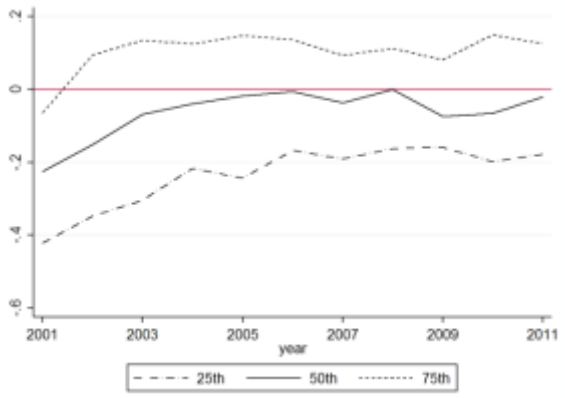


Panel B: Matching Estimates

Math

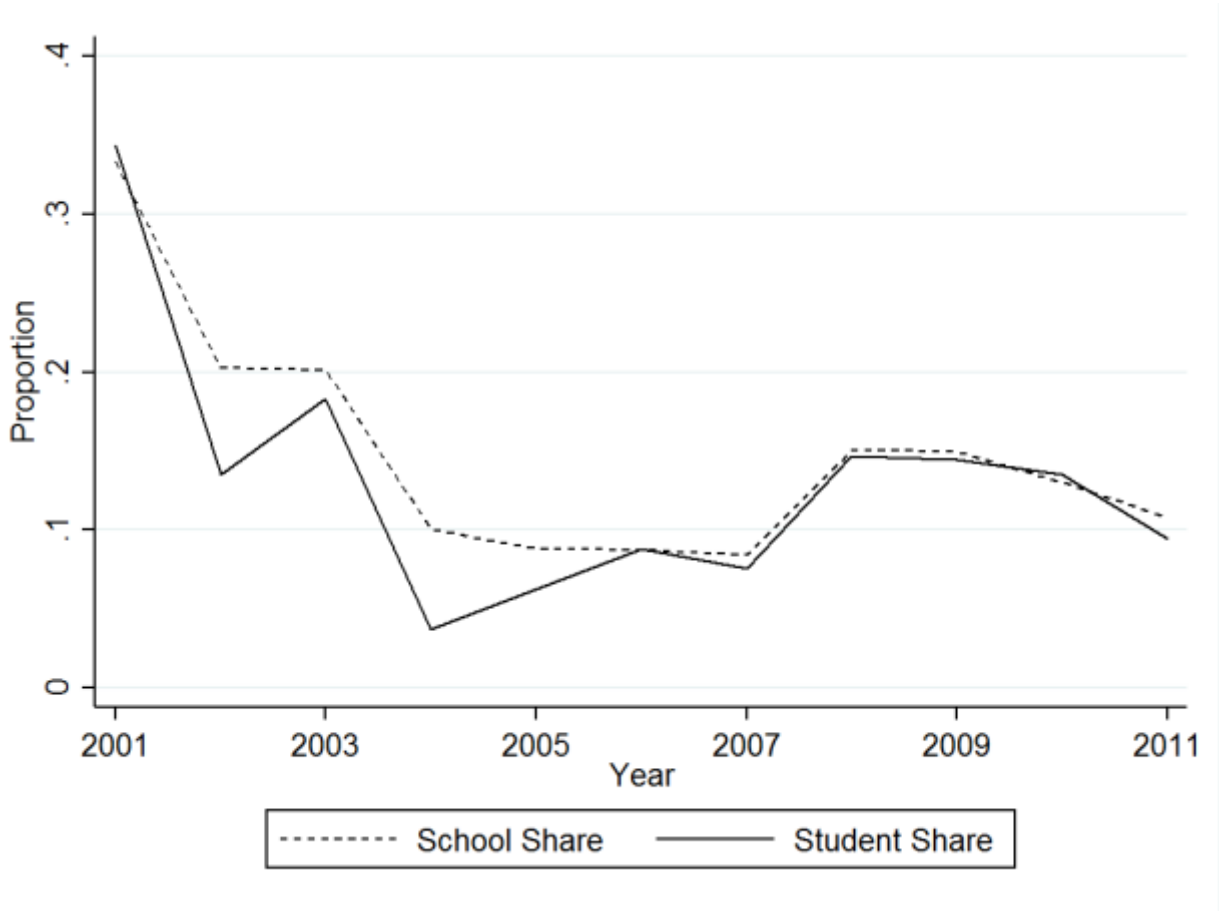


Reading



Note: Figures show estimates at the 25th, 50th, and 75th percentiles of charter school quality distributions relative to traditional public schools based on statewide comparison and matching models.

Figure 8: Fraction of Schools in the First Year of Operation and Fraction of Students Attending Schools in the First Year of Operation.

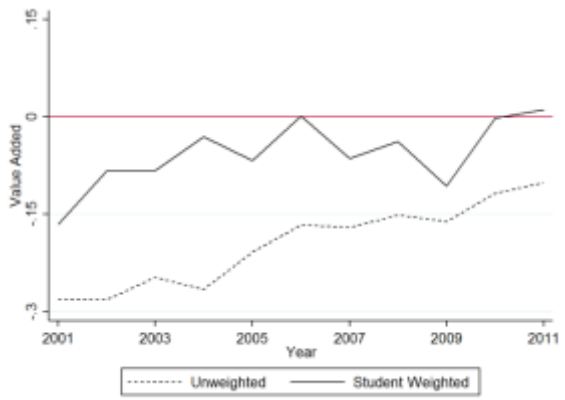


Note: Share data calculated using Texas Schools Project data on charter schools and students.

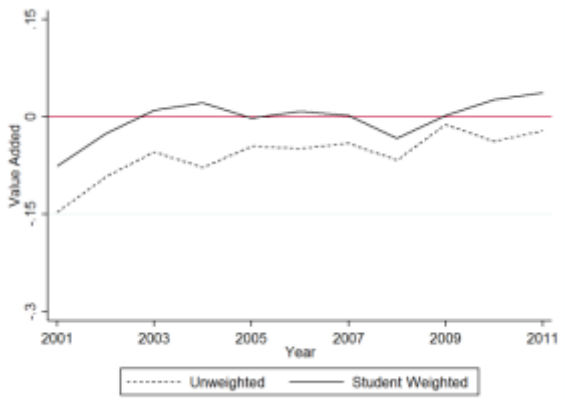
Figure 9: Unweighted and Enrollment Weighted Median Charter School Value-added Relative to Traditional Public Schools for Charter Schools Not in the First Year of Operation.

Panel A: Statewide Comparisons

Math

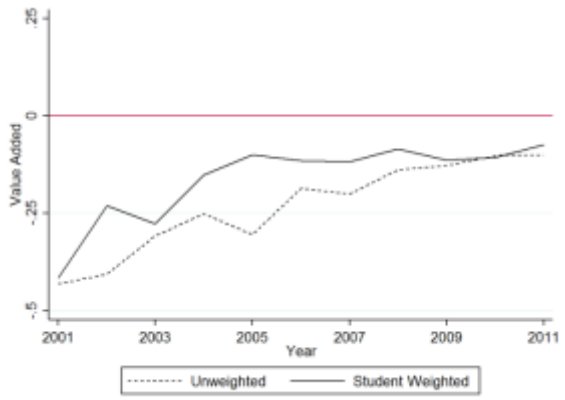


Reading

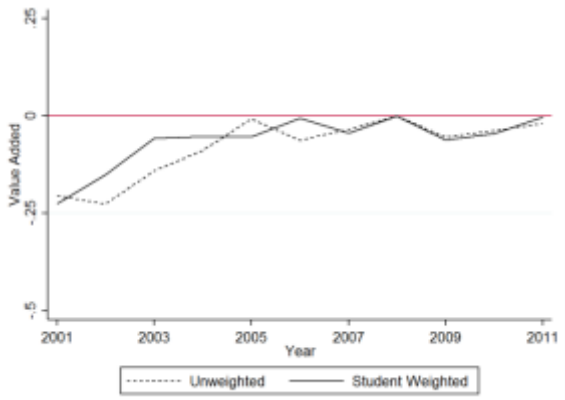


Panel B: Matching Model

Math



Reading



Note: Figures show estimates at the median of charter school quality distributions relative to traditional public schools based on statewide comparison and matching models.

Figure 10: Trends over Time in the Share of Schools that Adhere to a No Excuses Philosophy

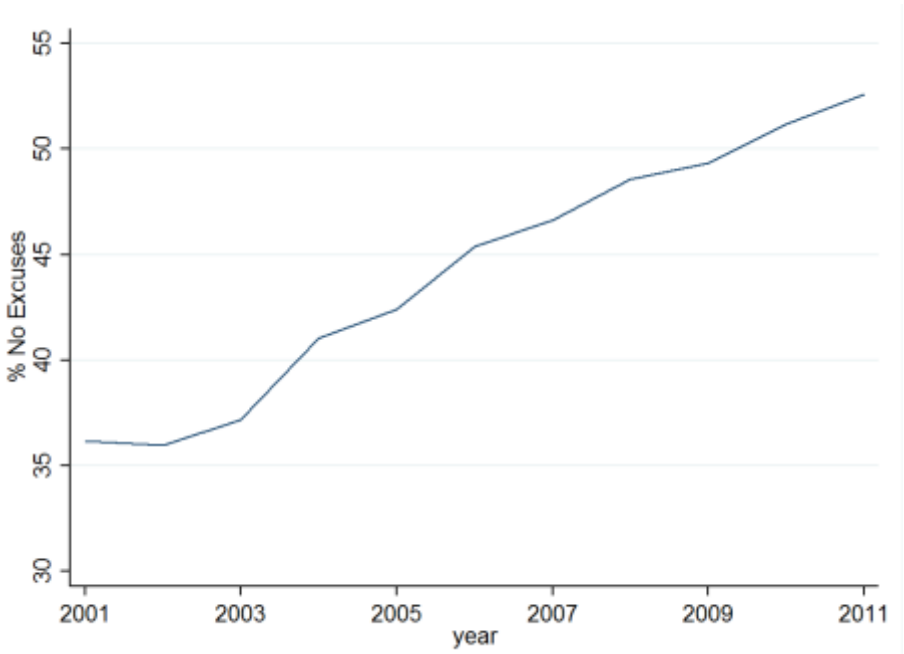


Figure 11: Proportion of students that are new to the school in charter and traditional public sectors: 2001 to 2011

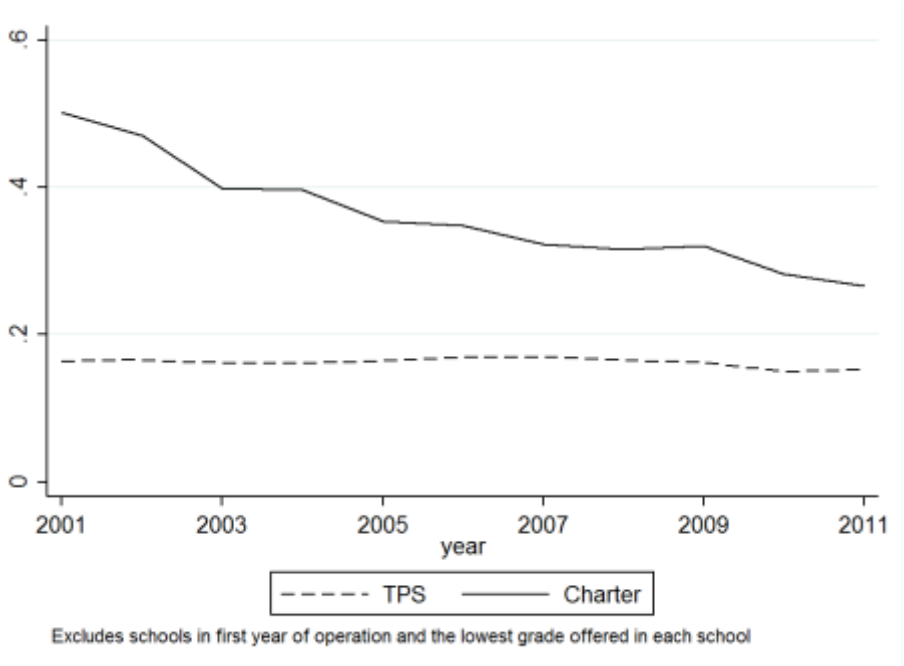
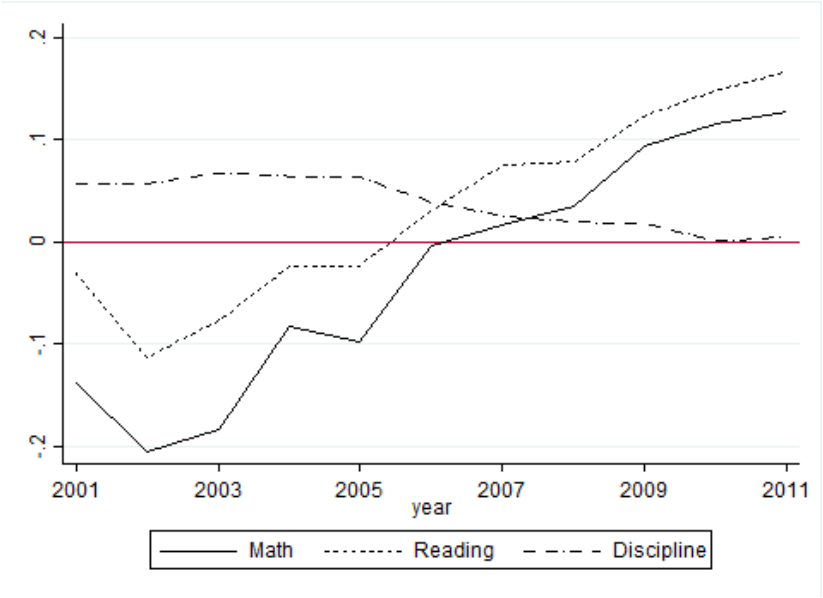
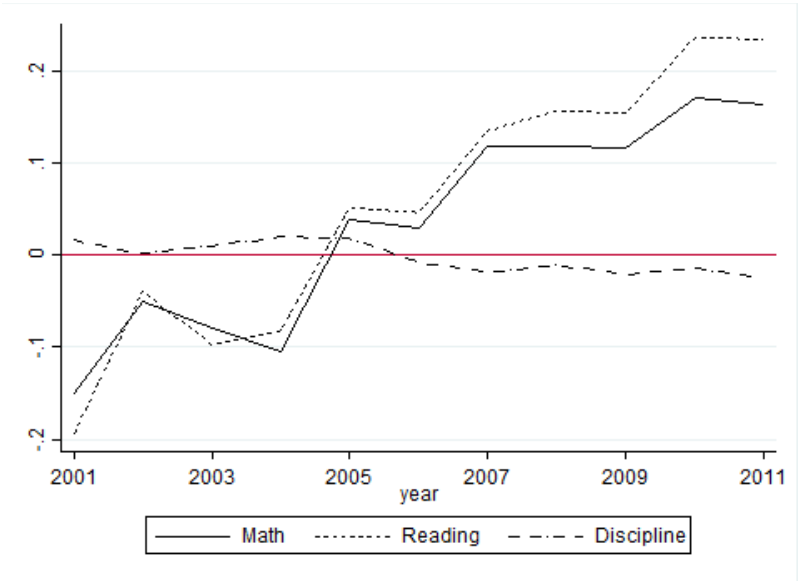


Figure 12: Trends over time in selection into the charter sector by prior mathematics and reading achievement and the probability of receiving a disciplinary infraction: 2001-2011

Panel A: All Charter School Entrants



Panel B: Charter Entrants Who Remain into their Second Year



Notes: These series compare students who transition to a charter school to their former schoolmates who remain at a traditional public school using information from the year prior to the transition. Math refers to average math achievement, reading refers to average reading achievement, and discipline refers to the probability of having committed any disciplinary infraction.

Table 1: Average Charter Schools Mathematics and Reading Value Added and Enrollment Shares for 2001 and 2011, by Status of School Operations (Statewide estimates)

	Mathematics		Reading	
	2001	2011	2001	2011
A. Schools in Operation in 2001 and in 2011				
Average Value-Added	-0.258	-0.120	-0.194	-0.075
Share of Charter Enrollment	0.78	0.19	0.78	0.19
Average Campus Age	2.47	12.44	2.47	12.44
Number of Schools	66		66	
B. Market Closures				
Average Value-Added	-0.598		-0.551	
Share of Charter Enrollment	0.17		0.17	
Average Campus Age	2.11		2.11	
Number of Schools	27		27	
C. Authorizor Closures				
Average Value-Added	-0.519		-0.597	
Share of Charter Enrollment	0.06		0.06	
Average Campus Age	2.23		2.23	
Number of Schools	13		13	
D. Schools in Operation in 2011 but not in 2001				
Average Value-Added		-0.146		-0.083
Share of Charter Enrollment		0.80		0.80
Average Campus Age		4.81		4.81
Number of Schools	253		253	

Notes: Average value-added for charter schools is net of traditional public school average value-added in each year. Empty cells in panels B, C, and D correspond to years when these school categories are no longer in operation or have yet to begin operation. Charter schools that open after 2001 and close before 2011 are not included. Estimates are constructed using statewide comparision group.

Table 2: Average Charter School Mathematics and Reading Value Added and Enrollment Shares for 2001 and 2011, by status of school operations (Matching Estimates)

	Mathematics		Reading	
	2001	2011	2001	2011
A. Schools in Operation in 2001 through 2011				
Average Value-Added	-0.326	-0.065	-0.294	-0.072
Share of Charter Enrollment	0.78	0.19	0.78	0.19
Average Campus Age	2.47	12.44	2.47	12.44
Number of Schools	66		66	
B. Market Closures				
Average Value-Added	-0.566		-0.506	
Share of Charter Enrollment	0.17		0.17	
Average Campus Age	2.11		2.11	
Number of Schools	27		27	
C. Authorizor Closures				
Average Value-Added	-0.736		-0.898	
Share of Charter Enrollment	0.06		0.06	
Average Campus Age	2.23		2.23	
Number of Schools	13		13	
D. Schools in Operation in 2011 but not in 2001				
Average Value-Added		-0.166		-0.062
Share of Charter Enrollment		0.81		0.81
Average Campus Age		4.81		4.81
Number of Schools	253		253	

Notes: Average value-added for charter schools in each year. Empty cells in panels B, C, and D correspond to years when these school categories are no longer in operation or have yet to begin operation. Charter schools that open after 2001 and close before 2011 are not included. Estimates are constructed using matcing comparision group.

Table 3: Estimated Effects of Program Characteristics and Student Selection on Charter School Value-added

	Statewide Esimtates				Matching Estimates			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Math								
No Excuses Indicator	0.0982***	0.0796***	0.0736***	0.0748***	0.155***	0.134***	0.123***	0.121***
	(0.0273)	(0.0221)	(0.0234)	(0.0232)	(0.0431)	(0.0386)	(0.0391)	(0.0387)
Proportion New		-0.520***	-0.496***	-0.490***		-0.587***	-0.537***	-0.546***
		(0.0483)	(0.0482)	(0.0493)		(0.0735)	(0.0720)	(0.0733)
Achievement Difference								
Entrants			0.0170	0.0111			0.0801**	0.0856**
			(0.0235)	(0.0232)			(0.0387)	(0.0399)
Persisters			0.0324*	0.0303			0.0213	0.0266
			(0.0187)	(0.0191)			(0.0278)	(0.0291)
Infraction Rate Difference								
Entrants				-0.0763				0.0127
				(0.0881)				(0.112)
Persisters				0.0114				0.0949
				(0.0588)				(0.0899)
Observations		1,481				1,459		
Reading								
No Excuses Indicator	0.0465***	0.0368***	0.0300**	0.0308**	0.0504*	0.0377	0.0293	0.0287
	(0.0147)	(0.0131)	(0.0136)	(0.0134)	(0.0267)	(0.0249)	(0.0254)	(0.0251)
Proportion New		-0.272***	-0.247***	-0.243***		-0.350***	-0.316***	-0.320***
		(0.0318)	(0.0320)	(0.0333)		(0.0586)	(0.0601)	(0.0584)
Achievement Difference								
Entrants			0.0415**	0.0390**			0.0489	0.0518
			(0.0162)	(0.0165)			(0.0354)	(0.0367)
Persisters			0.0149	0.0126			0.0256	0.0262
			(0.0124)	(0.0122)			(0.0190)	(0.0190)
Infraction Rate Difference								
Entrants				-0.0131				0.0547
				(0.0582)				(0.104)
Persisters				-0.0350				-0.0271
				(0.0406)				(0.0737)
Observations		1,480				1,459		

Note: Left panel estimates come from school-by-year level regressions with estimated value added produced by statewide comparison model as dependent variable. Right panel estimates come from school-by-year level regressions with estimated value added produced by matching comparison model as dependent variable. Regressions include campus demographic characteristics and year dummies. All regressions are enrollment weighted. Standard errors are clustered at the campus level. *** p<0.01, ** p<0.05, * p<0.10

Appendix A: Classification of Schools as Adhering to the No Excuses Philosophy

We used a number of sources of information to determine whether a CMO adhered to the No Excuses philosophy. First, our research assistant called each school, described our project, and asked the representative if they could answer some questions about the school's approach to education. This often proved difficult, as many offered vague or curt responses. The research assistant then explored the website (if available), focusing on the mission or vision statements, superintendent's message, history, and other relevant information to gain a general feel for the school. Perhaps the most important source of information was the school handbook and code of conduct, and the research assistant carefully sifted through these documents. Finally, if none of these sources proved adequate, the research assistant searched for school reviews and articles that provided information on school policies and practices.

We focused on six areas to determine whether to classify a school as adhering to the No Excuses Philosophy. These areas are the following:

- **Discipline:** Most schools follow a progressive disciplinary system and provide clear expectations for behavior. Some schools, however, stand out as being particularly strict. We classify schools as strict in the discipline dimension if they use corporal punishment, impose strict zero tolerance policies for misbehavior, curfews, fine dining requirements (no talking or sharing), or sizable monetary fines for having cell phones or electronics, or undertake legal prosecution if a teacher is offended by students' language or other actions.
- **Expectations:** We use the following questions to determine whether a school sets very high expectations: Does the school hold all students to the same high expectations regardless of extraneous circumstances or family background? Does the school follow state standards or hold their students to higher expectations (i.e. are students required to meet state required 90 percent compulsory attendance or do they require *all* students to maintain 95-100 percent attendance to stay enrolled?)? Does the school require that all students are accepted at a university? Are students expected to graduate from college?
- **Uniforms**: Does the school require students to wear uniforms? Adhere to a strict dress code? Are there serious consequences for failing to comply? Are students sent home? Fined? Given detention? How many infractions until there is a serious consequence?
- **Parental Involvement:** Are parents encouraged to actively participate in the school? Are parents required to sign a commitment form?
- **Incentives**: Does the school offer rewards to students who surpass expectations? Most schools recognize students through things such as honor roll, by allowing them to go on field trips, or by letting them have a free dress day. Some offer additional incentives such as monetary prizes or privileges for good grades, attendance, and have a strong belief in reinforcing good behavior.
- **Extra**: Is there an extended school day? Week? Year? Is Saturday school offered or required? Tutoring?

For some CMOs that were consistent across categories the classification decision was straightforward. For other CMOs the decision was more difficult, because they appeared to be strict in some dimensions but not others. In classifying these schools, we placed particular emphasis on the strictness of the disciplinary practices.