School Choice and Achievement: The Ohio Charter School Experience

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K–12 education policy has recently received much scrutiny from policymakers, taxpayers, parents, and students. Reformers have often cited increases in spending with little noticeable gain in test scores, coupled with the fact that American students lag behind their foreign peers on standardized tests, as the policy problem. School choice, specifically charter school policy, has emerged as a potential remedy. School choice is hypothesized to have both participant and systemic (sometimes called competitive) effects. This article concentrates on the latter by using a novel design not used before in studies of this subject. School level data from Ohio are analyzed to estimate if traditional public schools potentially threatened by charter schools respond with positive test score gains. Specifically, an exogenous change to the education system in 2003 provides a natural experiment to examine potential systemic effects. Results indicate that the threat of charter schools seems to have had a small positive effect on traditional public school achievement.

Evaluating the Systemic Effects of Charter Schools

Great concern exists that poorly educated citizens will be unable to compete in a more technical, globalized economy. Walberg (2007: 5) points to the fact that education and wages are highly and

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positively correlated, and thus citizens "without advanced mathematics . . . in high school are unlikely to succeed in the hard sciences and engineering." Similar conclusions follow logically for other disciplines. Thus, U.S. students appear to be at risk of losing in competitive labor markets (Hanushek 1998). The concerns expressed by these two researchers exemplify the policy problem: lower educational quality causes the United States to fall behind other countries in math and science, leading to lower wages for American workers and a decline in economic productivity.

The lack of any substantial connection between resources and school quality (Hanushek 1998) and the potential consequences for the nation if educational failure continues have caused citizens, policymakers, and researchers to examine a large number of potential educational reforms that go beyond altering resource levels. The nation has debated and implemented a number of such reforms, ranging from longer school days, year-round schools, and performance pay for teachers, to school choice policies. Unlike reforms that focus directly on mandating changes to the way schools are operated, such as seat time requirements or curriculum changes, school choice is a form of systemic reform. Such policies focus on altering the structure of public schooling itself, thereby altering incentives in ways that are believed to lead individuals to alter behaviors.

School choice policies can take on a myriad of forms including inter- and intra-district traditional public school choice, magnet schools, vouchers, and charter schools. To date, vouchers and charter schools, mainly by virtue of their more recent incorporation into the reform debate, have been less studied than other choice policies. These two policy alternatives have quite different characteristics, and generalizing effects from one to the other is difficult. The focus of this article is on charter schools—public schools of choice with fewer state restrictions but additional accountability for results (Finn, Manno, and Vanourek 2001).

Introducing school choice into the educational system through charter schools is hypothesized to yield two distinct types of effects on academic achievement: participant effects and systemic effects. Participant effects involve those students actually attending charter schools. Studies addressing participant effects attempt to estimate whether students who attend a charter school benefit from having done so. Systemic effects, by contrast, concentrate on the impact charter schools have on traditional public school performance. In particular, it is hypothesized that by introducing charter schools, traditional districts will be forced or incentivized to compete for students empowered to choose among several education suppliers, creating positive incentives for improvement in a market-like environment. Thus, the key question is: Do schools in districts facing the threat of charter school location near them respond positively with regard to academic performance?

There is a growing literature on the systemic effects of school choice, but many researchers fail to fully investigate those effects because the variables used to measure the systemic effects are often endogenous and poor indicators of competition[1] (Merrifield 2001). This article avoids those two limitations by using an exogenous threat variable to measure the systemic effect. Specifically, the state of Ohio provides for a unique opportunity to study the systemic threat of charter schools. The Ohio charter school law changed in 2003 providing a natural experiment. Prior to 2003, charter schools could locate only in certain school districts. From 2003 onward, the law expanded the geographical areas in which charter schools could locate and expanded the number of potential charter school authorizers and operators. Schools in poor performing districts suddenly became much more susceptible to having charter schools locate near them. That policy change created an exogenous shock that allows one to rigorously test whether academic achievement in a school facing the threat of charter school infiltration improves at a rate different than in schools not so threatened.

Evaluating the systemic effects of charter schools is important. Society puts enormous emphasis on education; it is the lifeblood of a free society and a thriving economy. Policies concerning education, therefore, deserve a thoughtful, appropriate, and thorough review as to their effects. The nation spends billions of dollars to educate K–12 students. Taxpayers, parents, policymakers, and students need to know the impact of charter school policy on traditional public schools.

Over the last two decades researchers and advocates have debated the benefits and deficiencies of school choice. Proponents of choice policies contend that allowing families to match students with schools will enhance learning for all children. Opponents fear those policies

[1]An endogenous variable is one that is correlated with the error term in a multiple regression.

may foster greater class segregation, drain resources from traditional public schools, and benefit only the most advantaged students. Furthermore, the answer to the question of the systemic effects of charter schools is vitally important to the larger school choice debate. If schools do not at least feel a threat from competition, then much of the theory surrounding charter schools and other accountability measures are seriously flawed and policies should change.

Literature Review

Two important facets of K–12 systemic effect studies emerge from a review of the existing literature and both deal with the quality of the independent variable of interest—competition. First, many measures of this variable are endogenous. Second many of those used are not reliable measures of competition.[2] Generally, the endogeneity issue in charter school studies stems from the non-randomness of charter location. That is, the poor quality of a traditional public school may attract charter schools just as the threat of rain attracts people to carry umbrellas. With regard to systemic effect measures, researchers have used a variety of variables to capture competition ranging from those of poor quality to those of higher quality. However, many of those measures technically fail to capture the true essence of competition.

One consequence of an endogenous independent variable is that it potentially confuses causation. There is reason to believe charter operators will choose to locate their school near poorer performing traditional public schools in an effort to attract as many students as possible. The theory is that those students in the poorest performing schools are probably the unhappiest and will take advantage of a nearby charter school with zero tuition. If researchers fail to control for enough variables affecting the location decision, they may wrongly conclude that charter schools cause poor achievement in

[2]Competition implies that schools are fighting for the same students, which may or may not be happening with regard to charter school policies. Identifying whether or not schools compete for students is difficult to measure, which means many "competition" variables are likely weak measures because researchers are unable to determine whether existing charter schools are complementary or competitors of traditional public schools. Hence, the term systemic effects is used to capture potentially other types of effects such as composition effects. These effects could mistakenly be attributed to competition when competition is not really present.

traditional public schools when actually the charter schools may have been purposely located near public schools that are already performing poorly.

Ni (2007) argued that the endogenous variable issue could be resolved using a fixed effects (FE) transformation. She suggested that the time invariant characteristics of a school determine the likelihood of charter alternatives locating near a traditional public school. According to Ni (2007: 16), "The FE estimator overcomes the nonrandomness of charter school location by implicitly controlling for the unobservable time invariant school characteristics that influence its likelihood of facing charter competition." That claim, however, may be unreliable because it depends on the cause of the endogeneity. Ni's contention is true only if the cause of endogeniety is time invariant. But such an assumption is difficult to support because very few characteristics of schools are actually time invariant. Nevertheless, many researchers use the fixed effects transformation to capture time invariant characteristics to ensure coefficients in regressions are as accurate as possible.

The most widely accepted practice for minimizing the adverse effects of an endogenous independent variable requires obtaining an instrumental variable (IV). Bettinger (2005) and Imberman (2011) represent the two studies that address the charter location endogeneity problem with an IV approach. Bettinger employed an IV strategy using two instruments: the proximity of a charter school to the nearest of 10 authorizing universities in the state, and a Herfindahl index for race. Imberman also used two instruments—the size and vacancy of large buildings—to predict the number of charter schools in a given area.

Betttinger supported his choices of instruments, stating that the location of a charter school is indeed correlated with the authorizing university but not with the residual test score. If true, his IV meets both conditions for being an appropriate instrument. Unfortunately, testing both requirements for quality instruments is impossible. The main concern with Bettinger's instrument is that the proximity of a school to a university may be correlated with the residual test score. Bettinger (2005: 143) addressed this issue, stating that there are 60 private and public colleges and universities in Michigan and 29 community colleges, of which only 10 are relevant for the instrument. He assumed that the 10 universities relevant to the first stage of his model are not systematically different in their effects on traditional public schools than the other colleges and universities in Michigan. This suggests that the IV approach may be of limited use for examining the systemic effects of charter schools.

The theory behind Imberman's instrument is that charter schools must locate in large, vacant buildings near traditional public schools. He thus assumed a high correlation between the location of charter schools and large vacant buildings, and his first-stage results showed that this IV was a good predictor of charter school location.

Imberman failed, however, to address the second condition of a good instrument—no correlation with the residual dependent variable. Is there reason to believe this point is true? One could imagine that large, vacant buildings tend to be located in economically depressed areas of the city. In economically advantaged sections of the urban area, one would believe most buildings would be occupied. One could also imagine that the schools located in more economically depressed areas also have systematically lower test scores than other schools.

The second major issue facing the primary independent variable is the measurement quality of competition. Studies of systemic effects have used six different measures of charter school competition. But those six variables all stem from three basic measures: charter existence in an arbitrary area, the number of charter schools in an arbitrary area, or market share of charters in an arbitrary area.

Some researchers have used binary or dummy variables to indicate whether a charter school exists within an arbitrary distance of a traditional public school. The arbitrary distances in most of these studies range from one kilometer (Greene and Forster 2002) to 25 kilometers (Holmes, DeSimone, and Rupp 2003). The problem with using a binary variable to indicate the level of competition is that information is lost concerning the number of schools within these distances. For example, consider two traditional public schools with at least one charter school within 25 kilometers. School A has 12 charter schools within 1 kilometer of it, and School B has 1 charter school within 24 kilometers. In a regression using a binary variable of a charter school existing within a given radius, both schools would receive a 1 despite the clear disparity between them.

Some researchers have improved on the previously mentioned measure of competition by counting the number of charter schools within an arbitrary distance (Bifulco and Ladd 2006, Bohte 2004, Buddin and Zimmer 2005, Sass 2006). This measure improves substantially on the previous measure, as it introduces a greater probability of variation among traditional public schools, lending more explanatory power to the model. Extending the previous example, School A would receive a competition measure of 10 rather than 1. This measure indicates that School A experiences greater competition than School B, whereas before, they were equal. Unfortunately, counting schools within a certain area does not provide information concerning variation in educational services offered (specialization features) or differences in innovation present in new schools. Researchers assume all schools compete for all students. Using a proximity variable assumes that each school in a given proximity offers an alternative product at an affordable price and is interested in the same students. Such an assumption is easily refuted as one can imagine that a traditional public school will not as ferociously compete against a charter school that caters to at-risk or delinquent students. The market-share variables suffer from similar issues.

Thus, a review of the systemic effects literature leads to the following problem: How can one conduct a study on charter school effects on traditional public schools using a reliable and exogenous measure? A partial response to this problem lies in a related body of literature, which examines the effect of *voucher* policies on traditional public school achievement. Rouse et al. (2007) capitalized on a change in Florida's Opportunity Scholarship Program voucher law that amounted to an exogenous "shock" for certain types of schools that could be operationalized. Although Rouse et al. evaluated vouchers, not charters, the basic approach to their independent variable is applicable. Under the Florida law, a school's students were eligible for vouchers if that school received an F grade in 2002. Prior to 2002, schools knew the method of grade calculation but the law changed, thus surprising schools in grade determination. Chakrabarti (2007) used a similar threat variable to study the same program. In both cases, the threat was based on the school's grade. If the school had received two failing grades in the previous four years, then that school's students were eligible for vouchers.

Using such a threat variable eliminates the two major issues other charter school systemic effects studies faced. The shock of a changing law eliminates the endogeneity issue—that is, a traditional public school cannot change its grade from the previous year, thus eliminating any self-selection. Location of charter schools does not matter either, because one is not concerned with charter location, only with charter *threat*. Using threat also resolves the competition issue. All schools receiving a certain grade are suddenly threatened, which may incentivize traditional public schools to increase performance because they are threatened by charter schools that *may* take students away from them.

Methodology

To address the research problem, a fixed effect regression was employed on school level panel data. The dataset includes data from years 2001 through 2008 on reading and math proficiency rates, performance index scores (PIS), the percentage of enrollment identified as disadvantaged, the percentage of enrollment identified as white, the per pupil instructional expenditure, pupil-teacher ratio, and type of school (elementary, middle, junior high, or high).

The dependent variables are the percentages of students scoring proficient or better on the reading and math exams in fourth and sixth grades and the PIS scores for each school. Unfortunately, the Ohio Department of Education (ODE) does not provide scaled score averages per school, which would yield greater variation and explanatory power when compared to proficiency rates. The proficiency rate is the percentage of students in a given grade for a particular subject who score at or above a predetermined criterion-scaled score. The PIS encompasses more than one grade's scores in a given subject; it includes other grades tested and other subject matter such as science or social studies. Also, the PIS includes all types of schools, including junior high and high schools, rather than just schools with fourth and sixth grade proficiency data.

The independent variable of interest stems from a change in the Ohio charter school law. In addition to increasing the cap on the number of charter schools, the Ohio legislature changed the limitations on their locations too. Any school district in Ohio may open a conversion charter school; there is no geographical restriction. Geographical restrictions do limit start-up charter schools, however, and the restrictions have changed over the years, allowing a unique situation to emerge in Ohio. Prior to August 15, 2003, only the Big 8 urban districts (Akron, Canton, Cincinnati, Cleveland, Columbus, Dayton, Toledo, and Youngstown), 13 other districts near those cities, and those districts with the lowest state-issued quality rating (Academic Emergency) could have nondistrict start-up charter schools. At that time, schools could be authorized only by school boards in the county of the failing district, the University of Toledo if the school was to locate in Lucas County, the state board of education, or the Lucas County Education Service Center if the school was to locate in Lucas County. On January 7, 2003, then governor Bob Taft signed into law H.B. 364, which increased the number of districts where start-up charter schools could locate to those with state-issued quality ratings of Academic Watch, the equivalent of a "D" in a grading system, and changed the permitted authorizing agents.

According to the new law, district performance would again determine the new geographical boundaries for start-up charter schools. Now, start-ups could locate in any "challenged" district (Ohio Revised Code 2003, 3314.02 § C (1)). A challenged school district was either one of the 21 urban districts (including the Big 8), or "a school district that is either in a state of academic emergency or in a state of academic watch under section 3302.03 of the Revised Code" (Ohio Revised Code 2003, 3314.02 § (A) (3) (b)). The new law also changed the authorizing agents for these start-up charter schools to more independent entities. Thus, the geographical expansion and change in authorizing agents for start-ups in 2003 allowed for additional start-up charter schools to emerge. There are five delineations for schools in Ohio. For example, academic emergency is the lowest rating, academic watch is the second lowest, and so on. To simplify the study, these delineations were translated into the straight A through F rating system.

Using the 2003 legal change, and excluding the Big 8, provides an exogenous measure to determine the threat of charter school competition. The Big 8 were excluded because they all had charter schools locating in their districts prior to 2003, so including them would introduce potential endogeneity as described above. The 13 other urban districts were included (coded 0) in 2001 through 2003 because these schools did not face any real threat like the Big 8 did, just a theoretical threat. Although charter schools could technically locate there, realistically they could not because prior to the legal change the authorizing agent was the school district itself. That was changed when the new law allowed more independent authorizing agents to charter schools. There is reason to believe that school districts are not going to authorize charter schools that are going to threaten their own schools. The threat variable is a dummy variable taking on 1 if the school resides in a threatened district and

0 otherwise. All schools, prior to and including 2003, receive a 0, but schools in D and F districts after 2003 receive a 1 because after that year they faced the threat of being eligible for charter location due to the legal change.

A variety of threat variables were tested, including changing the value each year after 2004 if a school changed status based on district grade. However, all tests employing these different threat variables yielded results similar to the "once in, always in" approach. So, if a school was threatened in 2003, then it remained threatened. Basing the threat variable on just the 2003 district grade provides for the most exogenous shock variable. Any time after 2003, schools could influence the district grade and know the consequences of failure. Knowing this information and having the ability to influence the district grade leads to worries about endogeneity. Confining the threat variable to the score in one year, the year of surprise, provides for the most exogenous independent variable.

The control variables attempt to eliminate systematic time-variant differences among schools. They include the percentage of disadvantaged students in the school, the percentage of white students, the instructional amount spent per pupil, the student-teacher ratio, and the type of school (elementary, middle, junior high, or high). Unfortunately, the ODE did not report economic data for years 2001 and 2002. A similar instance occurred with the expenditure data. These data were collected using the ODE Power User Reports that disaggregate expenditures into instructional, operational, and other uses. At the time of data collection, however, the ODE had not reported the 2007–08 school year data. The unavailability of those data truncated the complete dataset to between 2003 and 2007. Since the data on disadvantaged percentages and instructional percentages eliminated three years of the dataset, those data were imputed using other data that describe characteristics of a given traditional public school. The data on racial composition were collected from a similar report as the disadvantaged data. The white percentage and the disadvantaged data did have several instances of missing numbers or data indicated as "<10". All of those instances were treated as missing.

Given the possibility that schools with missing data points had systematic differences from those schools that provided such data, robustness tests were conducted to determine if imputation caused differing results. Multiple iterations of the models were run with and without the socioeconomic and expenditure variables. Similar results would suggest that imputing the data did not have an adverse effect on the charter school threat results.

The pupil-teacher ratio variable was calculated using two different databases from the Ohio Department of Education, enrollment per school and the number of FTE teachers in the school. The ratio was simply enrollment divided by number of teachers. Administrators and support staff were excluded from the ratio calculation. In some instances, the ODE reported missing data on those school characteristics concerning teacher count and enrollment. As with the white percentage, the assumption remained that the nature of those missing data was not systematic.

Two basic models were employed to estimate the systemic effect using all data, excluding the Big 8. With proficiency rates as the measure of school performance, the following equation was used:

$$(1)\quad P_{sdt} = \beta + \varphi C_{st} + \delta_j T_j + \gamma_j S_{jsdt} + \alpha_s + \varepsilon_{sdt}$$

where P_{sdt} is the proficiency performance of school s in district d at time t; β is a constant term; C_{st} is the effect of the charter school threat—the independent variable of interest; T_j is a vector of year dummy variables excluding 2001; S_{jsdt} is a vector of school characteristics used as control variables; α_s is the school fixed effect; and ε_{sdt} is an error term for school s in district d at time t. Robust standard errors clustered at the school level were used for more accurate indications of statistical significance.

Because the nature of the PIS variable differs from that of proficiency, additional controls for school type were used in that analysis:

$$(2)\quad PI_{sdt} = \beta + \varphi C_{st} + \delta_j T_j + \gamma_j S_{jsdt} + \lambda_j Y_{jsdt} + \alpha_s + \varepsilon_{sdt}$$

where notation was the same as in (1), except PI_{sdt} is the performance index score of school s in district d at time t and Y_{jsdt} is a vector of school type dummy variables denoting elementary, middle, junior high, or high school. One should interpret λ_j with reference to elementary schools.

Using a performance system as a base for a charter school threat-effect variable may lead to two possible issues: (1) stigma effect and (2) regression to the mean. Stigma or labeling effects mean that schools may respond positively simply by being labeled as failing. The stigma effect results from the labeling of a district as failing, which, in turn, causes improvement in response to the negative label attached to the district. In light of this possibility, an analysis using only data from before the legal change was conducted as a check for possible stigma effects. Specifically, data from years 2001 through 2003 were analyzed to test whether failing district schools improved at a faster rate than other schools. The analysis used essentially the same models described earlier, except the years used were prior to 2004. Schools that received a D prior to 2004 were coded 1 and C schools were coded 0. A significant result would indicate that stigma, rather than the threat of charter school penetration, could be the driving force behind improvement. The effect sizes for both competition and stigma were compared to determine the relative magnitude of stigma and competitive effects. Regression to the mean refers to the idea that schools above or below the mean will likely move toward the mean simply because that is the only direction those schools can go. To ameliorate this issue, tests were conducted that narrowed the bands of schools to just C and D schools, which eliminates those A and F schools that are most likely to move toward the mean. Since C and D schools are already close to the mean, regression to the mean becomes less of a concern.

The remaining area of concern stems from the passage of No Child Left Behind (NCLB) by Congress in 2001. The question here concerns internal validity: How does one know whether the effect of the charter competition variable on proficiency passage rates is not being confounded by the effect of the federal accountability law? This alternative hypothesis is plausible due to the fact that sanctions under NCLB in Ohio went into effect at about the same time the charter school threat emerged.

To test this hypothesis, the analytic models included a series of variables that were created for each school in each year that indicated the level of sanctioning a school experienced during that year as a result of NCLB. To construct those variables, the definitions of sanctions provided by the ODE were used. That task resulted in six categories of sanctioning, from those not sanctioned up to those that missed AYP for six consecutive years. No school was sanctioned as a result of NCLB until the 2003–04 school year.

Results

Table 1 shows the descriptive statistics for the complete dataset used in the analysis, excluding the Big 8 districts and charter schools.

TABLE 1
DESCRIPTIVE STATISTICS FOR SCHOOLS IN ALL DISTRICTS EXCLUDING BIG 8 AND CHARTER SCHOOLS

Variable	Mean	Std. Dev.	Min	Max	Obs
4th Grade Math Percent Proficient	71.7	17.2	0	100	12,315
4th Grade Reading Percent Proficient	75.9	15.4	3.8	100	12,315
6th Grade Math Percent Proficient	70.0	17.3	0	100	8,102
6th Grade Reading Percent Proficient	73.7	15.8	5.6	100	8,101
Performance Index Score	91.5	10.7	1.8	120	19,849
Charter Threat	0.1	0.3	0	1	24,389
School Enrollment	481.8	309.1	15	3,020	24,211
Percent White	87.8	17.7	1	100	24,203
Pupil/Teacher Ratio	17.3	4.3	3	60	24,155
Per Pupil Instructional Expenditure	4,747.0	1,314.8	1,000	25,000	24,137
Percent Disadvantaged	30.4	20.1	0.6	100	24,088

NOTE: To prevent outliers from skewing the results, minimums for School Enrollment, Pupil/Teacher Ratio, and Per Pupil Instructional Expenditure were adjusted to 15, 3, and $1,000, respectively. Maximums were adjusted for Pupil/Teacher Ratio and Per Pupil Instructional Expenditure to 60 and $25,000, respectively. Regressions results were not sensitive to these adjustments.

Table 2 illustrates results from the regressions using all districts except the Big 8, and it includes results for all control variables including time dummy variables. The charter threat variable, representing the independent variable of interest, has a coefficient of 4.98. This number means that a traditional public school in a threatened district can expect a 4.98 percentage point gain in its proficiency passage rates for fourth grade math relative to how other schools performed in the absence of the charter threat. That effect is statistically significant and has a relatively large effect size of 0.29 in proficiency passage rates for fourth grade math.

TABLE 2
Regression Results for 4th Grade Math Proficiency
All Districts Except Big 8

Variable	Coefficient	Std. Err.	Eff. Size
Charter Threat	4.98***	0.79	0.29
School Enrollment/100 students	−0.36*	0.00	0.00
Percent White	0.25***	0.04	0.01
Pupil/Teacher Ratio	−0.11**	0.05	−0.01
Per Pupil Instructional Expenditure/$1,000	0.20	0.00	0.00
Percent Disadvantaged	0.01	0.01	0.00
2002	3.39***	0.33	0.20
2003	−0.83**	0.39	−0.05
2004	6.29***	0.45	0.37
2005	4.56***	0.44	0.27
2006	17.10***	0.46	0.99
2007	16.07***	0.48	0.93
2008	15.04***	0.49	0.87
Constant	44.33***	3.88	
Obs	12,263		
R^2 Within	0.362		

Note: ***denotes statistical significance at the 0.01 level; ** denotes statistical significance at the 0.05 level; and * denotes statistical significance at the 0.10 level. Year dummy variables are relative to 2001.

Increasing confidence in the validity of these results, the coefficients on most of the control variables have the expected signs. That is, one would expect proficiency passage rates to have a positive and significant correlation with the percentage of white students in a school. In particular, a change of 10 percentage points (going from 40 percent of the school population being white to 50 percent) is related to a percent proficiency gain of 2.5 points in fourth grade math. Also, as indicated in these results and as expected, proficiency passage rates on the fourth grade math test correlate negatively and significantly with increases in enrollment and student/teacher ratios. Furthermore, the dependent variable does not correlate with instructional expenditure. As expected, the time variables, all relative to 2001, indicate generally positive and significant correlations with fourth grade math scores.

The one control variable in question concerns the coefficient on the variable for the percentage of disadvantaged students. Theory and empirical evidence suggest that the greater the percentage of disadvantaged students in the school, the lower the expected proficiency passage rate. In this case, the results indicate the disadvantaged coefficient is not significantly different from zero. A possible reason for this result is multicollinearity. That is, since a high correlation exists between race and socio-economic status, the racial composition effect may contain the effect of socioeconomic composition. Since neither of these two variables is the primary independent variable of interest, there is no reason to believe multicollinearity biased the charter effect coefficient. The following tables will only show results for the charter threat variable; similar results were found for the control variables in all regressions.

Table 3 illustrates the results of the charter threat variable on all five dependent variables. The table includes coefficients, standard errors, and effect sizes on the all districts except the Big 8.

TABLE 3
Regression Results for Charter School Threat on All Dependent Variables for All Districts Except Big 8

Dependent Variable	Coefficient	Std. Err.	Eff. Size	Obs	R^2 Within
4th Grade Math Percent Proficient	4.98***	0.79	0.29	12,263	0.362
4th Grade Reading Percent Proficient	3.57***	0.69	0.23	12,263	0.505
6th Grade Math Percent Proficient	3.71***	1.04	0.21	8,067	0.402
6th Grade Reading Percent Proficient	5.58***	0.69	0.35	8,066	0.592
Performance Index Score	2.14***	0.38	0.20	19,728	0.505

Note: ***denotes statistical significance at the 0.01 level; **denotes statistical significance at the 0.05 level; and *denotes statistical significance at the 0.10 level.

The results indicate that the charter threat has a significantly positive effect on achievement, with effect sizes ranging from 0.20 to 0.35. Historically, charter school systemic effect studies do not report effect sizes of this magnitude. Positive and significant findings usually have effect sizes ranging between 0.03 and 0.10 of a standard deviation. With such large effects, additional iterations were run to determine if the effects were sensitive to the wide range of districts in the dataset. One might believe that comparing "A" district schools to "F" district schools confounded the results because of regression to the mean. That is, despite the control variables, there still existed systematic differences among the districts included in the analysis.

Table 4 provides the charter school threat effect on all of the dependent variables for analyses of a sample restricted to only the C and D rated districts. Most notably, the charter threat variable lost significance on sixth grade math and fourth grade reading, and the fourth grade math results moved from a significance of 0.01 to 0.05. The effect sizes decreased by about 0.1 standard deviations, which is more in line with results from previous competitive effect studies

TABLE 4
Regression Results for All Dependent Variables for Only C and D Districts Excluding Big 8

Dependent Variable	Coefficient	Std. Err.	Eff. Size	Obs	R^2 Within
4th Grade Math Percent Proficient	1.89**	0.95	0.11	6,723	0.417
4th Grade Reading Percent Proficient	1.37	0.84	0.09	6,723	0.530
6th Grade Math Percent Proficient	1.32	1.20	0.08	4,737	0.441
6th Grade Reading Percent Proficient	3.75***	0.80	0.24	4,737	0.615
Performance Index Score	1.02**	0.46	0.10	10,676	0.541

Note: ***denotes statistical significance at the 0.01 level; ** denotes statistical significance at the 0.05 level; and * denotes statistical significance at the 0.10 level.

TABLE 5
Stigma Test Regression Results for All Dependent Variables for All Districts Excluding Big 8

Dependent Variable	Coefficient	Std. Err.	Eff. Size	Obs	R^2 Within
4th Grade Math Percent Proficient	−2.70***	0.95	−0.13	5,625	0.048
4th Grade Reading Percent Proficient	−1.72**	0.82	−0.09	5,627	0.354
6th Grade Math Percent Proficient	−2.89***	1.11	−0.13	3,635	0.227
6th Grade Reading Percent Proficient	−1.69*	0.96	−0.09	3,635	0.243
Performance Index Score	−1.36***	0.37	−0.10	7,206	0.190

Note: ***denotes statistical significance at the 0.01 level; ** denotes statistical significance at the 0.05 level; and * denotes statistical significance at the 0.10 level.

with positive results. These results suggest that the indications in Table 4 are indeed somewhat sensitive to a more restricted dataset.

The regressions to check for stigma effect used data prior to the implementation of the charter policy change in 2003. Therefore, only years 2001–03 were used. These results indicate that stigma or labeling has an opposite effect on performance. Rather than schools responding positively to failing grades, they respond negatively. In all cases, the coefficient on being labeled as failing is significantly negative. The effect sizes range from −0.13 to −0.09 for the stigma test results in Table 5, indicating that the labeling of schools as failing is related to a decline of about a tenth of a standard deviation on achievement scores. Regressions restricting the dataset to those districts receiving a C or D in 2003 and conducting the stigma tests returned similar results as presented in Table 4.

The final results include the NCLB sanction variables. Table 6 includes results for all covariates and the sanction variables for fourth grade math for all districts. The reference category for the sanction variables is no sanction at all.

TABLE 6
Regression Results for 4th Grade Math Proficiency with NCLB Sanction Variables for All Districts Excluding Big 8

Variable	Coefficient	Std. Err.	Eff. Size
Charter Threat	3.81***	0.82	0.22
NCLB Sanction Level 1	2.33***	0.72	0.13
NCLB Sanction Level 2	6.17***	1.26	0.36
NCLB Sanction Level 3	6.99***	2.29	0.41
NCLB Sanction Level 4	10.55***	3.31	0.61
NCLB Sanction Level 5	14.48***	5.08	0.84
Obs	12,263		
R^2 Within	0.366		

Note: ***denotes statistical significance at the 0.01 level; **denotes statistical significance at the 0.05 level; and *denotes statistical significance at the 0.10 level. Year dummy variables are relative to 2001.

As the table indicates, it appears that the charter threat variable is somewhat sensitive to the inclusion of the NCLB sanction variables, at least with regard to magnitude of effect. The same regression without the sanction variables returned a statistically significant estimated effect of 4.98 as compared to a 3.81 effect in this model.

To make the comparison of results between those models with and without the sanctions, Tables 7 and 8 present both sets of results for all five dependent variables. Table 7 illustrates the results from the entire dataset without the Big 8 districts, and Table 8 shows the results from the restricted dataset with just the C and D districts.

When including the NCLB sanction variables to the dataset with all the districts, the magnitudes in the charter school threat variables decrease by approximately 1 point. That is, the expected gain in the percent proficient decreased by 1 when including the sanction variable. This remains the case for all of the variables with the exception of sixth grade math; the expected gain in percent proficient dropped nearly 2 points when including the sanctions. Of note, the sixth grade math estimate was the only one to lose statistical significance; all others remained significant at the 0.01 level.

TABLE 7
Regression Results for All Dependent Variables for All Districts Except Big 8

Dependent Variable	Excluding NCLB Sanctions Coefficient	Eff. Size	Including NCLB Sanctions Coefficient	Std. Err.	Eff. Size	Obs	R^2 Within
4th Grade Math	4.98***	0.29	3.81***	0.82	0.22	12,263	0.366
4th Grade Reading	3.57***	0.23	2.77***	0.72	0.18	12,263	0.507
6th Grade Math	3.71***	0.21	1.74	1.06	0.10	8,067	0.409
6th Grade Reading	5.58***	0.35	4.39***	0.72	0.28	8,066	0.592
Perf. Index Score	2.14***	0.20	1.59***	0.39	0.15	19,728	0.508

Note: ***denotes statistical significance at the 0.01 level; **denotes statistical significance at the 0.05 level; and *denotes statistical significance at the 0.10 level.

The differences in estimates between the two models are negligible as the effect sizes remained quite high with the inclusion of the NCLB sanction variables.

The results when using the C and D dataset differ by about 0.5 in magnitude and a loss in significance on fourth grade math. The performance index score and the sixth grade reading score continue to show positive and significant correlations with charter school threat.

Discussion

In any study of systemic effects internal validity is a concern. That is, how does one know that the location or threat of charter schools is the *cause* of observed changes in academic performance? Three alternative stories other than charter school competition could be told to explain these results. The first is the stigma associated with labeling districts as failing. The theory is that if schools/districts are told they are failures, then they will improve in an effort to shed the

TABLE 8
Regression Results for All Dependent Variables for C and D Districts Except Big 8

	Excluding NCLB Sanctions		Including NCLB Sanctions				
Dependent Variable	Coefficient	Eff. Size	Coefficient	Std. Err.	Eff. Size	Obs	R^2 Within
4th Grade Math	1.89**	0.11	1.26	0.98	0.07	6,723	0.419
4th Grade Reading	1.37	0.09	0.93	0.86	0.06	6,723	0.531
6th Grade Math	1.32	0.08	0.38	1.22	0.02	4,737	0.445
6th Grade Reading	3.75***	0.24	3.30***	0.82	0.21	4,737	0.617
Perf. Index Score	1.02**	0.10	0.76*	0.46	0.08	10,676	0.543

Note: ***denotes statistical significance at the 0.01 level; **denotes statistical significance at the 0.05 level; and *denotes statistical significance at the 0.10 level.

stigma. The second is regression to the mean which suggests that subjects naturally revert toward the average, especially those subjects that are in the tails. Third, is the idea that sanctions associated with NCLB, rather than the charter school threat, may be the cause of improvement. These concerns have been evaluated in the preceding analyses, and results are somewhat sensitive to the NCLB sanctions; however, sanctions do not completely negate the charter school threat effect.

The stigma tests used only data prior to the exogenous legal change. As Table 5 shows, the effect of being labeled as failing was the *opposite* of the stigma theory's projection stated above. That is, instead of schools in failing districts responding positively to failure, they do worse and at a statistically significant rate by all measures of academic achievement. This test allows for some deeper thought about policies and their implications. These findings suggest that simply labeling districts without attaching incentives or consequences does not produce the desired effect of improving academic achievement.

The second internal validity concern is regression to the mean. That concern prompted the narrowing of the bands of schools used in the regression analysis. Such an analysis showed that results are sensitive, at least in magnitude and significance, to the narrowing of bands. The results reported in these analyses are in line with other studies on competitive effects with regard to effect size. Such results also suggest that the narrowing of bands was the proper step to take in the analysis.

The third internal validity concern is the influence of NCLB on traditional public school performance. The theory is that failure to control for the sanctions a school experiences may bias the estimates on the charter school threat variable. That is, not all of the increase indicated by charter school threat is actual threat; it could be that schools are responding to the NCLB sanctions as well. Results from models that include explicit controls for NCLB sanctions indicate that the threat of competition remains in effect, albeit more weakly.

The results indicate that school choice theory may have some credence when using an exogenous independent variable, and the analysis of the years prior to 2004 helps us understand the charter threat effect. Consider the policy environment and a school's situation between 2001 and 2003. A school in 2002 has been labeled with a grade and knows that NCLB sanctions are *possible or even likely* in the future. So, if the stigma associated with being labeled a D or the threat of NCLB sanctions were effective, this analysis would have indicated as much. However, the results suggest that neither of these consequences had any positive effect on school performance. In fact, the effect, if anything, was negative.

The right hand side of Table 8 provides the most robust results: two indicators still remain statistically significant but to a lesser degree. Two points emerge from the sanction results. First, the NCLB sanctions do not completely eradicate the positive results of the charter school threat variable in two of the cases, but the threat of charter schools seems to eliminate the significance of the negative slope observed prior to 2004. Even a careful review of the restricted dataset results shows effect size gains of close to a tenth of standard deviation on average with a range of 0.02 to 0.21. A tenth of a standard deviation means that a school would gain approximately 1.7 percentage points in fourth grade math simply from the threat of charter school competition *after* controlling for the sanctions associated with NCLB.

Second, and most telling, the sanctions associated with NCLB appear to have similar types of effects, suggesting similar conclusions as the stigma tests. That is, schools tend to respond to incentives or consequences. Indeed, the first level of sanctioning in Ohio is to offer students in the school some form of public school choice. These results, coupling both the charter school threat and the NCLB sanctions, suggest that schools do respond to the threat of losing students whether through sanctions such as NCLB or through the competitive threat of charter schools.

Conclusion

The results of this article suggest Ohio traditional public schools have responded positively in academic achievement to the threat of charter schools locating near them. Even after considering the sanctions of No Child Left Behind, the positive estimates yielded close to a tenth of a standard deviation in improvement. In the broader sense, this article indicates that schools, similarly to people and businesses, respond to incentives and consequences.

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