****** Preliminary draft ******

The Impact of Charter Schools on Academic Achievement

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October 2002

Abstract

Charter schools have become a very popular instrument for reforming public schools, because they expand choices, facilitate local innovation and provide incentives for the regular public schools while remaining under public control. Despite their conceptual appeal, little is known about their performance. This paper provides a preliminary investigation of the quality of charter schools in Texas. It finds that average school quality in the charter sector is not significantly different from that in regular public schools after the initial start-up period. Furthermore, the substantial variation in estimated school quality within the charter sector is quite similar to regular public schools. Perhaps most important, parent' decisions to exit a school appears to be much more sensitive to education quality in the charter sector than in regular public schools, consistent with the notion that the introduction of charter schools substantially reduces the transactions costs of switching schools.

The Impact of Charter Schools on Academic Achievement

by Eric A. Hanushek, John F. Kain, and Steven G. Rivkin*

Charter schools have been championed as the politically feasible form of school choice that offers most of the advantages of voucher schools without sacrificing the benefits of government oversight. The freedom from many of the constraints under which regular public schools operate allows for a diversity of educational approaches and increased competition within the public sector. In just ten years of development, they are found in over two-thirds of the states and their enrollment reaches four percent of the public school population in some states. Nonetheless, even though charter schools have captured the imagination of many school reformers, little evidence about their impact on student achievement is available. This comes about primarily because of the difficulty separating differences in the quality of charter and regular public schools from differences in the students who attend schools in the respective sectors.

This paper discusses the impediments to the evaluation of the effects of charter schools on the quality of education and provides some early evidence on their performance. Additionally, it provides a first glimpse at how the availability of charter schools affects the ways in which parents respond to school quality differences. By eliminating the need to move residences in order to switch schools, charter schools would be expected to lead to increase the sensitivity of parents to school quality and amplify the competitive pressure on public schools.

While the exact character differs by state, charter schools are hybrids of public and private institutions that allow independent development and decision-making in publicly financed schools that operate under the auspices of some form of public oversight. Charter schools are

* Stanford University, National Bureau of Economic Research, and University of Texas at Dallas; University of Texas at Dallas; and Amherst College and University of Texas at Dallas, respectively. The analysis in this paper has been supported by grants from the Smith Richardson Foundation and the Packard Humanities Institute. We would like to thank Aurora Swanson and Gregory Branch for excellent research assistance.

funded by state and local governments but are exempted from many of the state and local regulations that school reformers have argued stifle innovation and reduce the effectiveness of public schools (Nathan (1996)). To achieve this status, the charter must develop approved plans (their charter) and must attract sufficient students to be economically viable. Although appealing as an institutional device to encourage innovation, charter schools are frequently started by people with relatively little experience at either developing new enterprises or running schools.[1] By any standard, running effective schools is complex. Thus, the public policy issue is how these opposing forces – enthusiasm, freedom, and innovation versus inexperience and complexity – net out in terms of student achievement.

Since the nation's first charter school legislation was enacted into law in Minnesota in 1991, some 37 states and the District of Columbia have enacted legislation that provides for charter schools.[2] The number of charter schools increased from a handful in 1991 to some 2,700 in 2002. These schools served over one half million students. Our work concentrates on performance of charter schools in Texas. As part of an effort to expand public choice in elementary and secondary education, the Texas state legislature enacted charter school legislation in 1995 and amended it in 1997. As described in more detail below, Texas has quickly grown into one of the states with the largest numbers of charter schools – ranking third among the states in number of charter schools and fourth in number of students in 2001.

The considerable discussion and analysis of charter schools that has developed has centered chiefly on the growth in charters and to some extent the characteristics of students enrolling in them (e.g., see U.S. Department of Education (1999), Finn, Manno, and Vanourek (2000)). We are also beginning to obtain evidence about some of the impacts of charters on such things as teacher hiring (Hoxby (2001); Hoxby (2002)). The Texas open enrollment charter

[1] For a description of charter schools including both the legislation surrounding them and the heterogeneity of the sector, see Finn, Manno, and Vanourek (2000).
[2] Current data about charters can be obtained from the Center for Education Reform: http://www.edreform.com/.

schools have been evaluated annually by a consortium of research organizations (see Texas Center for Educational Research and others (2001)) and by private researchers (Gronberg and Jansen (2001)). Nonetheless, the information on charter school quality remains largely based on anecdotal evidence. The limited attempts to judge achievement (e.g., Gronberg and Jansen (2001)) have faced the difficulties both of the short history of programs and of the difficulty of conducting such an analysis – problems that also confront us.

The next section develops an analytical approach to extract information about the performance of charter schools, focusing on the problems caused by the endogeneity of school choice. Then we discuss the current state of the charter school program in Texas and describe the growth of different types of charter schools in the state. The central empirical section presents the preliminary results on the analysis of charter school quality relative to regular public schools. Based on this portrait of charter school performance, we consider how parents react to quality differences, specifically the degree to which exit rates out of charter schools appear to be more sensitive to school quality than exit rates out of regular schools. The final section summarizes the work to date and describes some future directions for this research.

An Empirical Model of Charter School Effects

This section describes the key estimation issues related to the identification of charter school effects and the empirical models used in the analysis of student achievement. Prior to the presentation of the empirical model we discuss related past research on the benefits of private schools. Analyses of private school effects must address virtually the same issues as those in the study of charter schools.

Related Research on the Private School Premium

The methodological problems that must be overcome in order to generate a consistent estimate of the benefits of charter schools are quite similar to those that must be addressed in

research on the quality difference between public and private schools. Beginning with the work by Coleman, Hoffer, and Kilgore (1982) the debate over research on public/private school quality differences has centered largely on whether a methodology is able to account for the non-random selection of students into private schooling.[3]

One line of research has sought to deal with this problem by modeling the selection process itself. Specifically, if one can obtain a consistent estimate of the probability of attending a private school, it is possible to correct the models of achievement for this, á la Heckman (1979). The typical problem with this approach, however, is that it is difficult to find factors that drive selection into private schools but that are unrelated to achievement, making identification dependent upon tenuous functional form or exclusion restrictions.

The most recent work on public/private school differences typically uses an instrumental variables approach, recognizing that the available information on students and communities does not adequately control for heterogeneity related to both outcomes and the probability of attending private school. Of course the validity of any particular approach hinges on the assumptions that the instrument is correlated with the probability of attending private school but otherwise uncorrelated with the outcome of interest, and tests of the latter assumption are generally weak or nonexistent.

An alternate approach, used often in the analysis of school voucher programs, has concentrated on intake randomization. If there is excess demand for a program (say, a privately offered school voucher) and if participants are chosen randomly from those applying, a comparison of those admitted with those not admitted provides information on program performance (e.g., Howell and Peterson (2002)). Such an approach circumvents some of the most serious problems about unobserved influences and student selection on scores. At the same time, these evaluations limit the comparison to those who have selected into the lottery for the program.

[3] Murnane, Newstead, and Olsen (1985) discuss the difficulties of isolating the impact of private schools on achievement. Studies of the public/private school quality difference include Evans and Schwab (1995); Sander (1996, (2001); Neal (1997); and Grogger and Neal (2000)).

In addition, problems with attrition and non-random selection raise some questions about the validity of the natural experiment. Finally, they tend to be undertaken on a very small scale, so it is difficult to say anything about program heterogeneity.

In this paper we adopt a very different approach to deal with the selection problems. Rather than comparisons among students we examine differences for the same student as she moves from a regular public school to a charter school or back. This panel data approach employing student fixed effects immediately removes the most obvious sources of bias caused by unobserved heterogeneity. What remains are concerns about changes over time in family and student circumstances that may be associated with entry into or exit from a charter school. Such changes are considered as part of a sensitivity analysis and are the subject of continuing analysis.

The remaining concern is the definition of the treatment. The evaluation approach found in the private schooling literature typically compares the average private school to the average public school. This method ignores any heterogeneity of either public or private schools (the focus of most research on regular public schools), at best allowing effects to vary by student characteristics. [4] In a parallel fashion, much of the discussion – and indeed our initial analysis here – focuses on just the mean differences between charter schools and regular public schools. Some attempts are made to disaggregate in terms of length of a school's existence, but clearly the idea behind charter schools is that even more fundamental differences should exist. We return to discussion and analysis of this issue below.

Empirical Framework for Estimating Mean Differences

We begin with a general model of the educational process that highlights important ways through which non-random selection into charter schools can contaminate estimates of the benefits of charter schools. Because achievement depends upon the entire past history of family,

[4] In a refinement of the basic approach (Neal (1997)) considers geographical alternatives such as central city public and private schools, but the comparisons still disregard significant differences among schools.

community and school inputs including mobility, the data requirements to model the entire achievement process are generally prohibitive. Our development here considers how longitudinal data on achievement and school type can be used to identify the average benefit of charter schools for those who attend.

Consider a value-added model of achievement growth in which annual learning (ΔA) for student i in school s in year t is a function of individual and family factors and type of public school. We concentrate on annual gains in achievement to deal with other well-known estimation problems that arise in estimating achievement models.[5] In order to lead into the subsequent analysis, we highlight the distinction between fixed factors and time varying factors:

$$\textbf{(1)} \qquad \begin{aligned} \Delta A_{ist} &= A_{ist} - A_{i,s-1,t-1} \\ &= \beta CH_{st} + m_{ist}\lambda + \gamma_i + \delta_{it} + \varepsilon_{ist} \end{aligned}$$

where CH is a dummy variable indicating that school s is a charter school, m is a dummy variable indicating a school transfer in year t, γ captures all fixed family and individual influences on achievement, and δ captures systematic influences that vary over time for student i, and ε is an idiosyncratic error.

One way to identify the benefits of charter schools would be the estimation of equation (1) using cross sectional data. This would generate an estimate of β based on the difference in achievement gains (or even levels) between students attending charter schools and those attending regular schools, controlling for any observable differences in family and community background. Such an approach is almost certain to lead to biased estimates of the benefits of charter schools,

[5] Since the level of achievement at any point will be related to cumulative family and school inputs to the time, value-added models can circumvent many problems of omitted or mismeasured past inputs. Some value added models put lagged test score on the right hand side, which allows its coefficient to differ from one. However, the inclusion of an endogenous variable on the right hand side that is a noisy measure of achievement introduces a number of statistical problems. In any event, preliminary work showed that coefficients on variables of interest were not sensitive to the form of the value added model. See Rivkin, Hanushek, and Kain (2001) for the development of a comprehensive model of education production.

because the probability of attending a charter school is almost certainly correlated with unobserved differences among students (i.e. cov(CH, $\gamma+\delta+\varepsilon$) does not equal zero). This is the precise problem that has impeded the estimation of the private school premium.

Our approach takes advantage of having panel data on individuals and uses the difference between achievement gain while attending a charter school versus achievement gain while attending a regular public school to estimate the benefit of charter schools. We explicitly remove fixed effects for individuals in their achievement growth. In this method only students who switch into or out of charter schools contribute to the identification of β, meaning that all fixed differences among students in the rate of learning (γ) are fully accounted for. The essence of our analysis is consideration of whether a student's achievement growth tends to be faster or slower in charter schools once consideration is given to their expected growth in regular public schools.

The key identifying assumption is that entry into a charter school is not correlated with other changes in family or student circumstances that affect achievement. One immediate concern addressed in this paper is the direct effect of mobility on academic achievement apart from any accompanying change in school quality (see Hanushek, Kain, and Rivkin (2001)). The inclusion of an indicator variable for a school transfer is designed to account for any move related transactions cost associated with changing schools. Further, the effects of structural moves – moving from middle school to junior high in the same attendance zone – are captured by a separate indicator variable.[6]

A second important concern is that a temporary change in student performance raises the probability of transfer to a charter school in a subsequent year. While the student fixed effects remove all stable differences related to family background, neighborhoods, peers, and the like, time varying aspects of these could be correlated with both choice of charter schools and student

[6] Because information on change of residence is not available, a school change was considered a structural change if the transition was to a school attended by more than 30 percent of previous classmates. Such structural transitions combine transitions between middle school and junior high with changes in attendance zones including the opening of new schools.

achievement. In particular, if a parent decides that the current public school is not performing well based on the child's immediate experiences and enrolls the child in a charter, the achievement prior to entry may not accurately represent the students starting point. Because the charter school effect is estimated by the rate of growth of achievement following entry into or exit from a charter school compared to that before the switch, temporary declines prior to the move would bias upward the estimated benefit of charter school attendance. (This is very similar to the evaluation problem when there is a preprogram dip in earnings prior to entering job training).[7] Fortunately, with sufficient longitudinal data, we can directly investigate the existence of such temporary declines by including dummy variables that identify changes in achievement growth in the year prior to charter school entry or exit. (In our related work using similar methods, analysis of special education program effects failed to find any evidence of temporary dips or improvements prior to program entry (see Hanushek, Kain, and Rivkin (forthcoming)).

A third concern not addressed here is that the presence of a charter school in the community provides an incentive for regular schools to raise the quality of instruction. Given that Texas already had a school reward program linked to the TAAS test in place, it is unlikely that the entry of a charter has a large impact on regular school performance. Nonetheless, the possibility that regular schools responded and raised achievement gains thereby biasing downward the estimated charter school effect should be considered.[8]

A final issue concerns the generalizability of the results to the entire population of public school students. Because the charter school effect is identified from the change in achievement gains for those who enter or exit charter schools, it is an open question as to the extent that these estimates are relevant for the student body as a whole. The general issue frequently arises in program evaluations; see Heckman, LaLonde, and Smith (1999). If those who expect to receive

[7] Heckman and Smith (1999) discuss the implications of a preprogram decline for the estimation of job training program effects.

[8] Hoxby (2003) suggests that charters and vouchers in other states have spurred the public schools to perform better. On the other hand, Texas Center for Educational Research and others (2001) suggests from survey information that there is limited reaction of the public schools to the existence of a charter.

higher benefits from attending a charter school are more likely to enroll, the estimated benefit may overstate the expected gain to the average student even though it provides a consistent estimate of the benefit of charters for those who attend.

Extensions

Heterogeneity of charter schools is clearly an important issue. The prior discussion addresses the simplest question: on average are charter schools better or worse than regular public schools in raising achievement. The idea behind charters is nonetheless to encourage new innovations, and the dimensions of possible innovation are left quite undefined. Thus, it is natural to believe that some charters are much better than others in raising the achievement of children.

In this vein, we explicitly consider the possibility that charter school effects vary along several dimensions including chartering authority (state or district) and age of the charter. Because the legislation creating the charter school program was only recently implemented, most charter schools have been in existence for only a short period of time. If it takes schools a year or two to get up to speed, estimates of the average benefits of charter schools for the period under study will not capture the long term or steady state differences between the two sectors. Consequently we divide charter schools into groups based on years in existence and examine whether older charter schools systematically outperform more recent entrants.

Though these groupings likely explain a portion of the difference in charter school effectiveness, they are unlikely to account for the bulk of the variation in school quality. Rather charter schools are likely to differ in quality in much the same way as regular public schools. Therefore, we expand the analysis to consider the entire distribution of performance in both charter and regular public schools. By using the matched panel data on schools and students, we are able to estimate fixed effects for all schools on the basis of differences in student achievement gains for students who attend more than one school. This method that controls for student fixed effects in gains as well as the impacts of moving and income changes on performance enables us

to present a picture of the distribution of performance in charter schools and to compare this directly to the distribution of performance in the regular public schools.

Importantly, these school fixed effects not only describe charter school and regular public school quality across the entire distribution, they also provide the information needed to investigate the sensitivity of parents to the quality of education. Because the opening of a charter school dramatically reduces the cost of switching schools through the elimination of the need to move residences, we expect the expansion of charter schools to increase mobility related to the search for better schools. In the future we intend to match charter schools with nearby regular public schools to test this hypothesis, but this matching is not yet complete. For now we focus on differences in the relationship between school quality and the probability of leaving a school across sectors.

The UTD Texas Schools Microdata Panel

The cornerstone of this research is the analysis of a unique microdata set of school operations constructed by the UTD Texas Schools Project.[9] The database tracks elementary students as they progress through school; it measures student performance each spring; and it contains detailed information about schools and teachers. This analysis follows four consecutive cohorts for the period 1996 to 2001, focusing on student achievement gains in grades 4 through 7. For each cohort there are over 200,000 students in over 3,000 public schools including over 100 charter schools. The large numbers of students who enter and exit charter schools are especially important for the methodology pursued here.

Beginning in 1993, the Texas Assessment of Academic Skills (TAAS) was administered each spring to eligible students enrolled in grades three through eight. Unique IDs link the student

[9] A more detailed description of the underlying database can be found in "Description of Texas Schools Project," February, 2000, at the website for the UTD Texas Schools Project (http://www.utdallas.edu/research/greenctr/).

records with the test data.[10] The criteria referenced tests evaluate student mastery of grade-specific subject matter and provide our measure of student outcomes. We use mathematics and reading test scores in this paper.[11] Because the number of questions and average percent right varies across time and grades, we transform all test results into standardized scores with a mean of zero and variance equal to one and included dummy variables for each grade-year combination. The regression results are robust to a number of transformations including the raw percentage correct.

The data contain a limited number of student, family and program characteristics including race, ethnicity, gender and eligibility for a free or reduced price lunch. Nonetheless, the panel feature can be exploited to account implicitly for time invariant individual effects on achievement. Importantly, students who switch schools can be followed as long as they remain in a Texas public school.

The TAAS data are merged with information on whether a school is a state authorized charter, a district authorized charter or a regular public school. Any school without any students in the TAAS data set is excluded in the sample, therefore our number of charters will differ from public records of the number of authorized charter schools. Note that students do not have to have to actually complete the tests to be included in the TAAS file.

School transitions (m_{it}) are constructed to exclude those that result from the structure of school districts. In other words, the transitions from elementary to middle and middle to junior high schools for students who remain in the same attendance zones are not considered moves, and a separate dummy variable captures the effect of such transitions.

[10] One important data consideration is the possibility that schools miscode student IDs, which would tend to depress the number of movers within the public schools and overstate the percentage who exit Texas public schools. While there is no sure check for coding errors, the evidence suggests that other types of coding problems are quite minimal. Less than one percent of observations in 4th grade and less than one half of one percent of observations in 5th thru 7th grades did not have unique IDs in each cohort; note that a small number of duplicate records were deleted.

[11] In previous investigations of school performance (Rivkin, Hanushek, and Kain (2001)) we found school effects on mathematics have been consistently larger than those on reading. Nevertheless, because charter schools have different emphases, we investigate alternative measures of performance here.

The Texas Charter School Program

The Texas Education Code established three types of charter schools: home rule school districts, campus or program charters, and open enrollment schools. Open enrollment schools receive their charters directly from the state, while campus and program charters are creatures of individual districts and are chartered by them. The largest number falls under the open enrollment charters governed by the State Board of Education. The Texas legislature placed limits on the number of charter schools that could be operated under the open enrollment program, and this limit has been raised since the introduction of the program in 1995. In 2002, the limit on open-enrollment charter schools was raised to 215 but a previously uncapped category for schools serving 75 percent or more at-risk students was folded into the total.

Prior to 1997 there were only a handful of charter schools in Texas, but since then the number of charter schools has increased dramatically. Table 1 shows that the percentage of 4th through 7th grade public school students attending charter schools rises from 0.2 percent in 1997 to about one percent in 2001. Though still only a small fraction of the entire student body, this growth rate shows both an interest in alternative schools and the existence of a supply response. Continued growth at this rate would make charter schools an increasingly important component of Texas public schools.

Participation in charter schools varies substantially by ethnicity and to a lesser extent by family income. As seen in Table 2, blacks have consistently been far more likely to attend charter schools than any other ethnic group. Whites, on the other hand, are much less likely to attend charter schools, although they also have had growth in attendance rates during this period. Interestingly, the differences among ethnic groups are far larger than the differences by family income despite the fact that the initial charter legislation favored schools for disadvantaged

Table 1. Charter School Attendance and Number of Charter Schools by Year and Grade in Texas Public Elementary Schools Grades 4-7, 1997-2001

	1997	1998	1999	2000	2001
Percentage of Students Attending a Charter					
4th Grade	0.2%	0.2%	0.4%	0.6%	0.8%
5th Grade	0.2%	0.2%	0.4%	0.6%	0.7%
6th Grade	0.2%	0.4%	0.6%	0.8%	1.0%
7th Grade	0.2%	0.4%	0.5%	0.8%	0.9%

Table 2. Charter School Attendance by Race/Ethnicity and Income in Texas Public Elementary Schools Grades 4-7, 1997-2001

	1997	1998	1999	2000	2001
Race/Ethnicity					
Asians	0.2%	0.5%	0.6%	0.8%	0.9%
Blacks	0.8%	0.9%	1.2%	1.7%	2.2%
Hispanics	0.1%	0.3%	0.4%	0.6%	0.6%
Whites	0.0%	0.1%	0.2%	0.4%	0.4%
Income					
Low Income	0.3%	0.3%	0.4%	0.8%	0.8%
Not Low Income	0.0%	0.2%	0.4%	0.6%	0.6%

populations. Note, however, that the crude measure of income captured by eligibility for subsidized lunch is undoubtedly error prone and may conceal important differences by family economic circumstances

Not surprisingly, the growth in charter school attendance resulted in large part from a rapid increase in the number of charter schools. Table 3 shows that the number of charter schools in their first year of operation rose from less than 10 in 1997 and 1998 to over 100 in 2000 and 2001. The vast majority of these new schools are chartered by the state, and the number of state charters now dwarfs the number of district charters, a reverse of the situation in the mid1990s. This change reflects new state legislation that opened up the number of schools that could be chartered. For our purposes, the dramatic growth means that our observations are heavily weighted toward recently opened schools. More specifically, over 40 percent of our annual observations of charter schools come from the first year of operation and another 30 percent come from the second year of operation.

A substantial decline in average enrollment accompanied the expansion of charter schools, particularly after 1998 (see Appendix Table A1). The median number of students by grade in charters fell across grades 4-7 by more than 50 percent, leaving roughly 13-17 students in each grade after 1998. Whether this decline results from the fact that a high percentage of charter schools in later years are in their first year or from disproportionate growth in smaller schools is unclear. The small samples in some schools potentially affect the subsequent estimation. Consequently all regression specifications were rerun excluding schools with fewer than ten students in a grade, and the results are virtually identical to those obtained from the full sample.

Charters, like all Texas schools, face considerable mobility of their population. Table 4 identifies the percentages of students leaving a charter (given that the charter had the subsequent grade available). Not surprisingly, exit rates are greater for charters than for the regular public schools, although a portion of this appears to be compositional. The charters have a

Table 3. Distribution of Charter Schools by Chartering Authority and Number of Years in Operation, 1997-2001

	1997	1998	1999	2000	2001
Chartering Authority					
State	7	10	47	106	116
District	8	11	17	17	18
Number of Years in Operation					
one	9	6	44	61	30
two	2	9	6	43	47
three	4	2	8	5	40
four	0	4	2	8	5
five	0	0	4	2	7
six	0	0	0	4	1
seven	0	0	0	0	4

Table 4. Charter and Regular Public School Annual Exit Rates by Destination, Grade, Income and Ethnicity (exit rates calculated only for schools that offer the next grade)

	Move to other public school		Exit Texas public schools	
	Charter	Regular	Charter	Regular
All students	17.5%	12.4%	12.4%	6.6%
Grade				
4th to 5th grade	19.4%	13.2%	9.9%	5.9%
5th to 6th grade	23.0%	12.9%	18.7%	6.9%
6th to 7th grade	14.3%	11.1%	10.8%	6.6%
Income				
disadvantaged	18.2%	15.3%	13.1%	7.8%
not disadvantaged	16.6%	9.8%	11.6%	5.5%
Ethnicity				
black	22.2%	18.2%	11.3%	7.9%
Hispanic	14.3%	12.8%	13.2%	6.5%
White	15.6%	10.5%	11.9%	6.2%

disproportionate black population, and, independent of the type of school, blacks tend to move much more frequently than other race and ethnic groups. Taking race and ethnic differences into account, transfer rates to a regular public school are quite similar for charter school and regular public school students.

The charter school exit rates peak in the fifth and sixth grade, suggesting that transitions might also relate to the structure of the regular public schools and the ability to re-enter at logical points (i.e., middle school transitions). While we calculate exit rates just for schools that offer the next grade, charter schools still do not in general cover the complete age spectrum – frequently necessitating a subsequent return to regular public schools or to a private alternative.

Regardless of ethnicity, however, charter school students are also much more likely to exit Texas public schools than are regular public school students. This summary statistic underscores the necessity of fully accounting for individual differences, because the group that would select charter schools also appears more likely to attend private schools.[12]

The summary view of the evolution of charter schools highlights two features that must enter into the analysis of performance. First, explicit consideration of the effects of a student's moving is necessary; enrolling in a charter requires a school move. Our prior work (Hanushek, Kain, and Rivkin (2001)) that investigated mobility in regular public schools indicated that a student's achievement is likely to suffer in the year of the move.[13] Moreover, higher student turnover appears to harm all students in a school regardless of whether or not they themselves move. Charter schools, which by necessity as start-ups have all students moving in initially and have higher mobility subsequently, clearly face challenges of this nature. For long term

[12] We do not observe where a student goes following an exit from the Texas public schools. While we can observe mobility across all public schools in the state, including charters, we have no way of tracking movement to private schools or out of the state. We interpret the larger exit rates from Texas public schools as arising from private school attendance, because we see no reason why mobility out of state would be significantly related to attending charter schools.

[13] The exact cause of this achievement loss is difficult to ascertain. Many moves are associated with other family disruptions – divorce, job loss, and the like – and it is not possible to partition the losses between school adjustment factors and nonschool factors; see Hanushek, Kain, and Rivkin (2001).

evaluation of charter performance, it is necessary to sort out short run and long run differences in mobility rates between charters and regular publics. Second, as highlighted by the pattern of exits out of the Texas public school system, charter school students do not follow the same paths as regular public school students, suggesting that they may differ from regular school students in potentially important ways.

Many questions have also been raised about what choice might do for the composition of schools and particularly the peer groups. Much of the early discussion, perhaps extrapolating from the experiences in elite private schools, suggested that choice would lead to more racial and economic segregation in schools. Past history has suggested that this has not been a very strong influence in private school choice (e.g., Coleman, Hoffer, and Kilgore (1982); Howell and Peterson (2002)).

The charter school experiences in Texas show interesting and diverse patterns of enrollment. Table 5 indicates that the percentage black increases by 9.5 percent for black students entering charter schools. In other words, blacks entering charter schools go into more segregated surroundings. At the same time the average black entering a charter school has 8.5 percent fewer Hispanic classmates. Hispanics also enter charters with more blacks (2.3 percent) and almost 10 percent fewer Hispanics. For whites, the proportion of both blacks and Hispanics falls upon charter entry (3.1 and 5.0 percent, respectively). Thus, it appears that the charters in Texas have led to some additional racial and ethnic concentration, but it does so importantly because of increased black concentration in charters selected by black students.

Our previous work on racial composition indicated that blacks suffered in terms of achievement growth when the concentration of black students increased (Hanushek, Kain, and Rivkin (2002)). In this case, where the charters frequently offer specialized programs that attract their clients, it seems entirely possible that the racial composition effects found for regular public schools differ for specialized charters. The implications, however, remain to be seen.

Table 5. Change in Racial and Ethnic Composition with Transitions of Students to Charter and Regular Public Schools

	Change in Percent Black		Change in Percent Hispanic	
	enters charter school	remains in regular school	enters charter school	remains in regular school
Blacks	9.5%	-1.4%	-8.5%	0.9%
Hispanics	2.3%	0.3%	-9.8%	-0.8%
Whites	-3.1%	0.3%	-5.0%	0.5%

Average Effects of Charter Schools on Achievement

This section reports the estimates of charter school effects on mathematics and reading achievement in increasing levels of detail. Table 6 begins with a number of specifications growing out of the basic model in equation (1) that differ according to whether student fixed effects are removed and whether information on student mobility and turnover is included in the regressions. For each specification charter schools effects are presented for all charters combined and by chartering authority (state or district). Subsequent specifications permit separate effects by age of charter and by family income and ethnicity of the student. All specifications include indicators for a transition from elementary school to junior high, subsidized lunch eligibility, and year-by-grade (to allow for differences in the tests across years). Specifications that do not remove student fixed effects also include a vector of ethnic group dummy variables (Asian, black, Hispanic and Native American) and a dummy variable for gender. Results for mathematics are reported in the top panel and results for reading are reported in the bottom panel. Standard errors are adjusted for the clustering of students into schools.

The first column provides a simple benchmark with which to compare the remaining estimates. By looking at the overall level of achievement (and not gains in performance over the school year), the estimated difference in scores combines both the immediate effect of the charter and the entire past history of family and school differences. Since this is likely to be dominated by prior achievement, it shows that charters on average tend to attract a sample of students rather similar to those in public schools controlling for the observable characteristics. However, the estimates for all charter schools combined conceals differences by chartering authority: state chartered schools tend to draw below average students (0.3 standard deviations in math and 0.14 standard deviations in reading below regular public schools), while district charters tend to attract a more elite group of students.

Table 6. Estimated Effects of Charter Schools on 4th-7th Grade Mathematics and Reading Test Score Levels and Gains

(absolute value of huber adjusted t statistics in parentheses)

	Levels	Achievement Gains (ΔA_i)		
		Individual fixed effects	*Individual fixed effects and move status*	*Individual fixed effects, move status, and school mobility*
Mathematics				
Charter School	-0.04 (0.40)	-0.05 (1.87)	-0.04 (1.80)	0.02 (0.72)
State Charter School	-0.30 (2.88)	-0.17 (4.77)	-0.17 (4.76)	-0.06 (1.81)
District Charter School	0.17 (1.89)	0.07 (1.80)	0.07 (1.99)	0.09 (3.05)
Reading				
Charter School	0.05 (0.55)	-0.07 (3.58)	-0.07 (3.52)	-0.03 (1.54)
State Charter School	-0.14 (1.72)	-0.15 (5.24)	-0.15 (5.26)	-0.09 (3.01)
District Charter School	0.21 (1.80)	0.00 (0.03)	0.00 (0.01)	0.01 (0.43)

The remaining columns move to a value added formulation and include student fixed effects in order to move past the standard selection issues by eliminating any stable current and historical family, ability, and motivational differences and by adjusting for a student's entering achievement. The effect of charter schools is now estimated by contrasting the achievement growth that a student has in a regular public school with that in a charter school. Regardless of specification, it is clear that much of the performance difference seen in the levels regressions is simply a result of selection into charter schools.

The results in the simplest specifications that do not control for student mobility in any form indicate that average achievement growth in charter schools is somewhat below that in regular public schools (0.05-0.07 standard deviations per year). This performance gap, moreover, comes from the lower growth in state charters; district sponsored charters do as well (reading) or better (math) than regular public schools. The results in the next set of columns based on specifications that include information on the move status of the student in each year are quite similar, indicating that the omission of individual mobility status does not bias the estimates.[14]

In both mathematics and reading, however, the negative and statistically significant effect of charter schools in the fixed effect specifications is reduced in magnitude or eliminated by the inclusion of information on overall student mobility into the school. The negative impact of student turnover is consistent with earlier work on Texas (Hanushek, Kain, and Rivkin (2001)), and it is not surprising that turnover would be important in a sector made up predominantly of new and very young schools. Yet it is premature to attribute such an important role to turnover, because turnover is by definition much higher in new schools in which none of the students are non-movers. Similarly, district charters are much older than state charters on average, which may explain the difference in estimated effectiveness across these two sectors. Consequently, the next

[14] Our previous work (Hanushek, Kain, and Rivkin (2001)) indicated that the first year effects mixed together the impacts of a wide variety of circumstances and that it was not possible from just achievement data to predict the nature of first year impacts.

specifications investigate the role of charter school age in an effort to identify the start up costs of new schools.

Table 7 reports results from specifications that include dummy variables for the age of the charter (first year of operation, second year, third year and fourth year or more) and the student mobility variables whose coefficients (not reported) are negative and statistically insignificant. The coefficients on the age variables provide support for the view that first year charter schools significantly underperform regular schools in both mathematics and reading but that charter schools get up to speed fairly rapidly. In mathematics only the coefficient on first year charter schools is negative and statistically significant; by the fourth year mathematics achievement appears above that in regular public schools though the coefficient is not significant. In reading charter schools perform significantly worse than regular public schools for the first two years, but any differences are insignificant after that initial period. The differences between district and state sponsored charters also become insignificant once the age of the charter is accounted for.

Finally, we examined whether the benefits of charter schools differed by family income or ethnicity. Despite the fact that nonwhites are much more likely to attend a charter school, there is little or no evidence of systematic differences by ethnicity or by income.[15] The results (not reported) show that all of the coefficients are small and none are statistically significant at any conventional level.

Distribution of Performance of Charters

Charters are by their very nature and design quite different, not only from regular public schools but also from each other. The previous analysis highlighted variations in performance of

[15] These findings differ from those of Gronberg and Jansen (2001), who find positive effects for disadvantaged students. Their empirical specifications, however, differ significantly from ours, making it difficult to diagnose the source of the differences in results.

Table 7. Student Fixed Effect Estimated Effects of Charter Schools on 4th-7th Grade Mathematics and Reading Test Score Gains by Age of Charter School (absolute value of huber adjusted t statistics in parentheses)

Year of Operation	Mathematics	Reading
First	-0.16	-0.13
	(2.76)	(3.08)
Second	-0.02	-0.09
	(0.37)	(2.49)
Third	-0.02	-0.03
	(0.34)	(0.55)
Fourth or more	0.13	-0.02
	(1.64)	(0.28)
District Charter	0.06	0.06
	(1.09)	(1.28)

charters along the simple dimensions of age and chartering authority ignoring any heterogeneity within these categories. Here we consider the entire distribution of performance.

The approach represents a simple extension of the prior work. Let $S_{i\rho t}=1$ if student i is in school ρ in year t and =0 otherwise. Then we estimate a modified form of equation 1:

$$\textbf{(2)} \qquad \Delta A_{ist} = \sum_{\rho} \beta_{\rho} S_{i\rho t} + m_{ist}\lambda + \gamma_i + \delta_{it} + \varepsilon_{ist}$$

This is simply the explicit form of a fixed effect estimator where β_s is the estimated value-added of school s. We estimate equation (2) for regular and charter schools for seven different regions of Texas.[16] Separate estimates are computed for each region because of the large number of schools in Texas make it computationally infeasible to combine all schools together, and most of the school switches needed to identify school fixed effects are for schools within the same region.[17] We also use only a random sub-sample of the students in each region that includes all students who ever attended a charter school plus a randomly selected twenty percent of the remaining students. One school in each region is randomly selected as the omitted category and assigned a fixed effect of zero. (Appendix Table A2 shows the numbers of movers that form the basis for the school value-added estimates).

Table 8 summarizes the distribution of quality for regular and charter schools. The number of charter schools varies between 4 and 47 in the different regions. Thus, for the smaller regions the distributional information is based on quite limited data. Nonetheless, the overall data make clear that there is no more a single "treatment" for charter schools than there is for regular public schools. As a result, asking the simple question of whether charter schools are better or worse than regular public schools ignores the heterogeneity that is the heart of the school quality issue.

[16] The regions are south, Houston, the east other than Houston, the north excluding Dallas and Fort Worth, Dallas and Fort Worth, central and west.

[17] The computational problem occurs because of the presence of two types of fixed effects (student and school) of large dimensionality.

Table 8. Distribution of Regular and Charter Quality by Region

	region						
	South	Houston	East (w/o Houston)	North (w/oDFW)	Dallas, Ft. Worth	Central	West
				Mathematics			
75th percentile							
Regular	0.28	0.06	0.69	0.68	0.30	0.59	0.70
Charter	0.00	0.16	0.75	0.14	0.25	0.33	0.83
Median							
Regular	0.06	-0.09	0.39	0.47	0.12	0.38	0.48
Charter	-0.12	-0.07	0.31	-0.12	-0.11	0.08	0.46
25th percentile							
Regular	-0.12	-0.26	0.15	0.22	-0.04	0.20	0.28
Charter	-1.26	-0.52	-0.08	-0.45	-0.28	-0.22	-0.32
				Reading			
75th percentile							
Regular	0.17	0.07	0.42	0.82	0.19	0.39	0.38
Charter	0.00	0.11	0.47	0.89	0.15	0.17	0.14
Median							
Regular	-0.03	-0.06	0.17	0.62	0.04	0.22	0.18
Charter	-0.34	-0.09	0.13	0.74	-0.10	0.01	-0.48
25th percentile							
Regular	-0.24	-0.18	-0.05	0.41	-0.10	0.06	0.00
Charter	-0.79	-0.28	-0.37	0.64	-0.34	-0.21	-1.06
Number of Schools							
Regular	606	830	300	349	1215	943	927
Charter	8	47	4	6	31	25	6

Note: Table provides estimates of the distribution of fixed effect coefficients from a common regression for each region. No age controls for charter schools are included.

The distribution of school performance differs across the region both for regular and charter schools. At the top end of the distribution, charter schools appear quite competitive with the regular public schools. For math and for reading, the 75th percentile of the school quality distribution is higher for charters in three of the seven regions. At the same time, the charter school sector appears to have a noticeably lower bottom end of the distribution. Virtually across the board, the bottom 25th percentile of charter schools is appreciably below the same point in the regular public schools.

An important caution about the interpretation is, however, that the charter school effects are estimated without regard to the age of the charter (the small number of charters in several of the regions precluded the inclusion of age controls). As demonstrated above, the initial years of a charter tend to exhibit lower performance than later years. And, by the distribution of ages, we know that a majority of charter observations come from the start-up period. Seventy-two percent of our observations of charter operations come from the first or second year that a charter is open.

Market Responses to Quality

The underlying notion behind introducing more competition, whether through charter schools or through more extensive measures such as vouchers, is that consumers will guide the development of schools that better meet their demands. Of course, consumers may demand a variety of things other than the quality of instruction. Since achievement test scores do not capture other types of school outcomes, this analysis does not provide a comprehensive investigation of all aspects of charter schools. Nevertheless, in designing their testing system the State of Texas has made higher achievement a primary objective of public education, and the degree of parental response to the quality of schools along the achievement dimension is an important determinant of the likely effectiveness of charter schools in reaching that goal.

We begin by asking a simple question: Do parents who select a charter school tend to leave if the quality is low? To answer this, we consider a simple linear model where the exit rate for a school is modeled as a function of estimated quality (the estimated β_s from eq. 2) and the average age of the charter. (We adjust for age because we wish to consider the steady state relationship after the initial settling of the curriculum and school). The models also contain separate intercepts for each region, because the school quality estimates were computed separately by region and because the opportunities both for other schools and for housing and jobs undoubtedly affect relocation probabilities. At this time the precision of the school quality estimates is ignored and no adjustments are made to the standard errors because of the inclusion of estimated coefficients as regressors.

Table 9 shows the estimated impact of quality on exit rates. Taken either separately or together, both math and reading value-added of a charter significantly influence exit rates. The higher the value-added of a school, the lower is its exit rate. These results are very encouraging in that they indicate parental awareness and reaction to quality differences. Whatever else parents may be looking for in a charter school, they respond to performance differences in the core academic subjects.

Even though Texas has had a reporting and accountability system for school in place during much of the 1990s, it is nontrivial to use the average level of achievement in a school to infer what the value-added of the school might be. Yet the evidence suggests that parents have this ability, and moreover that they react to their views about value-added and quality.

Of course, regular public school parents may also react to quality differences, so we repeat the exercise for the regular public schools.[18] Interestingly, exit rates are also significantly lower for higher quality public schools (see Table 10). However, the magnitude of the effect for regular public schools is roughly one-quarter the magnitude of the corresponding estimate for

[18] These models also include regional differences, although there is no comparable age of school measure for the regular public schools.

Table 9. Relationship of School Performance Exit rates for Charter Schools

	(1)	(2)	(3)
Math value-added	-0.16		-0.11
	(3.88)		(2.05)
Reading value-added		-0.18	-.10
		(3.59)	(1.52)
Average age of charter	-0.11	-0.10	-0.10
	(2.76)	(2.37)	(2.44)
N	92	92	92

Note: Regression all include regional indicator variables.

Table 10. Relationship of School Performance Exit rates for Regular Public Schools

	(1)	(2)	(3)
Math value-added	-0.031		-0.017
	(5.81)		(2.95)
Reading value-added		-0.044	-0.036
		(7.69)	(5.83)
N	4122	4122	4122

Note: Regression all include regional indicator variables.

charter schools despite the fact that the school quality estimates are obtained from regressions that pool both regular and charter schools.

The muted exit response of students in regular public schools quite likely results from the much higher transactions costs typically associated with moving. With fixed attendance zones, parents of students in regular public schools usually have to change residences in order for their child to attend another regular public school, while children in charter schools can opt back into the regular public schools without having to move. At this time the small number of existing charter schools cannot provide viable alternatives to the large number of regular public school students who face below average schools, therefore transactions costs are much higher for most students in regular public schools who desire to change schools.

Conclusions

Charter schools are one of many ways in which competition and choice have been introduced into the system of publicly supported elementary and secondary education. These schools enjoy enormous popularity as witnessed by the rapid growth of the number of charter schools in many states. Yet while charter schools may satisfy family preferences regarding various aspects of the education environment, there is little in the way of solid evidence regarding the academic quality of charter schools in comparison to the local public school alternative.

Deducing the effectiveness of charters is difficult, because they exclusively enroll a self-selected group of students. To the extent that factors influencing selection also affect achievement, simple comparisons of scores between charters and regular publics will obviously be very misleading. Texas provides a unique opportunity to gain insight into the quality of charter schools because of both a sizeable number of charter schools and a comprehensive system of collecting data.

The results in this paper show that charter schools typically have a rough beginning. Their performance (measured by average value-added in student performance) begins below that of regular public schools during the first year, but by the second or third year there are not significant differences in average performance. Of course this start-up phase leads to some uncertainty, as greater numbers of students exit charters than comparable regular public schools, and this feeds back to make the start-up even more difficult. Nonetheless, surviving charters develop programs that are competitive with regular public schools and that frequently surpass the average public schools.

Interestingly, while charter schools may differ dramatically in purpose, parents respond decisively to quality differences measured in terms of value added to learning in math and reading. A high quality charter has much lower exit rates than a poor quality charter. The comparison of school exit behavior for charters and regular public schools is also informative: the responsiveness to quality in the regular public sector is much smaller than that in the charter sector. Most likely these differences reflect the higher costs of switching out of a regular public school, though they may also reflect a greater willingness to exit the public schools entirely. We will examine this issue in much greater detail in the future along with other aspects of heterogeneity both within and between the charter and regular public school sectors.

Appendix Table A1. Mean, 25th Percentile, Median and 75th Percentile of Charter School Enrollment in a Grade, 1997-2001

	1997	1998	1999	2000	2001
4th Grade					
10th Percentile	4	8	2	4	4
25th Percentile	8	19	9	8	8.5
Median	44	34	17	16	16.5
75th Percentile	78	65	26	29.5	31.5
5th Grade					
10th Percentile	2	7	4	2	2
25th Percentile	19.5	14	7	6	7
Median	38.5	46.5	17	14	15
75th Percentile	101.5	80	28	33	40
6th Grade					
10th Percentile	15	12	4	2	1
25th Percentile	27	14	7.5	4	5
Median	34	37	14	14	13
75th Percentile	50	87	37	29	34
7th Grade					
10th Percentile	16	19.5	5	2	2
25th Percentile	36	38	6	3	5
Median	42	44.5	18	10	12.5
75th Percentile	77	61	45	31	28

Appendix Table A2. Numbers of Student Observations for Estimates of Charter School Value-added

	1997-1998	1998-1999	1999-2000	2000-2001	all years
Charter School Transitions					
Enters charter	757	1586	2149	1726	6218
Exits charter	316	537	697	943	2493
Remains in charter	454	1178	1899	1786	5317

Note: These transitions ignore the availability of another grade in the school. They provide information on the effective sample sizes in the identification of the school value-added.

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