The Evolution of Charter School Quality

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Abstract

Studies of the charter school sector typically focus on head-to-head comparisons of charter and traditional schools at a point in time. The impact of the charter reform on the overall quality of schooling, however, depends crucially on whether introducing a charter sector improves the quality of schooling options, particularly in high-poverty communities. We study changes in the quality of charter schools in Texas between 2001 and 2011. Our results suggest that the creation of the charter sector initially led to the entry of a set of schools that were highly variable in terms of quality and less effective on average than traditional public schools. However, exits from the sector, improvements of existing charter schools, and positive selection of charter management organizations that open additional schools raised the average charter school effectiveness over time relative to traditional public schools in Texas. Although data limitations preclude the identification of the specific causes of charter school improvement, the evidence is consistent with the belief that more effective schools have greater success in attracting and retaining less disruptive and higher-achieving students. It also appears that reductions over time in student turnover have contributed to the improvement in the charter sector.

JEL Codes: H0, H75, I20, I28

1. Introduction

The role of charter schools in improving academic achievement is controversial. Although some studies of charter schools in specific cities have found positive achievement impacts,[1] other studies, encompassing a wider range of environments and often using different methodologies, have found essentially no or even negative differences in average achievement between charter and traditional public schools.[2] These incongruous findings provide some support for both advocates and opponents of charter schools. Advocates can point to the high quality of a small number of oversubscribed schools. On the other hand, opponents highlight the mediocre average outcomes and large variability in performance among the broader set of charter schools. Efforts to distinguish more successful from less successful charter schools highlight the importance of specific inputs or features; these comparisons, however, yield little insight to the basic market dynamics that proponents hope will facilitate increases in overall school.

Although there is not comprehensive research on the evolution of charter school quality, two studies provide some evidence consistent with effective market forces. First, Hanushek, Kain, Rivkin, and Branch (2007) show that higher school value-added has a much stronger effect on the probability of reenrollment in a charter school than in a traditional public school. Second, CREDO (2013) finds that average charter school effectiveness has improved relative to traditional public schools in a number of states. Importantly, the closure of poorly performing charter schools appears to be one of the primary mechanisms for improvement.

[1] Abdulkadiroğlu et al. (2011), Angrist et al. (2012), and Angrist, Pathak, and Walters (forthcoming) report results for charter schools in and around Boston.

[2] See, for example, evidence from statewide studies in Bifulco and Ladd (2006), Sass (2006), Booker, Gilpatric, Gronberg, and Jansen (2007), and Hanushek, Kain, Rivkin, and Branch (2007). See also the multiple state comparisons in CREDO (2009, (2013).

This paper seeks to bring new evidence to bear on these important issues. Specifically, the paper has two principal aims: (i) investigate the evolution of the distribution of charter school quality in Texas between 2001 and 2011 and (ii) document key contributors to these observed changes. We use state administrative data compiled by the Texas Schools Project to provide a much more comprehensive analysis than has been provided in the literature to date.

Our main results indicate that charter school quality has improved over time in Texas. Using value added on mathematics and reading exams, we show that though initially below traditional public schools, the value –added distributions for charters rapidly catch up to the distributions for traditional public schools. In aggregate, these quality improvements can be partly attributed to the closing of bad charters, but also, improvements among those that persist.

A key aspect of the Texas law that governs the charter sector is that the granting of a charter creates a school district that can open additional schools with little involvement of state authorities. A CMO can operate one or more charter districts in Texas, and a CMO that operates a Texas charter district possesses the freedom to expand with a new school. By 2001 there were over 150 separate CMOs operating at least one charter school in Texas, and between 2001 and 2011 existing charter holders opened far more schools than new charter holders that had to satisfy government authorities. These results suggest that CMO decisions to open and close and other management practices may be important determinants to improvements in this sector. Therefore, we highlight the association between the quality of CMO schools and growth as well as CMO differences in the association between teacher quality and the probability of leaving a school.

After establishing that charter school quality has improved, we then turn to understanding the source of these improvements. Despite the fact that average school value-added for charter school students is roughly comparable to average value-added for students in traditional public schools in 2011, the results provide strong support for the belief that market forces are generating dynamic improvements in the charter sector. First, similar to CREDO (2013), we find that schools that close are drawn disproportionately from the less effective part of the charter school distribution. Second, we find that schools that open during the period of study far outperform those that close, with average value-added for new charters roughly equal to the average for existing charters. Third, charter schools open throughout the decade from 2001 to 2011 exhibit substantial increases in average school value-added. Together these changes raise the mean and reduce the variance of school value-added relative to traditional public schools.

Although data limitations preclude the identification of the specific causes of charter school improvement, the evidence highlights the potential role of three factors. First, we document a positive relationship between the prior achievement and behavior of charter school entrants relative to their traditional public school peers that did not enter a charter and charter school value added. Second, conditional on the characteristics of entrants, there is an additional evidence of positive selectivity among those that persist and school value added. Finally, our results indicate a substantial decline in student and teacher turnover over time; existing evidence reveals that each type of turnover adversely affects achievement. In contrast, the results do not show that higher value-added CMOs tend to retain more effective teachers than lower value-added CMOs, but this work remains at the early stage.

The remainder of the paper is organized as follows: we first provide some basic background on charter schools in Texas and some descriptive information on the growth of this

sector in Section 2. Section 3 describes the comprehensive Texas Schools Project data set used in the analysis. We then turn to our value-added specification used to characterize the quality of school in Section 4 and document how the distributions of charter school vary over time. Section 5 investigates some of the potential contributors to these quality improvements, focusing specifically on the role of student selectivity and turnover. Section 6 concludes by summarizing our key result and discussing some implications of our study for further research on charter schools.

2. The Texas Charter School Program

Texas – the focus of analysis here – is an active charter school state. Since enacting charter school legislation in 1995, the Texas charter sector has grown into one of the largest in the nation, ranking 5th nationally in the number of charters operating.[3] We begin this section with a description of the enabling legislation and subsequent modifications. We then describe the evolution of the charter school sector.

2.1. Institutional Structure

The Texas Education Code established 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 constitute the majority of charter schools and educate a substantial fraction of the students enrolled in the sector. These schools are independent educational entities; charters intended for open-enrollment districts are awarded under the auspices of the Texas State Board of Education and are the primary oversight for these schools. Upon approval, the state designates a unique

3Stutz, Terrence. "Legislature Oks bills expanding charter schools, cutting high-stakes tests" May 27, 2013 dallasnews.com.

county-district identifier for schools operating under that open enrollment charter. District charters, by contrast, are established by and accountable to the school districts in which they reside. University charters make up the remaining charters in the state and their establishment and operation is similar in character to open-enrollment charters. No home-rule district charters have been established as of this writing.

Figure 1 illustrates the typical Texas open enrollment charter management organizational structure. This figure shows the expansion of America Can, a non-profit organization that operated one of the first charter schools in Texas. America Can operated one school in one charter district in 1997 and later expanded by successfully applying for and receiving an additional 4 open enrollment charters between 1999 and 2005. By 2005, America Can operated a total of ten schools in the five charter districts, and that number has remained constant since.

From 1995 to 2000, there was no statutory limit on open-enrollment charters as long as 75% of enrolled students were classified as "at-risk". In 2001, in response to reports of poor performance and mismanagement at some schools, the legislature relaxed the at-risk student composition constraint. Strict limits, however, were imposed on the number of charters awarded under the open-enrollment program. In 2002, the limit on open-enrollment charters was raised to its current level of 215.

The defining feature of open-enrollment charter schools is their receipt of public funding without many of the regulatory restrictions inherent in traditional public schools, chiefly in the realm of hiring. Specifically, outside of the requirements for teachers in core areas imposed by No Child Left Behind legislation in open-enrollment charters receiving federal funds, charter schools have almost no restrictions on hiring and firing. In practice, these charters 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 able 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 important differences in the characteristics of staff: open-enrollment charters tend to employ less experienced

teachers less likely to have a post-graduate degree than teachers in district charters. Charters also pay, on average, lower salaries.[4]

Despite these differences in hiring and staffing, all charters in Texas are similar in their stated goals to implement new curriculum and discipline practices that seek to improve the educational outcomes of their students through enrichment. The path to achieving these goals, however, is disparate as the public mission statements and foci of charters do vary. Many combine standard skills enrichment with an emphasis on discipline; others center their curriculum on more specialized interests such as science or music and arts. Regardless of their curriculum, all charters are subject to the same accountability and testing requirements as traditional public schools, and measures of school contributions to achievement capture quality along a dimension central to the enabling legislation and interest in educational reform in Texas.

2.2. Open Enrollment Charter School Growth

The bottom panel of Figure 2 illustrates the growth of open enrollment charters between 1995 and 2011. By 2011 roughly 3.5% of public school students attended an open enrollment charter. Up to 2001, growth in the number charter school operators and districts largely drove the expansion in the charter sector as both the number of charter holders and districts increased only slightly more slowly than the number of charter schools. After 2001, however, the numbers of charter holders and districts remained roughly stable (around 150 holders and 200 districts), while the number of schools roughly doubled. This pattern of expansion is important to note because it suggests that entry costs may be crucial: the approval process for a charter district to open a new school is far less involved than the initial process to become a charter district.

The top panel of Figure 2 shows the numbers of charter districts by active status relative to the state limit and the annual charter authorizations and discontinuations. Elimination of the separate high poverty charter category and more than doubling of the cap on open enrollment charters in 2000

constituted a major change, though the increase in the total number of charters declined steadily between 1999 and 2002, hovering slightly above zero. Thus, although some charter school operators entered and some exited the system during the past decade and some charters were revoked or voluntarily turned in and the state authorized some new charters, the bulk of the increase in the number of charter schools occurred through the expansion of existing charter districts. Given the low level of entry by the end of the period it is not surprising that the inactive share of charters districts fell to below 5 percent by 2011.

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 that includes test scores, demographic characteristics, and information on school attendance and academic programs.[5] Our analysis focuses on over 400 charter schools and their enrollees for the period 2001 to 2011. School information includes location, grades offered, enrollment, charter school type, Texas accountability rating, and information on all staff. Student information includes demographic information, mathematics and reading test results, school attended, grade, and academic program information. Students who switch schools including those that transition between traditional public and charter schools can be followed as long as they remain in a Texas public school.

Mathematics and reading assessments come from two statewide criterion-referenced achievement tests that were administered during our period of study. From 1993 - 2003, the Texas Assessment of Academic Skills (TAAS) was administered each spring to eligible students enrolled in grades three through eight. In 2003, Texas introduced a new exam called the Texas Assessment of Knowledge and Skills (TAKS).[6] TAKS expanded the number of subjects that students were required to demonstrate proficiency and elevated the level of difficulty of the tests. Because the test structure and number of

[5] A more detailed description of the underlying database can be found in Kain (2001) and other publications on the website for the UTD Texas Schools Project.
[6] The TAKS exam was recently repealed by the Texas legislature and schools will now transition to End of Course Exams.

questions and average percent right vary across time and grades, we transform all test results into standardized scores with a mean of zero and variance equal to one for each grade and year. Nonetheless, we will test the sensitivity of the results to the movement to a new testing regime. To avoid potential bias introduced by pooling Spanish language exams with the rest, we standardized these exams separately.

Any school without students in the TAAS/TAKS data is excluded from the sample; therefore, our number of charters will differ from public records of the number of authorized charter schools. (Note, however, that students do not have to have to complete the tests to be included in the TAAS/TAKS file). Also omitted are those charter schools exclusively serving children with special needs, residents in treatment programs, or other behavioral problems.

4. Distribution of Charter School Quality

This section describes changes over time in the quality of education in the charter sector relative to traditional public schools between 2001 and 2011 and the contributions of school improvement, closure and entry to these changes. We begin with a description of the value-added specification used to generate the measures of charter school quality. Subsequently, we describe changes over time in the distribution of charter school quality in the charter and traditional public school sectors and the contributions of school improvement, enrollment shifts, and school closure and entry to these changes.

4.1 Estimation of School Value-added

Our approach generally follows the existing literature which includes lagged test scores to account for student heterogeneity and the influences of prior school quality in order to isolate school value-added to achievement.[7] Note that the panel data also make possible the inclusion of

[7] Bifulco and Ladd (2006), Sass (2006), Booker, Gilpatric, Gronberg, and Jansen (2007), and Hanushek, Kain, Rivkin, and Branch (2007) also use panel data methods to identify charter school effects.

controls for transition costs associated with changing schools. This is particularly important in the study of a sector with a large share of schools in their first few years.

Equation (1) presents the specification used in the estimation of school quality. Here achievement A for student i in grade G and school s is modeled as a function of student, family, and peer factors and a school fixed effect:

$$A_{igs} = \alpha_{ig} + X_{ig}\beta + P_{gs}\gamma + \mu_g + \delta_s + e_{igs} \qquad (1)$$

where *X* and P are vectors of contemporaneous family background and peer characteristics during grade G, α is an individual intercept specific to grade *g*, and *e* is a stochastic term capturing other unmeasured influences. The year subscript is suppressed as is the year by grade error component that captures grade-specific changes over time in the test instrument; year by grade indicators are included in the estimation.

If school quality was uncorrelated with α and *e*, OLS would yield an unbiased estimate of δ. But as noted above, the choice based determinants of school enrollment and evidence on other types of school effects strongly suggest that typically available variables contained in *X* do not account adequately for potentially confounding factors. In particular, unobserved student differences between regular and charter schools could contaminate the estimates, as could shocks that accompany enrollment into a charter school.

As Hanushek, Kain, Rivkin, and Branch (2007) illustrate, both time invariant and time varying unobserved differences that could potentially introduce bias. In this analysis we use lagged achievement to capture the cumulative effects of prior family, community and school influences. Our approach assumes that conditional on prior achievement differences in unobserved effort, ability or the timing of prior knowledge acquisition do not introduce bias into

the estimates of school value-added. Much of the research on value-added has focused in teachers rather than schools, but there is some evidence on charter school estimation methods. Abdulkadiroğlu et al. (2011) find that "lottery and observational identification strategies generate broadly similar estimates", and Fortson, Verbitsky-Savitz, Kopa, and Gleason (2012) find that matching and lottery-based identification strategies produce quite similar estimates with no statistically significant differences. In terms of estimates of teacher value added, Guarino, Reckase, and Wooldridge (2011) finds that typically considered shocks 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.

It is possible that unobserved differences between charter attendees and traditional public schools may remain. Alternative methods used to account for these potential confounding factors include student fixed effects, lottery-based random assignment, and matching by the distribution of prior traditional public school attended. Fortson, Verbitsky-Savitz, Kopa, and Gleason (2012) find that the matching method produces estimates that tend to be closer to lottery-based estimates, though the differences between the estimates from regressions, matching, and fixed effects are small. Importantly, the magnitude of differences between lottery-based experimental estimates on the one hand and the respective observational estimates on the other potentially reflect differences in both the influences of confounding factors and the average value-added of the traditional public schools that comprise the counterfactual. Given that the distribution of traditional public schools is somewhat more similar for the lottery based and matching estimates than for the regression adjusted specifications, the fact that the matching estimators tend to be closer to the experimental estimates may provide little if any information about the magnitude of bias.

The absence of lotteries in most schools rules out the use of lottery-based methods, leaving the other two approaches as alternative observational methods for accounting for unobserved differences between charter school and traditional public school attendees. Student fixed effects compares outcomes while in a charter school to outcomes for the same student while in traditional public school. This approach fully accounts for fixed differences in ability other achievement determinants between charter and traditional public school students. However, it does not account for time-varying differences that may be related to entry into a charter school (e.g. a temporary negative family shock leads to low achievement followed by charter school entry). Moreover, as CREDO (2013) points out only students that switch between schools in the charter and traditional public school sectors contribute to the estimates. Over time this throws out the experiences of an increasing share of students that enter charter schools prior to 4th grade and therefore do not have even one year of achievement gains or losses in traditional public school. This would reduce the effective sample size, increasing standard errors and elevate the importance of correctly accounting for transition costs.

CREDO (2013) therefore adopts an alternative approach that matches charter school students to students in traditional public schools. Importantly, information on the distribution of traditional public school attended by the subset of charter school students that attended such a school is used in the matching procedure. Essentially each charter school student is matched with a similar student in one of the traditional public schools attended by a charter school student in that school, and the distribution of control students matches the distribution of the traditional public schools previously attended by the students in the specific charter school with data on prior school attended. Note that this approach permits the inclusion of all charter school students in the estimation of charter school effectiveness. It must, however, rely on the stronger

assumption of no differences in the unobserved time invariant and time varying factors for the charter and traditional public school students with whom they are matched.

For the purposes of describing changes over time in charter school quality relative to that in the traditional public schools each of these three alternative approaches possess some potentially serious drawbacks. First, any general equilibrium effects on the quality of traditional public schools will be amplified by the fact that these methods focus solely on those public schools from which charter school students are drawn and are therefore the schools facing the strongest competitive pressures. In fact preliminary estimates (not reported) reveal a positive correlation between estimated charter school value added and the estimated value added of traditional public schools previously attended by new entrants to charters, even in specifications that include charter school fixed effects. Of course the difference in the influence of general equilibrium effects on sector comparisons between these methods and our value-added specification is one of degree.

Second and more important, the counterfactual traditional public school value-added to which students are compared in each of these three methods is likely to evolve over time in a way that attenuates estimates of the change in average charter school value-added vis-à-vis average value-added in traditional public schools. In the case of lotteries charter school quality almost certainly affects the applicant pool from which winners and losers are drawn, and the matching and student fixed effect estimators each use a weighted average of traditional public school quality based on the observed transitions from traditional public to charter schools. As noted above, the accuracy and availability of information on charter school quality improves the longer a school is open, and this would tend to reduce the number of families that select a charter based upon inaccurate information. Over time charter school students would be expected to be

drawn increasingly from schools of similar quality to the charter. Any perceived improvements in charter school quality would tend to raise the alternative public school quality distribution of the applicant pool or sending schools. Over time, the comparison group used to generate the counterfactual estimate of traditional public school quality evolves along with the perceived quality of charter schools.

The findings in Gleason, Clark, Tuttle, and Dwoyer (2010) illustrate the possibility that changes over time in the distribution of alternative public schools can alter estimates of charter school effects. First, 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, which is consistent that effects are likely to be higher in areas with lower-quality traditional public schools (assuming that school quality tends to be lower as poverty increases).

Thus, although there remains some uncertainty about the "optimal" estimator, we believe that value-added regressions that account for demographic characteristics provide the best approach to learn about the evolution of the distribution of the quality of education in the charter sector. Moreover, given the focus on changes over time in charter school quality, we rely on the assumption that the direction and magnitude of any bias remains stable over time and not the stronger assumption that the estimator produces unbiased estimates in all periods.

4.2 Evolution of the Charter School Quality Distribution

In this section we describe changes over time in charter school value-added between 2001 and 2011. Specifically, we examine the contributions of school improvement, charter student composition changes due to enrollment, school closures, and the entry of new schools. Figures 3a and 3b report value-added distributions for the odd-numbered years, but results for all

years produce a similar picture of monotonic changes. Because of prior evidence showing charter school improvement in the early years of school operation, we also report kernel density distributions based on residuals from estimates of school value added on indicators for the first, second and third years of operation (the indicators are set to zero for traditional public schools). The coefficients on the indicators (not reported) support the previous findings of significant quality improvement during the initial years of operation.

Figure 3a illustrates the distribution of school value-added to mathematics achievement in the charter and traditional public school sectors. In 2001, the distribution of charter school value-added was located to the left the corresponding TPS distributions and exhibited much higher variation. Throughout the period the sector differences in both the location and variance of the distributions fell steadily. By 2011, the distributions lie roughly on top of one another, though the charter school distribution continues to be slightly more dispersed. Note that the differential declines between 2001 and 2005, the period in which the state switched from the TAAS to the TAKS test, and the period between 2005 and 2011 when the TAKS was used throughout. In addition, note that the larger variance in the charter school distribution may result in part from the smaller average school sizes and consequently higher error variance in the charter sector and charter school enrollment increases may contribute to the lower variance in more recent years.

The steady expansion of charter schools shown in Figure 2 reflects the fact that large numbers of charter schools were in their early years of operation throughout the period, and this would be expected to lower the distribution of charter school quality. The distribution of quality residuals from the regressions that control for years of operation shown in Figure 3b support this

belief, and by 2011 the distribution of adjusted charter school effectiveness lies slightly to the right of the corresponding distribution for the traditional public schools.

Figures 4a and 4b present quality distributions for reading, and the pattern is quite similar to the pattern reported for mathematics. Again relative charter school effectiveness tends to rise throughout the period, and the improvement is more pronounced in distributions that adjust for length of school operation. Together the results for mathematics and reading paint a consistent picture of gains in charter school effectiveness relative to traditional public schools.

Initial investigation revealed different patterns by grade level, and the following two sets of figures reproduce the mathematics and reading value added distributions for middle schools and high schools separately, conditional on years of operation. Figure 5 shows that the distribution of charter middle school value added to mathematics and reading achievement shifts right relative to traditional public schools between 2001 and 2011. By 2011the distributions for the charter sector lie to the right of the corresponding distributions for traditional public schools.

Figure 6 reveals similarities and differences between the time paths of charter middle and high school value added. On the one hand, charter high schools improve in comparison to traditional public high schools, as the charter school value added distributions for both mathematics and reading shift right over time. On the other hand, however, the distributions for charter high schools do not lie to the right of those for traditional public high schools at the end of the sample period.

4.3 Exit, Entry and Improvement

School entry, exit, and improvement potentially contribute to the improvements in charter school quality, and this section describes the contribution of each and the dynamics of school

closure for all grades combined. Table 1 shows that the decrease in the average charter-traditional public school value-added differential of 0.125 between 2001 and 2011 resulted from a combination of improvement in charter schools that persist throughout the period, the disproportionate closure of low value-added schools, and an average value-added of new schools that far exceeds that of the schools that closed. Value-added increased by roughly 0.08 standard deviations for schools open at both the beginning and end of the period, and the difference between the average value-added of schools that closed during the period and those that entered exceeds 0.23 standard deviations.[8] The large number of entrants relative to the number of charter schools open in both 2001 and 2011 and the number that closed between 2001 and 2011 highlight the major contribution of entrants to the overall changes in the distribution of charter school quality.

Table 2 illustrates the relationship between CMO performance on the one hand and expansion and contraction on the other. Regardless of whether CMO fixed effects are included, the probability of increasing the number of schools in operation is positively related to average CMO value added in the prior year, and the probability of decreasing the number of schools in operation is negatively related to CMO average value added. This pattern is consistent with the notion that CMO market share increases with quality over time.

Given the importance of the negative selection of school closures, we now examine the dynamics of school quality and enrollment in the years prior to closing. Figure 7 plots coefficients on indicators for the final year of operation, the penultimate year, two years prior to closure, three years prior to closure, and four plus years prior to closure from regressions of

[8] Value-added of schools that closed is measured in 2001 while that of entrants is measured in 2011 meaning that a portion of the gap may result from the higher average experience of entrants at the time of measurement. However, the small differences in the school tenure distribution suggest that the impact of tenure is likely to be small relative to fixed differences in school performance.

either school value-add, log grade average enrollment, or percentage low-income on these indicators, year indicators and in some specifications a full set of school fixed effects. The sample is restricted to years prior to 2009 and schools that close at some point between 2001 and 2011 in order that all years contain schools four, three, two, one and zero years prior to closure. This mitigates problems introduced by the correlation between year and the number of years prior to closure in models with school fixed effects.

The top two graphs in Figure 7 plots coefficients from the math value-added and log enrollment regressions, with the graph on the right reporting coefficients from regressions that include school fixed effects. The left graph suggests that enrollment fell each year prior to closure, while value-added fell each year prior to rising in the final year of operations. Importantly, schools contribute different numbers of observations in the sample, meaning that differences in the coefficients reflect both trends prior to closure and differences across schools. The contrast between this graph and the one to the right that reports coefficients from school fixed effects regressions illustrates the contribution of between school differences in the number of years in the sample. Schools open fewer than five years appear to have lower average enrollment than those open at least five years, while schools open fewer than four years appear to have lower average enrollment.

The school fixed effect coefficients plotted in the upper right panel show a pronounced pattern in the years prior to closure. Enrollment appears to change little until the final year of operations at which point schools experience a precipitous drop on average. Value added also remains fairly stable until the penultimate year of operation, at which point value added declines sharply. The substantial enrollment drop following the sharp decline in value added is consistent

with a negative shock to quality that precipitates departures. It is also consistent with a return to prior quality that comes too late to avoid closure.

The bottom two graphs plot the value added and percentage black coefficients from the same two models. In comparison to the log enrollment coefficients the inclusion of school fixed effects has little impact on the time pattern of the low-income share coefficients in the period within four years of school closure. Specifically, the low-income share remains roughly stable up into the final year of operation at which point it increase by more than five percentage points or roughly ten percent. This is consistent with a much smaller response by low-income families to the negative quality shock.

5. The Sources of Charter School Improvement

This section examines potential contributors to charter school effectiveness and improvement in the charter sector. Conversations with executives of a number of the largest Texas CMOs emphasized the importance of attracting and developing effective school leaders[9]. Leadership quality cannot be easily quantified on the basis of characteristics of training or background, making it difficult to measure. However, many executives also emphasized factors that contribute to classroom environment, and much research highlights these factors as key determinants of both the quality of education and demand.

Substantial research on public schools emphasizes two key contributors to student classroom outcomes: the adverse effects of student disruption and turnover and the positive

[9] We conducted phone conversation with a number of the largest CMOs to obtain real-world input about how decisions are made.

effects of peer achievement on learning. In this section, we characterize these features in our data and examine their association with our estimates of charter school quality[10]. In the case of student turnover, we illustrate changes over time and, relying on additional evidence, estimate its contribution to charter school quality changes. To study student behavioral outcomes, we first illustrate the relationship between disciplinary outcomes and school value added. Then, we further investigate the characteristics of charter school new entrants and those who actually remain in charter schools. Finally, we examine how the likelihood of receiving a disciplinary infraction varies with tenure at a charter school and the school's quality.

Figure 8 illustrates share of charter school students who are new in schools where students could have attended the previous grade in the prior year. As shown in the figure, there has been a dramatic decline in this type of student turnover. Table 3 presents evidence of a negative relationship between school quality and the share of students that did not attend the school in the prior year. This finding is qualitatively similar to evidence presented in Hanushek et al. (2007). They find a negative relationship between school quality and the probability a student leaves the school. More important, this stability likely increases achievement. For example, estimates in Hanushek et al. (2007) based on traditional public schools indicate that the roughly 20 percentage point decline in the share of students that are new to a school between 2001 and 2011 contributes roughly .04 standard deviations to the improvement of relative charter school performance between 2001 and 2011.[11]

The left half of Figure 9 illustrates the negative association between the share of students that receive any disciplinary infractions and mean value added to mathematics (top panel) and

[10] Epple and Romano (1999) highlight the importance of cognitive skills in the determination of school quality and the demand for a school, while other theoretical work including Lazear (1999) highlights the importance of behavioral skills that influence time available for learning.

[11] Hanushek, Kain, and Rivkin (2004) find that a ten percentage point higher level of mobility reduces mathematics achievement by approximately 0.02 standard deviations in Texas public schools.

reading (bottom panel). The right half, however, shows that these negative associations persist using only within school variation in the share that receives any infraction. This pattern is consistent with the belief that behavior exerts a substantial impact on achievement, but it certainly does not provide causal evidence. Infraction thresholds may change over time, other variables may jointly determine achievement and behavior, or the composition of students may change in response to school quality. Therefore, we focus on the determinants of the classroom environment rather than attempting to identify its causal effect.

Selection and school policies and practices jointly determine the classroom environment. Here, we consider both patterns of student sorting and behavioral changes over time. To study the role of student sorting, we begin by describing the prior academic achievement and disciplinary record of charter school entrants and compare them to their traditional public school peers that do not enter a charter. Using these groups, we calculate the average differences between entrants to each charter and their schoolmates who remain in a traditional public school. We then examine the association between these differences and estimates of school quality.

Recognizing that charter schools are subject to substantial attrition, we also compare new charter-school entrants with the smaller group of entrants who remain in their charter into their second year. Recent research on charter schools finds that schools setting high expectations and those adhering to the new excuses philosophy tend to perform better and that a uniform requirement is one of the strongest predictors of charter school success.[12] These findings highlight the importance of behavior and discipline, but there is some ambiguity over the causal mechanism. No Excuses schools may create positive environments by improving student attitudes and behavior, but the strictness including uniform requirements may also influence the composition of entrants and stayers. A high fraction of charter school entrants leave the school

[12] See, for example, Angrist et al. (2013) or Fryer and Dobbie (2013)

after a single year, and this raises the possibility that school structure and practices affect student composition in ways that improve the classroom environment.

5.1 Selection in Texas Charters

This section describes selection into charter schools on the basis of mathematics and reading achievement and disciplinary infractions. New entrants to the charter sector are compared with their peers that remain in a traditional public school. Importantly, disciplinary infraction comparisons within a traditional public school hold constant infraction policies and procedures and isolate differences in behavior. Table 4 reports average differences between charter school entrants and those remaining in traditional public schools without consideration of the subsequent transitions of non-entrants, and Table 5 reports differences between those that persist into the second year in their charter school and those that exit the charter, non-entrants that remain in the same traditional public school, and non-entrants that do not remain in the same traditional public school for a second year.

Table 4 reports large average differences in both achievement and behavior between entrants and schoolmates who remain in the traditional sector, though the pattern differs sharply by grade of entry. Columns 1, 3, and 5 of the top row show that entrants had substantially lower reading and mathematics achievement and a much higher probability of committing an infraction on average. However, comparisons across the remaining rows highlight the sharp differences in the composition of charter school entrants by grade. The average math and reading achievement for those entering a charter middle school in the lowest grade offered exceeded their other schoolmates by roughly 0.16 standard deviations, and there was little difference in the probability of committing a disciplinary infractions; the positive selection along the achievement

dimension is roughly 0.1 standard deviations smaller for those entering a middle school in other than the lowest grade, and these entrants were slightly more likely to receive a disciplinary infraction than schoolmates who remain in the traditional sector.

In contrast, there is strong negative selection into charter high schools, particularly for those entering into other than the first grade. Differences in mathematics and reading achievement hover around 0.5 standard deviations, and the probability a charter school entrant received a disciplinary infraction was roughly one third higher than the infraction rate for students remaining in the traditional sector. As is the case for middle school, entrants in the lowest high school grade offered were more positively selected, though the differences between high school and middle school swamp the differences by grade within schooling level.

Table 5 also illustrates differences between students who enter and remain in the charter for a second year and those that remain in the traditional sector, and these numbers also reveal differences between middle and high schools. In the case of middle schools, charter school entrants who remain in their charter school into the second year are more positively selected than the entire pool of entrants. The differences in the degree of positive selection for charter middle school entrants and the smaller number that persist into the second year exceed 0.06 standard deviations for mathematics and reading achievement and 0.03 percentage points in the probability of receiving an infraction for those entering in the lowest grade; the corresponding numbers for those entering in a different grade are roughly twice as large.

Charter high school students that persist into their second year appear to be similarly selected based on prior achievement and slightly less negatively selected in terms of behavior than the entire group of entrants. Moreover, the degree of selection does not vary substantially by grade of entry.

We now turn to estimates of the relationship between school value added to mathematics and reading achievement and differences in prior achievement and behavior for all charter school entrants those that persist. The estimated specifications differ according to whether they include school fixed effects and whether they include all or a subset of the prior student characteristics. The entrant 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 public sector. Next, these differences are averaged over all students that enter a particular charter school. The persistent variables are computed similarly with the exception that the differences are averaged over only those students who remain in the charter into their second year.

The results in Table 6 reveal a strong positive relationship between mathematics value added and the average difference in prior mathematics achievement between entrants and non-entrants. This relationship holds conditional on including information on disciplinary infractions; a similar pattern holds for reading. In both subjects, the inclusion of school fixed effects reduces the estimate by roughly 30 to 40 percent, though the coefficient remains significant. By contrast, the coefficient on the average difference in the probability of receiving an infraction, although negative in all specifications, never approaches statistical significance in specifications that include information on prior achievement.

Table 6 also reveals that conditional on selection for entrants, the prior achievement difference between those that persist into their second year in the charter and their traditional public school classmates that remain in that sector is positively related to value added. The results are much stronger for math, where the estimates are largely insensitive to the inclusion of school fixed effects. For reading, the magnitude and significance of the estimates substantially

decline following the inclusion of school fixed effects. Finally, the estimated effects of the difference in the probability of receiving an infraction never approach statistical significance.

Taken as a whole, these results are consistent with the evidence that peer achievement and behavior affects school quality. Importantly, Table 7 produces very similar estimates at the CMO level, showing that CMOs that attract and retain higher-achieving students tend to have higher value-added in mathematics and reading. Moreover, the effects of nonrandom selection and retention along the discipline infraction dimension appears to exert a far smaller effect, though it does seem to be relatively more important in reading. In future work we will explore whether differences in the degree of selection at entry and at retention among CMOs are systematically related to CMO average value added and philosophy. The results also raise some concerns that lottery-based estimates may be subject to non-random attrition that could introduce upward bias.[13]

Next, we use specifications based on student fixed effects to examine the association between the probability a student receives a disciplinary infraction and their tenure at a charter school. In order to investigate whether the probability of receiving an infraction declines more rapidly in higher value added schools we interact charter school value mathematics value added with either years at the charter school or an indicator for attending, at least, a second year in the school. The latter interaction captures the possibility that improvements in behavior are concentrated in the first two years at the school. Note that some specifications also include school-by-year fixed effects to account for potential differences over time in school policies and practices regarding discipline and other time varying factors.

[13] Appendix Table A1 investigates the effects of selection and retention on achievement rather than value added. Specifications compare lagged outcome of charter school entrants with their traditional public school counterparts, and we find a similar relationship holds. In particular, we find that these differences are positive and significantly related to mathematics and reading scores

In contrast to the strong relationship between charter school selection and value added, the results in Table 8 reveal little or no evidence of a significant negative relationship between charter school value added and the change over time in the probability of receiving a disciplinary infraction. In all specifications the coefficient on the interaction term is positive and in some cases statistically significant. It may be that the more positive selection in higher value added schools leaves less room for improvement, and the direct effect of value added on the probability of being cited for an infraction is negative.

6. Discussion and Conclusion

The principal aims of this paper have been to establish new facts about how charter school quality in Texas has evolved since the introduction of charters and to examine key drivers of these observed patterns. In this concluding section, we summarize the central findings of the paper and discuss their implications for the study of charter school achievement.

Using administrative micro-data on schools and students in Texas, we characterize the evolution of charter school quality in Texas and establish that, indeed, charters schools have improved relative to traditional public schools over the observation period. Specifically, the results suggest fast convergence of the charter value-added distribution with traditional public schools. Further, our results indicate that poor performing charters are found to be more likely to exit while those that persist improve over time. We also observe that higher quality CMOs are more likely to expand, while CMOs operating less effective schools are more likely to contract.

After establishing the improvement of charter schools relative to their TPS peers we explore a number of potential contributors to both the improvement of the charter sector and quality variation within the sector. A lower rate of student turnover along with the retention of

higher achieving students less likely to receive a disciplinary infraction are associated with higher charter school value added. Given the substantial decline over time in the rate of student turnover this would appear to explain a substantial fraction of the improvement in the charter sector. The contributions of a higher achieving group of students less prone to disciplinary infractions is more difficult to pin down. Nonetheless, the results are consistent with the possibility that shaping the student body provides a mechanism for raising achievement. In the future we will explore the contributions to such selection to differences among CMOs and examine whether they occur more frequently in the No Excuses schools that have tended to be among the leaders in the sector.

References (preliminary and incomplete)

Abdulkadiroğlu, Atila, Joshua D. Angrist, Susan M. Dynarski, Thomas J. Kane, and Parag A. Pathak. 2011. "Accountability and flexibility in public schools: Evidence from Boston's charters and pilots." *Quarterly Journal of Economics* 126, no. 2: 699-748.

Angrist, Joshua D., Susan M. Dynarski, Thomas J. Kane, Parag A. Pathak, and Christopher R. Walters. 2012. "Who Benefits from KIPP?" *Journal of Policy Analysis and Management* 31, no. 4 (Fall): 837-860.

Angrist, Joshua D., Parag A. Pathak, and Christopher R. Walters. forthcoming. "Explaining Charter School Effectiveness." *American Economic Journal: Applied Economics*.

Bifulco, Robert, and Helen F. Ladd. 2006. "The impacts of charter schools on student achievement: Evidence from North Carolina." *Education Finance and Policy* 1, no. 1 (Winter): 50-90.

Booker, Kevin, Scott M. Gilpatric, Timothy Gronberg, and Dennis Jansen. 2007. "The impact of charter school attendance on student performance." *Journal of Public Economics* 91, no. 5-6: 849-876.

CREDO. 2009. *Multiple choice: Charter school performance in 16 states*. Stanford, CA: Center for Research on Education Outcomes, Stanford University.

———. 2013. *National Charter School Study: 2013*. Stanford, CA: Center for Research on Education Outcomes, Stanford University.

Fortson, Kenneth, Natalya Verbitsky-Savitz, Emma Kopa, and Philip Gleason. 2012. *Using an Experimental Evaluation of Charter Schools to Test Whether Nonexperimental Comparison Group Methods Can Replicate Experimental Impact Estimates*. Washington, DC: Institute for Education Sciences (April).

Gleason, Philip, Melissa Clark, Christina Clark Tuttle, and Emily Dwoyer. 2010. *The Evaluation of Charter School Impacts: Final Report*. Washington, DC: National Center for Education Evaluation and Regional Assistance (June).

Guarino, Cassandra M., Mark D. Reckase, and Jeffrey M. Wooldridge. 2011. "Can Value-Added Measures of Teacher Performance be Trusted?" Education Policy Center Working Paper #18. East Lansing, MI: Michigan State University (April).

Hanushek, Eric A., John F. Kain, Steve G. Rivkin, and Gregory F. Branch. 2007. "Charter school quality and parental decision making with school choice." *Journal of Public Economics* 91, no. 5-6 (June): 823-848.

Imberman, Scott A. 2011. "The effect of charter schools on achievement and behavior of public school students." *Journal of Public Economics* 95, no. 7-8 (August): 850-863.

Kain, John F. 2001. "The UTD Texas Schools Microdata Panel (TSMP): Its History, Use and Ways to Improve State Collection of Public School Data." Paper prepared for The Secretary's Forum on Research and Value-Added Assessment Data: U.S. Department of Education (December 5).

Ronfeldt, Martthew, Susana Loeb, and James Wyckoff. 2011. "How Teacher Turnover Harms Student Achievement." NBER Working Paper 17176.

Sass, Tim R. 2006. "Charter schools and student achievement in Florida." *Education Finance and Policy* 1, no. 1 (Winter): 91-122.

Figure 1: An example of the organizational hierarchy using the America Can! CMO structure

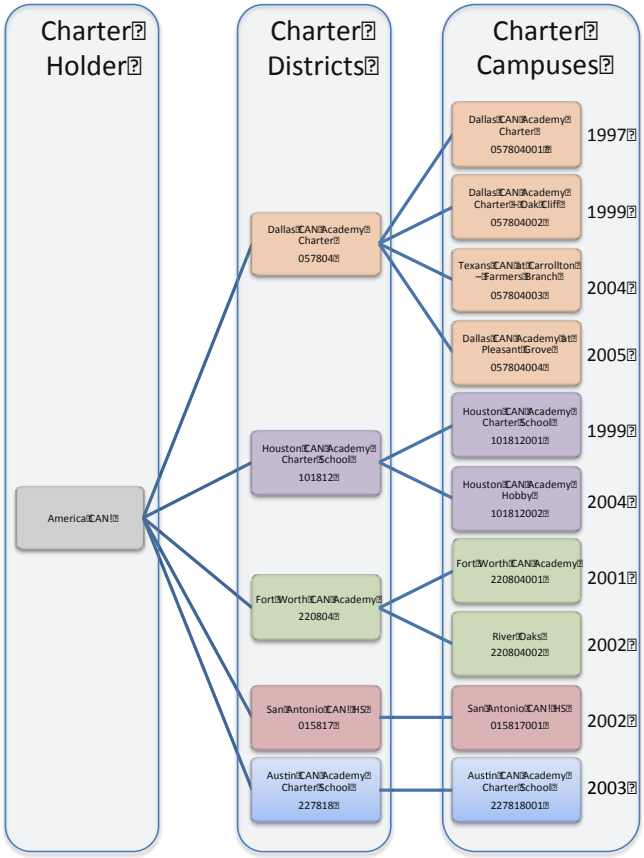
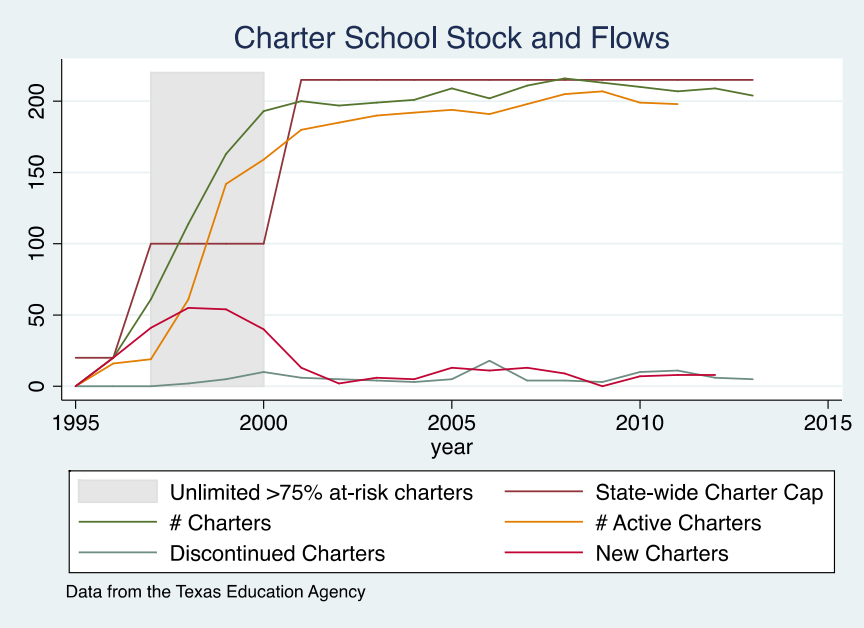


Figure 2: The Growth of Open-enrollment Charter Schools

Panel A:



Panel B:

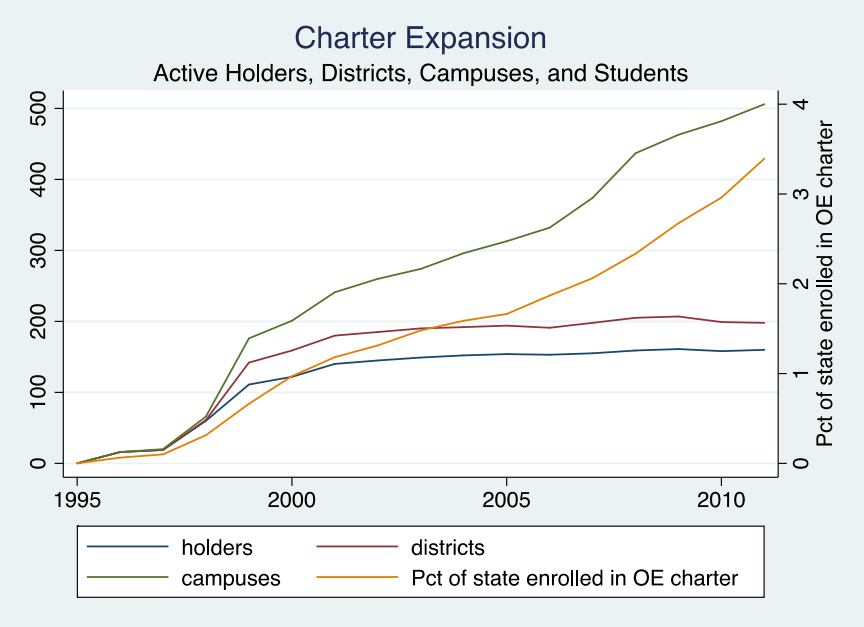
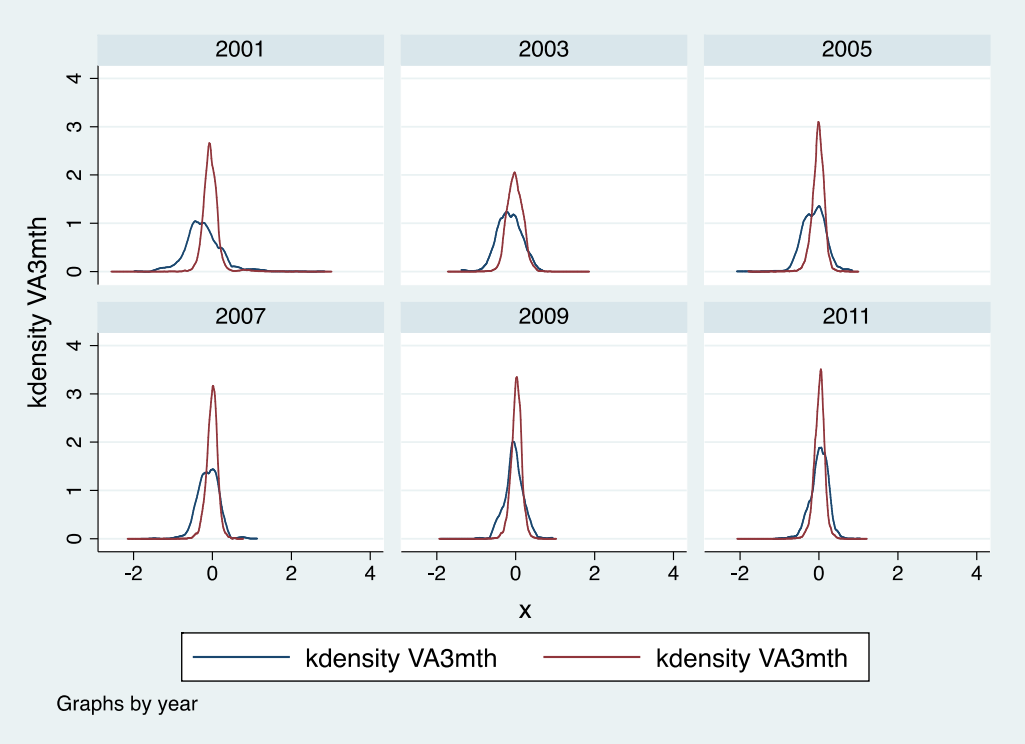


Figure 3: Distributions of School Quality as measured by VA to MATH test scores.

Panel A: Evolution of quality over time. Figures in blue are charters; figures in red are TPS



Panel B: Conditional on school tenure (1, 2, 3, 4, 5+ yrs.). Figures in blue are charters; figures in red are TPS

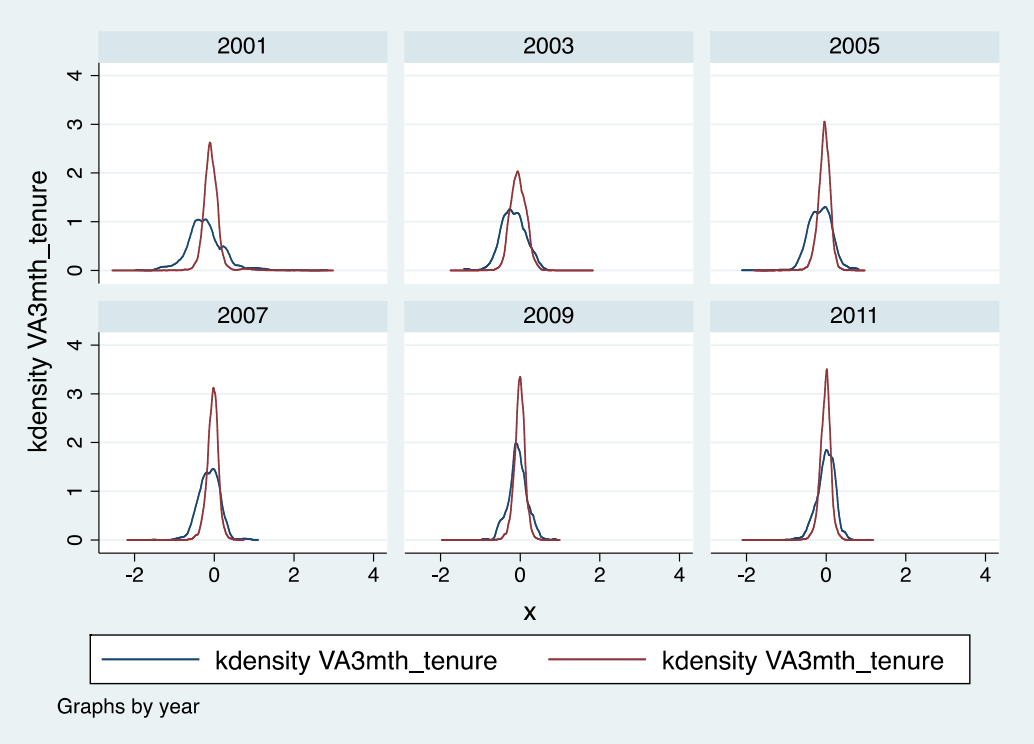
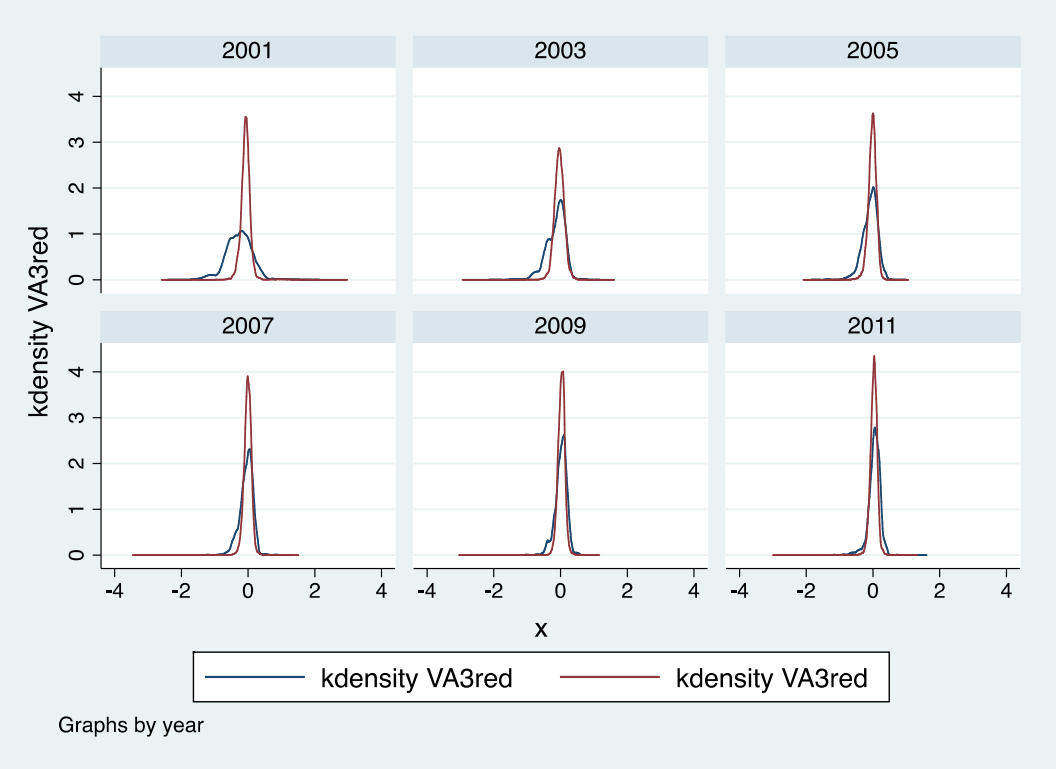


Figure 4: Distributions of School Quality as measured by VA to READING test scores.

Panel A: Evolution of quality over time. Figures in blue are charters; figures in red are TPS



Panel B: Conditional on school tenure (1, 2, 3, 4, 5+). Figures in blue are charters; figures in red are TPS

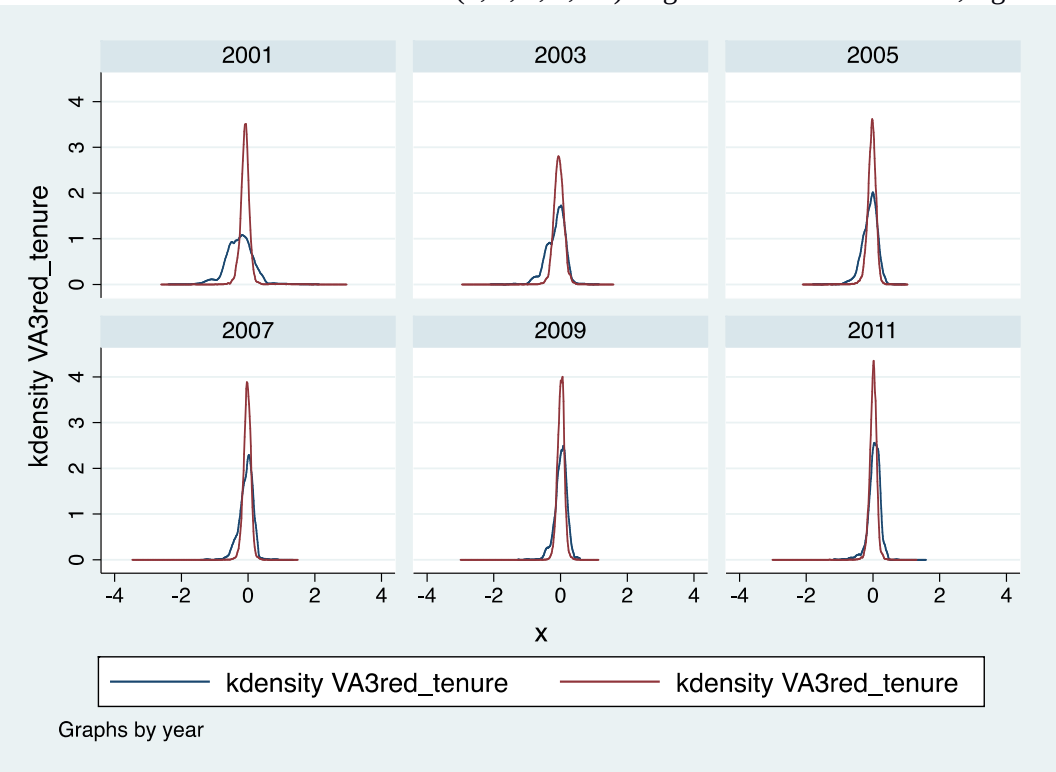
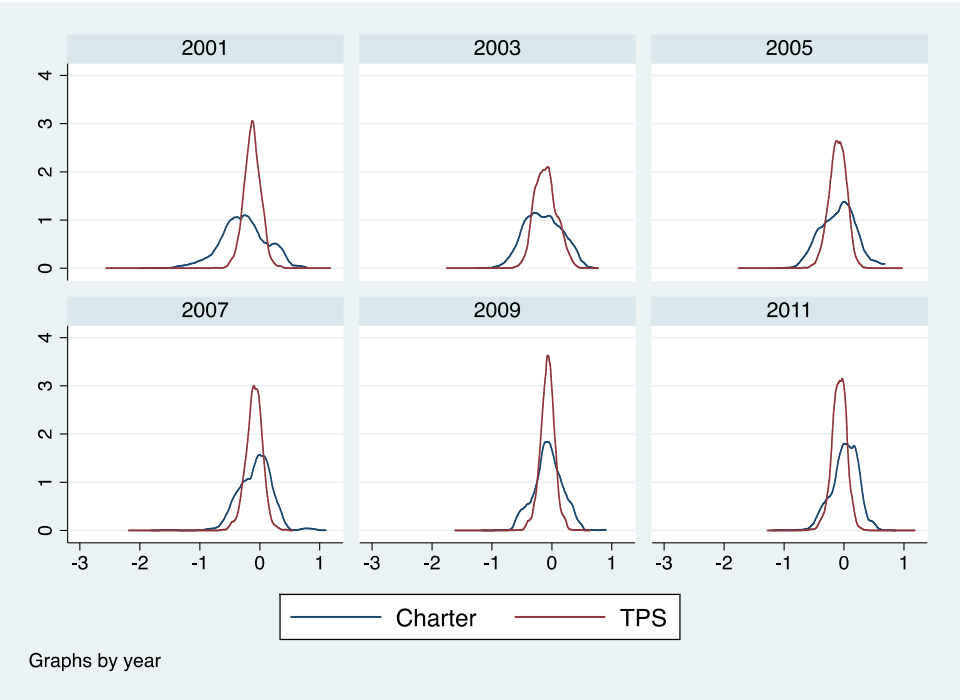


Figure 5: Distributions of Middle School Quality (conditional on school tenure)

Panel A: Math Value Added



Panel B: Reading Value Added

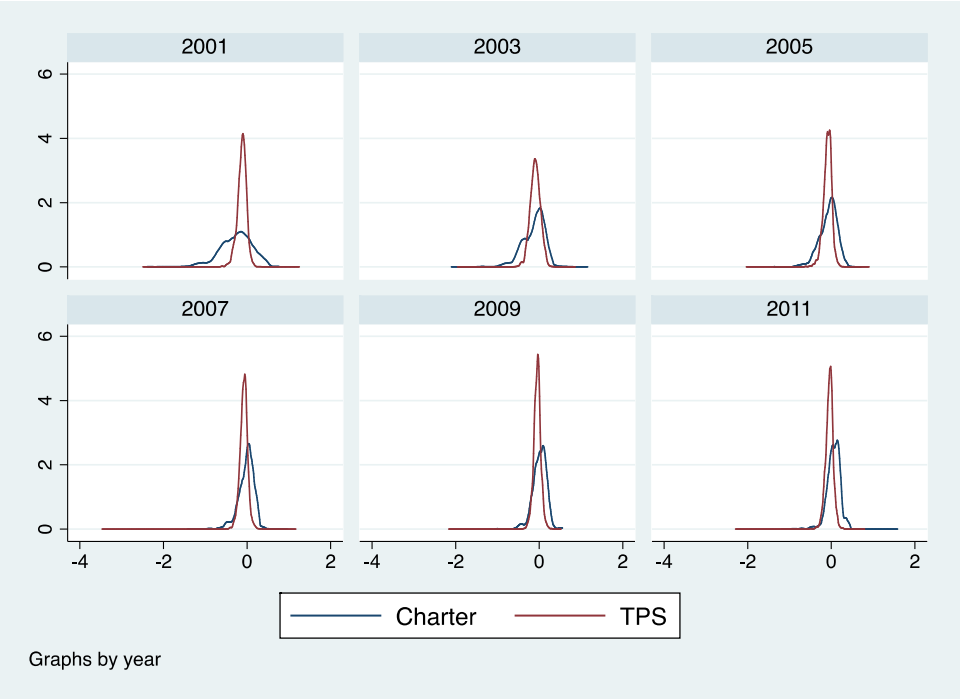
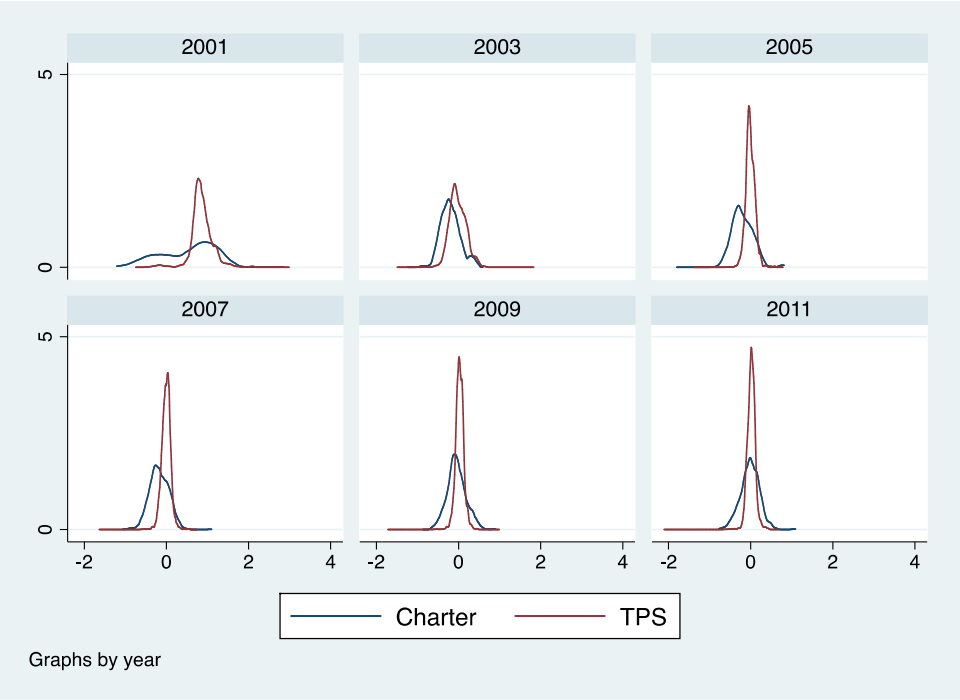


Figure 6 – Distributions of High School Quality (conditional on school tenure)

Panel A: Math value added



Panel B: Reading value added

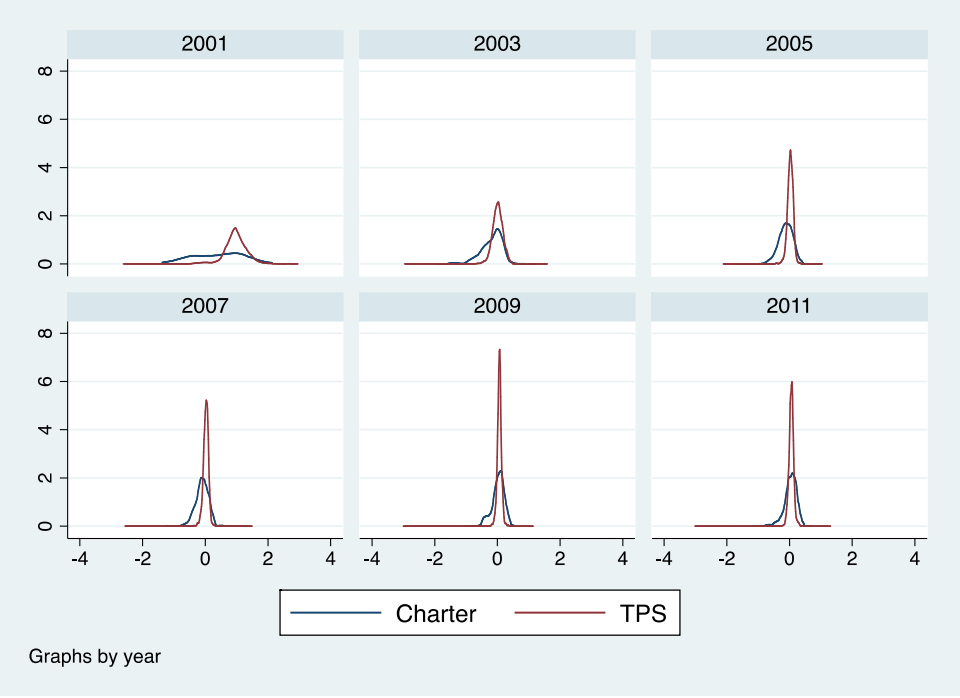
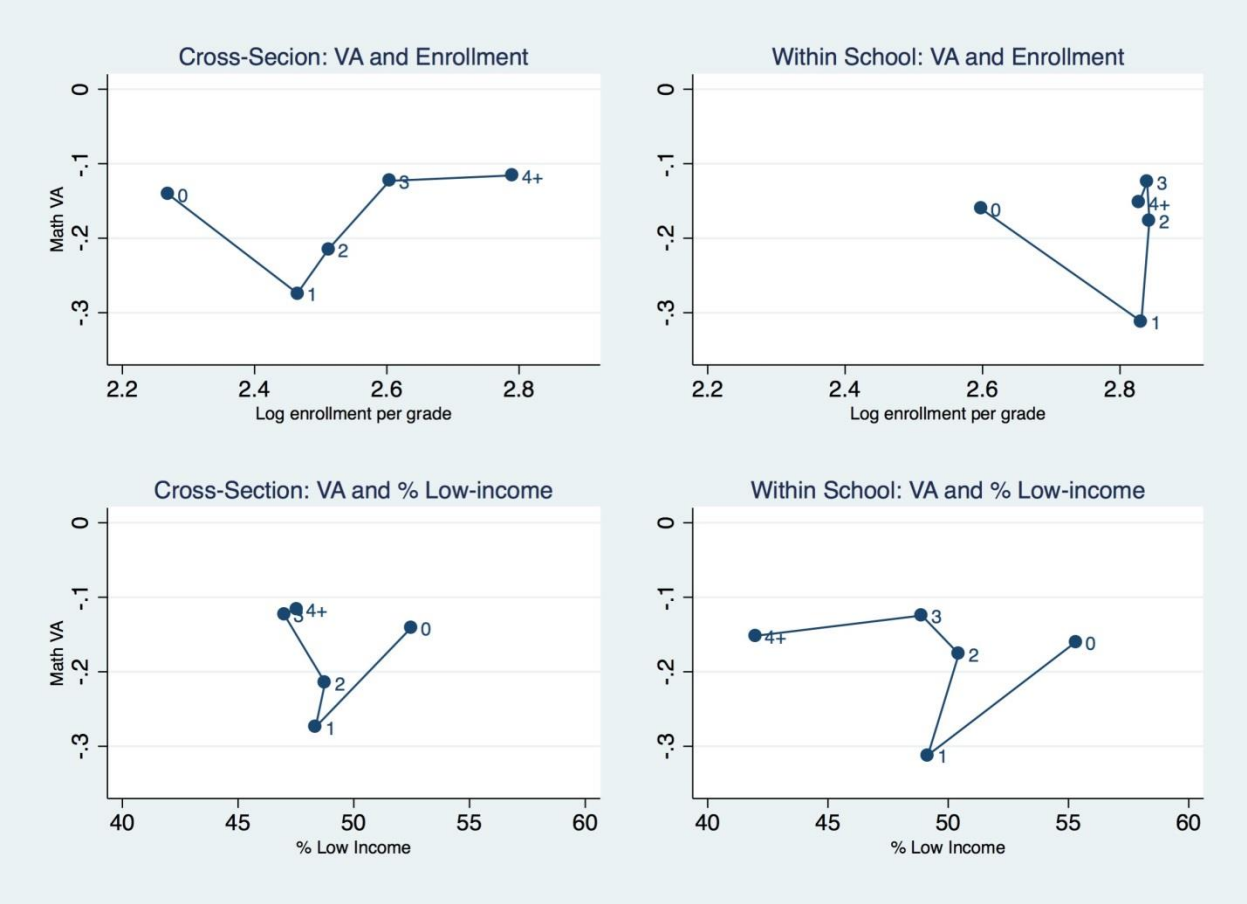


Figure 7 – Changes in School Quality, Enrollment, and Percent Low-Income, by Years until School Closure



Notes: Figures plot the coefficients on school value added and either log enrollment or percent low income. The left hand panel coefficients come from regressions with indicator variables for zero, one, two, three and four or more years until closure and year, while the right hand panel coefficients come from regressions that also include school fixed effects. None of the regressions include a constant.

Figure 8: Comparison of Student Turnover in Charter and Traditional Public Schools

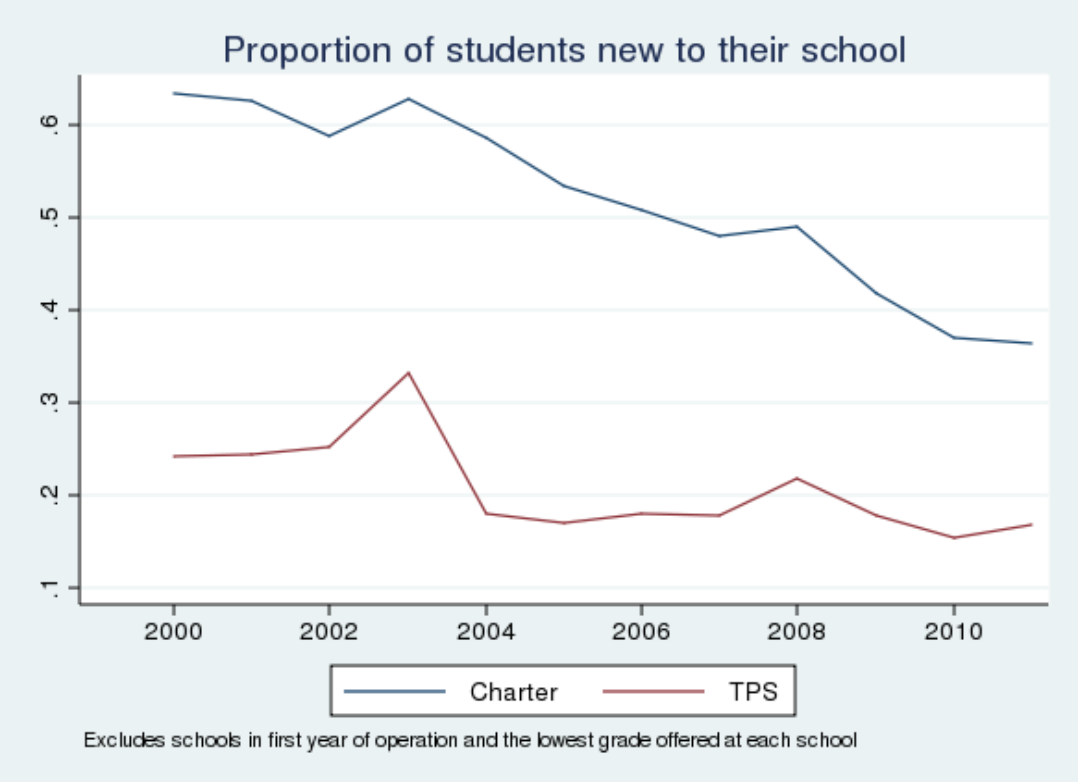
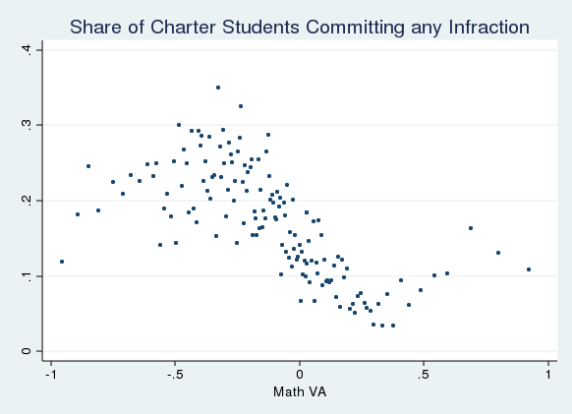
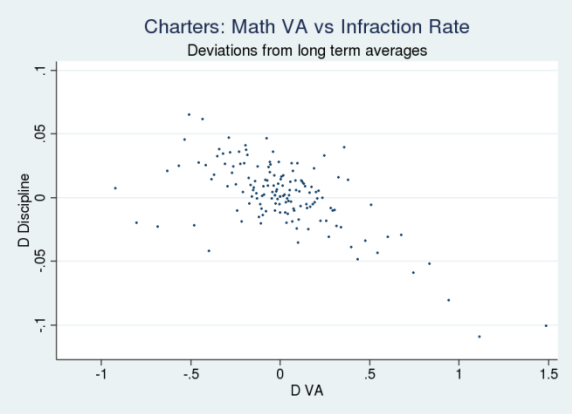


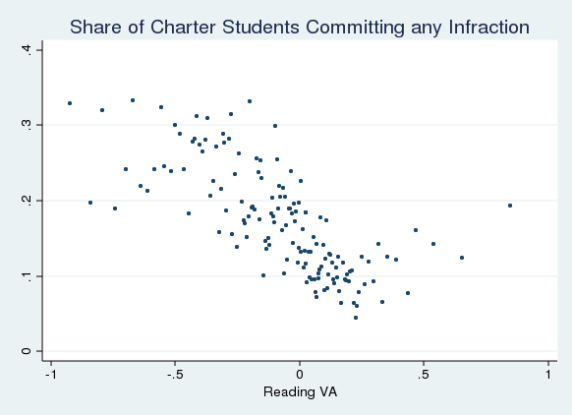
Figure 9: Share of Charter School Students that Receive Any Disciplinary Infractions by School Value Added to Mathematics or Reading, Overall and Deviations from School Mean Infraction Rate



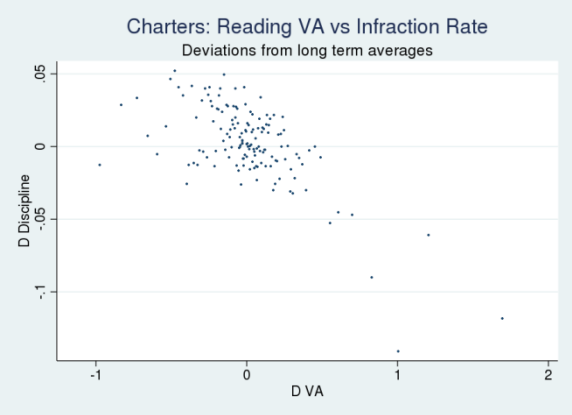
(a)



(b)



(c)



(d)

Table 1: Decomposition of Charter – Traditional Public School (TPS) quality differential

Panel A.	Math					
	2000-2011		2001-2011		2004-2011	
Persisters						
Avg VA	-0.297	0.002	-0.179	0.008	-0.131	-0.005
Share	0.755	0.176	0.789	0.241	0.813	0.383
N	87		105		185	
Exiters						
Avg VA	-0.285	.	-0.397	.	-0.209	.
Share	0.245	.	0.211	.	0.187	.
N	52		59		66	
Entrants						
Avg VA	.	0.015	.	0.013	.	0.021
Share	.	0.824	.	0.759	.	0.617
N	345		318		249	

Panel B.	Reading					
	2000-2011		2001-2011		2004-2011	
Persisters						
Avg VA	-0.229	-0.023	-0.211	0.007	-0.084	0.015
Share	0.76	0.167	0.794	0.232	0.822	0.379
N	78		98		185	
Exiters						
Avg VA	-0.384	.	-0.46	.	-0.24	.
Share	0.24	.	0.206	.	0.178	.
N	51		55		67	
Entrants						
Avg VA	.	0.058	.	0.055	.	0.063
Share	.	0.833	.	0.768	.	0.621
N	345		318		249	

Notes: Decomposition of the change in the charter-TPS quality differential into changes in the quality and test-taker share of persisting schools, and the quality and share of schools that enter/exit.

Table 2: Estimated Effects of Charter Management Organization (CMO) Performance on the Number of Schools Operated, by Inclusion of CMO Fixed Effects

	Net increase in # Campuses		Net decrease in # Campuses	
	(1)	(2)	(3)	(4)
CMO average mathematics VA	0.080	0.070	-0.043	-0.046
	(0.019)	(0.020)	(0.013)	(0.014)
CMO FE	NO.	Yes	NO.	Yes
Year FE	Yes	Yes	Yes	Yes
Mean	0.120		0.055	
N	1847		1847	

Table 3: School Fixed Effect Estimates of the Effects of the Proportion of Students That are New to the School on Charter School Value Added

Dependent Variable	VA Math	VA Reading
Proportion of students new to the school	-0.246***	-0.210***
	(0.026)	(0.030)
N	3403	3376

Notes: The regressions include year indicators. The sample excludes schools in the first year of operation and the lowest grade offered at each school. Standard errors clustered at the school level in parentheses * p<0.05, ** p<0.01, *** p<0.001. Regressions are weighted by school enrollment.

Table 4: Mean Differences in prior achievement and disciplinary infraction rate of charter school entrants relative to those who stayed at their previous traditional public school, by grade of entry and length of stay in the charter school

	Math Score		Reading Score		Infraction Rate	
	All	Stayers	All	Stayers	All	Stayers
Enter in any grade	-0.224	-0.029	-0.119	0.031	0.157	0.049
Enter in Middle School						
Enter in lowest grade offered	0.164	0.23	0.169	0.222	-0.001	-0.03
Enter in grade other than lowest	0.042	0.178	0.108	0.215	0.028	-0.043
Enter in High School						
Enter in lowest grade offered	-0.456	-0.464	-0.344	-0.331	0.283	0.239
Enter in grade other than lowest	-0.561	-0.542	-0.36	-0.372	0.333	0.295

Notes: Sending TPS stayer mean achievement and infraction rates are calculated at school-grade-year level. For classification purposes, middle schools have a minimum grade >= 5 and a maximum grade <=9; high schools have a minimum grade >=8. Stayers are the subset of all charter entrants who remain in their charter school for at least two years.

Table 5: Mean Differences in prior achievement and disciplinary infraction rate of charter school entrants who persist into the second year at the charter relative to peers at their previous traditional public school, by and grade of charter school entry

	Lowest grade offered			Other than lowest grade offered		
Comparison group	Math Score	Reading Score	Infraction Rate	Math Score	Reading Score	Infraction Rate
Middle School						
Year 1: remained in a TPS Year 2: no transition	0.397	0.382	-0.031	0.262	0.313	-0.064
Year 1: remained in a TPS Year 2: switched schools	0.369	0.325	-0.06	0.371	0.354	-0.124
Year 1: entered a charter Year 2: switched schools	0.169	0.087	-0.06	0.457	0.327	-0.223
High School						
Year 1: remained in a TPS Year 2: no transition	-0.495	-0.358	0.258	-0.628	-0.425	0.348
Year 1: remained in a TPS Year 2: switched schools	-0.158	-0.07	0.089	-0.215	-0.146	0.134
Year 1: entered a charter Year 2: switched schools	0.103	0.138	-0.133	0.132	0.026	-0.095

Notes: Prior achievement and disciplinary infraction rate of charter school entrants relative to different comparison groups of students from their prior TPS by level of entry. All comparison groups consist of students from the charter entrants prior TPS and grade (time t=0)

Table 6: Estimated Effects of achievement and infraction rate differentials for entrants and persisters on charter school value added

	Math VA						Reading VA			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Math score										
entrants	0.142***	0.084***			0.140***	0.078**				
	(0.020)	(0.032)			(0.024)	(0.031)				
persisters	0.048***	0.050**			0.048***	0.045**				
	(0.016)	(0.022)			(0.017)	(0.022)				
Reading score										
Entrants							0.152***	0.103***	0.136***	0.098***
							(0.018)	(0.032)	(0.021)	(0.032)
persisters							0.036**	0.015	0.029*	0.012
							(0.015)	(0.020)	(0.015)	(0.020)
Infraction Rate										
Entrants			-0.219***	-0.141*	-0.027	-0.096			-0.037	-0.045
			(0.045)	(0.077)	(0.049)	(0.073)			(0.045)	(0.065)
persisters			-0.046	-0.054	0.021	-0.039			-0.045	-0.061
			(0.041)	(0.043)	(0.044)	(0.043)			(0.038)	(0.043)
School FE	.	Yes	.	Yes	.	Yes	.	Yes	.	Yes
N	1680	1680	1680	1680	1680	1680	1663	1663	1663	1663

Notes: Regressions of charter school quality on measures of student selection. Entry selection compares lagged outcomes for charter entrants to their sending TPS counterparts who did not enter a charter. Exit selection compares student who stay on for a 2nd year at the charter to the same comparison group. Robust standard errors at the level of the campus in parentheses: * p<0.10, ** p<0.05, *** p<0.01

Table 7: Estimated Effects of achievement and infraction rate differentials for entrants and persisters on CMO mean value added.

	Math VA						Reading VA			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Math score										
entrants	0.128***	0.119***			0.125***	0.113***				
	(0.030)	(0.043)			(0.036)	(0.042)				
persisters	0.066***	0.080***			0.064**	0.073**				
	(0.024)	(0.030)			(0.025)	(0.030)				
Reading score										
Entrants							0.161***	0.111***	0.131***	0.106***
							(0.026)	(0.040)	(0.030)	(0.041)
persisters							0.041	0.009	0.031	0.006
							(0.026)	(0.029)	(0.026)	(0.030)
Infraction Rate										
Entrants			-0.207***	-0.196	-0.018	-0.098			-0.069	-0.042
			(0.074)	(0.131)	(0.080)	(0.119)			(0.062)	(0.084)
persisters			-0.066	-0.081	0.000	-0.053			-0.086*	-0.098*
			(0.068)	(0.056)	(0.071)	(0.055)			(0.048)	(0.050)
School FE	.	Yes	.	Yes	.	Yes	.	Yes	.	Yes
N	950	950	950	950	950	950	944	944	944	944

Notes: Regressions of CMO mean school quality on measures of student selection. Entry selection compares lagged outcomes for CMO entrants to their sending TPS counterparts who did not enter a charter. Exit selection compares student who stay on for a 2nd year at the CMO to the same comparison group. Robust standard errors at the level of the campus in parentheses: * p<0.10, ** p<0.05, *** p<0.01

Table 8: Estimated effects of school value added on the relationship between years at a charter school and the probability of receiving a disciplinary infraction

	(1)	(2)	(3)	(4)
Years at Charter	-0.007*	-0.013***		
	(0.003)	(0.004)		
Years at Charter * School VA	0.012	0.003		
	(0.009)	(0.006)		
>1 Yr at Charter			-0.037***	-0.023***
			(0.006)	(0.005)
>1 Yr at Charter * School VA			0.030*	0.023*
			(0.015)	(0.012)
School-Year VA	-0.037*		-0.028**	
	(0.019)		(0.013)	
Student FE	Yes	Yes	Yes	Yes
Grade FE	Yes	Yes	Yes	Yes
Year FE	Yes	.	Yes	.
School * Year FE	.	Yes	.	Yes
N	275764	275764	275764	275764

Notes: Standard errors clustered at campus level in parentheses:* p<0.05, ** p<0.01, *** p<0.001

Table A1: Estimated Effects of achievement and infraction rate differentials for entrants and persisters on charter school achievement

	Math score						Reading score			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Math score										
entrants	0.555***	0.153***			0.450***	0.150***				
	(0.042)	(0.032)			(0.042)	(0.033)				
persisters	0.226***	0.0847***			0.173***	0.0810***				
	(0.023)	(0.024)			(0.023)	(0.024)				
Reading score										
Entrants							0.525***	0.182***	0.401***	0.175***
							(0.033)	(0.036)	(0.033)	(0.036)
Persisters							0.209***	0.0809***	0.166***	0.0787***
							(0.022)	(0.025)	(0.022)	(0.026)
Infraction Rate										
Entrants			-1.019***	-0.134	-0.383***	-0.061			-0.428***	-0.108
			(0.086)	(0.087)	(0.076)	(0.085)			(0.079)	(0.073)
persisters			-0.386***	-0.065	-0.156***	-0.039			-0.177***	-0.027
			(0.055)	(0.045)	(0.055)	(0.047)			(0.052)	(0.05)
School FE	.	Yes	.	Yes	.	Yes	.	Yes	.	Yes
N	1665	1665	1665	1665	1665	1665	1654	1654	1654	1654

Notes: Robust standard errors at the level for the campus in parentheses: * p<0.10, ** p<0.05, *** p<0.01