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Evaluating the Impact of Charter Schools on Student Achievement:
A Longitudinal Look at the Great Lakes States

Executive Summary

June 2007

EPIC Education and the Public Interest Center

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• The policy brief is available online at: http://epsl.asu.edu/epru/documents/EPSL-0706-236-EPRU.pdf

Evaluating the Impact of Charter Schools
on Student Achievement:
A Longitudinal Look at the Great Lakes States

Gary Miron, Chris Coryn, and Dawn M. Mackety

The Evaluation Center, Western Michigan University

Executive Summary

The aim of this study is to examine the impact of charter schools on student achievement in the Great Lakes states: Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. This evaluation addresses two specific questions:

- How does student achievement in charter schools compare with student achievement in demographically similar, traditional public schools?
- Do charter schools show promise of being an effective strategy for improving student achievement over time, even if they are not yet outperforming traditional public schools?

Current Performance of Charter Schools on State Assessments

We conclude that charter schools in the Great Lakes region are currently performing at lower levels than predicted on state assessments—that is, student achievement in them is lower than it is in demographically similar public schools. Lowest performance appears in the states with the newest charter school initiatives, Indiana and Ohio. Illinois has the highest relative results, perhaps because some 15 percent of its charter schools have closed since 2000; when poorly performing schools close, aggregate results for remaining schools rise.

Despite the performance of charter schools in the region overall, at the school level a number of successful charter schools are consistently performing better than expected. Still, for some 60 percent of the school level comparisons drawn, charter schools were performing at levels lower than predicted.

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Are Charter Schools Improving Over Time?

Despite lower achievement results than expected, there is evidence that charter schools are gaining ground and that results are improving over time. Trends in the older reform states—including Minnesota, Wisconsin, and Michigan—show a relatively slow rate of improvement. Relatively newer reform states—Ohio and Indiana—have the lowest current results, but over time their charter schools are making relatively large improvements.

The findings from this study represent an important contribution to the growing body of knowledge about the performance of charter schools as measured by student achievement. Similar to the conclusions that can be drawn from that broader body of research, we have found that charter schools are not performing at levels that exceed traditional public schools. While Illinois has taken measures to close some of its poorly performing schools, the weaker charter schools in the other states continue to overshadow the successful charter schools.

Summary of Findings

- Charter schools in the Great Lakes states are not currently outperforming demographically similar, traditional public schools.
- Trends indicate that generally, charter schools are making notable gains in achievement over time, with newest initiatives showing some of the greatest rates of improvement.
- All states in the region do have some successful charter schools.

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Introduction

The aim of this study is to examine the impact of charter schools on student achievement in the Great Lakes states: Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin. The Great Lakes region has been a leader in developing charter schools, with Minnesota passing the first law and Ohio, Michigan, and Wisconsin among the top seven states in terms of the number of charter schools in operation. The Great Lakes states account for one-quarter of the nation's charter schools. Although extensive research has been conducted on the charter school reforms in the region, few studies have examined the relative performance of charter schools in terms of student achievement (Michigan being the exception). Instead, existing literature on charter schools in the region largely focuses on start-up and implementation. The few studies or reports that address student achievement typically examine single schools or are comprised of annual reports with descriptive data listed for schools, but no aggregation and no evaluative judgments regarding whether charter schools are performing better or worse than expected, either in terms of their individual performance or in terms of their relative performance when compared to similar non-charter schools.[1]

Some argue that each charter school is unique, and therefore aggregate data on charter schools is an inappropriate indicator of their reform potential. Only aggregate data and cross-school analyses, however, can help answer key policy questions such as, "Will providing greater autonomy to schools actually result in improved student achievement, as charter school advocates contend?"

Two specific evaluation questions are addressed in this study:

- How does student achievement in charter schools compare with student achievement in demographically similar, traditional public schools?
- Do charter schools show promise of being an effective strategy for improving student achievement over time, even if they are not yet outperforming traditional public schools?

The next section summarizes the design and methodology of the study.

Methodology

This evaluation focuses exclusively on student achievement. An analysis of differences among schools or states or the extent to which charter schools benefit from their increased autonomy is beyond the scope of this work. Table 1 presents decision criteria and the rationale followed regarding the study's scope and focus. Although data collection and analytical challenges varied considerably by state, the intent of the criteria was to ensure that the study was as structured and systematic as possible.

Table 1. Decision Criteria and Descriptions

Topic	*Decision Criteria, Description, Rationale*
States Included	This evaluation was sponsored by the Great Lakes Center, so the decision to focus on these states is based on its location in the Great Lakes region.
Tests	Only the results of state achievement tests were used since all public schools, including charter schools, must participate in these assessments and they are familiar to a broad range of stakeholders. While some states administer other standardized tests,[2] these typically include only a sample of schools or students.
Outcome Measure	Preference was given to the most sensitive test measure available in the following order: normal curve equivalent, percentile rank, scaled score (mean achievement test score for a school), and cut score (mean percentage of students meeting or exceeding state standards).
Test Content	Math and reading test results were used because they had the best longitudinal data and typically comprise the high stakes component of state assessment programs.
Grade Levels	One grade at each school level (elementary, middle, high) was included. Preference was given to the highest grade with longitudinal data at each level.[3]
Years	Trends were analyzed over a five-year period, with preference given to the five most recent years for which data were available.

Design and Overview

This evaluation compared student math and reading achievement in charter and public schools in the six Great Lakes states over a five-year period. The National Center for Education Statistics' Common Core of Data[4] was the source of data on several factors, including school enrollment, ethnicity, free and reduced-price lunch, locale, and a charter school identifier. State Department of Education web sites were the sources for data on special education enrollment, limited English proficiency enrollment, number of students tested, and achievement test scores. Independent variables included minority, free/reduced-price lunch, special education, limited English proficiency, and locale for each school. The dependent variable was achievement test results for each school. See Table 2 for study variables and definitions.

Table 2. Independent and Dependent Study Variables

Variable	*Definition*
Minority	Percentage of students in each school who are American Indian/Alaska Native, Hispanic, and Black (White and Asian/Pacific Islander students were intentionally excluded)
Free/Reduced-price Lunch	Percentage of students in each school eligible to receive free or reduced-price lunch. This variable identified a school's "low income" status
Special Education	Percentage of students in each school identified as "special education" students (have disabilities, receive special education services, have individualized education plans/programs, or IEPs)
Limited English Proficiency	Percentage of students in each school with limited English proficiency
Locale	8-category urbanicity rating for each school based on its community's population density (see Appendix A for categories and definitions)
Test Results	Order of preference in selecting test score data was based on the sensitivity of the measure: scaled scores (mean achievement test score for a school) were preferred and used over cut scores (mean percentage of students meeting or exceeding standards) when possible

Residual Gains Analysis

Linear regression models were used to estimate student achievement growth/decline patterns, producing three estimates: (1) actual scores, based on observed student achievement data provided by each school; (2) predicted scores, based on the performance of demographically similar public schools across the state; and (3) residual scores, based on the difference between predicted and actual charter school student achievement. These residuals, or differences, indicate whether the charter school (or group of schools) is performing at, above, or below predicted levels, with predicted levels equating performance levels of demographically similar traditional public schools. A zero residual score indicates predicted performance; a negative residual score indicates lower performance than predicted; a positive residual indicates higher performance than predicted.

Limitations

While the longitudinal design, broad scope, and overall quality of this study makes it one of the most rigorous and comprehensive evaluations of charter school student achievement, several limitations should be considered when interpreting results:

1. This study is based on school-level rather than student-level analyses; thus, fully controlling for student mobility or identifying differences within schools was not possible.

2. Analyses were conducted on consecutive cohorts of students in identical grades (4th graders in 2003, 4th graders in 2004, 4th graders in 2005); therefore, each cohort group had different students. Data were not available to track the same cohorts of students as they progressed through grades (for example, from grade 4 in 2003 to grade 5 in 2004).

3. The quality (sensitivity) of student achievement scores varied by state, with all states reporting cut scores but only a few reporting mean scaled scores.

4. Charter schools with missing or incomplete data were dropped from analyses. The most common explanation for missing data was that specific charter schools had too few test takers. (One of the most common measures to ensure the confidentiality of findings is to report performance results only when there are 10 or more test takers; in some states this threshold was as low as 5). The results from Ohio were particularly affected by incomplete data. Although Ohio has the most charter schools in the region, this state had the highest proportion of schools dropped from the analysis due to incomplete data (see Appendix F for more details).

5. Data on special education and limited English proficiency were not available in some states at the school level. Even when we can control for the percentage of special education students, we cannot control for differences in the nature and degree of severity of disabilities. Our state evaluations revealed that charter schools have, on average, a substantially lower proportion of students with disabilities, and the students with disabilities who enroll in charter schools tend to have disabilities that are less severe and less costly to remediate.[5]

In the following section, we summarize the findings from each of the six states.

Findings: Actual Scores, Predicted Scores, and Residuals

In this section, tables and line graphs are used to illustrate the findings, which are ordered alphabetically by state. As noted in the methods section, we compared each charter school's actual test results with its predicted results, which are based on a statistical analysis of results for all demographically similar public schools statewide. Thus, the difference between prediction and performance, or the residual score, indicates the charter school performance in relation to similar public schools: a positive residual score indicates better than predicted performance, and a negative one indicates lower than predicted performance.

Table 3 summarizes all positive and negative residual scores, with results broken out by subject- and grade-level tests. The total number of comparisons made for each state is considerably higher than the total number of charter schools, since each charter school typically participates in a number of different

grade- and subject-level tests. Figure 2 illustrates positive score percentages for each state. Illinois has the best record, with 57 percent of its school-level residual scores being positive. Indiana and Ohio have less impressive results, with only 27 and 33 percent positive residual scores, respectively. These rates indicate that while some schools are doing better than predicted, nearly two-thirds of the schools have test results lower than predicted.

Table 3. Cross-Sectional Comparison of Schools with Positive or Negative Residual Scores Using Most Recent Year of Available Data

Illinois	*Grade 5 Math*	*Grade 5 Reading*	*Grade 8 Math*	*Grade 8 Reading*	*Grade 11 Math*	*Grade 11 Reading*	*Totals*
Positive Residuals	5	3	7	8	4	4	31
Negative Residuals	4	6	4	3	3	3	23
Percent Positive	55.5%	50%	63.6	72.7%	57.1%	57.1%	57.4%
Indiana	*Grade 3 Math*	*Grade 3 Reading*	*Grade 6 Math & Reading*	*Grade 8 Math & Reading*	*Grade 10 Math*	*Grade 10 Reading*	*Totals*
Positive Residuals	4	4	10	7	4	4	33
Negative Residuals	17	17	24	19	6	7	90
Percent Positive	19.0%	19.0%	29.4%	26.9%	40.0%	36.4%	26.8%
Michigan	*Grade 4 Math*	*Grade 4 Reading*	*Grade 8 Math*	*Grade 7 Reading*	*Grade 11 Math*	*Grade 11 Reading*	*Totals*
Positive Residuals	66	66	57	67	19	23	298
Negative Residuals	98	96	72	72	32	30	400
Percent Positive	40.2%	40.7%	44.2%	48.2%	37.3%	43.4%	42.7%
Minnesota	*Grade 5 Math*	*Grade 5 Reading*	*Grade7 Math*	*Grade 7 Reading*	*Grade 11 Math*	*Grade 10 Reading*	*Totals*
Positive Residuals	13	15	13	13	19	20	93
Negative Residuals	30	23	19	19	29	25	145
Percent Positive	30.2%	39.5%	40.6%	40.6%	39.6%	44.4%	39.1%
Ohio	*Grade 4 Math*	*Grade 4 Reading*	*Grade 6 Math*	*Grade 6 Reading*	*Grade 10 Math*	*Grade 10 Reading*	*Totals*
Positive Residuals	36	39	34	51	4	7	171
Negative Residuals	82	78	81	65	25	15	346
Percent Positive	30.5%	33.3%	29.6%	44.0%	13.8%	31.8%	33.1%
Wisconsin	*Grade 4 Math*	*Grade 4 Reading*	*Grade 8 Math*	*Grade 8 Reading*	*Grade 10 Math*	*Grade 10 Reading*	*Totals*
Positive Residuals	16	14	18	20	4	5	77
Negative Residuals	20	22	19	17	15	14	107
Percent Positive	44.4%	38.9%	48.6%	54.1%	21.1%	26.3%	41.8%

TOTALS ACROSS ALL GL STATES	Grade 4/5 Math	Grade 4/5 Reading	Grade 6/7/8 Math	Grade 6/7/8 Reading	Grade 10/11 Math	Grade 10/11 Reading	TOTALS
Positive Residuals	140	141	139	166	54	63	703
Negative Residuals	251	242	219	195	110	94	1,111
Percent Positive	35.8%	36.8%	38.8%	46.0%	32.9%	40.1%	38.8%

The results in Table 3 provide a cross-sectional picture of charter school performance for the most recent year that test data were available. For Indiana and Michigan, the most recent year for which test data could be obtained was 2006-2007, which is very recent. For the other states, the most recent year of data was 2005-2006, or 2004-2005 for some specific tests. Further details about each state's data and results are included in appendices B-G.

The bottom three rows in Table 3 include total figures across all six Great Lakes states. As one can see, in 703 of the school-level comparisons the charter schools had scores that were higher than predicted. Unfortunately, a total of 1,111 of the comparisons reveals that charter schools had a negative residual, indicating they were performing at levels lower than predicted (i.e., lower than demographically similar public schools upon which the predicted values are based).
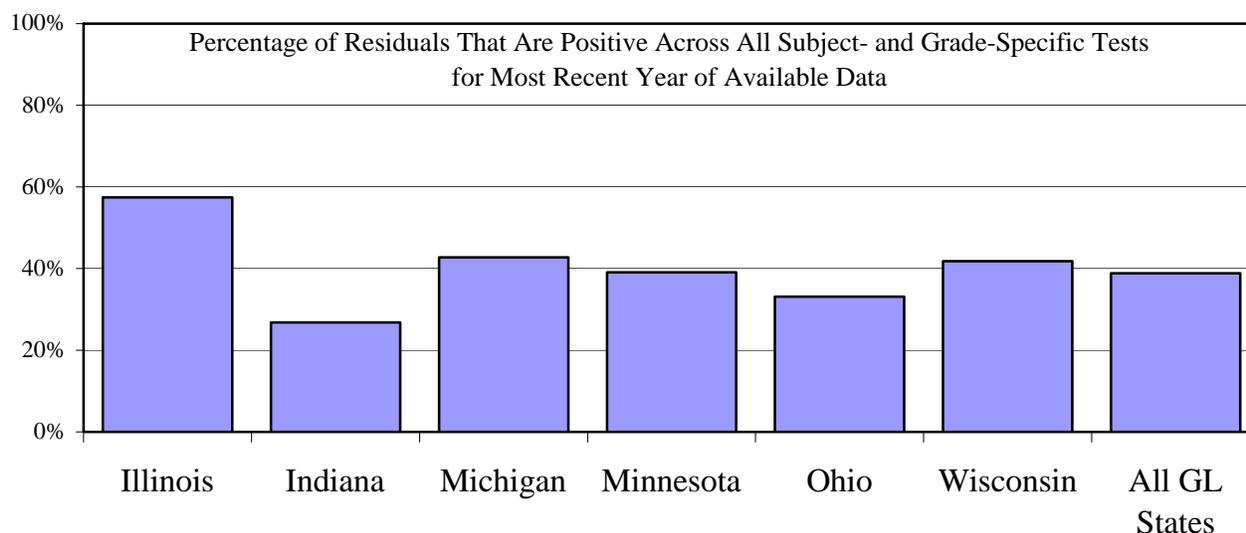

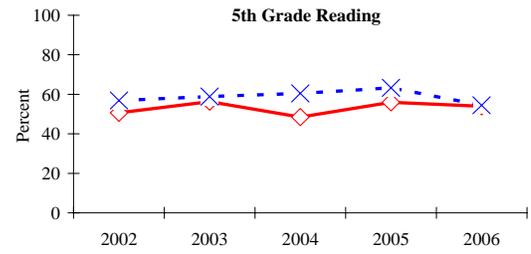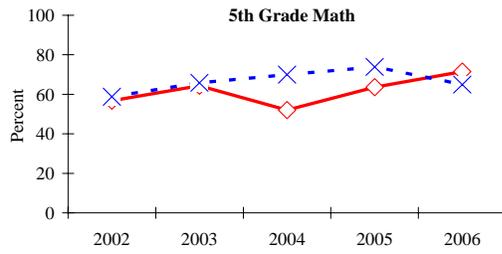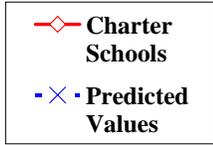**Figure 2. Percentage of Positive Residual Scores by State**

The following pages contain graphs that illustrate the findings for each of the six states. A dedicated page for each state illustrates its charter schools' performance results on state assessment tests. The upper half of the page presents graphs that illustrate the actual results achieved as well as the results predicted. Trends over time are clearly illustrated, and it is evident that most charter school achievement trends are improving. The lower half of the page summarizes residual scores.

It is important to remember that the data in these particular graphs represent a subset of charter schools, those which had complete and valid test data and demographic data available for the years tracked. Generally, the sample represents approximately half of the charter schools in a given state. If all schools had been included, there would have been considerable "noise" in the data: some schools may have opened only recently; others might have appeared in aggregate findings for a few years but then dropped out of them when they closed or failed to report valid test data. The decision to limit the sample to the same schools over the years studied was made in the interest of better estimating charter schools' impact over time.
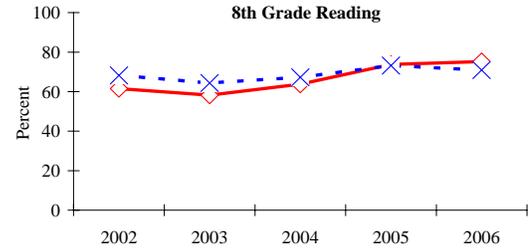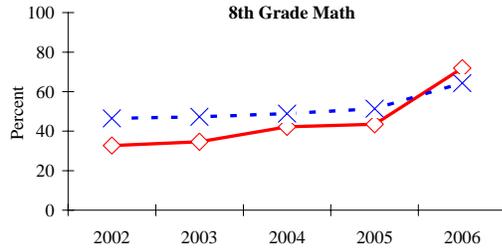
Another note to keep in mind is that when results are combined across schools, the results are weighted by the number of test takers in each school; therefore, large schools influence the combined results more than small schools. For example, if a large school has extremely positive results, its results will outweigh those of a small school with less positive results.

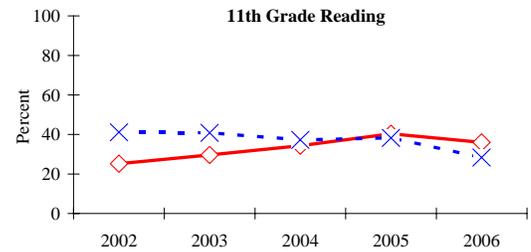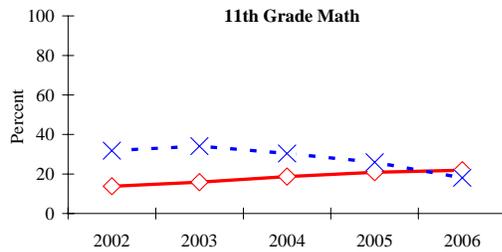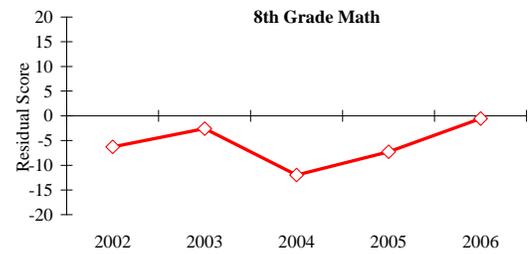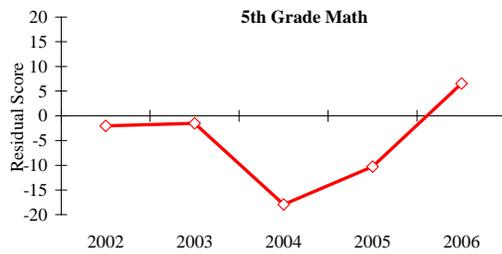# Illinois Charter School Results and Their Predicted Scores

Grade 5

5th Grade Math

5th Grade Reading

Grade 8

8th Grade Math

8th Grade Reading

Grade 11

11th Grade Math

11th Grade Reading

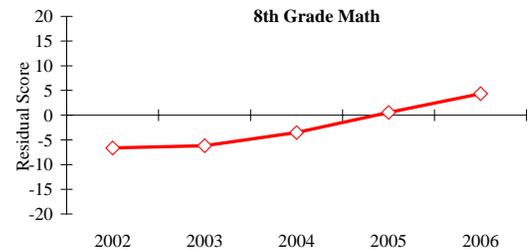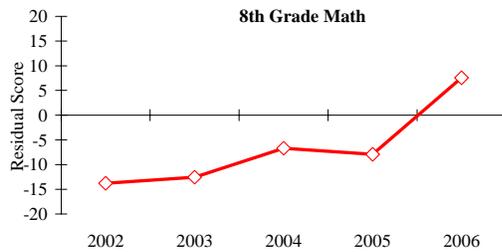# Residuals for Illinois Charter Schools

Grade 5

5th Grade Math

8th Grade Math

Grade 8

8th Grade Math

8th Grade Math

Grade 11

11th Grade Math

8th Grade Math

Indiana Charter School Results and Their Predicted Scores

Grade 3

3rd Grade Math

3rd Grade Language Arts

Grade 6

6th Grade Math

6th Grade Language Arts

Grade 8

8th Grade Math

8th Grade Language Arts

Grade 10

10th Grade Math

10th Grade Language Arts

Legend:
- ◇ Charter Schools
- ✕ Predicted Values
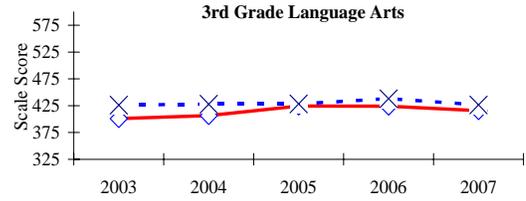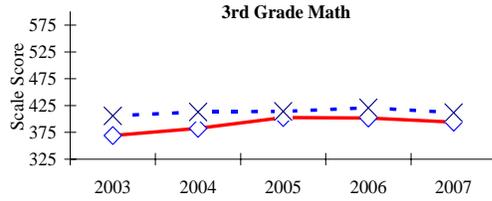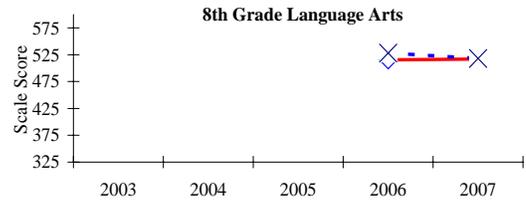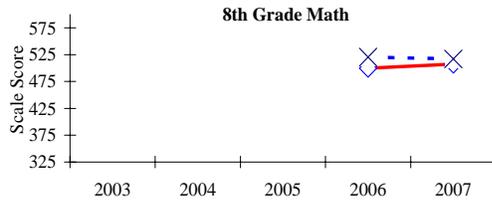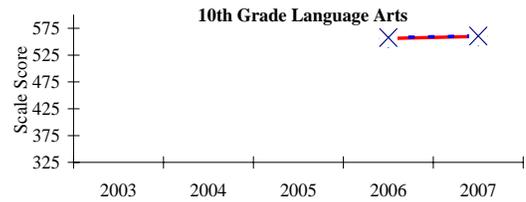
Residuals for Indiana Charter Schools

Grade 3
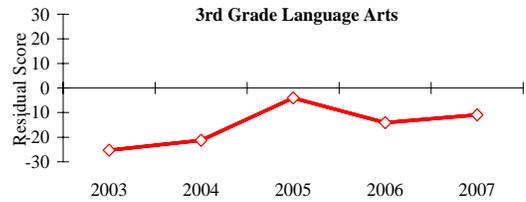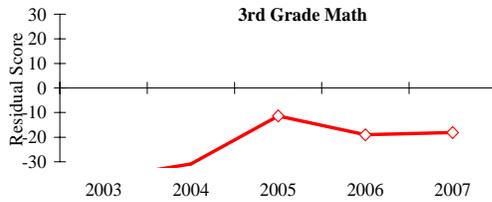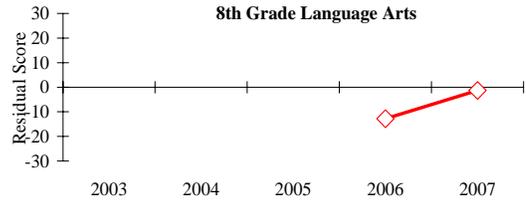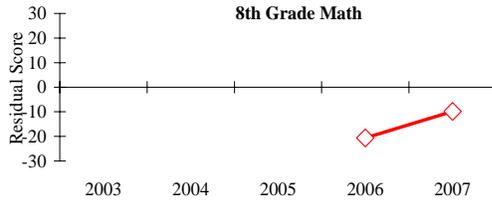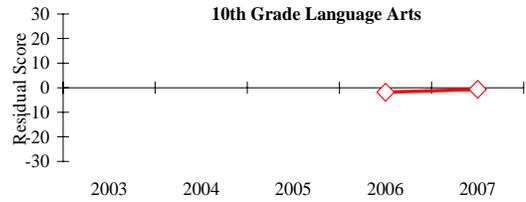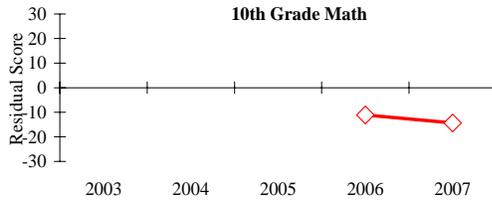
3rd Grade Math

3rd Grade Language Arts

Grade 6

6th Grade Math

6th Grade Language Arts

Grade 8

8th Grade Math

8th Grade Language Arts

Grade 10

10th Grade Math

10th Grade Language Arts

Michigan Charter School Results and Their Predicted Scores

Grade 4

Charter Schools
Predicted Values

4th Grade Math

4th Grade Reading

Grade 7 Reading
Grade 8 Math

8th Grade Math

7th Grade Reading

Grade 11

11th Grade Math
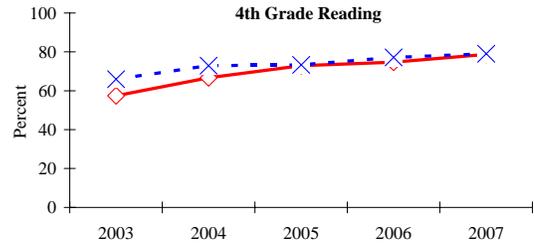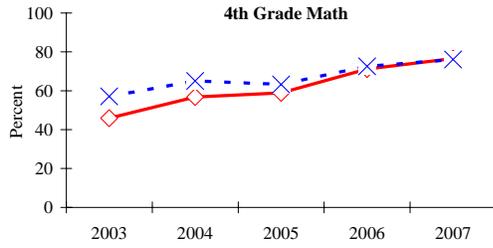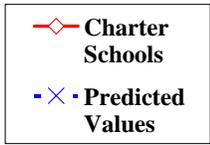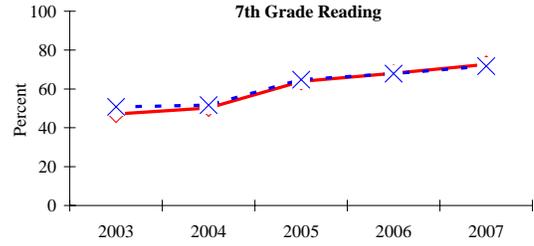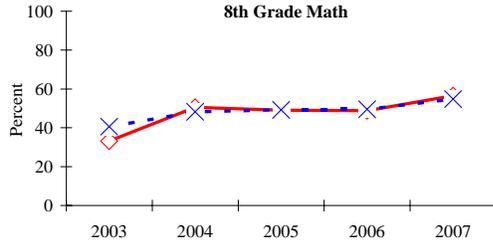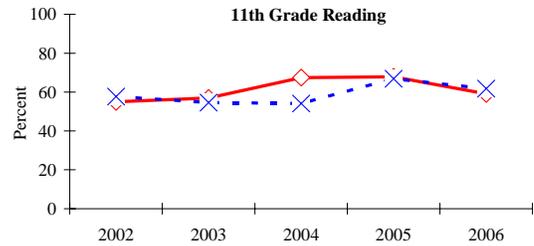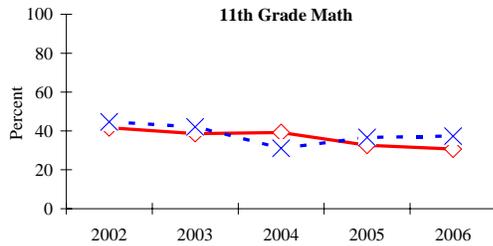
11th Grade Reading

Residuals for Michigan Charter Schools
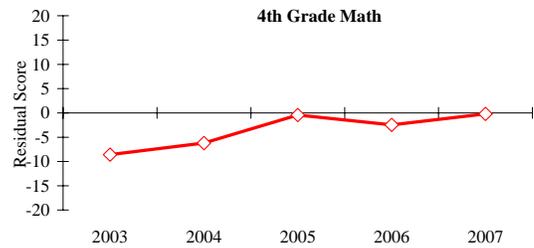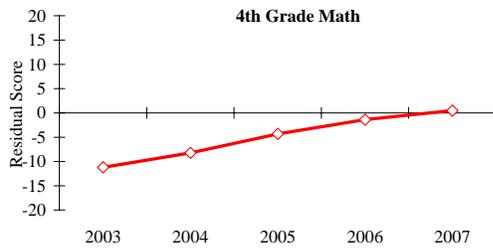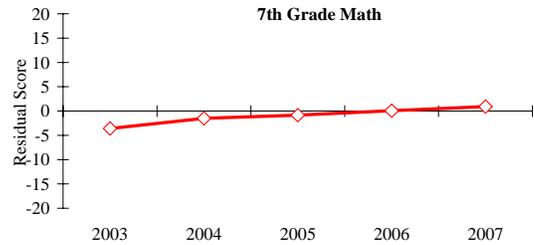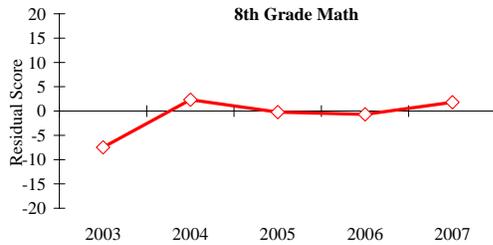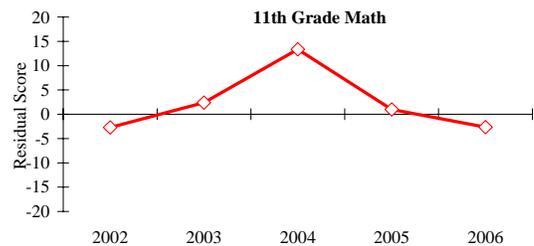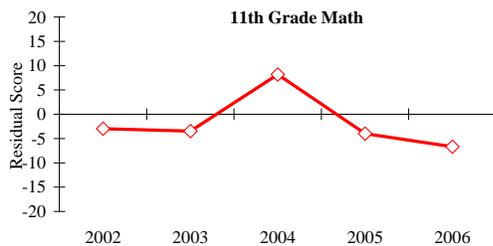
Grade 4

4th Grade Math

4th Grade Math

Grade 7 Reading
Grade 8 Math

8th Grade Math

7th Grade Math

Grade 11

11th Grade Math

11th Grade Math

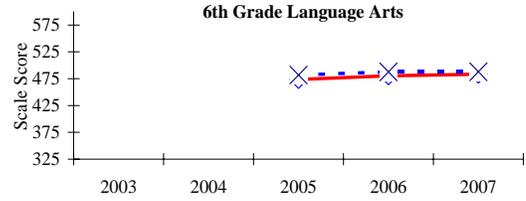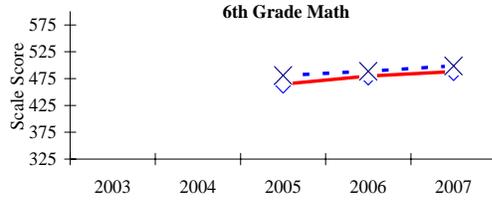## Minnesota Charter School Results and Their Predicted Scores

Grade 5

Charter Schools (red diamond line)

Predicted Values (blue X dashed line)

5th Grade Math

5th Grade Reading

Grade 7

7th Grade Math

7th Grade Reading

Grade 10 Reading
Grade 11 Math

11th Grade Math

10th Grade Reading
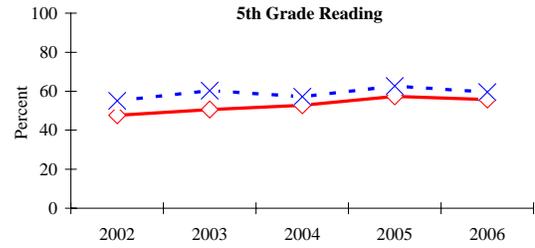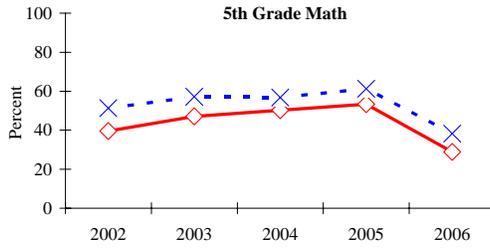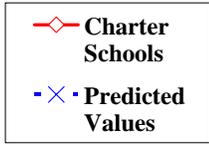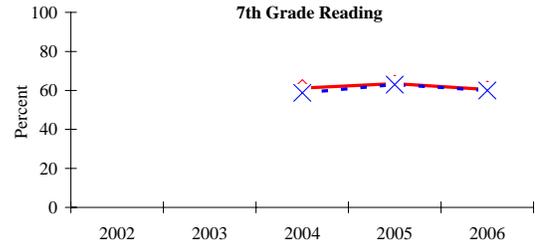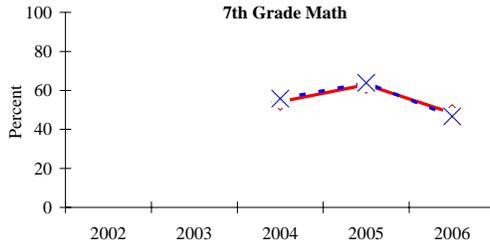
Residuals for Minnesota Charter Schools

Grade 5

5th Grade Math

5th Grade Math

Grade 7

7th Grade Math

7th Grade Math

Grade 10 Reading
Grade 11 Math

11th Grade Math

10th Grade Math

Ohio Charter School Results and Their Predicted Scores

Grade 4

Charter Schools
Predicted Values

Grade 6

Grades 10

Residuals for Ohio Charter Schools

Grade 4
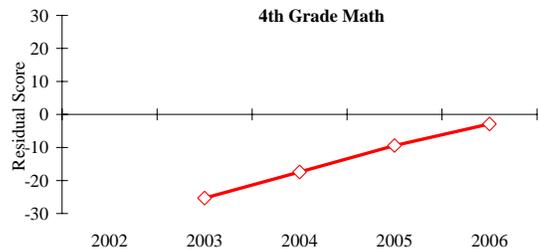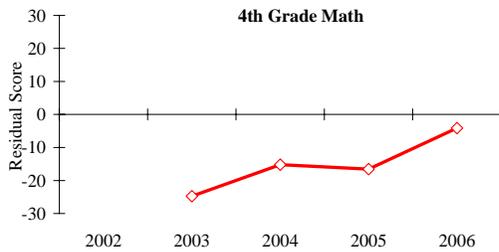
Grade 6
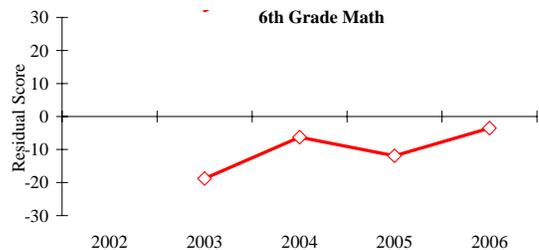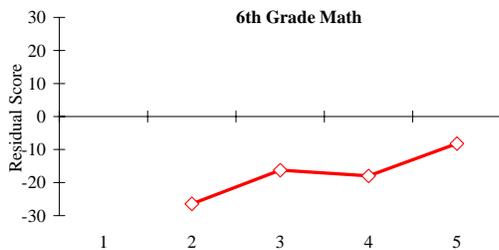
Grades 10
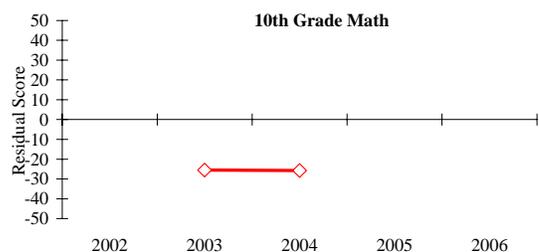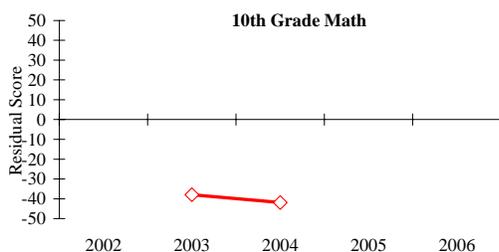
Note: The findings from Ohio should be interpreted with care given that only a small protion of the schools had valid data (see Appendix F for more details)

Wisconsin Charter School Results and Their Predicted Scores

Grade 4

4th Grade Math
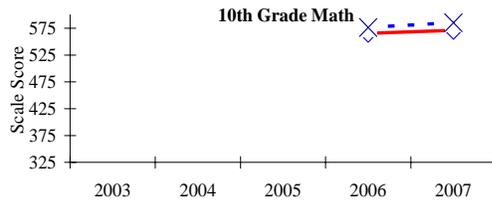
4th Grade Reading

- ◇ **Charter Schools**
- ✕ **Predicted Values**

Grade 8

8th Grade Math

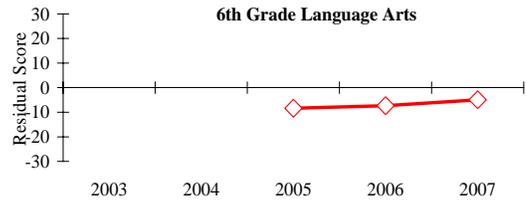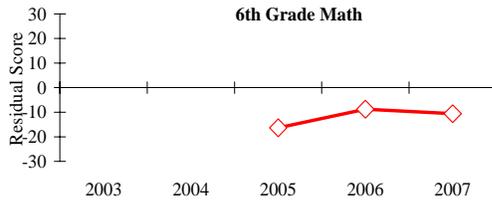**8th Grade Reading**

Grade 10

10th Grade Math

10th Grade Reading
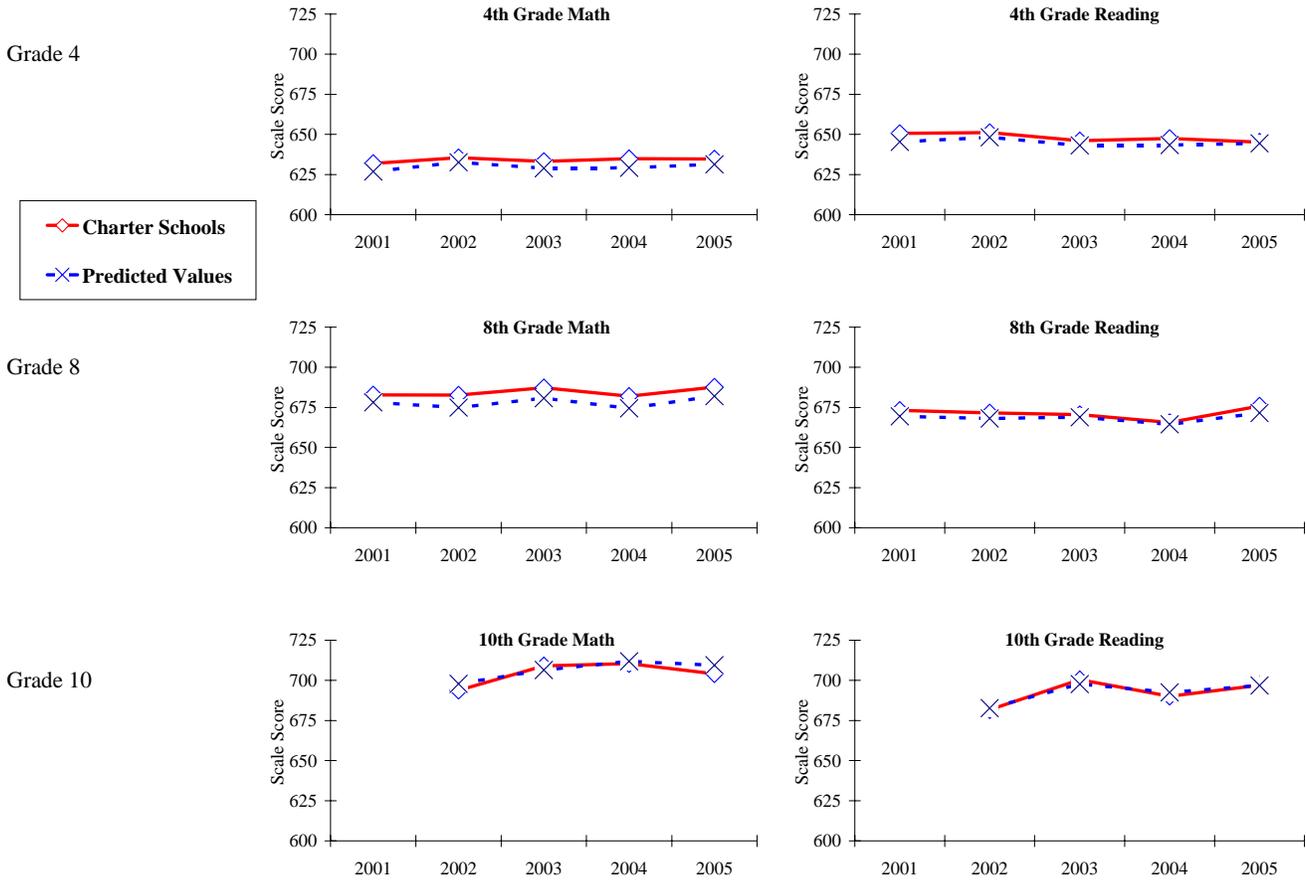
Residuals for Wisconsin Charter Schools

Grade 4

4th Grade Math

4th Grade Reading

Grade 8

8th Grade Math

8th Grade Reading

Grade 10

10th Grade Math

10th Grade Reading
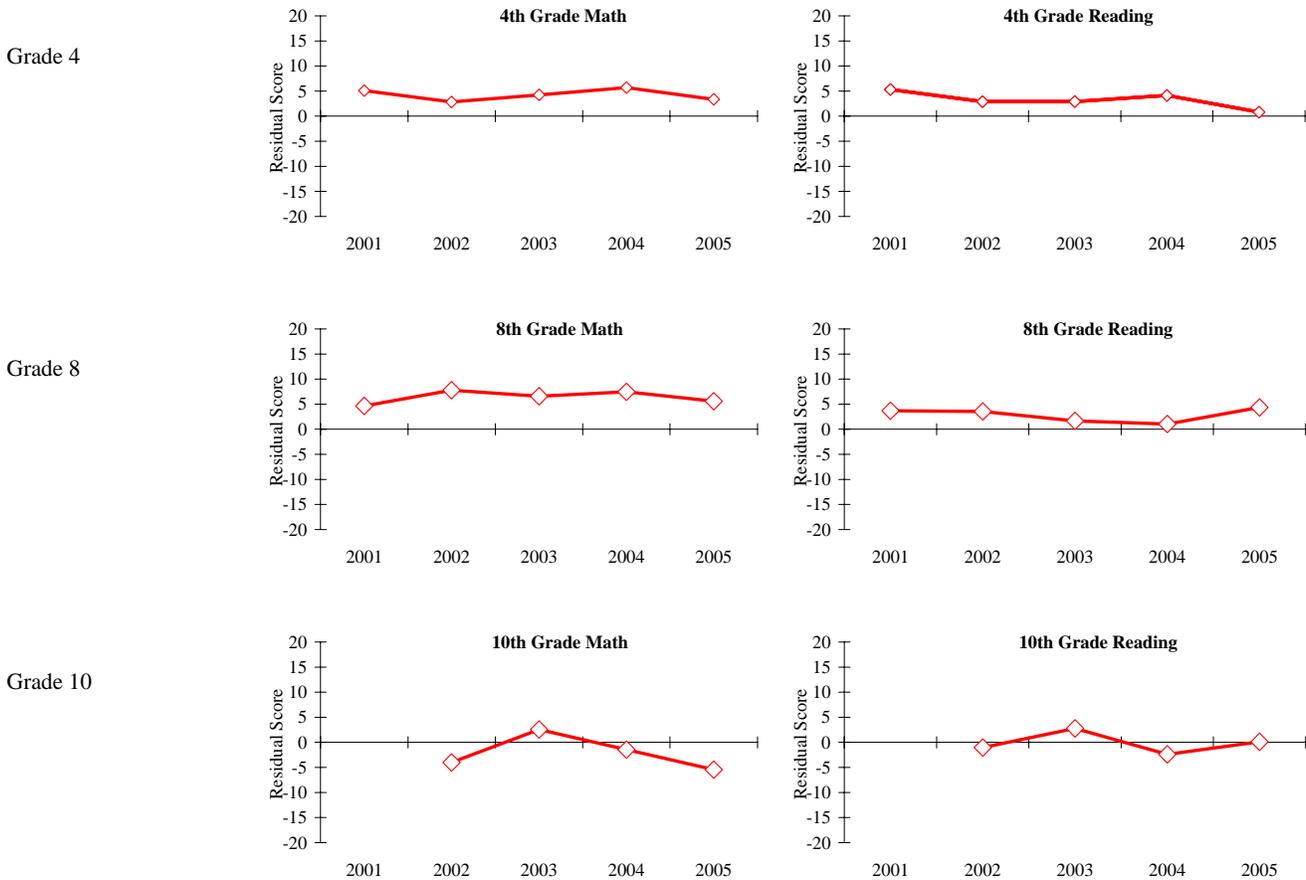
The grade 10 cohort starts in 2002, since half as many schools would have been included in a cohort starting in 2001.

Table 4. Comparison of Average Annual Change in Test Residuals by Grade for Charter Schools and Charter School Cohorts Over Five Years

Illinois	*Grade 5 Math*	*Grade 5 Reading*	*Grade 8 Math*	*Grade 8 Reading*	*Grade 11 Math*	*Grade 11 Reading*	*Totals*
Average Annual Change in Residuals	+2.10	+2.16	+4.51	+2.79	+5.33	+5.85	+3.79
Average Annual Change in Residual Scores for Cohort	+2.15	+1.43	+5.33	+2.75	+5.47	+5.90	+3.84
Indiana	*Grade 3 Math*	*Grade 3 Reading*	*Grade 6 Math & Reading*	*Grade 8 Math & Reading*	*Grade 10 Math*	*Grade 10 Reading*	*Totals*
Average Annual Change in Residuals	+3.35	+3.25	+5.62	-16.13	-3.19	-3.40	-1.75
Average Annual Change in Residual Scores for Cohort	+4.63	+3.58	+2.31	+11.17	-3.28	+1.23	+3.27
Michigan	*Grade 4 Math*	*Grade 4 Reading*	*Grade 8 Math*	*Grade 7 Reading*	*Grade 11 Math*	*Grade 11 Reading*	*Totals*
Average Annual Change in Residuals	+2.51	+1.88	+1.53	+0.93	-0.31	+0.40	+1.16
Average Annual Change in Residual Scores for Cohort	+2.92	+2.09	+2.31	+1.13	-0.92	+0.02	+1.26
Minnesota	*Grade 5 Math*	*Grade 5 Reading*	*Grade 7 Math*	*Grade 7 Reading*	*Grade 11 Math*	*Grade 10 Reading*	*Totals*
Average Annual Change in Residuals	+1.60	+1.03	+1.58	-0.10	+0.91	+0.60	+0.94
Average Annual Change in Residual Scores for Cohort	+0.60	+0.91	+1.68	-1.01	+0.91	+0.60	+0.61
Ohio	*Grade 4 Math*	*Grade 4 Reading*	*Grade 6 Math*	*Grade 6 Reading*	*Grade 10 Math*	*Grade 10 Reading*	*Totals*
Average Annual Change in Residuals	+0.43	+3.01	+1.60	+2.66	-2.86	+2.85	+1.28
Average Annual Change in Residual Scores for Cohort	+6.87	+7.48	+6.08	+5.08	-3.93	-0.25	+3.56
Wisconsin	*Grade 4 Math*	*Grade 4 Reading*	*Grade 8 Math*	*Grade 8 Reading*	*Grade 10 Math*	*Grade 10 Reading*	*Totals*
Average Annual Change in Residuals	-2.61	-3.09	-0.18	-0.19	+3.77	+3.54	+0.20
Average Annual Change in Residual Scores for Cohort	-0.43	-1.13	+0.23	+0.16	-0.48	+0.39	-0.21

Table 4 summarizes data used to determine longitudinal trends for changes in annual residual scores across the six Great Lakes states. In the table, one row for each state indicates how much and in which direction residual scores have changed over time for all of a state's charter schools. A second row for each state offers the same information for the cohort of same schools that were tracked over time. As noted and explained above, the authors believe the cohort results provide a better estimate of charter schools' impact and their ability to improve student achievement over time.

While it is important not to confuse the change rate with performance, these data provide important information: the average annual change in residuals is sensitive to schools that may be performing poorly but are making improvements over time. For example, a school may have had all negative residual scores, but if scores are becoming gradually less negative over time, the average annual change score is positive.[6]

Figure 3 illustrates the average annual change in residual scores by state. These aggregated findings mask considerable differences among the schools and even within schools over time. The figure contains results for all charter schools as well as for the cohort of same schools that had data available for all years that we tracked. The cohort of schools usually represents less than half of all the schools, but these are schools that have remained open and have had a chance to establish themselves. In general, however, this representation of the data contained in Table 4 offers an immediate snapshot of trends and patterns of growth over time.
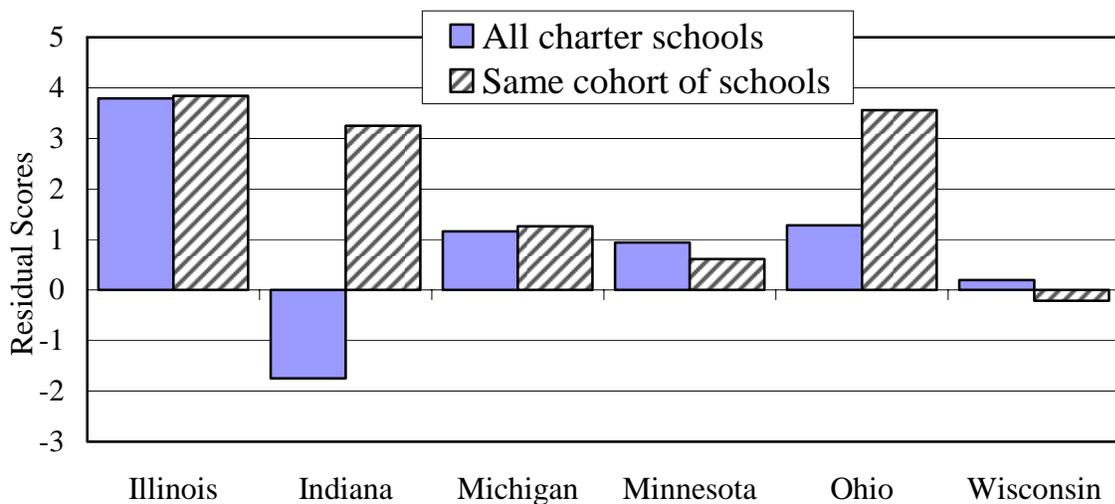
Figure 3. Average Annual Change in Residual Scores by State

On the whole, states with the newest reforms and states with the lowest overall test results for their charter schools are making the largest improvements over time. The older charter school states such as Minnesota, Wisconsin, and Michigan are showing only modest improvements over time.

Summary and Discussion of Findings

This study asked two central questions about charter schools' current performance levels on state assessments and whether they appear to be improving over time. Answers to these questions are summarized below.

How does student achievement in charter schools compare with student achievement in demographically similar, traditional public schools?

- Charter schools in the Great Lakes states are not currently outperforming demographically similar, traditional public schools.
- The relatively youngest reforms in Indiana and Ohio have the lowest performance levels in the region.
- Illinois has the highest relative results, perhaps because some 15 percent of its charter schools have closed since 2000. When poorly performing schools are eliminated, aggregate results for the remaining schools rise.
- At the school level, a number of successful charter schools consistently perform better on their respective state assessments than predicted. This is true for only some 40 percent of the schools, however; 60 percent of the charter schools are performing more poorly than predicted.

Do charter schools show promise of being an effective strategy for improving student achievement over time, even if they are not yet outperforming traditional public schools?

- Trends indicate that generally, charter schools are making notable gains in achievement over time.
- The older reform states, including Minnesota, Wisconsin and Michigan, are experiencing a relatively slow rate of improvement over time.
- Relatively newer reform states, Ohio and Indiana, have the poorest current results; their rate of improvement over time is relatively large, however.

Although there have been a number of multistate or national studies of student achievement in charter schools nearly all of these have relied on cross-sectional designs that yield little or no information about relative change over time.[7] With its longitudinal design, this study has addressed that key area and significantly extends the knowledge base available to policymakers. Collectively, the body of evidence presents a mixed picture and provides no clear evidence that charter schools—on the whole—can perform better than traditional public schools.[8]

Some argue that the impact of charter schools should be measured by a random assignment study (i.e., experimental design). We believe, however, that there may never be a single authoritative and definitive study that settles the question regarding the performance of charter schools. The variations within and between states are large, and the impact of charter schools also appears to change over time. Nevertheless, studies such as this one that contrast results across

states, and also examine results over time, can provide important insights for educators and policymakers alike.

The fact that many traditional schools also perform poorly should not be used as a justification for excusing charter schools from meeting the standards they agreed to in their contracts. The intention of charter school reform was not to replicate the existing system, which many argue suffers from a lack of accountability. Rather, charter schools were envisioned as a means of pressuring traditional public schools to improve, both by example and through competition. If the charter school reform is to serve as a lever for change, it must demonstrate accountability: overall, charter schools should outperform similar district schools on standardized tests. Aside from recent advancements in Illinois, charter school reforms in the Great Lakes Region have so far failed to meet this key expectation.

Notes and References

[1] Relevant studies or evaluations of student achievement in charter schools are reviewed in the state specific appendices.

[2] For example, the NAEP, college entrance examinations, or tests developed and administered for largely diagnostic purposes. The perceived importance of these other tests is negligible and varies by schools since they are not high-stakes test.

[3] Each state's accountability system has relied on a high stakes test at 3 or 4 grade levels over the past 7-10 years. More recently and in response to the requirements of NCLB, states have been adding high stakes test at more grades until they now when they all are testing at grades 3-8 as well as 1 or 2 high school grade levels. For our analysis it was important to follow relative progress over time, so we sought to include only grade level tests that could be tracked over 5 consecutive years were used.

[4] National Center for Education Statistics Common Core of Data web site: http://nces.ed.gov/ccd/

[5] Miron, G., & Nelson, C. (2002). *What's public about charter schools: Lessons learned about choice and accountability*. Thousand Oaks, CA: Corwin Press.

[6] The average annual change score is computed for patterns of actual, predicted, and residual scores across time by subtracting the first score from the most recent and dividing by the number of observations (that is, years) minus 1.

[7] Lubienski, C., & Lubienski, S. (2006). *Charter, private, public schools and academic achievement: New evidence from NAEP mathematics data.* Research paper #111. New York: National Center for the Study of Privatization in Education, Teachers College, Columbia University.

Carnoy, M., Jacobsen, R., Mishel, L., & Rothstein, R. (2005). *The charter school dust-up: Examining the evidence on enrollment and achievement.* Washington, DC: Economic Policy Institute.

Hoxby, C. (2004). *Achievement in charter schools and regular public schools in the United States: Understanding the differences.* Retrieved March 2007 from http://www.economics.harvard.edu/faculty/hoxby/papers/hoxbycharter_dec.pdf

[8] See Miron, G., & Nelson, C. (2004). Student achievement in charter schools: What we know and why we know so little. In K. Bulkley, & P. Wohlstetter, *Taking account of charter schools*. New York: Teachers College Press.

In this study, we synthesized the findings from 27 major studies of student achievement in charter schools. The impact rating from each study was weighed by the quality of the design of the study. The bottom-line conclusion, from this body of research was that charter schools were performing similar to or slightly lower than traditional public schools.

The National Charter School Research project at the University of Washington maintains an annotated bibliography of research studies and other writing on student achievement in charter schools, http://www.ncsrp.org/cs/csr/print/csr_docs/achstud.htm.

Evaluating the Impact of Charter Schools on Student Achievement:
A Longitudinal Look at the Great Lakes States

Appendix A

June 2007

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- The policy brief is available online at: http://epsl.asu.edu/epru/documents/EPSL-0706-236-EPRU.pdf

Appendix A
Methodology

Overview

This evaluation used a nonexperimental, longitudinal, and cross-sectional design to compare student math and reading achievement in charter and public schools in six Great Lakes states (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin) over a five-year period. The time period was the most recent five years for which data were available for each of the states (typically the 2001-02 to 2005-06 academic years). The unit of analysis was individual schools in each state. One grade at each of the three school levels (i.e., elementary, middle, & high school) was selected for analysis (e.g., grades 4, 7, and 10). Ex post facto data were obtained from the National Center for Education Statistics Common Core of Data Web site and from each state's department of education Web site. Independent predictor variables were percentage minority, percentage low income (free/reduced lunch), percentage special education, percentage limited English proficiency, and urbanicity; and the dependent variable was achievement results on state assessment tests. Linear regression models were used to conduct residual gains analyses on school-level data that produced three estimates: (1) actual scores based on observed student achievement data provided by each school; (2) predicted scores based on an aggregate of actual scores for demographically similar public schools; and (3) residual scores, which identified the difference between charter school actual and predicted student achievement. Patterns of growth/decline were then analyzed over time. Two evaluation questions were used in this study: (1) How does student achievement in charter schools compare to demographically similar public schools? (2) Are charter schools an effective strategy for improving student achievement over time?

Scope and Design

This evaluation focuses exclusively on student achievement. Brief descriptions of charter school reform for the schools included in this study are provided. These descriptions contain general details regarding the age and relative size of the reforms as well as comments regarding whether the reforms are restrictive or permissive with regard to autonomy. Comments on the rigor of oversight are also included. An in-depth analysis of the differences among schools or states is beyond the scope of this current evaluation. Table 1 presents decision criteria and rationale regarding the scope and focus of the evaluation. Trade-offs and compromises always need to be made when narrowing a study. Though data collection and analysis challenges varied considerably by state, the intent of the criteria was to ensure that the study was as structured and systematic as possible.

Table 1. Decision Criteria and Descriptions

Topic	Decision Criteria, Description, Rationale
States Included	This evaluation was sponsored by the Great Lakes Center, so the decision to focus on these states is based on their location in the Great Lakes region (i.e., Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin)
Test/ Assessment	Only state assessments were used since all public schools, including charter schools, must participate in these assessments. In some states, other standardized tests also are administered,[1] but these typically include only a sample of schools or students. The state assessments are commonly viewed as high stakes tests, and they are familiar to a broad range of stakeholders.
Outcome Measure	Preference was given to the most sensitive test/assessment measure available in the following order: normal curve equivalent, percentile rank, scaled score (mean achievement test score for a school), and cut score (mean percentage of students meeting or exceeding state standards). All states in this study had cut score data. Additionally, Wisconsin and Indiana had scale score data equated from year to year over the previous 5 years. These were used instead of the cut scores, given their increased sensitivity to change over time.
Test Content	Math and reading tests were selected because these subjects had the best longitudinal data and typically comprise the high stakes component of state assessment programs.
Grade Levels	One grade at each of the three school levels (i.e., elementary, middle, & high) was selected for this study. Preference was given to the highest grade with longitudinal data at the elementary level.[2]
Years	Trends were analyzed over a five-year period, with preference given to the five most recent years in which data were available. For most states, this meant tracking data from 2001-02 to 2005-06. In Michigan and Indiana, we were able to obtain 2006-07 data.

Data Sources

Data including district and school name, district and school number, school enrollment, ethnicity, free and reduced lunch (low income), urbanicity (locale), and a charter school identifier were obtained from the National Center for Education Statistics Common Core of Data (CCD).[3] Data including district and school name, district and school number, special education enrollment, limited English proficiency enrollment, number of students tested, and achievement test scores were obtained from each state's department of education Web site.

Data Set Construction

Longitudinal data sets containing demographic and student achievement data for all charter and traditional public schools needed to be constructed for each of the six states. Data collection and preparation were conducted by several graduate students and research

staff over the course of several months. Complications encountered included (1) extremely large and difficult to manage data files (many exceeding Microsoft Excel's capacity); (2) inconsistent data formatting, including changes in data structures and variable names from year to year; and (3) inconsistent and/or missing building or school codes, which were necessary for matching and merging data. In some cases, we needed to create unique identification numbers combining district and school numbers in order to merge CCD data sets to state board of education data sets. Data cleaning involved complex data transformations, recoding, and creating new variables since the source data often did not contain the specific predictor variables required for analysis. The preparation of these data sets literally meant that several gigabytes of files were downloaded from state or federal Web sites. After extracting or creating the variables of interest, cross-sectional data sets for each year in the trend were then merged into six longitudinal data sets (one for each state) that could be managed by common desktop computers and software. Although the process started with several gigabytes of information for each state, the final flat files were typically less than 10 megabytes in size.

Variables

Independent variables included percentage minority (MINORITY), percentage low income (LOW INCOME), percentage special education (SPED), percentage limited English proficiency (LEP), and population density where school is located (URBANICITY) for each school. The dependent variable was achievement test results (TEST) for each school. A moderator variable identifying charter school status was used to distinguish charter schools in the state. See Table 2 for study variables, codes, and operational definitions.

Table 2. Independent and Dependent Study Variables

Variable	*Operational Definition*
Minority	Percentage of students in each school who are American Indian/Alaska Native, Hispanic, Black, or mixed ethnicity (White and Asian/Pacific Islander students were intentionally excluded. Although Asian-American students are considered part of a minority group, they typically are the ethnic group that performs highest on standardized tests, followed by White or European Americans).
Low Income	Percentage of low income students in each school who are eligible to receive free or reduced lunch.
Special Education (SPED)	Percentage of students in each school who are identified as "special education" students (e.g., have disabilities, receive special education services, have individualized education plans/programs-IEPs)
Limited English Proficiency (LEP)	Percentage of students in each school with limited English proficiency

Variable	*Operational Definition*
Urbanicity (Locale)	8-category urbanicity rating for each school based on the community's population density: 1. **Large city**: A principal city of a metropolitan core based statistical area (CBSA), with the city having a population greater than or equal to 250,000 2. **Midsize city**: A principal city of a metropolitan CBSA, with the city having a population less than 250,000 3. **Urban fringe of a large city**: Any incorporated place, census-designated place, or nonplace territory within a metropolitan CBSA of a large city and defined as urban by the census bureau 4. **Urban fringe of a midsize city**: Any incorporated place, census-designated place, or nonplace territory within a CBSA of a midsize city and defined as urban by the census bureau 5. **Large town**: An incorporated place or census-designated place with a population greater than or equal to 25,000 and located outside a metropolitan CBSA or inside a micropolitan CBSA 6. **Small town**: An incorporated place or census-designated place with a population less than 25,000 and greater than or equal to 2,500 and located outside a metropolitan CBSA or inside a micropolitan CBSA 7. **Rural, outside CBSA**: Any incorporated place, census-designated place, or nonplace territory not within a metropolitan CBSA or within a micropolitan CBSA and defined as rural by the Census Bureau 8. **Rural, inside CBSA**: Any incorporated place, census-designated place, or nonplace territory within a metropolitan CBSA and defined as rural by the Census Bureau
Achievement Test (TEST)	The dependent variables for the analyses are state achievement test results for each school. Order of preference in selecting test score data was based on the sensitivity of the measure: scaled scores (mean achievement test score for a school) were preferred and used over cut scores (mean percentage of students meeting or exceeding standards) when possible.

Residual Gains Analysis

Analyses based on changes within individual students are more rigorous and desirable than analyses based on school-level data; however, only school-level data were readily available for states in this study. This is common in the country as a whole. Some states that have student level data sets are restricted from sharing this data with researchers. The few states that have student level data that could be used for evaluating the impact of charter schools on student achievement include Arizona,[4] Delaware,[5] Florida,[6] North Carolina,[7] and Texas.[8] Several more years will be needed before new value-added assessment systems can provide student level data for longitudinal designs. Thus, residual gains analysis was selected because it provides one of the most rigorous designs and methodological approaches suitable for analyzing group or school-level student achievement data. This approach has been used successfully for a number of state evaluations when individual student data were not available. In a recent evaluation of the Delaware charter school reform, a quasi-experimental design based on student-level data was used as well as a longitudinal residual gains analysis based on school-level data. This

Appendix A: Methodology

provided a unique opportunity to compare results from the best possible analyses of student-level data with the best possible analyses of school-level data. Results from the two approaches revealed nearly identical findings.[9]

Linear regression models were used to conduct residual gains analyses on school-level data to estimate growth/decline patterns of student achievement. To facilitate estimating these patterns, school-level performance needed to be tracked across time. Regression models were fit to each test content area (math or reading) and each grade level included in the study. Approximately 30 separate regression models were tested for each state. Independent variables used as predictors in the models included percentage of minority students (MINORITY), percentage of low-income students receiving free or reduced lunch (LOW INCOME), percentage of students qualifying for special education (SPED), percentage of students with limited English proficiency (LEP), and each school's urbanicity rating based on its community's population density (URBANICITY) (see Table 2). While these variables represent the desired set of predictor variables, substantial difficulty was encountered when obtaining school-level SPED and LEP data in a few of the states, either because these data were not available for 1 or more years or because these data were available only at district but not school levels.

From these regression models, three estimates were produced: (1) actual, or observed scores; (2) predicted, or expected scores; and (3) residual, or difference in scores. The actual performance scores presented in the tables for each state represent the cut scores or scaled scores reported by schools for a given grade and test content area in a given year.

Predicted scores are those that were anticipated in comparison with public schools (charter and noncharter) for a given grade in a given year. In other words, the predicted scores represent how a charter school is expected to score based on how demographically similar public schools perform. The predicted values were determined using an ordinary least squares (OLS) multiple regression procedure, in the form of the linear equation given in Equation 1

$$\hat{Y}_i = a + b_1 MINORITY_i + b_2 LOWINCOME_i + b_3 SPED_i + b_4 LEP_i + b_5 URBANICITY_i + \varepsilon_i \quad (1)$$

where $\hat{Y}$ is the predicted value for a given school i, expressed in terms of the constant a of the intercept term; $MINORITY_i$ is the proportion of minority students (does not include White or Asian-American students) for a given school i; $LOWINCOME_i$ is the proportion of students receiving free or reduced lunch for a given school i; $SPED_i$ is the proportion of special education students for a given school i; LEP_i is the proportion of students who qualify for limited English proficiency accommodations for a given school i; $URBANICITY_i$ is the degree of urbanicity or population density for a given school i; and the error term ε_i. In this equation, the regression coefficients (bs) represent the independent contributions of each independent variable to the prediction of the dependent variable $\hat{Y}$.

Residual values e_i are simply the difference between the observed value Y_i and the fitted value (predicted) $\hat{Y}_i$ for given school i as shown in Equation 2. These residuals, or differences, indicate whether a school (or group of schools) is performing at, above, or below other demographically similar schools. A residual of 0 indicates that the school performs at the average of all other similar schools. A negative residual means the charter

school is performing lower than predicted, and a positive residual indicates it is performing higher than predicted.

$$e_i = Y_i - \hat{Y}_i \tag{2}$$

To obtain the observed, predicted, and residual scores aggregated for each state, a weighted mean was calculated for the observed value Y_i and the fitted value (predicted) $\hat{Y}_i$ from the school-level Y_is and $\hat{Y}_i$ s, from which state aggregate e_i is calculated. The weighted mean is determined simply by multiplying each school-level Y_i and $\hat{Y}_i$ by the number of test takers within each school. To obtain the state-level Y_is and $\hat{Y}_i$s, the school-level weighted means are averaged and divided by the number of schools in the state. In other words, the average across all the charter schools takes the number of students within those schools into account (for any given grade and any given year).

Average annual change (AAC) scores were computed for patterns of observed, predicted, and residual scores across time by subtracting the first score from the most recent and dividing by the number of observations (e.g., years) minus 1 (i.e., N-1). An example of the procedure for the average annual change in residual scores is shown in Equation 3.

$$AAC = (e_{2005} - e_{2001})/N\text{-}1 \tag{3}$$

Typically, the predictor variables in the regression equations accounted for 45 to 65 percent (adjusted R^2 = .45-.65) of the variability in school-level outcome measures (e.g., scaled scores, cut scores), which suggests that these models were rather strong in terms of predicting school performance with a limited number of background indicators.

The focus of this report is on the aggregate results across all charter schools. At a later point in time, we will make available additional appendices with school level results for each charter school in the participating states that have at least two valid points of data on any particular test.

The discussion of methods in this report has been kept brief and relatively nontechnical. Readers interested in a more detailed exposition of methods may contact the authors or refer to our state evaluations of charter schools in Pennsylvania and Delaware where we provide further details and insights regarding the application of this methodology.

Limitations

Below, we summarize the key limitations of the evaluation:

1. This study is based on school-level rather than student-level analyses; thus, fully controlling for student mobility or identifying differences within schools was not possible.

2. Analyses were conducted on consecutive cohorts of students in identical grades (4th graders in 2003, 4th graders in 2004, 4th graders in 2005); therefore, each cohort group had different students. Data were not available to track the same cohorts of students as they progressed through grades (for example, from grade 4 in 2003 to grade 5 in 2004) because most states did not have tests in consecutive grades until very recently when NCLB mandated testing in grades 3-8.

3. The quality (sensitivity) of measures of student achievement varied by state, with all states reporting cut scores but only a few reporting mean scaled scores. Thus, the criterion variable in the regression equations varies by state.

4. Charter schools with missing or incomplete data were dropped from analyses. The most common explanation for missing data was that specific charter schools had too few test takers. (One of the most common measures to ensure the confidentiality of findings is to report performance results only when there are 10 or more test takers; in some states this threshold was as low as 5). The results from Ohio were particularly affected by incomplete data. Although Ohio has the most charter schools in the region, this state had the highest proportion of schools dropped from the analysis due to incomplete data (see Appendix F for more details).

5. Data on special education and limited English proficiency were not available in some states at the school level. Data on special education and limited English proficiency was not available in some states at the school level. Even when we could control for the percentage of special education students, we could not control for differences in the nature and degree of severity of disabilities. Our state evaluations revealed that charter schools have—on average—a substantially lower proportion of students with disabilities and the students with disabilities that enroll in charter schools tend to have less severe and less-costly to remediate disabilities.[10]

While the longitudinal design, broad scope, and overall quality of this study make it one of the most rigorous and comprehensive evaluations of charter school student achievement, these limitations should be considered when interpreting results.

Notes and References

[1] For example, the NAEP, college entrance examinations, or tests developed and administered for largely diagnostic purposes. The perceived importance of these other tests is negligible and varies by schools since they are not high stakes tests.

[2] Each state's accountability system has relied on a high stakes test at 3 or 4 grade levels over the past 7-10 years. More recently and in response to the requirements of NCLB, states have been adding high stakes tests at more grade levels until now when they all are testing at grades 3-8 as well as 1 or 2 high school grade levels. For our analysis it was important to follow relative progress over time, so we sought to include only grade level tests that could be tracked over 5 consecutive years.

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Evaluating the Impact of Charter Schools
on Student Achievement:
A Longitudinal Look at the Great Lakes States

Appendix B

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Appendix B
Student Achievement in Illinois Charter Schools

Illinois passed its charter school law in 1996. The state's first charter school opened in Peoria during the 1996-97 academic year. Currently, 42 charter agreements have been granted for Illinois charter schools. These schools serve close to 13,000 students.[1] Since 1996, the charter school law has been amended a few times, most recently in 2003. Charter applicants in Illinois may include individuals or organizations—with parents, educators, existing public schools, businesses, colleges, universities, community-based organizations, or partnerships among these. Like other statutes, Illinois also places restrictions on the types of organizations that may authorize charter schools. Under Illinois law, charters are granted primarily by local education agencies (LEAs).

The Illinois charter school law provides a number of mechanisms to facilitate accountability of charter schools. The primary instrument of accountability is the learning goals specified in the charter agreement. Goals for student performance in charter schools are also subject to the Illinois Learning Standards, which define what Illinois public school students should know and be able to do in seven core areas.[2] Charter schools in Illinois are required to report information for the state's school report card system to the Illinois State Board of Education (ISBE).

There are differing opinions as to perceived strength of the Illinois charter school law. The Center for Education Reform rates Illinois' charter school law as weak, assigning it a "C."[3] However, Chi and Welner (in press)[4] rated Illinois as one of the strongest charter school laws because of issues related to accessibility for all students, particularly at-risk students, as well as rigor of oversight and accountability. Illinois has a cap on the number of charter schools that can be authorized. Specifically, the law allows 15 schools in Chicago, 15 in suburban Chicago, and 15 in the remainder of the state. Determining the actual number of charter schools in operation, however, is confused by the fact that many of the Chicago-based charter schools have opened multiple buildings under the same charter umbrella. Tracking the number of schools is also complicated by the fact that some of the school buildings under the same charter contract have split to operate under separate charter contracts.

Illinois has closed a higher proportion of its charter schools than the other Great Lakes states. Six of the state's charter schools have been closed since 2000, which represents nearly 15 percent of all the schools. These closures represent high standards for accountability and the willingness and ability of the oversight agencies to close charter schools that are not meeting expectations.

A number of studies analyzed student achievement in Illinois. Nelson and Miron (2002)[5] presented findings from a three-year evaluation of Illinois charter schools. Analysis of the data from the Illinois Standards Achievement Test (ISAT) in this evaluation shows that charter schools performed at or just below the levels of demographically similar noncharter schools. Hoxby and Rockoff (2004) compared the performance of students in one Chicago charter school who were successful in being

admitted through a lottery with those who applied but were not accepted by the lottery. Their study found higher reading scores in the schools that were successful in the lotteries especially in elementary school students.[6] In 2004, SRI completed an evaluation for the U.S. Department of Education that included state studies of student achievement in 5 states, including Illinois.[7] This study based on three years of data (1999-00 through 2001-02 school years) focused on the status of charters schools with regard to the state standards. When controlling for proportion of minority and low-income students, charter schools and traditional public schools performed similarly.

More recently, the Chicago Public Schools and Illinois Network of Charter Schools (2006) released a report showing that Chicago charter schools outperformed their comparison neighborhood traditional public schools in reading, science, and math in 2004-05.[8] This report found that Chicago charter schools had a higher percentage of students meeting and exceeding Illinois Learning Standards for both the ISAT and PSAE composite scores than their comparison neighborhood schools, outperforming them on 86% of the student performance measures. Additionally, students in the eight charter public high schools were more likely to graduate on time than students in neighboring traditional public high schools (75% vs. 54%). This study noted that the relative performance of comparison neighborhood traditional public schools was a "weighted, aggregate average of the performance of the neighborhood schools that the students would most likely have attended if the charter school did not exist" (p. 3). Given that some charter schools are not representative of their neighborhood traditional public schools in demographics, special education and low income enrollment, socioeconomic status, and mobility, these findings should be interpreted with some caution. The Illinois State Board of Education prepares an annual report each year that lists the charter schools and their passing rates together with their respective host district.[9] No aggregation or summative conclusions of these data are made, however.

Data Sources, Outcome Measures, and Methods for Analysis

We obtained demographic variables from the Common Core of Data at the National Center for Education Statistics (NCES).[10] These include school enrollment, ethnicity, free and reduced lunch, and urbanicity or locale. A variable designating whether or not a school was a charter school or traditional public school was used from this data set to distinguish the charter schools in the state. From the Illinois State Board of Education Web site we obtained student achievement test results.[11] Unfortunately, we were not able to secure data on special education and limited English proficiency for most of the years covered in our evaluation. Therefore, these are not considered in the regression models for Illinois.

Because scale scores were not available, the outcome measure used for this analysis was the mean percentage of students that met or exceeded the Illinois Learning Standards[12] as revealed on the Illinois Standards Achievement Test for grades 5 and 8 and on the Prairie State Achievement Examination (PSAE)[13] for grade 11. The five most recent years of data available for these grades were the 2001-02 through 2005-06 academic years. Table 1 illustrates the range of grades, years, and subjects included in our analyses.

Table 1. Test Data Used in Analyses by Year, Grade, and Subject

	2001-02	*2002-03*	*2003-04*	*2004-05*	*2005-06*
Grade 5	Reading Math	Reading Math	Reading Math	Reading Math	Reading Math
Grade 8	Reading Math	Reading Math	Reading Math	Reading Math	Reading Math
Grade 11	Reading Math	Reading Math	Reading Math	Reading Math	Reading Math

Variables Used to Create the Predicted Values for Each School

The data set we created for Illinois was rather incomplete, since we were not able to obtain data on special education or limited English proficiency at the building level. Although we could assemble data records for 37 charter schools, during the time period under consideration, only 24 of these schools had both valid test data and information on percentage of low-income and percentage of minority students. This obviously decreased the sample size considerably. Three of the 13 schools that were excluded—due to an absence of data—were closed. Three additional schools that were excluded were relatively new and did not yet have student performance data reported. Seven charter schools that were in operation during the years covered by our analyses were dropped from the sample because of incomplete data, which represents an important limitation. Table 2 displays the variables used in developing the residual gain score analysis for Illinois.

Table 2. Variables Included in Residual Gain Score Analysis for Illinois

Variable	*Description*
Percentage Passing (Dependent Variable)	Percentage of students meeting or exceeding state standards on the ISAT and the PSAE
Percentage Minority	Percentage of nonwhite and non-Asian-American students enrolled at the school
Percentage Low Income	Percentage of students receiving free or reduced lunch
Urbanicity (Locale)	Rating from 1-8 indicating population density

Table 3 contains tables and line graphs that illustrate our findings across all schools. Actual or observed scores are simply the actual school-level score (i.e., the percentage of students meeting state standards) for each grade and subject-level test. The predicted values were created using an ordinary least squares (OLS) multiple regression procedure, in the form of the linear equation included below:

$$\hat{Y}_i = a + b_1 MINORITY_i + b_2 LOWINCOME_i + b_3 URBANICITY_i + \varepsilon_i$$

Table 3. Illinois Aggregate Results by Grade, Subject, and Year

School Name	Year	Math					Reading				
		Schools	Students	Actual	Predicted	Residual	Schools	Students	Actual	Predicted	Residual
Grade 5	2002	6	326	56.51	58.60	-2.09	6	326	48.75	56.74	-7.99
	2003	9	387	58.13	57.42	0.71	9	387	50.17	50.50	-0.33
	2004	10	642	53.19	68.50	-15.31	10	642	48.13	58.91	-10.78
	2005	10	693	65.16	73.59	-8.43	10	693	56.15	62.95	-6.80
	2006	9	1,351	71.74	65.43	6.31	9	1,351	55.61	54.95	0.66
Average annual change				3.81	1.71	2.10			1.72	-0.45	2.16
Grade 8	2002	9	410	29.76	42.84	-13.09	9	410	57.11	65.30	-8.19
	2003	11	814	26.79	35.65	-8.86	11	814	51.19	54.90	-3.70
	2004	11	1,124	35.95	46.04	-10.09	11	1,124	61.36	64.73	-3.37
	2005	10	1,227	43.59	51.72	-8.13	10	1,227	73.43	73.35	0.08
	2006	11	898	71.74	66.79	4.95	11	898	75.77	72.78	2.99
Average annual change				10.50	5.99	4.51			4.66	1.87	2.79
Grade 11	2002	7	839	13.37	31.67	-18.30	7	839	24.77	40.99	-16.22
	2003	8	835	15.94	34.35	-18.41	8	835	29.82	41.07	-11.25
	2004	10	1,230	18.04	30.55	-12.51	10	1,230	32.64	37.42	-4.78
	2005	9	1,348	19.57	25.53	-5.96	9	1,348	38.69	37.98	0.71
	2006	7	1,446	21.32	18.29	3.03	7	1,446	35.70	28.50	7.20
Average annual change				1.99	-3.34	5.33			2.73	-3.12	5.86
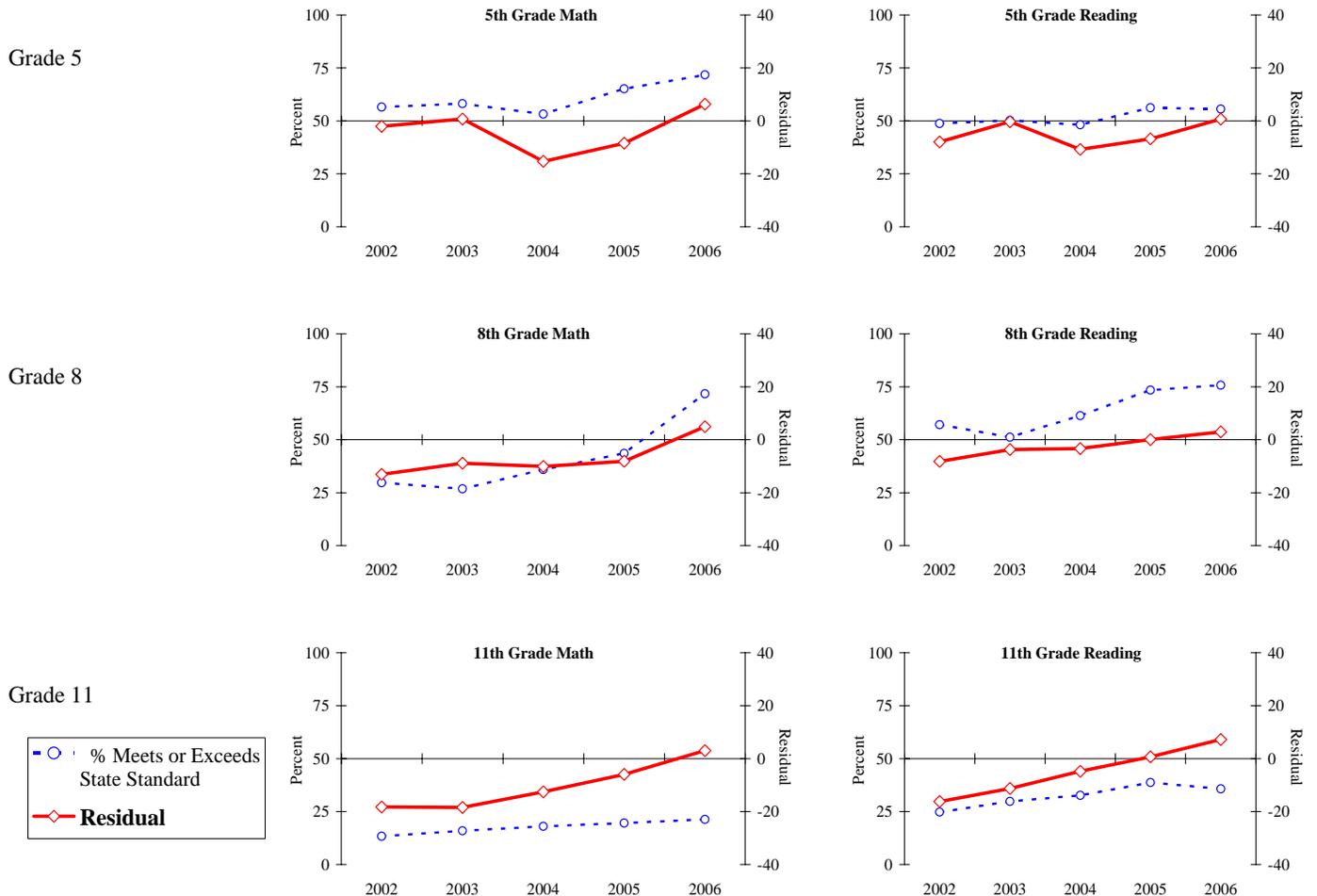
Figure 1. Illinois Aggregate Results: Residual Scores and Percent Meeting State Standards

The variables included in the regression analysis are described in Table 2. Essentially, the predicted values indicate how the school is expected to score based on how other schools in the state with similar demographics have performed on the same test.

The residual is the difference between the actual score and the predicted score. If the residual score is negative, then the school is doing worse than expected. If the residual score is positive, the school is performing better than expected. The rows in the tables contain the average annual change scores, which indicate the relative direction in which the school is moving. For example, the school may have all negative residual scores; but if they are becoming less negative over time, the average annual change score will be a positive number. The average annual change score is computed for patterns of actual, predicted, and residual scores across time by subtracting the first score from the most recent and dividing by the number of observations (e.g., years) minus 1.

It is important to note that the results in Table 3 and Figure 1 are aggregate results across all charter schools with available data. When calculating the aggregate results, we weighted the data by the relative number of test takers per school. For example, if a large school has extremely positive results, it will carry more weight than a small school with less positive results.

Actual Performance and Residual Gains for All Charter Schools

Table 3 and Figure 1 illustrate the overall results aggregated for all Illinois charter schools from 2001-02 to 2005-06 for grades 5, 8, and 11. Data on the number of schools and students included in the results on each of the grade and subject-specific tests are also included in the table.

The dashed line in the charts in Table 3 indicates the actual (i.e., observed) scores for the charter schools. In other words, this illustrates the proportion of students that met or exceeded state standards. Based on these trend lines, we see that between 25 and 75 percent of the students in charter schools—depending on the test—typically are meeting state standards. This is generally lower than the state average (see Figure 2). The charter high schools appear to be serving students who are performing at noticeably lower levels. Nonetheless, the residuals for grade 11 are similar to the residuals for grades 5 and 8; and over time it appears that the grade 11 residuals are improving at a more rapid pace than the other grades.

Figure 2 illustrates the statewide trend in terms of percentage of students meeting or exceeding state standards in math and reading. One should be cautious in using state figures to evaluate charter schools, since the state results include a large portion of schools that are not similar in term of student demographics to charter schools. Our residual gains analyses, however, create a demographically similar comparison group for each and every charter school.

Reading and Math Proficiency on State Tests
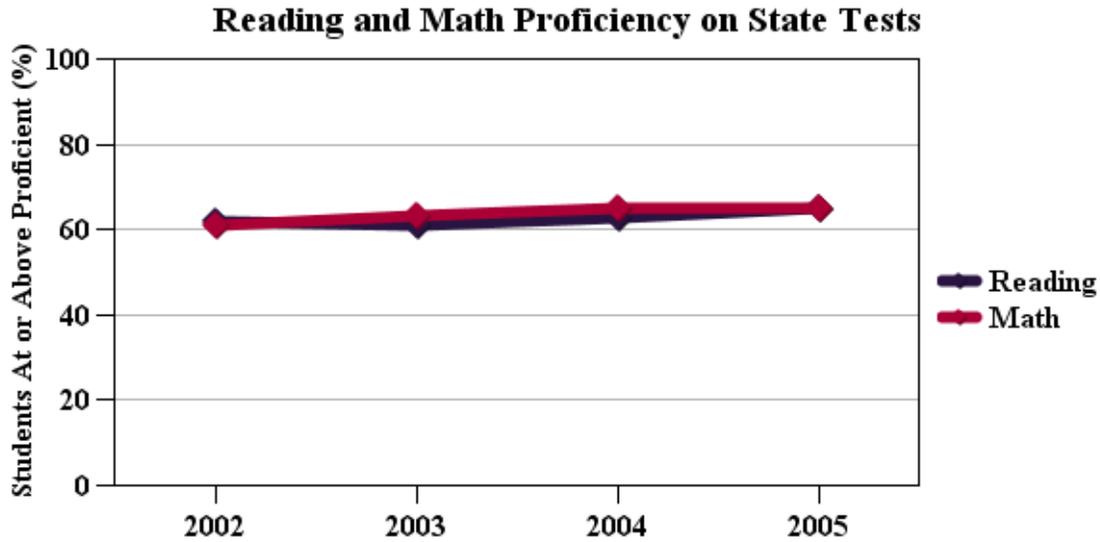
Figure 2. Performance on ISAT and PSAT from 2002-2005[14]

Actual Performance and Residual Gains for Same Cohort of Schools

The changes over time depicted in the results from Figure 1 may be due to the addition of new charter schools. The number of schools and the number of students included in each set of results are indicated in Table 3. Between the first and last test dates, from 7 to 19 charter schools were added to the aggregate results. Therefore, changes in overall results may be due to the inclusion of new schools. To control for this we tracked a subset of the same charter schools that had test data available for all years. The results from these aggregate results for cohorts of the same schools over time are included in Table 4 and illustrated in Figure 3.

The total number of schools decreased in these cohorts to 4 or 5 schools, but these schools are relatively large in size. The results in Table 4 are rather similar to the results for all schools presented in Table 3.   The dashed line simply indicates the percentage of charter school students meeting or exceeding state standards. The solid red line indicates the residuals, of which are all negative at the beginning of the trends and improve over time to the point where they cross over to becoming positive residuals, meaning that the schools are doing better than predicted, given their demographic composition. Grade 11 results show the largest improvement over time.

Table 4. Illinois Results from Cohorts of Same Schools Tracked Over Time

School Name	Year	Math					Reading				
		Schools	Students	Actual	Predicted	Residual	Schools	Students	Actual	Predicted	Residual
Grade 5	2002	4	282	56.76	58.79	-2.03	4	282	50.60	56.86	-6.26
	2003	4	142	64.31	65.82	-1.51	4	142	56.29	58.89	-2.60
	2004	4	451	52.01	69.96	-17.95	4	451	48.49	60.46	-11.97
	2005	4	480	63.62	73.89	-10.27	4	480	56.00	63.25	-7.25
	2006	4	578	71.50	64.95	6.55	4	578	53.91	54.47	-0.56
Average annual change				3.69	1.54	2.15			0.83	-0.60	1.43
Grade 8	2002	5	296	32.73	46.51	-13.78	5	296	61.58	68.21	-6.63
	2003	5	158	34.67	47.22	-12.55	5	158	58.21	64.39	-6.18
	2004	5	461	42.21	48.88	-6.67	5	461	63.75	67.27	-3.52
	2005	5	512	43.46	51.40	-7.94	5	512	73.75	73.20	0.55
	2006	5	613	71.85	64.29	7.56	5	613	75.26	70.91	4.35
Average annual change				9.78	4.45	5.34			3.42	0.67	2.75
Grade 11	2002	6	811	13.83	31.84	-18.01	6	811	25.26	41.13	-15.87
	2003	6	755	15.89	34.08	-18.19	6	755	29.66	40.85	-11.19
	2004	6	1,106	18.69	30.39	-11.70	6	1106	34.32	37.25	-2.93
	2005	6	1,235	20.89	25.90	-5.01	6	1235	40.36	38.25	2.11
	2006	6	1,390	21.97	18.09	3.88	6	1390	36.07	28.34	7.73
Average annual change				2.03	-3.44	5.47			2.70	-3.20	5.90
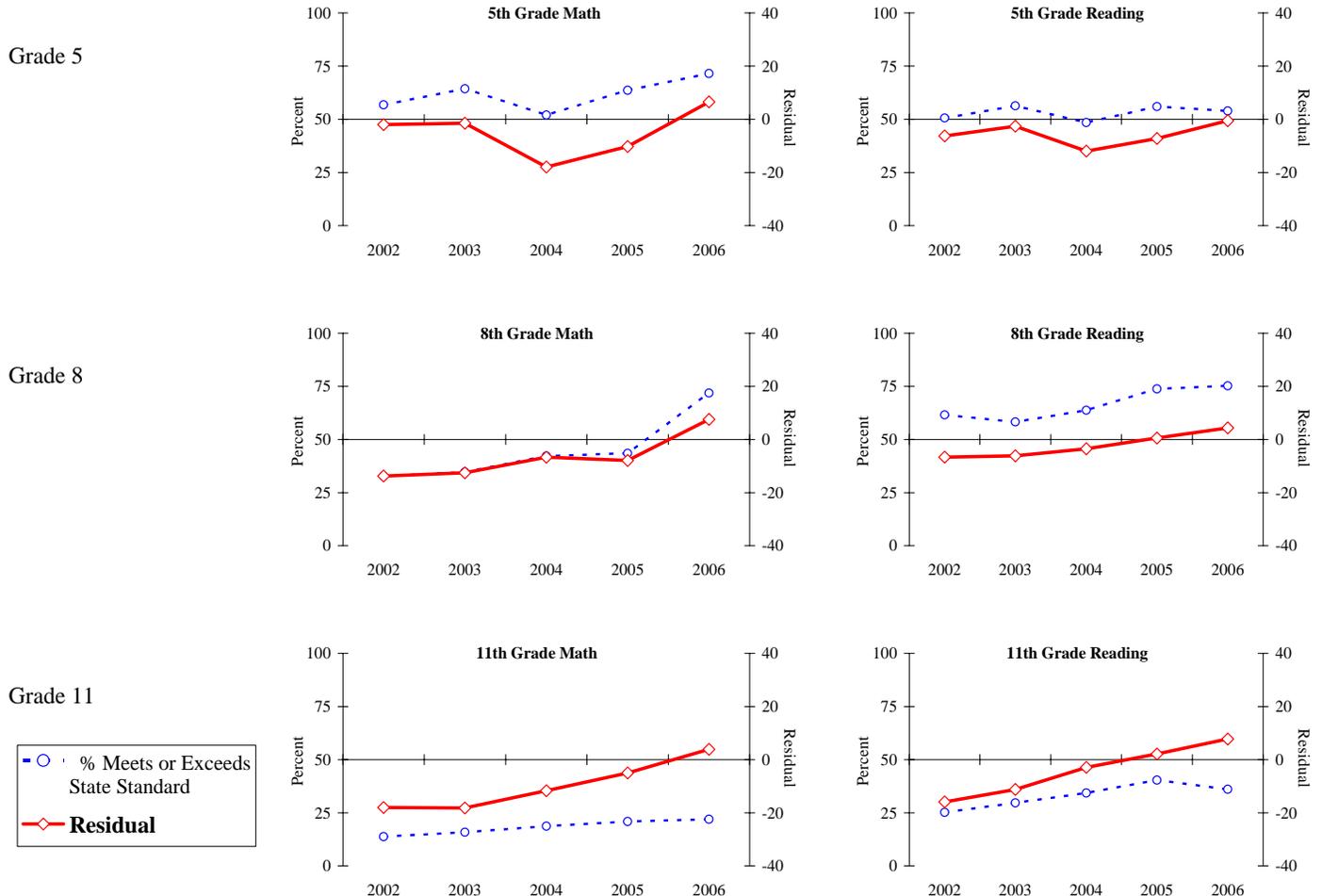
Figure 3. Illinois School Cohort Results: Residual Scores and Percent Meeting State Standards

Summary of Findings from Illinois

Two evaluation questions were asked in this study: (1) How does student achievement in charter schools compare to demographically similar public schools? (2) Are charter schools an effective strategy for improving student achievement over time? Results for these two questions are summarized in Tables 5 and 6. Table 5 presents a cross-sectional comparison of 6 mean test residuals by grade and subject for Illinois charter schools using the most recent year of available data. Results revealed 31 instances in which charter school residuals are positive (i.e., student achievement is higher than expected) and 23 instances in which they are negative (i.e., student achievement is lower than expected). In total, that means that 57 percent of the comparisons favored charter schools.

Table 5. Cross-Sectional Comparison Test Residuals by Grade for Charter Schools Using the Most Recent Year of Available Data (2006)

	Grade 5 Math	*Grade 5 Reading*	*Grade 8 Math*	*Grade 8 Reading*	*Grade 11 Math*	*Grade 11 Reading*	*Totals*
# Schools With Positive Residuals	5	3	7	8	4	4	31
# Schools with Negative Residuals	4	6	4	3	3	3	23

Table 6 presents a comparison of the average annual change in test residuals by grade for Illinois charter and cohort charter schools over five years. Results revealed that the residuals for charter schools overall are increasing by 3.79, and residuals for charter school cohorts are increasing by 3.84. This means that over a five-year period, the trend in student achievement is improving with the largest gains occurring at Grade 11.

Table 6. Comparison of Average Annual Change (AAC) in Test Residuals by Grade for Charter Schools and Charter School Cohorts Over Five Years (2002 to 2006)

	Grade 5 Math	*Grade 5 Reading*	*Grade 8 Math*	*Grade 8 Reading*	*Grade 11 Math*	*Grade 11 Reading*	*Mean AAC across all tests*
Average Annual Change in Residual Scores for All Schools with Available Data	+2.10	+2.16	+4.51	+2.79	+5.33	+5.86	+3.79
Average Annual Change in Residual Scores for Cohort of Same Schools	+2.15	+1.43	+5.34	+2.75	+5.47	+5.90	+3.84

As the results in this section reveal, Illinois charter schools are performing at levels that are similar or slightly better than demographically similar schools. Over time, the Illinois charter schools have seen steady and noticeable improvement. These impressive results are likely due to the closure of poor performing schools, which lifts the aggregate of remaining schools. It is also important to point out that the fact that we could not include special education and limited English proficiency when we created the predicted values also is likely to overestimate the results of charter schools. Nonetheless, even if we could have created estimates with special education and limited English proficiency, it is very likely that the improvement or growth trend over time would be similar to what we observe in Figures 1 and 3, although the trend line likely would have been lowered by 2 and 3 residual points at each annual data point.

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Evaluating the Impact of Charter Schools on Student Achievement:
A Longitudinal Look at the Great Lakes States

Appendix C

June 2007

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Appendix C
Student Achievement in Indiana Charter Schools

Indiana charter school law was approved in 2001 and later revised in 2003. Eleven charter schools opened in Indiana in 2002. Since then, the number of charter schools has continued to increase with 38 charter schools currently operating in the state with a total enrollment of more than 7,900 students. Charter school authorizers in Indiana include The Indianapolis mayor's office, Ball State University, and 3 school corporations: Carmel Clay School Corporation, Evansville-Vanderburgh School Corporation, and MSD Steuben County. While there is no cap on the number of charter schools in Indiana, the law stipulated that only 5 charters could be authorized in 2001-02 and that the number of charters that could be authorized would be increased by 5 in each subsequent year.

Indiana is generally considered to have a charter school law that is not restrictive. The Center for Educational Reform ranked Indiana sixth in the nation, grading it an "A."[1] This strong rating was due to the extensive autonomy granted the charter schools and the fact that multiple groups can authorize charter schools. Similarly, Chi and Welner (in press)[2] gave Indiana high marks for the public nature of the reform and relatively strong demands for accountability.

Ball State University[3] and the Indianapolis mayor's office[4] issued performance reports of the charter schools they sponsor. These studies show mixed results of student progress. Finch et al. (2007) conducted a study that yielded relatively positive results for Indiana charter school students. "The data revealed that students who attended charter schools for three years are more likely to meet normal growth benchmarks than those who are newer to charter schools."[5] In addition, they found that minority students who attended charter schools for three years achieved at a higher level than those who are new to the school.

Data Sources, Outcome Measures, and Methods for Analysis

We obtained demographic variables from the Common Core of Data at the National Center for Education Statistics (NCES).[6] These include school enrollment, ethnicity, free and reduced lunch, and urbanicity or locale. A variable designating whether or not a school was a charter school or traditional public school was used from this data set to distinguish the charter schools in the state. Student achievement test results, special education enrollment, and limited English proficiency enrollment data were obtained from the Indiana Department of Education Web site.[7] Since special education was only reported at the district level, we assigned the district value to all schools within the district. Since charter schools are their own districts, the special education data reported for them was actually building level data.

The outcome measure used for this analysis was the mean scale score from the Indiana state assessment (i.e., Indiana Statewide Testing for Educational Progress-Plus, also known as the ISTEP+)[8]. The scale score provided a more sensitive measure of change in the schools than a cut score; however, scale scores were missing for grade 10

in 2004-05. Although the state now tests students at grades 3-10, grades 3, 6, 8, and 10 were selected this analysis to permit comparison over multiple years. Overall, there were more limited years of data for Indiana's charter schools since this is the newest reform in the region, so the decision was made to include more than three grades in the analysis. Longitudinal data were available for math and language arts in grades 3, 6, 8, and 10. The five most recent years of data available for these grades were the 2002-03 through 2006-07 academic years.[9]   Table 1 illustrates the range of grades, years, and subjects included in our analyses.

Table 1. Test Data Used in Analyses by Year, Grade, and Subject

	2002-03	*2003-04*	*2004-05*	*2005-06*	*2006-07*
Grade 3	Language Arts Math	Language Arts Math	Language Arts Math	Language Arts Math	Language Arts Math
Grade 6	Language Arts Math	Language Arts Math	Language Arts Math	Language Arts Math	Language Arts Math
Grade 8	Language Arts Math	Language Arts Math	Language Arts Math	Language Arts Math	Language Arts Math
Grade 10	Language Arts Math	Language Arts Math	Language Arts Math	Language Arts Math	Language Arts Math

Variables Used to Create the Predicted Values for Each School

The data sets we created for Indiana were rather complete in terms of student achievement data, but not as complete in terms of demographic variables. Because there are relatively few charter schools in Indiana, it was critical that we sought to retain as many schools in our analyses as possible. For this reason, when schools were missing a demographic indicator for one or more years, we used mean substitution to impute the missing value so that the school would not be dropped from the analyses.[10]

Table 2. Variables Included in Residual Gain Score Analysis for Indiana

Variable	*Description*
Mean Scale Score (dependent variable)	School level mean scale score on the ISTEP+
Percentage Minority	Percentage of nonwhite and non-Asian-American students enrolled at the school i
Percentage Low Income	Percentage of students in school i receiving free or reduced lunch
Percentage Special Education	Percentage of students in school i with disabilities
Percentage Limited English Proficient	Percentage of students in school i classified as limited English proficient
Urbanicity (locale)	Rating from 1-8 indicating population density

Table 3 and Figure 1 illustrates our findings across all schools. Actual scores are simply the observed school-level score (i.e., mean scale score) for each grade and subject level test. The predicted values were created using an ordinary least squares multiple regression procedure, in the form of this linear equation:

$$Y_i = a + b_1 MINORITY_i + b_2 LOWINCOME_i + b_3 SPED_i + b_4 LEP_i + b_5 URBANICITY_i + \varepsilon_i$$

The variables included in the regression analysis are described in Table 2. Essentially, the predicted values indicate how the school is expected to score based on how other schools in the state with similar demographics have performed on the same test.

The residual is the difference between the actual score and the predicted score. If the residual score is negative, then the school is doing worse than expected. If the residual score is positive, the school is performing better than expected.

The rows in the tables contain the average annual change scores, which indicate the relative direction in which the school's performance is moving.   For example, a school may have all negative residual scores; but if it is becoming less negative over time, the average annual change score will be a positive number. The average annual change score is computed for patterns of actual, predicted, and residual scores across time by subtracting the first score from the most recent and dividing by the number of observations (e.g., years) minus 1.

The five year trends we sought to construct run from 2003 to 2007. At grade 8, there were no test results in math and reading for 2003 and 2004. Also note that there were no scale score for grade 10 in 2005. These gaps in test results were common for both charter schools and traditional public schools.

Because of the limited number of charter schools and the limited number of years of test data for the Indiana charter schools—and because there were no upper elementary grades with longitudinal test data—we opted to include and track an additional grade level. In the other five Great Lakes states we tracked 3 grades, however, in Indiana we tracked 4 grades (i.e., grades, 3, 6, 8, and 10).

Actual Performance and Residual Gains for All Charter Schools

It is important to note that the results in Table 3 and Figure 1 are aggregate results across all charter schools with available data. When calculating the aggregate results, we weighted the data by the relative number of test takers per school. For example, if a large school has extremely positive results, it will carry more weight than a small school with less positive results.

Appendix C: Student Achievement in Indiana Charter Schools

Table 3. Indiana Aggregate Results by Grade, Subject, and Year

School Name	Year	Math					Language Arts				
		Schools	Students	Actual	Predicted	Residual	Schools	Students	Actual	Predicted	Residual
Grade 3	2003	7	152	369.16	405.83	-36.66	36	152	400.73	426.01	-25.28
	2004	10	374	367.28	412.34	-45.06	36	374	400.09	428.36	-28.27
	2005	11	401	386.49	416.99	-30.49	36	401	407.47	431.94	-24.48
	2006	17	703	388.73	411.11	-22.38	37	703	414.32	427.70	-13.38
	2007	21	887	378.75	402.03	-23.28	37	887	405.00	417.29	-12.29
Average annual change				2.40	-0.95	3.35			1.07	-2.18	3.25
Grade 6	2003	1	18	426.00	469.77	-43.77	1	18	471.00	487.96	-16.96
	2004	4	113	439.44	471.56	-32.12	4	113	463.79	479.91	-16.12
	2005	10	306	465.41	481.56	-16.15	10	292	473.53	481.93	-8.39
	2006	14	514	468.83	486.12	-17.29	14	514	472.46	485.78	-13.33
	2007	17	645	483.08	493.81	-10.73	17	645	478.31	483.35	-5.03
Average annual change				14.27	6.01	8.26			1.83	-1.15	2.98
Grade 8	2003	0					0				
	2004	0					0				
	2005	1	12	539.00	518.28	20.72	1	12	544.00	521.15	22.85
	2006	7	301	499.88	520.53	-20.65	7	301	515.51	528.32	-12.81
	2007	11	450	504.42	519.83	-15.41	11	450	514.05	519.60	-5.54
Average annual change				-17.29	0.78	-18.07			-14.97	-0.78	-14.20
Grades 10	2003	2	70	519.37	520.74	-1.37	2	70	519.46	509.12	10.34
	2004	3	112	517.30	502.11	15.19	3	112	517.74	493.61	24.13
	2005										
	2006	8	341	565.56	576.65	-11.09	8	341	556.04	557.91	-1.87
	2007	13	453	569.91	584.02	-14.11	13	485	555.69	558.94	-3.25
Average annual change				12.63	15.82	-3.19			9.06	12.46	-3.40

Grade 3

Grade 6

Grade 8

Grades 10

Legend: - ○ - Scale Scores; ◇ Residuals
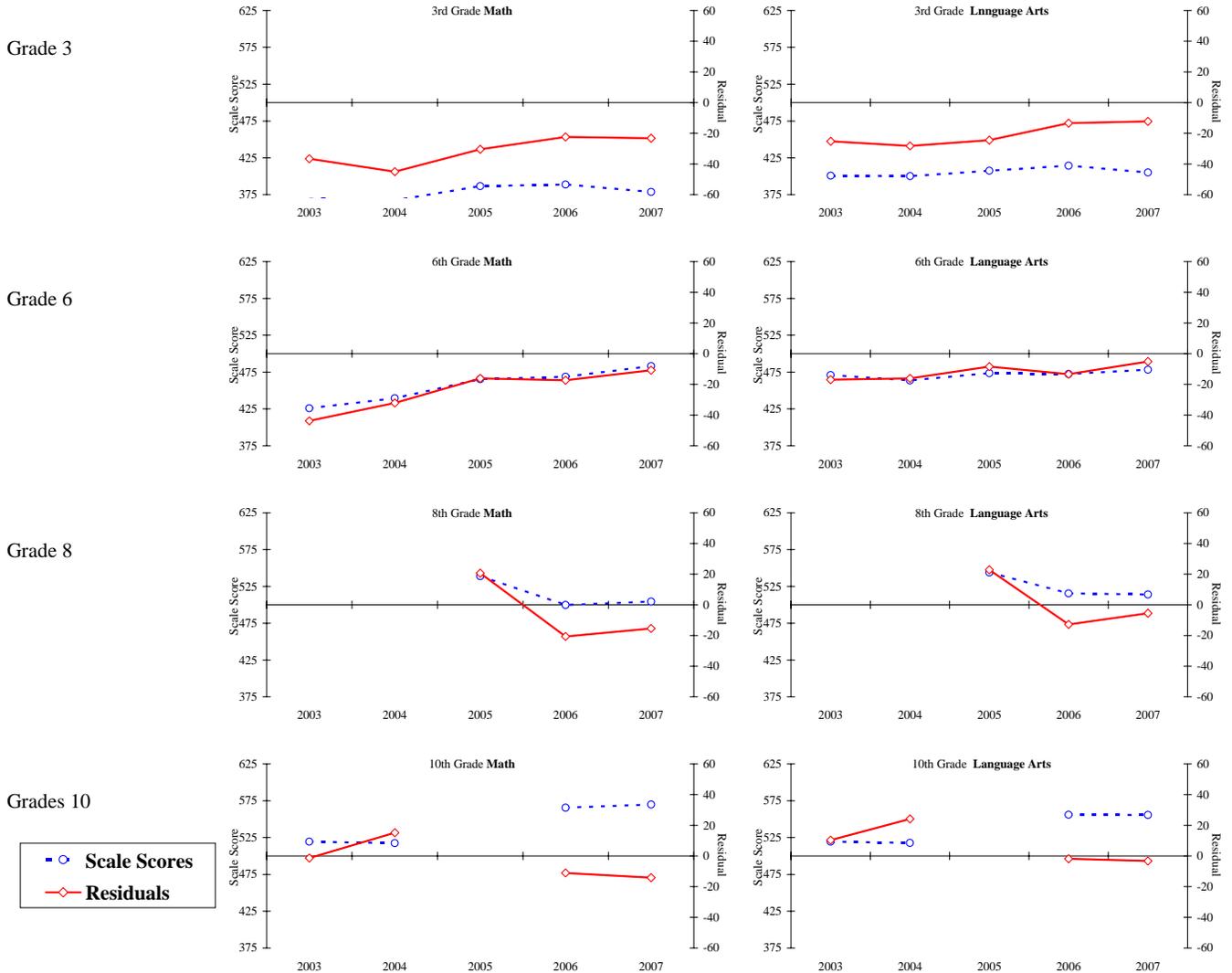
Figure 1. Indiana Aggregate Results: Residual Scores and Mean Scale Scores

The data and charts in Table 3 and Figure 1 illustrate the overall results aggregated for Indiana charter schools. The dashed line in the charts in Figure 1 indicates the actual (i.e., observed) scale scores for the charter schools. These scores are lower than state means and are generally lower than demographically similar schools represented by the predicted values.

Actual Performance and Residual Gains for Same Cohort of Schools

The changes over time depicted in Figure 1 are likely to be influenced by the addition of new charter schools and the growing enrollment in many of the initial schools. The number of schools and the number of students included in each set of results are indicated in Table 3. Note that the number of schools in the analyses fluctuates considerably from year to year. At grade 6, for example, the number of schools with valid test data increases from 1 in 2003 to 17 in 2007. Changes or lack of change in the test results are more likely to be due to the inclusion of new schools, rather than changes in performance among existing schools.

To control for the possibility that differences over time were due to changes in the schools included in the analyses, we tracked a subset of the same charter schools that had test data available over two or more years. At grade 3, we could create a cohort of seven schools that had test data reported for five consecutive years. At grade 6, the cohort was cut to three years during which ten schools had test data. For grades 8 and 10, we could only build two-year cohorts that contained seven and eight schools, respectively. The results from these aggregate results for cohorts of the same schools over time are illustrated in Table 4 and Figure 2.

The results for the cohorts of schools are rather similar to the results for all schools, although many of the trends are shorter in duration. The solid red line in Figure 2 indicates the residuals, which are consistently negative at grade 3 and 6. At grades 8 and 10, the residuals are also negative, but the schools are scoring closer to their predicted values.

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Table 4. Indiana Results from Cohorts of Same Schools Tracked Over Time

School Name	Year	Math					Language Arts				
		Schools	Students	Actual	Predicted	Residual	Schools	Students	Actual	Predicted	Residual
Grade 3	2003	7	152	369.16	405.83	-36.66	7	152	400.73	426.01	-25.28
	2004	7	188	382.34	413.25	-30.92	7	188	406.66	427.93	-21.26
	2005	7	189	402.76	414.13	-11.38	7	189	424.32	428.39	-4.07
	2006	7	253	401.78	420.82	-19.04	7	253	424.06	438.17	-14.11
	2007	7	250	393.83	411.97	-18.14	7	250	415.70	426.66	-10.96
Average annual change				6.17	1.54	4.63			3.74	0.16	3.58
Grade 6	2003										
	2004										
	2005	10	292	464.62	480.98	-16.36	10	292	473.53	481.93	-8.39
	2006	10	330	479.90	488.68	-8.78	10	330	480.38	487.71	-7.33
	2007	10	363	488.10	498.70	-10.60	10	363	483.16	488.08	-4.93
Average annual change				11.74	8.86	2.88			4.81	3.08	1.73
Grade 8	2003										
	2004										
	2005										
	2006	7	301	499.88	520.53	-20.65	7	301	515.51	528.32	-12.81
	2007	7	314	507.39	517.22	-9.83	7	314	516.99	518.28	-1.29
Average annual change				7.51	-3.31	10.82			1.48	-10.04	11.52
Grades 10	2003										
	2004										
	2005										
	2006	8	341	565.56	576.65	-11.09	8	341	556.04	557.91	-1.87
	2007	8	349	571.09	585.45	-14.37	8	349	560.12	560.75	-0.63
Average annual change				5.52	8.80	-3.28			4.08	2.84	1.23
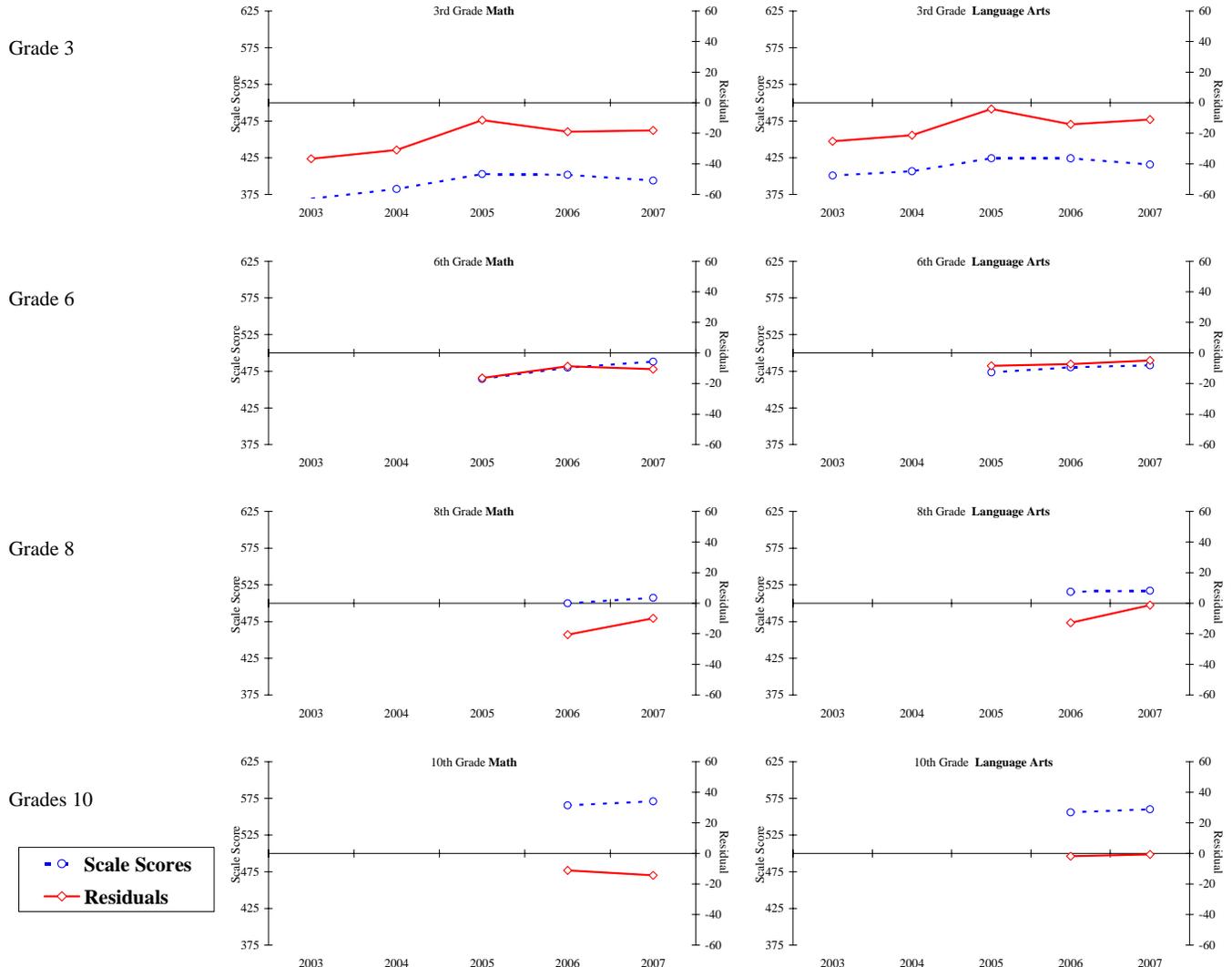
Figure 2. Indiana School Cohort Results: Residual Scores and Mean Scale Scores

Summary of Findings from Indiana

Two evaluation questions were asked in this study: (1) How does student achievement in charter schools compare to demographically similar public schools? (2) Are charter schools an effective strategy for improving student achievement over time? Results for these two questions are summarized in Tables 5 and 6. Table 5 presents a cross-sectional comparison of eight mean test residuals by grade for Indiana charter schools using the most recent year of available data (i.e., 2006-07). Results revealed 33 instances in which charter school residuals are positive (e.g., student achievement is higher than expected) and 90 instances in which they are negative (e.g., student achievement is lower than expected). In other words, only one-quarter of the comparisons favored charter schools. Therefore, one can conclude the charter schools in Indiana are currently performing at levels lower than predicted and lower than demographically similar traditional public schools.

Table 5. Cross-Sectional Comparison Test Residuals by Grade for Charter Schools Using the Most Recent Year of Available Data

	Grade 4 Math	*Grade 4 Reading*	*Grade 6 Math*	*Grade 6 Reading*	*Grade 8 Math*	*Grade 8 Reading*	*Grade 10 Math*	*Grade 10 Reading*	*Totals*
Schools with Positive Residuals	4	4	5	5	3	4	4	4	33
Schools with Negative Residuals	17	17	12	12	10	9	6	7	90

Table 6 contains data that seeks to answer our second evaluation questions: Are charter schools improving over time? The results in this table present a comparison of the average annual change in residual scores. The results are broken out for the aggregate of all Indiana charter schools, and for the cohort of same schools that we tracked over time. Results revealed that the residuals for charter schools overall are decreasing by 1.75 with the greatest decreases occurring in grade eight. This drop in residuals among the aggregate of all charter schools can be explained by the inclusion of new charter schools over time that have low test results. The residuals for the cohort of charter schools show an average increase of 3.27 residual points per year with the greatest increases occurring in grade eight.

Table 6. Comparison of Average Annual Change (AAC) in Test Residuals by Grade for Charter Schools and Charter School Cohorts Over Five Years

	Grade 3 Math	Grade 3 Reading	Grade 6 Math & Reading	Grade 8 Math & Reading	Grade 10 Math	Grade 10 Reading	Totals
Average Annual Change in Residuals	3.35	3.25	5.62	-16.13	-3.19	-3.40	-1.75
Average Annual Change in Residual Scores for Cohort	4.63	3.58	2.31	11.17	-3.28	1.23	3.27

In summary, Indiana's charter schools are not performing as well as predicted. On the whole, charter schools lag behind state performance levels, and they are performing at levels that are lower than demographically similar traditional public schools. Although this reform is still relatively new, the trends for the cohort of schools we tracked indicated that Indiana's charter schools are improving over time and decreasing the gap in performance between themselves and demographically similar public schools in the state.

Notes and References

[1] Retrieved [March 15, 2007] from http://www.edreform.com/_upload/ranking_chart.pdf.

[2] Chi, W. C., & Welner, K. G. (in press). Charter ranking roulette: An analysis of reports that grade states' charter school laws. *American Journal of Education*.

[3] Finch, W.H., Baker-Boudissa, M., & Cross, T. (2007). *ISTEP+ Performance for Indiana charter school students.* Muncie, IN: Office of Charter School Research, Ball State University.

[4] Indianapolis Mayor's Office (2006). *Indianapolis mayor's office fourth year charter review*. Indianapolis: Indianapolis mayor's office.

[5] Finch, W.H., Baker-Boudissa, M., Cross, T. (2007). *Student progress and achievement in Indiana charter schools: The impact of continued enrollment.* Muncie, IN: Office of Charter School Research, Ball State University.

[6] The Web site for the Common Core of Data is http://nces.ed.gov/ccd/.

[7] Retrieved [March 26, 2007] from http://www.doe.state.in.us/htmls/education.html

[8] Retrieved [March 23, 2007] from http://www.learnmoreindiana.org/k12academics/Assessments/Pages/ISTEP+.aspx

[9] Retrieved [February 20, 2007] from http://www.doe.state.in.us/istep/welcome.html.

[10] For example, if a school reported that it had 70 percent minority students in 2003, no data in 2004 and 90 percent minority students in 2005, we would insert a value of 80 percent for the missing data point. There was insufficient data among charter schools to conduct more sophisticated approaches for imputing missing values.

Evaluating the Impact of Charter Schools on Student Achievement:
A Longitudinal Look at the Great Lakes States

Appendix D

June 2007

Appendix D
Student Achievement in Michigan Charter Schools

The Michigan charter school law was approved in 1993.   Given that there were multiple authorizers and given pressure applied—and incentives provided—by the governor,[1] the number of charter schools increased rapidly until 1999 when the state cap on university-sponsored charter schools was met. Since 2000, the growth in the number of charter schools has slowed considerably. Currently, around 220 charter schools are reportedly operating. These schools enroll more than 82,000 students which accounts for approximately 4.6 percent of all public school students in the state.

Aside from the cap on university-sponsored charter schools, the Michigan charter school law is generally seen to be among the least restrictive. The Center for Education Reform consistently rates Michigan's charter school law among the most permissive.[2] Chi and Welner (in press)[3] rated Michigan as one of the weakest charter school laws, because of issues related to equity of access, accountability, and proliferation of private interests. Michigan's charter school reform is unique in that three-quarters of its charter schools are operated by for-profit education management organizations. Michigan is also somewhat unique in that the average size of charter schools in approaching the average size of traditional public schools.

Because of the large number of charter schools operating in the state in the 1990s, Michigan became the focus of a number of studies that examined student achievement in charter schools. All of the independent studies found charter schools to be performing at levels that were lower than comparison groups. Eberts and Hollenbeck (2002), for instance, found that Michigan charter schools scored between 2 and 4 percent lower than comparable host districts on the state assessment tests.[4] Miron and Nelson (2002) found that charter school trends in performance were either indistinguishable from or lower than those of their host districts in all grades and areas except fifth grade science.[5] Similarly, Bettinger (1999) reported generally negative findings; however, he found some evidence that charter schools had moved some students out of the "low" category on the state examination.[6]   In a more recent Michigan Department of Education (2006) report to the legislature, an analysis of 2005 test results indicated that charter schools has scores that were lower overall than non-charter public schools in both English Language Arts and Mathematics, however, the charter schools had slightly higher proficiency rates than 18 urban host districts.[7]

Data Sources, Outcome Measures, and Methods for Analysis

We obtained demographic variables from the Common Core of Data at the National Center for Education Statistics (NCES).[8] These include variables covering school enrollment, ethnicity, free and reduced lunch, and urbanicity or locale. A variable designating whether or not a school was a charter school or traditional public school was

used from this data set to distinguish the charter schools in the state. Student achievement test results and special education enrollment data were obtained from the Michigan Department of Education Web site.[9] Since special education was only reported at the district level, we assigned each district value to all schools within the district. Since charter schools are their own districts, the special education data reported for them were actually building or school level data. Unfortunately, it was not possible to obtain school level data regarding limited English proficiency. Therefore, we were not able to include this variable in the regression analyses.

The outcome measure we used for our analyses was the percentage of students who met or exceeded state standards on the state assessment (Michigan Educational Assessment Program—MEAP). Although the state now tests students at grades 3-8, and 11, we selected grades 4 and 7, 8, and 11 for our analyses since these were the only grades in which we could track trends on the math and reading assessment for 5 or more years. [10] We were fortunate to have access to the most recent results from the state test administered in the autumn of 2006. Working backwards from there we selected the 2002-03 to 2006-07 academic years in order to establish 5 years trends. Table 1 illustrates the range of grades, years, and subjects included in our analyses.

Table 1. Test Data Used in Analyses by Year, Grade, and Subject

	2002-03	*2003-04*	*2004-05*	*2005-06*	*2006-07*
Grade 4	Reading Math	Reading Math	Reading Math	Reading Math	Reading Math
Grade 7	Reading	Reading	Reading	Reading	Reading
Grade 8	Math	Math	Math	Math	Math
Grade 11	Reading Math	Reading Math	Reading Math	Reading Math	Reading Math

Variables Used to Create the Predicted Values for Each School

The data sets we created for Michigan were rather complete in terms of student achievement data but not as complete in terms of demographic variables. However, given that we had relatively large numbers of schools to track over time, we did not seek to impute missing demographic values. This means that a number of schools that have not reported data, such as the proportion of students qualified for free or reduced lunch, are dropped from the analyses. One exception to this was the 2006-07 demographic data.

Although we were able to obtain very recent test data from the autumn of 2006, the corresponding demographic variables will not be available until the summer of 2007. Our preference was to establish the 5 year trend of data including 2006-07, since the alternative was to start the trend in 2001-02 which was a year with noticeably more missing data on ethnicity and free and reduced lunch status. Rather than impute values on demographic variables for the 2006-07 school year, we simply used the 2005-06 variables on percent minority and percent low-income in the regression models for 2006-07. As noted earlier in the report, the quality and completeness of data on both student achievement and demographics has been improving dramatically with each passing year.

This trade-off allowed us to include the most recent year of test data and exclude an earlier year when the data was less complete. However, this represents a compromise in the methodology and a potential limitation, especially if the demographic composition of the charter schools has shifted between 2005-06 and 2006-07. Table 2 displays the variables used in developing the residual gain score analysis for Michigan.

Table 2. Variables Included in Residual Gain Score Analysis for Michigan

Variable	Description
Percentage passing (dependent variable)	Percentage of students meeting or exceeding state standards on the Michigan Educational Assessment Program (MEAP) tests
Percentage minority	Percentage of nonwhite and non-Asian American students enrolled at the school *i*
Percentage low income	Percentage of students in school *i* receiving free or reduced lunch
Percentage special education	Percentage of students in school *i* with disabilities
Urbanicity (Locale)	Rating from 1-8 indicating population density

Actual Performance and Residual Gains for All Charter Schools

Table 3 and Figure 1 illustrate our findings across all schools. Actual scores are simply the observed school-level score (i.e., the percentage of students meeting or exceeding state standards) for each grade and subject level test. The predicted values were created using an ordinary least squares (OLS) multiple regression procedure, in the form of this linear equation included below:

$$Y_i = a + b_1 MINORITY_i + b_2 LOWINCOME_i + b_3 SPED_i + b_4 URBANICITY_i + \varepsilon_i$$

The variables included in the regression analysis are described in Table 2. Essentially, the predicted values indicate how the school is expected to score based on how other schools in the state with similar demographics have performed on the same test. The residual is the difference between the actual score and the predicted score. If the residual score is negative, then the school is doing worse than expected. If the residual score is positive, the school is performing better than expected.

Table 3. Michigan Aggregate Results by Grade, Subject, and Year

School Name	Year	Math					Reading				
		Schools	Students	Actual	Predicted	Residual	Schools	Students	Actual	Predicted	Residual
Grade 4	2003	136	6,409	44.81	56.48	-11.67	135	6,380	56.07	65.46	-9.39
	2004	144	6,668	55.44	64.78	-9.34	145	6,634	65.54	72.45	-6.91
	2005	160	7,131	56.44	63.61	-7.17	159	7,018	70.75	73.52	-2.78
	2006	161	7,800	68.51	72.40	-3.89	158	7,601	72.86	76.91	-4.05
	2007	164	8,201	74.25	75.90	-1.65	162	8,004	76.92	78.80	-1.87
Average annual change				7.36	4.85	2.51			5.21	3.33	1.88
Grade 7 Reading Grade 8 Math	2003	104	4,189	31.44	39.10	-7.66	113	5,197	44.88	48.78	-3.91
	2004	116	4,895	47.23	46.96	0.27	120	5,643	48.02	50.35	-2.34
	2005	121	5,122	46.73	48.63	-1.90	127	6,089	62.06	63.62	-1.56
	2006	126	5,961	46.09	48.68	-2.59	131	6,789	65.85	66.72	-0.87
	2007	129	6,535	52.45	53.98	-1.53	140	7,438	70.42	70.61	-0.19
Average annual change				5.25	3.72	1.53			6.38	5.46	0.93
Grade 11	2002	39	1,103	38.53	45.75	-7.22	37	1,056	52.18	58.17	-5.99
	2003	37	1,218	38.75	43.29	-4.54	35	1,183	56.33	54.71	1.62
	2004	38	1,347	40.24	32.79	7.45	39	1,357	65.67	55.76	9.91
	2005	42	1,703	31.29	36.06	-4.77	43	1,696	66.22	66.52	-0.29
	2006	50	2,237	27.76	36.23	-8.47	53	2,266	56.09	60.49	-4.40
Average annual change				-2.69	-2.38	-0.31			0.98	0.58	0.40
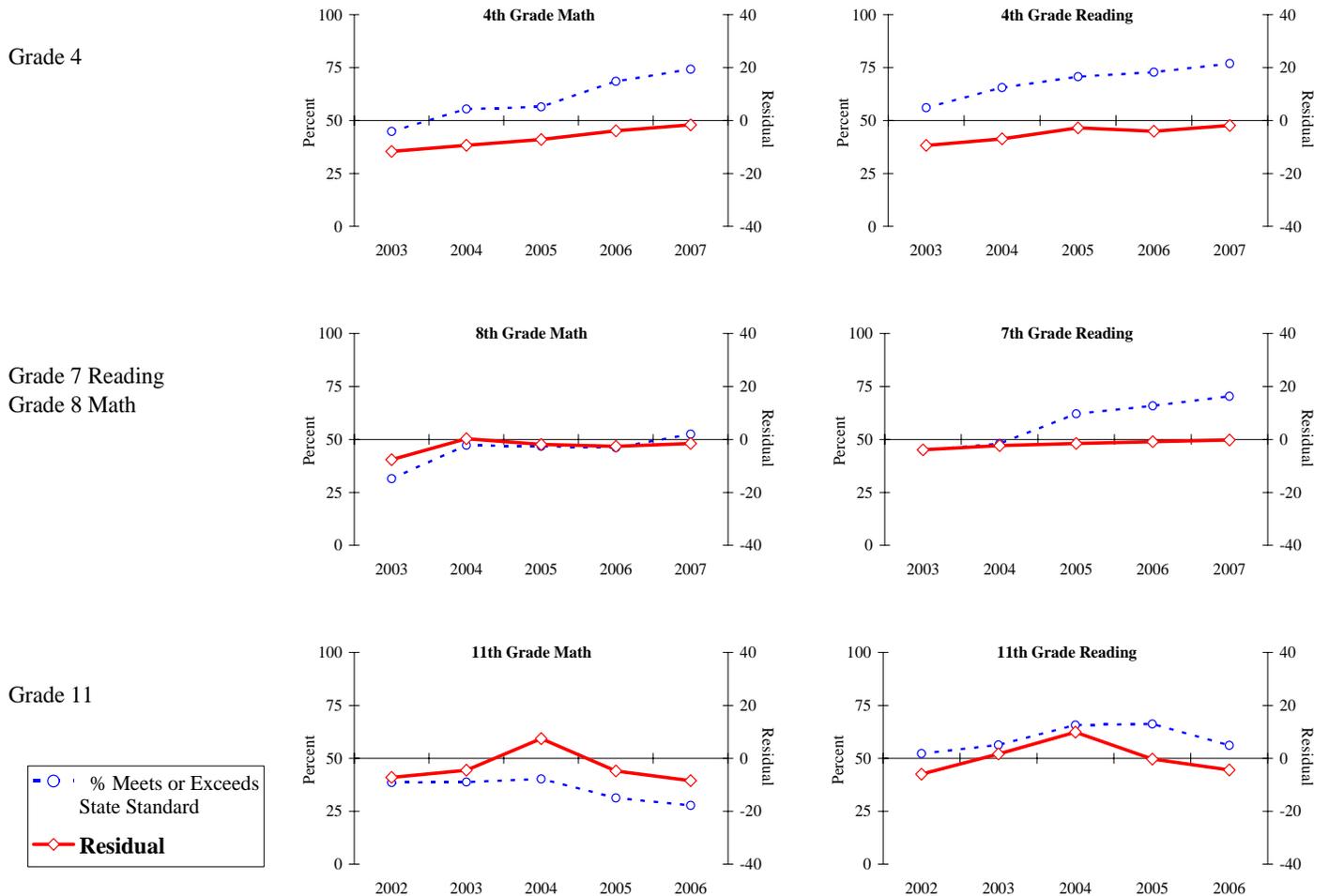
Figure 1. Michigan Aggregate Results: Residual Scores and Percent Meeting State Standards

The rows in the tables contain the average annual change scores, which indicate the relative direction in which the school's performance is moving.   For example, a school may have all negative residual scores; but if it is becoming less negative over time, the average annual change score will be a positive number. The average annual change score is computed for patterns of actual, predicted, and residual scores across time by subtracting the first score from the most recent and dividing by the number of observations (e.g., years) minus 1.

It is important to note that the results in Table 3 are aggregate results across all charter schools with available data. When calculating the aggregate results, we weighted the data by the relative number of test takers per school. For example, if a large school has extremely positive results, it will carry more weight than a small school with less positive results.

The findings illustrated in the charts contained in Figure 1 are for the aggregate of all Michigan charter schools. The dashed line in the charts indicates the actual proportion of students that meet or exceed state standards. Based on these trend lines, we see that typically between 35 and 75 percent of the students in charter schools are meeting state standards.   The results are much more positive at the elementary school level, and progressively less positive at grades 7, 8, and 11.

Overall the charter school results are still noticeably lower than state averages. Figure 2 illustrates the statewide trend in terms of percentage of students meeting or exceeding state standards in math and reading. Nevertheless, state figures should not be used to evaluate charter schools, since the state results include a large portion of schools that are not similar to charter schools in term of student demographics. Our residual gains analyses, however, create demographically similar comparison groups for each and every charter school.

Figure 2.   Performance on MEAP Tests from 2003-2005[11]

Actual Performance and Residual Gains for Same Cohort of Schools

The number of schools and the number of students included in each set of results are clearly indicated in Table 3. Note that the number of schools in the analyses fluctuates considerably from year to year. The reason for this is because of the differences in the completeness of available data for the charter schools. In some years, as many as 164 schools have complete data and a suff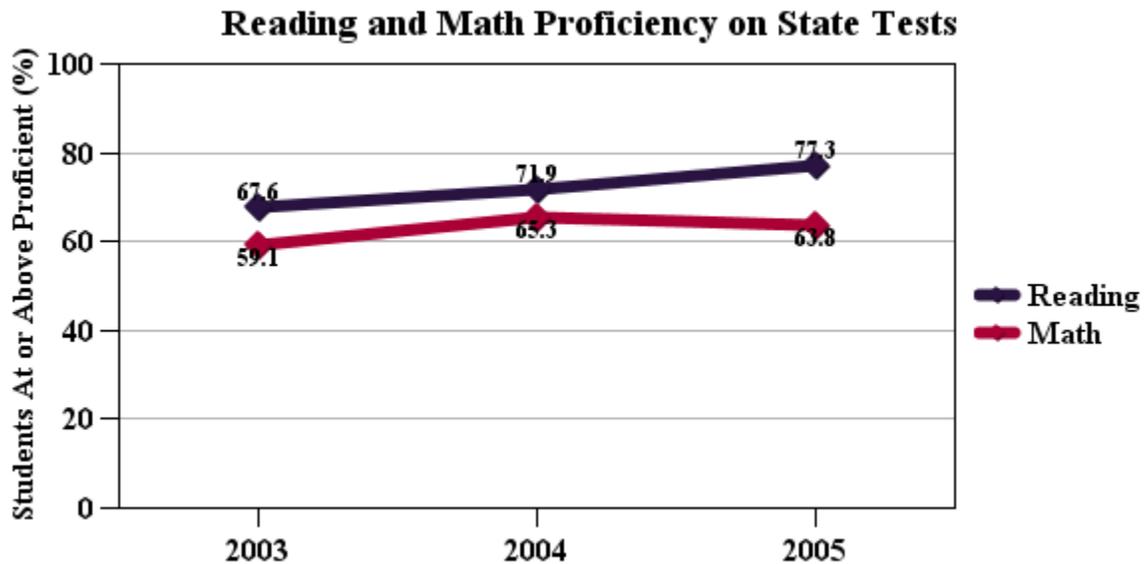icient number of test takers at grade 4 required to have the data publicly reported. In other years, the number of schools with valid test data at grade 4 was as low as 125. Another reason for the change in the number of schools included is the addition of new schools, or the exclusion of schools when they are closed. Even with the cap on state university sponsors in place, Michigan continues to add new charter schools; most are chartered by Bay Mills Community College. An increasing number of charter schools are also opening additional buildings under the same charter which has also promoted growth in the number of charter schools. Sometimes, these new buildings (that receive a unique state school code) are at the same site as the original charter school, and sometimes they are miles apart.

To control for the possibility that differences in results over time are due to changes in the schools included in the analyses, we tracked a subset of the same charter schools that had test data available over five years. At grade 4, this cohort included 121 schools, at grade seven 87 schools were included, and at grade eight 94 schools were included   At grade 11, only 27 schools could be tracked over the 5 year trend. The results from these aggregate results for cohorts of the same schools over time are included in Table 4 and Figure 3.

The results in Table 4 and Figure 3 are rather similar to the results for all schools, although on the whole the trend lines are slightly "flatter" for the cohorts. Overall results at grades 4 and 6 were consistently lower than their demographically matched peers. The solid red line indicates the residuals, which are consistently negative but become progressively less negative over time. By 2007, most of the trends are leveled out as the charter schools reached performance levels similar to their demographically matched peers.

Compared to the other Great Lakes states, we see far fewer differences between the aggregate results for all charter schools and the cohort of same schools in Michigan. This is likely to be due to the fact that Michigan has clearly the most charter schools with valid data available. Also this is likely to be due to the fact that the composition of charter schools is changing less over time in Michigan than in the other states. Finally, this is also likely to be due to a more homogeneous population of charter schools in Michigan than we find in the other Great Lakes' states.

Although the results in illustrated in Figure 3 are gradually improving at grades 4, 7, and 8, this is not the case with grade 11 where results have dropped sharply over the past 3 years.

Table 4. Michigan Results from Cohorts of Same Schools Tracked Over Time

| School Name	Year	Math					Reading				
		Schools	Students	Actual	Predicted	Residual	Schools	Students	Actual	Predicted	Residual
Grade 4	2003	121	6,000	45.84	57.05	-11.21	119	5,847	57.40	65.98	-8.58
	2004	121	6,049	56.83	65.07	-8.24	119	5,932	66.69	72.90	-6.21
	2005	121	6,027	58.95	63.28	-4.33	119	5,822	72.91	73.34	-0.43
	2006	121	6,216	71.15	72.56	-1.41	119	6,027	74.67	77.15	-2.48
	2007	121	6,365	76.56	76.08	0.48	119	6,178	78.78	79.01	-0.22
Average annual change				7.68	4.76	2.92			5.35	3.26	2.09
Grade 7 Reading **Grade 8 Math**	2003	87	3,596	33.14	40.59	-7.45	94	4,414	47.13	50.73	-3.61
	2004	87	3,874	50.53	48.20	2.33	94	4,627	50.20	51.68	-1.48
	2005	87	4,097	49.03	49.24	-0.21	94	4,786	63.89	64.75	-0.86
	2006	87	4,422	48.85	49.52	-0.68	94	5,106	68.00	67.90	0.10
	2007	87	4,629	56.52	54.71	1.81	94	5,224	72.65	71.75	0.90
Average annual change				5.84	3.53	2.31			6.38	5.25	1.13
Grade 11	2002	27	844	41.71	44.72	-3.01	27	824	54.98	57.71	-2.73
	2003	27	1,046	38.62	42.10	-3.48	27	1,020	56.96	54.59	2.37
	2004	27	1,160	39.22	31.06	8.16	27	1,140	67.47	54.13	13.34
	2005	27	1,190	32.68	36.68	-3.99	27	1,183	67.80	66.83	0.97
	2006	27	1,323	30.69	37.37	-6.68	27	1,312	59.08	61.75	-2.67
Average annual change				-2.75	-1.84	-0.92			1.03	1.01	0.02

Grade 4

Grade 7 Reading
Grade 8 Math

Grade 11
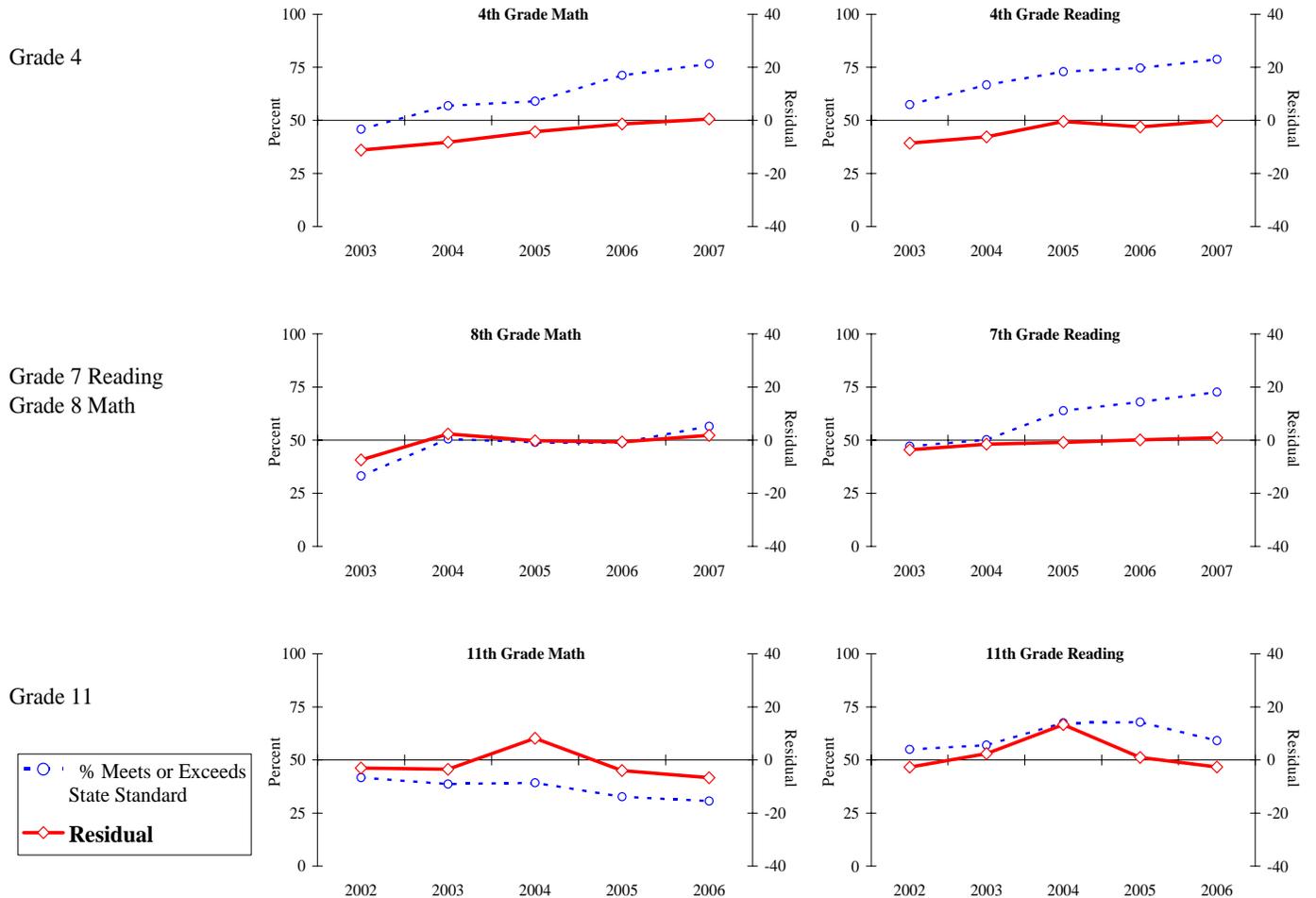
Figure 3. Michigan School Cohort Results: Residual Scores and Percent Meeting State Standards

Summary of Findings from Michigan

The evaluation questions in this study were (1) How does student achievement in charter schools compare to demographically similar public schools? (2) Are charter schools an effective strategy for improving student achievement over time? Results for these two questions are summarized in Tables 5 and 6, respectively. Table 5 presents a cross-sectional comparison of six mean test residuals (one for each grade and subject specific test included in the analyses) for Michigan charter schools using the most recent year of available data. Results revealed 298 instances in which charter school residuals are positive (i.e., student achievement is higher than expected) and 400 instances in which they are negative (i.e., student achievement is lower than expected). Across all school comparisons, only 42.7 percent of the comparisons favored charter schools. These findings represent some improvement over earlier studies, but still the majority of charter schools are still trailing behind demographically similar traditional public schools.

Table 5. Comparison of Schools with Positive or Negative Residuals in Most Recent Year of Available Data

	Grade 4 Math	Grade 4 Reading	Grade 8 Math	Grade 7 Reading	Grade 11 Math	Grade 11 Reading	Totals
Positive Residuals	66	66	57	67	19	23	298
Negative Residuals	98	96	72	72	32	30	400
Percent Positive	40.2%	40.7%	44.2%	48.2%	37.3%	43.4%	42.7%

Table 6 presents a comparison of the average annual change in test residuals by grade for the aggregate of all Michigan charter schools and for the cohort of same charter schools over five years. Results revealed that the residuals for charter schools overall are increasing by 1.16 points per year, on average, and residuals for the cohorts of same charter schools are increasing by an average 1.26 points per year. This means that over a five-year period, the trend in student achievement is increasing for the charter schools.

Table 6. Comparison of Average Annual Change (AAC) in Test Residuals by Grade for Charter Schools and Charter School Cohorts Over Five Years (2003 to 2007)

	Grade 4 Math	Grade 4 Reading	Grade 8 Math	Grade 7 Reading	Grade 11 Math	Grade 11 Reading	Totals
Average Annual Change in Residuals	+2.51	+1.88	+1.53	+0.93	-0.31	+0.40	+1.16
Average Annual Change in Residual Scores for Cohort	+2.92	+2.09	+2.31	+1.13	-0.92	+0.02	+1.26

In summary, Michigan's charter schools—on the whole—are not performing better than demographically similar traditional public schools. However, except at grade 11,

there are incremental improvements being made each year. While the gap is closing, we can see in the trend lines for Michigan and the other Great Lakes States, that as charter school performance levels approach the performance levels of their demographically matched peers, they tend to flatten out rather than continue on the same growth trajectory.

Notes and References

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Evaluating the Impact of Charter Schools on Student Achievement:
A Longitudinal Look at the Great Lakes States

Appendix E

June 2007

EPIC Education and the Public Interest Center

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Appendix E
Student Achievement in Minnesota Charter Schools

Minnesota is renowned for passing the nation's first charter school law in 1991. This state has also been the focus of a number of charter school studies, although few of them have addressed the relative performance of the charter schools on standardized tests. A state evaluation of the charter school reform in 1998 contained some findings on student performance in charter schools. Unfortunately, data was only available for only a small number of schools and no comparison groups were considered. Essentially, the evaluators found that most charter schools were scoring below the 50th percentile on norm-referenced tests.[1] Loveless' (2003) study of charter performance across 10 states found that in Minnesota 33 percent of charter schools were failing as compared with 13 percent failure of all traditional public schools using the state's criteria for failure.[2]

Minnesota currently has close to 140 charter schools serving more than 22,000 students. Charter schools account for 2.6 percent of all public school enrollments in Minnesota. Minnesota's charter school reform has exhibited a relatively even pace of growth over the years.

Minnesota is generally seen to have a relatively permissive charter school law. The Center for Education[3] has consistently rated Minnesota's law as one of the least restrictive laws in the nation because multiple authorizers are permitted (e.g., local and intermediate school boards, public and private postsecondary institutions, and the state board of education, upon appeal). Also, there are no caps on the number of schools or students allowed in charter schools. Finally, conversions are permitted for both public and private schools.

Minnesota does not forbid for-profit education management organizations (EMOs), although they are not permitted to hold the charter contract. Relatively few EMOs are operating in the state.

Chi and Welner (in press)[4] suggested an alternative framework for rating and ranking charter school laws that places more emphasis on rigor of oversight, accountability, and measures to promote/ensure equity in access. According to their review, Minnesota's law was deemed to be rather strong and positive and was therefore ranked fifth among the 41 state charter school laws they reviewed.

Data Sources, Outcome Measures, and Methods for Analysis

We obtained demographic variables from the Common Core of Data at the National Center for Education Statistics (NCES).[5] These include variables covering school enrollment, ethnicity, free and reduced lunch, and urbanicity or locale. A variable designating whether or not a school was a charter school or traditional public school was used from this data set to distinguish the charter schools in the state. Student achievement

test results, special education enrollment, and limited English proficiency enrollment data were obtained from the Minnesota Department of Education Web site.[6]

The outcome measure we used for our analyses was the percentage of students who met or exceeded state standards on the Minnesota Comprehensive Assessments (MCA). Scale scores were available, but several schools did not have average scale scores reported. Had we used the scale score instead of cut score, close to 20 percent of the charter schools would have been dropped from the analysis. For this reason, we used the cut scores. The cut scores are divided across four categories: (1) does not meet standards, (2) partially meets standards, (3) meets standards, and (4) exceeds standards.

The MCA was administered to students in grades 3, 5, 7, 10, and 11. Data on these grades are available from 1998 until 2005. Starting in the 2005-06 academic year, a new version of the MCA (i.e., MCA-II) was rolled out for grades 3-8 and 11. Our analyses focused on math and reading from 2001-02 to 2005-06. This provided five-year trends for the test data for the elementary grades and three-year trends for grades 7, 10, and 11 where data were available only for 2003-04 through 2005-06.[7] Table 1 illustrates the range of grades, years, and subjects included in our analyses.

Table 1. Test Data Used in Analyses, by Year, Grade, and Subject

	2001-02	*2002-03*	*2003-04*	*2004-05*	*2005-06*
Grade 5	Reading Math	Reading Math	Reading Math	Reading Math	Reading Math
Grade 7			Reading Math	Reading Math	Reading Math
Grade 10			Reading	Reading	Reading
Grade 11			Math	Math	Math

Variables Used to Create the Predicted Values for Each School

In terms of the demographic variables required for the regression analyses, the data set we created for Minnesota was relatively complete compared to the other states in the study. No imputation of missing values was conducted, although in a number of instances schools were dropped from specific analyses because they had too few test takers (test results in Minnesota are not reported if there are fewer than 10 test takers in a specific group). For example, in the 2005-06 analyses, only 38 out of 55 schools had test data for grade 5; 32 of 47 schools had test data for grade 7; and 48 of 60 schools had test data for grade 11. This meant that between 20 and 30 percent of the schools had to be excluded because their test results were not reported. This may represent a bias in the data, since many of the small schools were excluded. In a very few cases, a school was dropped from specific analyses because it did not have complete demographic data available. Table 2 displays the variables used in developing the residual gain score analysis for Minnesota.

Table 2. Variables Included in Residual Gain Score Analysis for Minnesota

Variable	*Description*
Percentage passing (dependent variable)	Percentage of students meeting or exceeding state standards on the Minnesota Comprehensive Assessments
Percentage minority	Percentage of nonwhite and non-Asian American students enrolled at the school *i*
Percentage low income	Percentage of students in school *i* receiving free or reduced lunch
Percentage special education	Percentage of students in school *i* with disabilities
Percentage limited English proficient	Percentage of students in school *i* classified as limited English proficient
Urbanicity (Locale)	Rating from 1-8 indicating population density

Table 3 and Figure 1 illustrate our findings across all schools. "Actual" scores are simply the observed school-level score (i.e., the percentage of students meeting or exceeding state standards) for each grade and subject specific test. The predicted values were created using an ordinary least squares (OLS) multiple regression procedure, in the form of this linear equation included below:

$$Y_i = a + b_1 \, MINORITY_i + b_2 LOWINCOME_i + b_3 SPED_i + b_4 LEP_i + b_5 URBANICITY_i + \varepsilon_i$$

The variables included in the regression analysis are described in Table 2. Essentially, the predicted values indicate how the school is expected to score based on how other schools in the state with similar demographics have performed on the same test.

The residual is the difference between the actual score and the predicted score. If the residual score is negative, then the school is doing worse than expected. If the residual score is positive, the school is performing better than expected.

The rows in the tables contain the average annual change scores, which indicate the relative direction in which the school's performance is moving. For example, a school may have all negative residual scores; but if it is becoming less negative over time, the average annual change score will be a positive number. The average annual change score is computed for patterns of actual, predicted, and residual scores across time by subtracting the first score from the most recent and dividing by the number of observations (e.g., years) minus 1.

It is important to note that the results in Table 3 and Figure 1 are aggregate results across all charter schools with available data. When calculating the aggregate results, we weighted the data by the relative number of test takers per school. For example, if a large school has extremely positive results, it will carry more weight than a small school with less positive results.

Table 3. Minnesota Aggregate Results by Grade, Subject, and Year

School Name	Year	Math					Reading				
		Schools	Students	Actual	Predicted	Residual	Schools	Students	Actual	Predicted	Residual
Grade 5	2002	26	615	38.37	52.13	-13.76	26	619	46.69	56.34	-9.66
	2003	30	744	47.18	58.85	-11.68	31	756	51.46	61.81	-10.35
	2004	34	875	50.86	58.56	-7.70	34	876	53.65	58.92	-5.27
	2005	41	1068	56.27	65.54	-9.27	40	1036	59.65	66.65	-7.00
	2006	43	1123	35.17	42.53	-7.36	38	870	59.08	64.61	-5.53
Average annual change				-0.80	-2.40	1.60			3.10	2.07	1.03
Grade 7	2002										
	2003										
	2004	25	712	48.59	53.19	-4.60	25	707	54.93	56.45	-1.52
	2005	30	947	63.78	66.14	-2.36	30	936	63.99	65.13	-1.13
	2006	32	1023	47.21	48.65	-1.44	32	894	59.17	60.91	-1.73
Average annual change				-0.69	-2.27	1.58			2.12	2.23	-0.10
Grade 10 Reading **Grade 11 Math**	2002										
	2003										
	2004	37	966	38.51	44.52	-6.01	35	929	55.44	55.20	0.24
	2005	40	1026	44.74	48.76	-4.02	45	1280	59.22	60.16	-0.94
	2006	48	1290	10.54	14.73	-4.19	45	1138	47.10	45.67	1.43
Average annual change				-13.98	-14.89	0.91			-4.17	-4.76	0.60

Grade 5

Grade 7

Grade 10 Reading
Grade 11 Math

- ○ % Meets or Exceeds State Standard
- ◇ Residual

Figure 1. Minnesota Aggregate Results: Residual Scores and Percent Meeting State Standards

Actual Performance and Residual Gains for All Charter Schools

The data and charts in Table 3 and Figure 1 illustrate the overall results aggregated for all Minnesota charter schools from 2001-02 to 2005-06 for grade 5. The results for grades 7, 10, and 11 are limited to three years, since these are the only years in which consistent and comparable test data could be gathered for these grades and subjects.

The dashed line in the charts in Figure 1 indicates the proportion of students that meet or exceed state standards. Based on these trend lines, we see that typically between 44 and 60 percent of the students in charter schools are meeting state standards. This is noticeably lower than the state average, which is typically near or above 70 percent. Figure 2 illustrates the statewide trend in terms of percentage of students meeting or exceeding state standards in math and reading. Nevertheless, one should be cautious in comparing charter schools to the state average since the state results include a large portion of schools that are not similar in terms of student demographics to charter schools. Our residual gains analyses, however, create demographically similar comparison groups.
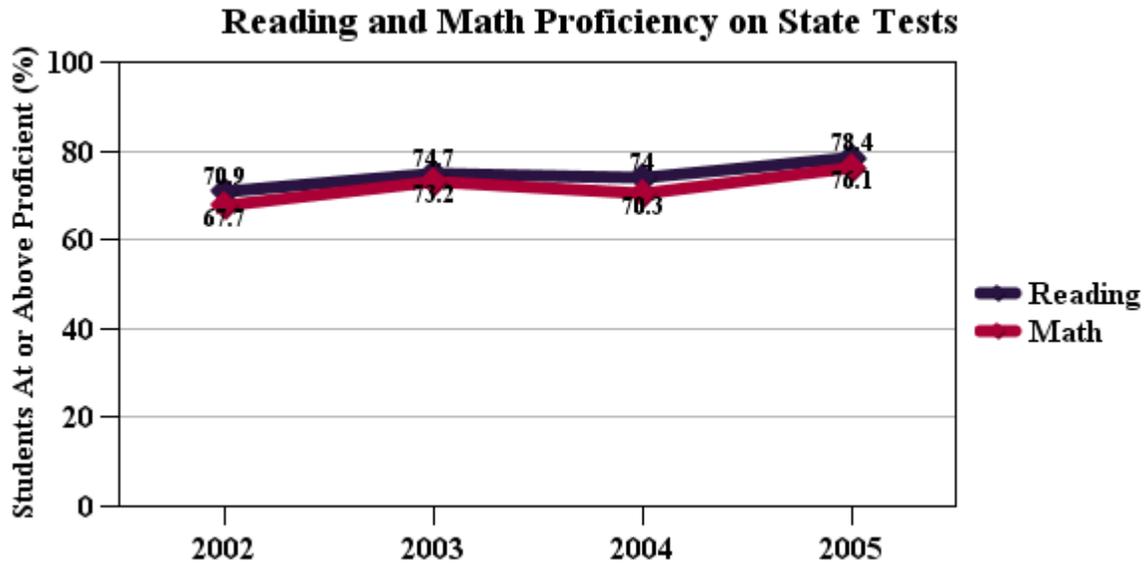
Figure 2. Performance on MCA from 2002-2005[8]

Actual Performance and Residual Gains for Same Cohort of Schools

As indicated in Table 3, from 7 to 19 charter schools were added to the aggregate results between 2002 and 2006. Therefore, changes in aggregate results may be due to the inclusion of new schools. To control for this, we tracked a subset of the same charter schools that had test data available for all years. The results from these aggregate results for cohorts of the same schools are illustrated in Table 4 and Figure 3.

Table 4. Minnesota Results from Cohorts of Same Schools Tracked Over Time

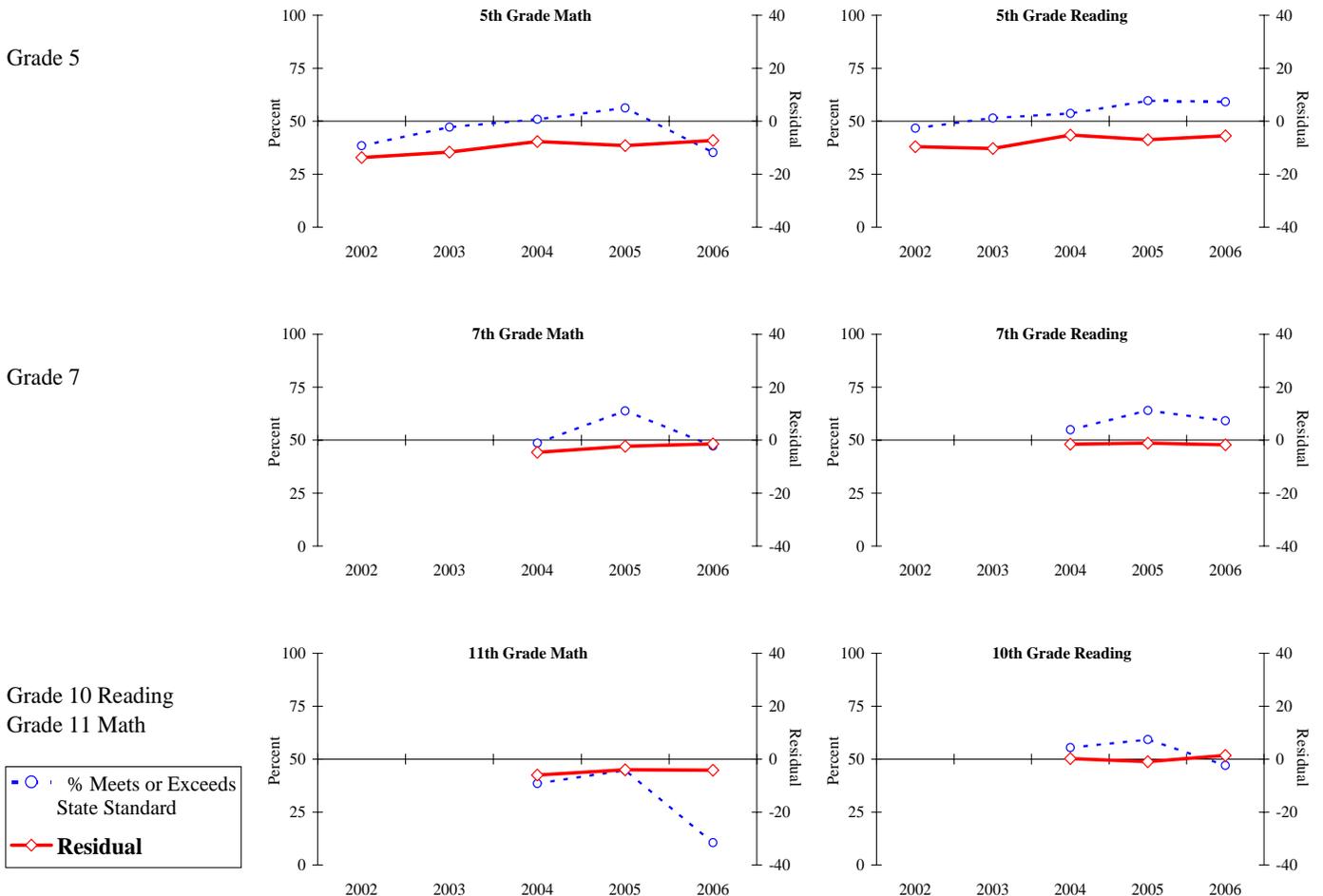| School Name	Year	Math					Reading				
		Schools	Students	Actual	Predicted	Residual	Schools	Students	Actual	Predicted	Residual
Grade 5	2002	19	468	39.53	51.29	-11.76	19	468	47.65	55.10	-7.45
	2003	19	484	47.11	57.18	-10.08	19	484	50.62	60.30	-9.68
	2004	19	535	50.28	56.84	-6.56	19	538	52.79	57.25	-4.46
	2005	19	573	53.40	61.27	-7.87	19	565	57.35	62.65	-5.31
	2006	19	613	28.87	38.23	-9.36	19	490	55.71	59.53	-3.82
Average annual change				-2.66	-3.26	0.60			2.02	1.11	0.91
Grade 7	2002										
	2003										
	2004	17	587	54.17	55.78	-1.61	17	582	61.22	58.73	2.50
	2005	17	664	62.95	63.88	-0.93	17	660	63.48	63.03	0.45
	2006	17	647	48.38	46.63	1.74	17	556	60.43	59.95	0.48
Average annual change				-2.90	-4.57	1.68			-0.40	0.61	-1.01
Grade 10 Reading Grade 11 Math	2002										
	2003										
	2004	28	61	58.22	2.42	-6.01	28	929	55.44	55.20	0.24
	2005	28	67	64.18	2.37	-4.02	28	1280	59.22	60.16	-0.94
	2006	28	48	44.87	2.95	-4.19	28	1138	47.10	45.67	1.43
Average annual change				-6.68	0.27	0.91			-4.17	-4.76	0.60
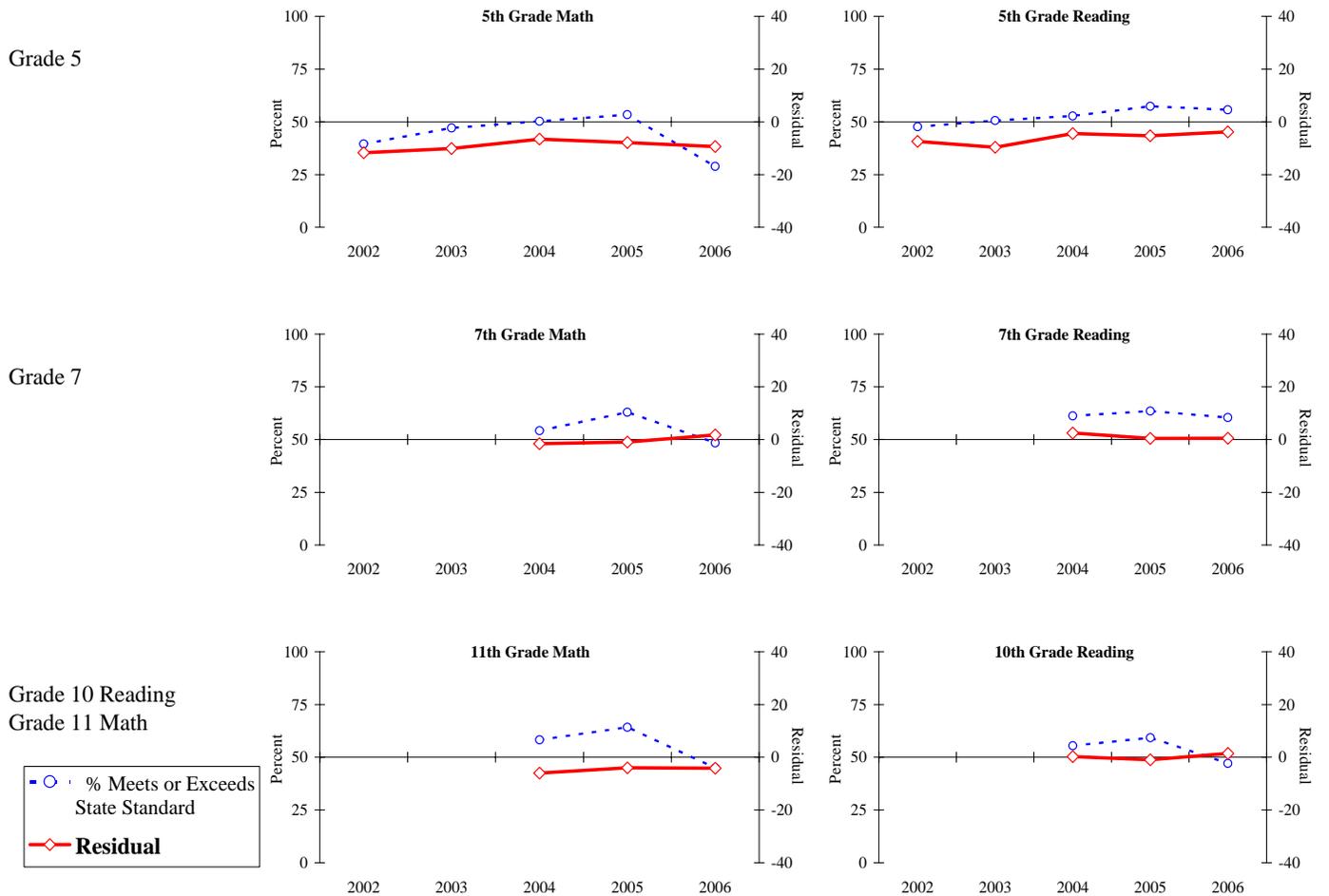
Figure 3. Minnesota School Cohort Results: Residual Scores and Percent Meeting State Standards

We were able to track between 17 and 28 schools in each of the cohorts. The results in Table 4 and Figure 3 are "flatter" and show less change over time. The actual performance levels illustrate that the schools consistently have between 30 and 60 percent of their students meeting or exceeding state standards. Overall results for grade 5 were consistently lower than for the other grades. The solid red line indicates the residuals, which are consistently negative at grade 5 but are close to "0" for grades 7 and 10. The math results at grade 11 are consistently lower than predicted, but show incremental improvements over time.

Summary of Findings from Minnesota

The evaluation questions in this study were (1) How does student achievement in charter schools compare to demographically similar public schools? (2) Are charter schools an effective strategy for improving student achievement over time? Results for these two questions are summarized in Tables 5 and 6, respectively. Table 5 presents a cross-sectional comparison of six mean test residuals (one for each grade and subject specific test included in the analyses) for Minnesota charter schools using the most recent year of available data. Results revealed 93 instances in which charter school residuals are positive (i.e., student achievement is higher than expected) and 145 instances in which they are negative (i.e., student achievement is lower than expected). In total, that means that only 39 percent of the comparisons favored charter schools.

Table 5. Cross-Sectional Comparison Test Residuals by Grade for Charter Schools Using the Most Recent Year of Available Data

	Grade 5 Math	*Grade 5 Reading*	*Grade 7 Math*	*Grade 7 Reading*	*Grade 11 Math*	*Grade 10 Reading*	Totals
# Schools with Positive Residuals	13	15	13	13	19	20	93
# Schools with Negative Residuals	30	23	19	19	29	25	145

Table 6 presents a comparison of the average annual change in test residuals by grade for Minnesota charter and cohort charter schools over five years. Results revealed that the residuals for charter schools overall increased by 0.94 and residuals for charter school cohorts increased by 0.61. This means that over a five-year period, the trend in student achievement is indicates a very small and incremental improvement.

Table 6. Comparison of Average Annual Change in Test Residuals by Grade for All Charter Schools and a Cohort of Same Charter Schools Over Five Years

	Grade 5 Math	*Grade 5 Reading*	*Grade 7 Math*	*Grade 7 Reading*	*Grade 11 Math*	*Grade 10 Reading*	*Mean AAC across all tests*
Average Annual Change in Residual Scores for All Schools with Available Data	1.60	1.03	1.58	-0.10	0.91	0.60	0.94
Average Annual Change in Residual Scores for Cohort of Same Schools	0.60	0.91	1.68	-1.01	0.91	0.60	0.61

As the results in this section reveal, Minnesota's charter schools are not performing better than demographically similar schools. Rather, the charter schools in Minnesota are performing at levels that are similar to or slightly worse than demographically similar noncharter public schools. Although the charter schools in Minnesota do not trail by much, when we looked at a cohort of the same schools over time, we found the charter schools results were largely flat over time, although there was an average annual improvement of 0.6 residual points.

Compared with the other states in the study, the current performance of Minnesota charter schools on state assessments is similar to the other Great Lakes states, although it has showed less growth over time.

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Evaluating the Impact of Charter Schools on Student Achievement:
A Longitudinal Look at the Great Lakes States

Appendix F

June 2007

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● The policy brief is available online at: http://epsl.asu.edu/epru/documents/EPSL-0706-236-EPRU.pdf

Appendix F
Student Achievement in Ohio Charter Schools

The Ohio charter school law was approved in 1997.[1] Although Ohio's charter school reform grew rather slowly in the late 1990s, it has experienced rapid growth over the last six years. This growth has occurred at a time when there was relatively lax and confusing oversight, due to lack of funding for oversight[2] followed by legislative changes regarding authorizers. Currently, just over 300 charter schools are operating in Ohio, which makes this the largest charter school reform in the Great Lakes' region in terms of the number of schools.   Charter schools in Ohio enroll close to 65,000 students, which account for 3.5 percent of all public school enrollments in the state.

Ohio is perceived to have a rather permissive charter school law. The Center for Education Reform gives Ohio a "B" grade.[3] Although some restrictions appear in the letter of the law, in practice, Ohio's charter schools have extensive flexibility, and experience relatively little oversight (Sullins & Miron, 2003).[4] Chi and Welner (in press)[5] suggested an alternative framework for rating charter school laws that places more emphasis on rigor of oversight, accountability, and measures to promote/ensure equity in access. According to their review, Ohio was given a rather strong and positive rating.

Ohio has become a popular site for education management organizations; major EMOs that operate schools in the state include White Hat Management, Constellation Schools, and National Heritage Academies. Ohio's charter school reform also has provided opportunities for large cyber-based schools to operate.

Plenty has been written about the Ohio charter school reform, although most of this has been rhetorical—rather than empirical—in nature. One noteworthy study that examined student achievement in Ohio charter schools was conducted by the Legislative Office of Education Oversight (2003).[6] This evaluation examined the proficiency test results in Ohio's 15 "first generation" community schools and compares each charter school to a matched traditional public school. The results were mixed. Of 155 possible comparisons across subject and grade level tests, 101 of 155 were not statistically significant.   For the remaining 54 statistically significant comparisons, 34 favored traditional schools and 20 favored community schools.

Other studies that were less comprehensive in nature largely have found mixed or negative results for charter schools. Porch et al. (2005) examines charter school achievement in Ohio's inner cites, comparing them with their host school districts. The results were mixed, with charter schools outperforming their districts in some subjects and grades; in others, the district schools did better.[7] Similar results were found by Ryan (2004) when comparing Dayton charter schools to Dayton public schools, though both groups lagged behind state average results.[8] Carr (2005) used findings from the Ohio Proficiency test to compare charter and traditional public schools and found charter schools had greater year-to-year gains in the percentage of their students passing the Ohio Proficiency Test in several subjects while controlling for demographics including 4th grade citizenship, math, reading and writing and 6th grade writing. There were no

statistically significant differences between traditional and charter schools on five other tests: 4th grade science and 6th grade citizenship, math, reading and science.[9]

Data Sources, Outcome Measures, and Methods for Analysis

We obtained demographic variables from the Common Core of Data at the National Center for Education Statistics (NCES).[10] These include variables covering school enrollment, ethnicity, free and reduced lunch, and urbanicity or locale. A variable designating whether or not a school was a charter school or traditional public school was used from this data set to distinguish the charter schools in the state. Student achievement test results and special education enrollment data were obtained from the Ohio Department of Education Web site. Because only a small portion (i.e., 15 percent) of the schools had data on limited English proficiency, we decided not to include this in the regression analysis.

The outcome measure used for our analyses was the percentage of students who met or exceeded state standards on the state assessments. Grades 4 and 6 were used to track trends over time because we could link data from the Ohio Proficiency Test to the new Ohio Assessment Test. At the high school level, it was not possible to build longer trends at any particular grade level. The best trend we were able to build was for the grade 10 proficiency test. This instrument contained data we could extract from the local report cards for 2000-01 until 2003-04. After building these datasets, it turned out that the data for 2000-01 and 2001-02 were not viable. Therefore, we were left with only 2 years of usable results at grade 10.

Our analyses focused on math and reading from 2001-02 to 2005-06. With the available test data, we could build five-year trends in the elementary grades and a two-year trend for grade 10.[11] Table 1 illustrates the range of grades, years, and subjects included in our analyses.

Table 1. Test Data Used in Analyses by Year, Grade, and Subject

	2001-02	*2002-03*	*2003-04*	*2004-05*	*2005-06*
Grade 4	Reading Math	Reading Math	Reading Math	Reading Math	Reading Math
Grade 6	Reading Math	Reading Math	Reading Math	Reading Math	Reading Math
Grade 10		Reading Math	Reading Math		

Variables Used to Create the Predicted Values for Each School

The data sets we created for Ohio contained the highest proportion of missing data of all the Great Lakes states. For this reason, when schools were missing a demographic indicator we sought to use mean substitution to impute the missing value so that the school would not be dropped from the analysis.[12] Unfortunately, a large portion of the missing data for Ohio charter schools was performance data. Test results in Ohio are not reported if there are fewer than seven test takers in a specific group. Also, Ohio also does

not report data on schools that have been operating for less than three years. Although we did impute missing demographic data, we did not impute performance data, and thus, a large portion of the charter schools were still excluded from the analyses. This severely limited the amount of test data available, particularly in 2001 and 2002.   Table 2 displays the variables to be used in developing the residual gain score analysis for Ohio.

Table 2. Variables Included in Residual Gain Score Analysis for Ohio

Variable	*Description*
Percentage passing (dependent variable)	Percentage of students meeting or exceeding state standards on the Ohio Proficiency Tests
Percentage minority	Percentage of nonwhite and non-Asian American students enrolled at the school *i*
Percentage low income	Percentage of students in school *i* receiving free or reduced lunch
Percentage special education	Percentage of students in school *i* with disabilities
Urbanicity (locale)	Rating from 1-8 indicating population density

Table 3 and Figure 1 contain the aggregate findings across all schools. Actual scores are simply the observe school-level score (i.e., the percentage of students meeting or exceeding state standards) for each grade and subject level test. The predicted values were created using an ordinary least squares (OLS) multiple regression procedure, in the form of this linear equation included below:

$$Y_i = a + b_1 MINORITY_i + b_2 LOWINCOME_i + b_3 SPED_i + b_4 URBANICITY_i + \varepsilon_i$$

The variables included in the regression analysis are described in Table 2. Essentially, the predicted values indicate how the school is expected to score based on how other schools in the state with similar demographics have performed on the same test.

The residual is the difference between the actual score and the predicted score. If the residual score is negative, then the school is doing worse than expected. If the residual score is positive, the school is performing better than expected.

The rows in the tables contain the average annual change scores, which indicate the relative direction in which the school's performance is moving.   For example, a school may have all negative residual scores; but if it is becoming less negative over time, the average annual change score will be a positive number. The average annual change score is computed for patterns of actual, predicted, and residual scores across time by subtracting the first score from the most recent and dividing by the number of observations (e.g., years) minus 1.

It is important to note that the results in Table 3 and Figure 1 are aggregate results across all charter schools with available data. When calculating the aggregate results, we weighted the data by the relative number of test takers per school. For example, if a large school has extremely positive results, it will carry more weight than a small school with less positive results.

Table 3. Ohio Aggregate Results by Grade, Subject, and Year

| School Name	Year	Math					Reading				
		Schools	Students	Actual	Predicted	Residual	Schools	Students	Actual	Predicted	Residual
Grade 4	2002	27	992	17.94	32.32	-14.39	28	1191	18.47	38.53	-20.07
	2003	43	1730	17.80	41.14	-23.35	43	1730	27.22	51.46	-24.23
	2004	60	2568	33.65	50.39	-16.74	59	2531	39.83	56.78	-16.96
	2005	84	3696	32.90	51.57	-18.67	84	3616	50.44	61.62	-11.18
	2006	118	4789	48.26	60.93	-12.67	117	4772	54.74	62.77	-8.03
Average annual change				7.58	7.15	0.43			9.07	6.06	3.01
Grade 6	2002	21	1039	11.64	30.09	-18.45	22	1160	15.48	30.79	-15.31
	2003	38	1597	12.44	35.80	-23.36	38	1597	30.41	48.49	-18.08
	2004	59	2777	30.54	49.82	-19.28	57	2773	40.73	51.79	-11.07
	2005	77	3565	27.99	48.01	-20.01	76	3556	43.86	58.19	-14.33
	2006	115	4915	39.54	51.57	-12.03	116	4929	67.55	72.22	-4.67
Average annual change				6.97	5.37	1.60			13.02	10.36	2.66
Grades 10	2002										
	2003	16	1105	33.93	71.73	-37.80	15	1063	62.34	90.16	-27.82
	2004	29	2451	29.27	69.94	-40.66	22	1774	64.32	89.29	-24.98
	2005										
	2006										
Average annual change				-4.66	-1.80	-2.86			1.98	-0.87	2.85

Grade 4

Grade 6

Grades 10
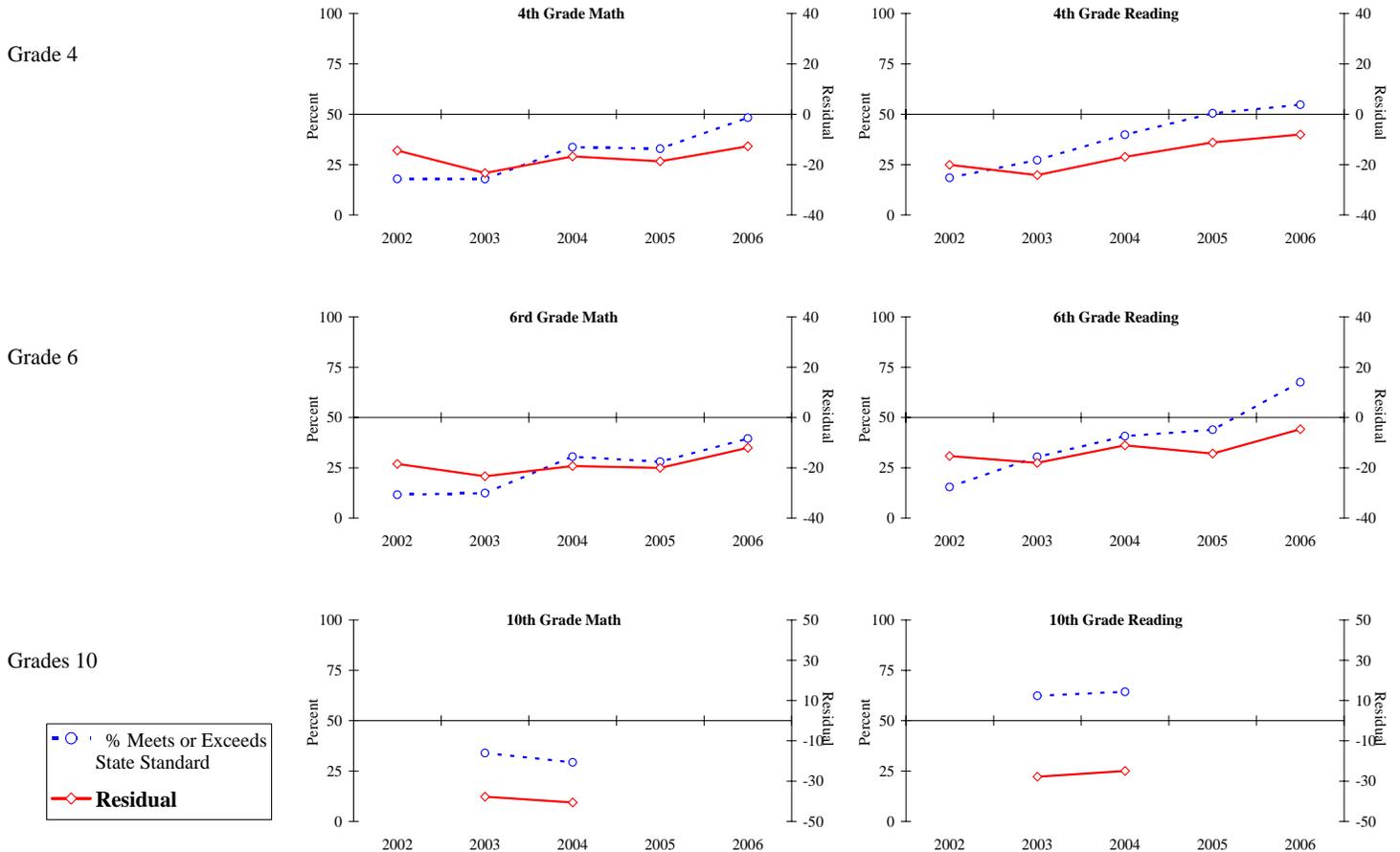
Figure 1. Ohio Aggregate Results: Residual Scores and Percent Meeting State Standards

Actual Performance and Residual Gains for All Charter Schools

The data and charts in Table 3 and Figure 1 illustrate the overall results aggregated for Ohio charter schools. The dashed line in the charts in associate with this table indicates the proportion of students that meet or exceed state standards. Based on these trend lines, we see that typically between 25 and 60 percent of the students in charter schools are meeting state standards. This is noticeably lower than the state average.

Overall the charter school results are substantially lower than state averages. Figure 2 illustrates the statewide trend in terms of percentage of students meeting or exceeding state standards in math and reading. Nevertheless, state figures should not be used to evaluate charter schools, since the state results include a large portion of schools that are not similar to charter schools in term of student demographics. Our residual gains analyses, however, create demographically similar comparison groups for each and every charter school.
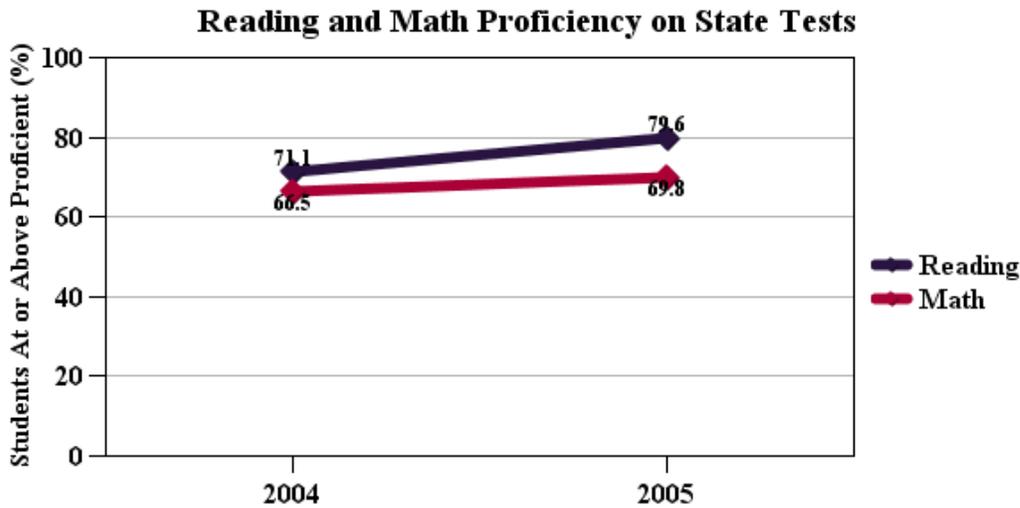
Figure 2.   Performance on Ohio Proficiency Test from 2004-2005[13]

Actual Performance and Residual Gains for Same Cohort of Schools

The changes over time depicted in the results from Figure 1 are likely to be heavily influenced by the addition of new charter schools. The number of schools and the number of students included in each set of results are indicated within Table 3. Note that in 2002, only a handful of schools had viable data. One of the reasons for the lack of data was a regulation that data would not be reported on new schools until they had completed their third year of operation. Between the first and last test dates, more than 100 schools were added to the grades 4 and 6 trends. Therefore, changes in aggregate results may be due to the inclusion of new schools. To control for this we tracked a subset of the same charter schools that had test data available 3 or more years.   Because so few schools had data in2001-02, we created the cohort for the schools that had data for the subsequent 4 years.

Appendix F: Student Achievement in Ohio Charter Schools

Table 4. Ohio Results from Cohorts of Same Schools Tracked Over Time

| School Name	Year	Math					Reading				
		Schools	Students	Actual	Predicted	Residual	Schools	Students	Actual	Predicted	Residual
Grade 4	2002										
	2003	31	1381	18.18	42.93	-24.75	30	1344	27.99	53.33	-25.34
	2004	31	1669	35.25	50.42	-15.17	30	1637	39.17	56.57	-17.40
	2005	31	1873	33.06	49.60	-16.54	30	1846	50.56	59.97	-9.40
	2006	31	1648	53.81	57.95	-4.14	30	1631	57.21	60.09	-2.88
Average annual change				11.88	5.01	6.87			9.74	2.25	7.48
Grade 6	2002										
	2003	24	1255	11.68	38.13	-26.45	24	1255	32.02	50.78	-18.77
	2004	24	1621	33.28	49.55	-16.27	24	1621	45.15	51.44	-6.28
	2005	24	1816	27.87	45.84	-17.98	24	1816	44.59	56.49	-11.90
	2006	24	1552	41.13	49.34	-8.21	24	1552	67.35	70.88	-3.53
Average annual change				9.82	3.74	6.08			11.78	6.70	5.08
Grades 10	2002										
	2003	15	1099	33.70	71.68	-37.98	11	798	65.10	90.60	-25.50
	2004	15	1485	29.50	71.41	-41.91	11	1162	65.06	90.81	-25.75
	2005										
	2006										
Average annual change				-4.20	-0.27	-3.93			-0.04	0.22	-0.25
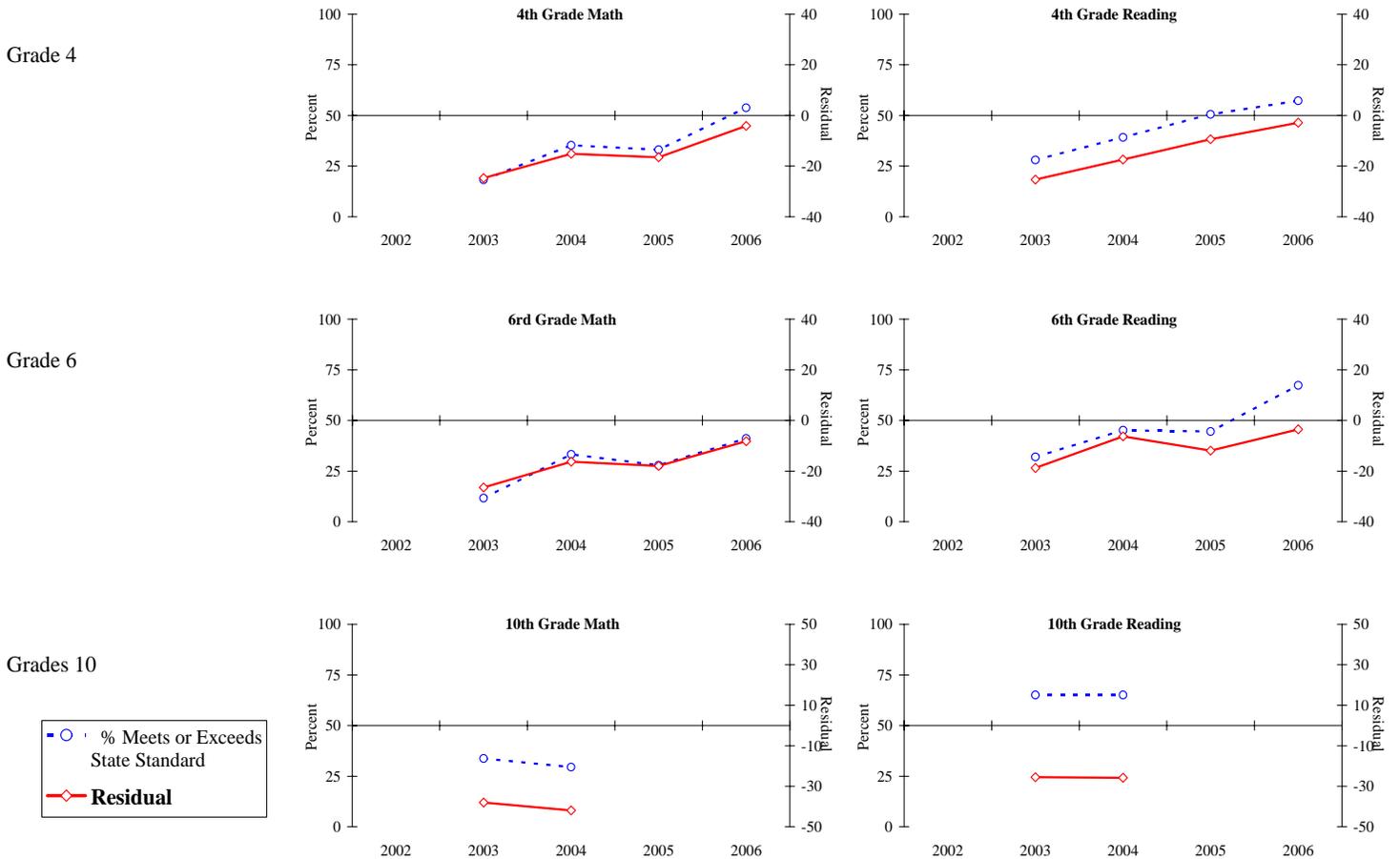
Figure 3. Ohio School Cohort Results: Residual Scores and Percent Meeting State Standards

At grade 4, this cohort included 31 schools; and at grade 6, 24 schools were included. At grade 10, only 15 schools could be tracked for the two years from which data was available in math. The results from these aggregate results for cohorts of the same schools over time are illustrated Figure 3.

The results in Table 4 and Figure 3 are rather similar to the results for all schools, although at grade 10 a noticeable change occurred as the trend in residuals became negative when we looked at only the same schools over time.   Overall results at grade 4 and 6 were consistently lower than their demographically matched peers. The solid red line indicates the residuals, which are consistently negative at grade 4 and 6, and became progressively less negative over time. At grade 10 the results are much more negative and show no improvement over time.

Summary of Findings from Ohio

The evaluation questions in this study were (1) How does student achievement in charter schools compare to demographically similar public schools? (2) Are charter schools an effective strategy for improving student achievement over time? Results for these two questions are summarized in Tables 5 and 6, respectively. Table 5 presents a cross-sectional comparison of six mean test residuals (one for each grade and subject specific test included in the analyses) for Ohio charter schools using the most recent year of available data.

There are large differences in performance at the school level. We found 33 percent of the schools with positive residuals, indicating that the school was performing better than predicted on specific grade and subject level tests. Unfortunately, in 66 percent of the comparisons made, the charter schools had negative residuals, indicating that they are performing at levels lower than predicted and lower than demographically similar schools. Of the Great Lakes states, only Indiana has a higher proportion of negative residuals.

Table 5. Comparison of Schools with Positive or Negative Residuals in Most Recent Year of Available Data

	Grade 4 Math	Grade 4 Reading	Grade 6 Math	Grade 6 Reading	Grade 10 Math	Grade 10 Reading	Totals
Positive Residuals	36	39	34	51	4	7	171
Negative Residuals	82	78	81	65	25	15	346
Percent Positive	30.5%	33.3%	29.6%	44.0%	13.8%	31.8%	33.1%

Table 6 presents a comparison of the average annual change in test residuals by grade for the aggregate of all Ohio charter schools and for the cohort of same charter schools over five years. Results revealed that the residuals for charter schools overall are increasing by 1.28 points per year, on average, and residuals for the cohorts of same charter schools are increasing by an average 3.56 points per year. This means that over a five-year period, the trend in student achievement is increasing for the charter schools.

Table 6. Comparison of Average Annual Change (AAC) in Test Residuals by Grade for Charter Schools and Charter School Cohorts Over Five Years (2002 to 2006)

	Grade 4 Math	Grade 4 Reading	Grade 6 Math	Grade 6 Reading	Grade 10 Math	Grade 10 Reading	Totals
Average Annual Change in Residuals	+0.43	+3.01	+1.60	+2.66	-2.86	+2.85	+1.28
Average Annual Change in Residual Scores for Cohort	+6.87	+7.48	+6.08	+5.08	-3.93	-0.25	+3.56

As the results in this appendix reveal, Ohio's charter schools are not performing better than demographically similar schools. Instead, they are consistently performing at levels that are lower than their demographically matched peers. Over time, however, the Ohio charter schools are closing the gap. For the cohort of schools we could track, relatively large annual gains were being made by charter schools relative to demographically similar traditional public schools. Although this finding shows hope for the future, one should be cautious in interpreting the Ohio results because of the very high proportion of schools that did not have valid test data and had to be excluded from the analyses.[14]

Notes and References

[1] Note that charter schools are referred to as community schools in the state of Ohio. We use the term *charter school* instead of *community* school in this report to reduce confusion regarding terms.

[2] See Petro, J. (2002). Ohio Department of Education community schools operational review. Columbus, OH: Office of the Auditor.

[3] Retrieved [February 27, 2007] http://www.edreform.com/_upload/charter_school_laws.pdf

[4] Sullins, C., & Miron, G. (2005) *Challenges of starting and operating charter schools: A multicase study.* Kalamazoo, The Evaluation Center, Western Michigan University.

[5] Chi, W. C., & Welner, K. G. (in press). Charter ranking roulette: An analysis of reports that grade states' charter school laws. *American Journal of Education.*

[6] Legislative Office of Education Oversight. (2003). *Community schools in Ohio: Final report on student performance, parent satisfaction, and accountability.* Columbus, OH: Author.

[7] Porch, A., Phillips-Schwartz, K., Ryan, T. (2005). *School performance in Ohio's inner cities: Comparing charter and district school results in 2005.* Dayton, OH: Thomas B. Fordham Foundation.

[8] Ryan, T. (2004) *A wide angle look at the charter school movement in Ohio/Dayton, circa September 2004.* Dayton, H: Thomas B. Fordham Foundation.

[9] Carr, M., & Staley, S. (2005). *Using the Ohio proficiency test to analyze the academic achievement of charter school students: 2002-2004.* Columbus, OH: Buckeye Institution.

[10] Retrieved [February 27, 2007] from the Web site for the Common Core of Data: http://nces.ed.gov/ccd/.

[11] Retrieved [March 3, 2007] from http://www.ode.state.oh.us/GD/Templates/Pages/ODE/ODE Primary.aspx?page=2&TopicID=263&TopicRelationID=263 l

[12] For example, if a school reported that it had 70 percent minority students in 2003, no data in 2004 and 90 percent minority students in 2005, we would insert a value of 80 percent for the missing data point. There was insufficient data among charter schools to conduct more sophisticated approaches for imputing missing values.

[13] Retrieved [February 25, 2007] from <http://www.schoolmatters.com/pdf/state_reports/SMN.pdf >

[14] Although Ohio has the most charter schools in the region, this state had the highest proportion of schools dropped from the analysis due to incomplete data.

Evaluating the Impact of Charter Schools
on Student Achievement:
A Longitudinal Look at the Great Lakes States

Appendix G

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Appendix G
Student Achievement in Wisconsin Charter Schools

The Wisconsin Charter Program was established in 1993 with authorization for 10 school districts to establish up to 2 charter schools for a total of 20 statewide. Thirteen charter schools were created under this law during that time. The charter school law underwent many revisions. In 1995, chartering authority was extended to all school boards statewide and the cap on the total number of charter schools was removed. In 1997, the state legislature extended chartering authority in Milwaukee to the chancellor of the University of Wisconsin-Milwaukee, the Milwaukee Area Technical College, and the Common Council of the city of Milwaukee (Wisconsin Charter School Association, 2007).[1]

Although there are a number of studies on charter schools in Wisconsin, there are few empirical studies or evaluations that look at the academic performance of its charter schools. An early report by Stuiber, Swenson, Normandin, and Varana (1998) provided a performance evaluation of Wisconsin's charter schools open during the 1997-98 school year.[2] The report compared charter-school programs and policies to traditional district schools. On average, charter school students scored higher on standardized tests than other district students, but test results were only available for a half dozen schools. A study by Witte, Weimer, Schlomer, and Shober (2004) found that charter schools in operation for more than one year generally were more likely to meet state standards than noncharter students.[3] This study used in innovative approach for comparing charter school and district results, but only two years of data were considered (2000-01 and 2001-02) and no analyses of high school grades was pursued because most of these were deemed to be at-risk schools. Loveless' (2003) analyses of charter school performance in 10 states using the state's own criteria for rating schools found that 11 percent of charter schools were rated as "failing" in Wisconsin compared with 3.5 percent of traditional public schools that were rated as failing.[4]

Data Sources, Outcome Measures, and Methods for Analysis

In Wisconsin, students demonstrate their progress toward achieving academic standards in reading, language arts, mathematics, science, and social studies through their performance on the Wisconsin Student Assessment System (WSAS). The WSAS includes the Wisconsin Knowledge and Concepts Examinations—Criterion-Referenced Test (WKCE-CRT), taken by nearly all students in grades 3-8 and 10. The WKCE-CRT is a large-scale, standardized achievement test administered using carefully defined directions, time limits, materials, and scoring procedures for all test takers to ensure uniform test-taking conditions.

Many of the demographic variables used to create the predicted values were obtained from the Common Core of Data at the National Center for Education Statistics (NCES).[5] From this data source were obtained variables covering school enrollment, ethnicity, free and reduced lunch, and urbanicity or locale. A variable designating charter school status also was used from this data set to distinguish the charter schools in the

state. From the DPI and Office of Educational Accountability Web site, the mean school-level scaled scores for reading and math were obtained for the period 2001 through 2005 for grades 4, 8, and 10, including the number of test takers within each school that reported test results.[6]

A scale score is a score on a numeric scale with intervals of equal size. The scale is applied to all students taking the WKCE-CRT in a particular subject at a particular grade level. The scale score makes possible the comparison of scores from different groups of students or individuals—or schools—from year to year. Each content area is scaled separately. Therefore, the scale scores for one content area cannot be compared with the scale scores from another.

Table 1. Test Data Used in Analyses, by Year, Grade, and Subject

	2000-01	2001-02	2002-03	2003-04	2004-05
Grade 4	Reading & Math	Reading & Math	Reading & Math	Reading & Math	Reading & Math
Grade 8	Reading & Math	Reading & Math	Reading & Math	Reading & Math	Reading & Math
Grade 10	Reading & Math	Reading & Math	Reading & Math	Reading & Math	Reading & Math

The data set created for Wisconsin was complete in terms of test data and the demographic variables required for the regression analysis. No imputation of missing values was conducted, although there were a number of instances where schools were dropped from specific analyses because they had too few test takers (test results in Wisconsin are not reported if there are fewer than 5 test takers in a specific group).

Variables Used to Create the Predicted Values for Each School

Table 2 displays the variables used in developing the residual gain score analysis for Wisconsin's charter schools. The predicted values and residual scores were created using an ordinary least squares multiple regression procedure, in the form of the linear equation given in Equation 1

$$Y_i = a + b_1 MINORITY_i + b_2 LOWINCOME_i + b_3 SPED_i + b_4 URBANICITY_i + \varepsilon_i$$

Where $\hat{Y}$ is the predicted value for a school's mean scaled score i, expressed in terms of the constant a of the intercept term, and where $MINORITY_i$ is the percentage of minority students (minus Asians) for given school i, where $LOWINCOME_i$ is the percentage of students receiving free or reduced lunch for given school i, and where $URBANICITY_i$ is the value (i.e., from 1-8) indicating population density for school i. In this equation, the regression coefficients (bs), also referred to as the *partial regression coefficients*, represent the independent contributions of each independent variable to the prediction of the dependent variable $\hat{Y}$. Essentially, the predicted values indicate how the

school is expected to score based on how other schools in the state with similar demographics have performed on the same test.

Table 2. Variables Included in Residual Gain Score Analysis for Wisconsin

Variable	Description
Mean Scale Score (dependent variable)	School-level mean scale score on the WKCE-CRT
Percent Minority	Percentage of nonwhite and non-Asian-American students enrolled
Percent Low Income	Percentage of students receiving free or reduced lunch
Special Education	Percentage of students with disabilities
Urbanicity (locale)	Rating from 1-8, indicating population density

The residual is the difference between the actual score and the predicted score. If the residual score is negative, then the school is doing worse than expected. If the residual score is positive, the school is performing better than expected.

In the data tables, there are rows that contain the average annual change scores, which indicated the relative direction the school is moving. For example, the school may have all negative residual scores; but if they are becoming less negative over time, the average annual change score will be a positive number. The average annual change score is computed for patterns of actual, predicted, and residual scores across time by subtracting the first score from the most recent and dividing by the number of observations (e.g., years) minus 1 (i.e., *N*-1).

It is important to note that the results presented in Tables 3 and 4 are aggregate findings across all charter schools with available data. When calculating the aggregate results, the data were weighted by the relative number of test takers per school. For example, if a large school has extremely positive results, they will carry more weight than a small school with less positive results.

Some schools were excluded because they either had too few test takers or else they did not report demographic data. The data for Wisconsin was surprisingly complete. In 2001, the trends captured 84 percent of the schools, and for the last 2 years of the trends we typically were able to include 100 percent of the schools that had students taking specific tests.

Actual Performance and Residual Gains for All Charter Schools

The data presented in Table 3 and Figure 1 illustrate the overall results aggregated for all Wisconsin charter schools from 2001 through 2005 for grades 4, 8, and 10 on WKCE-CRT math and reading assessments for which data were available. The dashed line in Figure 1 illustrates the actual or observed scale scores for charter schools. Based

Table 3. Wisconsin Aggregate Results by Grade, Subject, and Year

| School Name	Year	Math					Reading				
		Schools	Students	Actual	Predicted	Residual	Schools	Students	Actual	Predicted	Residual
Grade 4	2001	25	923	631.31	627.03	4.28	25	911	650.37	645.50	4.87
	2002	27	1,067	626.62	631.49	-4.86	27	1,066	641.98	647.66	-5.68
	2003	31	1,039	624.86	628.16	-3.30	31	1,029	638.22	642.41	-4.19
	2004	34	1,089	623.57	627.07	-3.51	34	1,089	637.37	642.23	-4.86
	2005	36	1,121	623.32	629.49	-6.16	36	1,121	635.41	642.90	-7.49
Average annual change				-2.00	0.61	-2.61			-3.74	-0.65	-3.09
Grade 8	2001	23	1,634	682.36	679.10	3.26	23	1,637	672.88	670.24	2.64
	2002	28	1,791	682.08	675.91	6.17	28	1,799	671.27	668.82	2.45
	2003	28	1,812	687.56	683.81	3.75	28	1,808	671.42	671.22	0.20
	2004	34	1,916	679.95	675.88	4.07	34	1,918	665.26	665.61	-0.36
	2005	37	2,025	687.27	684.74	2.53	37	2,022	675.30	673.42	1.88
Average annual change				1.23	1.41	-0.18			0.61	0.80	-0.19
Grade 10	2001	15	333	696.03	718.65	-22.61	15	329	685.82	702.84	-17.01
	2002	21	511	695.43	711.51	-16.09	21	515	682.28	690.35	-8.07
	2003	17	382	715.48	714.30	1.18	17	383	702.36	701.06	1.30
	2004	16	404	713.77	716.83	-3.06	16	404	691.67	695.89	-4.22
	2005	19	490	703.75	711.31	-7.55	19	493	695.17	698.03	-2.87
Average annual change				1.93	-1.83	3.77			2.34	-1.20	3.54
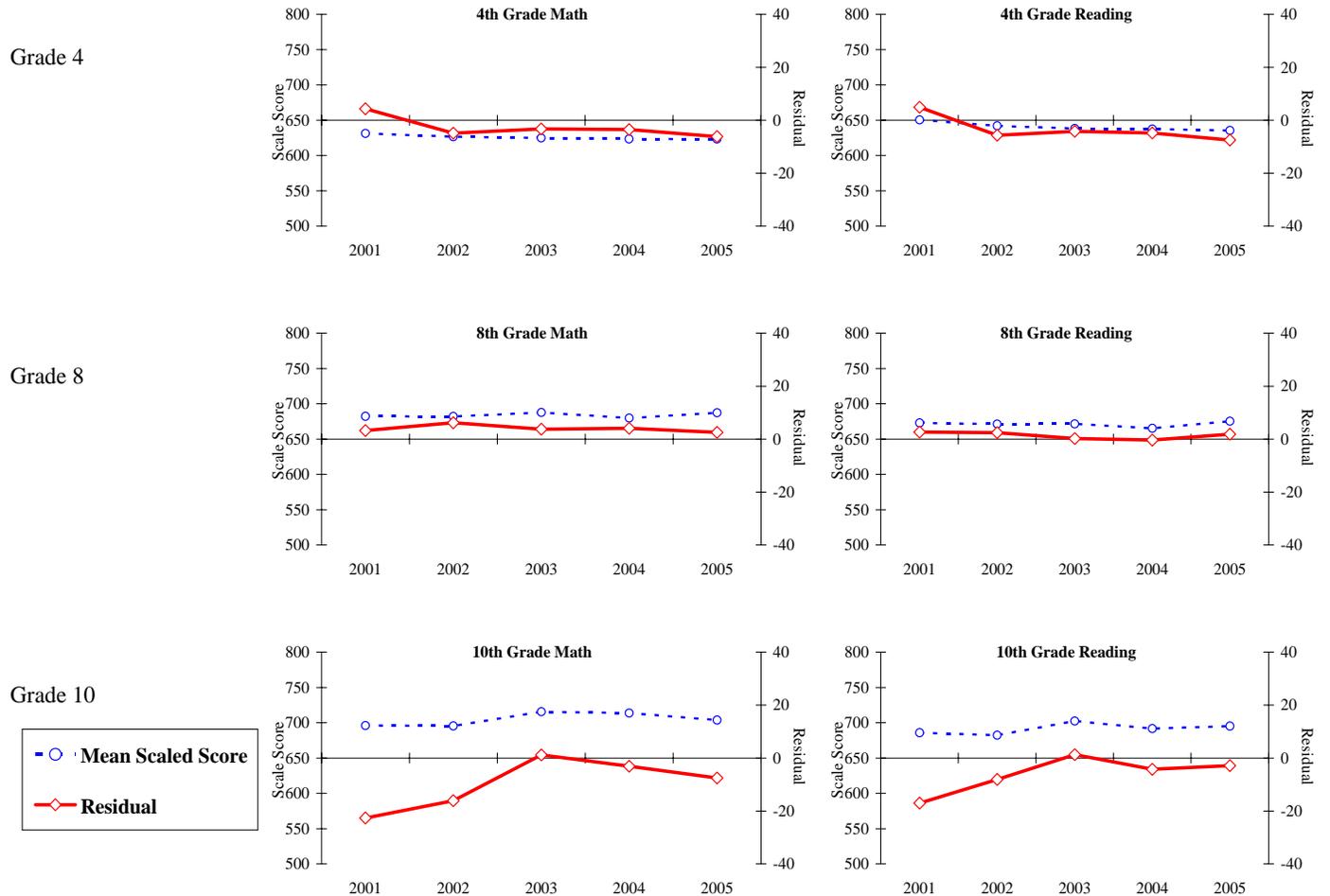
Figure 1. Wisconsin Aggregate Results: Residual Scores and Mean Scale Scores

on these trend lines, performance for students in Wisconsin's charter schools is relatively flat indicating that the mean scale score for charter schools is not improving over time.

The residual lines are also rather flat, except at grade 10 where noticeable improvements are evident. The average annual change in residual scores is negative for 4th grade, close to zero for 8th grade and positive at 10th grade where the charter school aggregate results improve dramatically in 2002. This increase in 2002 can largely be explained by the addition/inclusion of 6 more charter schools serving high school students.

The aggregate results across all charter schools is still lower than state averages. Nonetheless, state figures should not be used to evaluate charter schools since the state results include a large portion of schools that are not similar in terms of student demographics to charter schools. Our approach that uses residual gains analysis, however, creates demographically similar comparison groups for each charter school.

Actual Performance and Residual Gains for Same Cohort of Schools

As noted earlier, the changes over time depicted in the results from Figure 1 may be due to the addition of new charter schools. The number of schools and the number of students included in each set of results is also indicated in Table 3. Between the first and last test dates, between 7 and 19 charter schools were added to the aggregate results. Therefore, changes in aggregate results may be due to the inclusion of new schools. To control for this we tracked a subset of the same charter schools that had test data available for all years. The results from these aggregate results for cohorts of the same schools over time are illustrated in Table 4 and Figure 2.

For grades 4 and 8, the results for the cohorts of schools are rather similar to the results for all schools. The data for grade 10 had more gaps in it, so the best cohort we could construct of same schools started in 2002 instead of 2001. At grade 10, we were able to track 8 charter schools over time. Many of the small high schools or presumably many of those schools serving at-risk students did not have test data available for each year of the cohort and thus were not included.

The cohort results for grades 4 and 8 are more robust and include a relatively large proportion of the all schools with valid test data. The residual scores for grades 4 and 8 are all positive, but over time become slightly less positive for grade 4. For grade 10, the residual scores are initially negative and improve slightly over time.

Table 4. Wisconsin Results from Cohorts of Same Schools Tracked Over Time

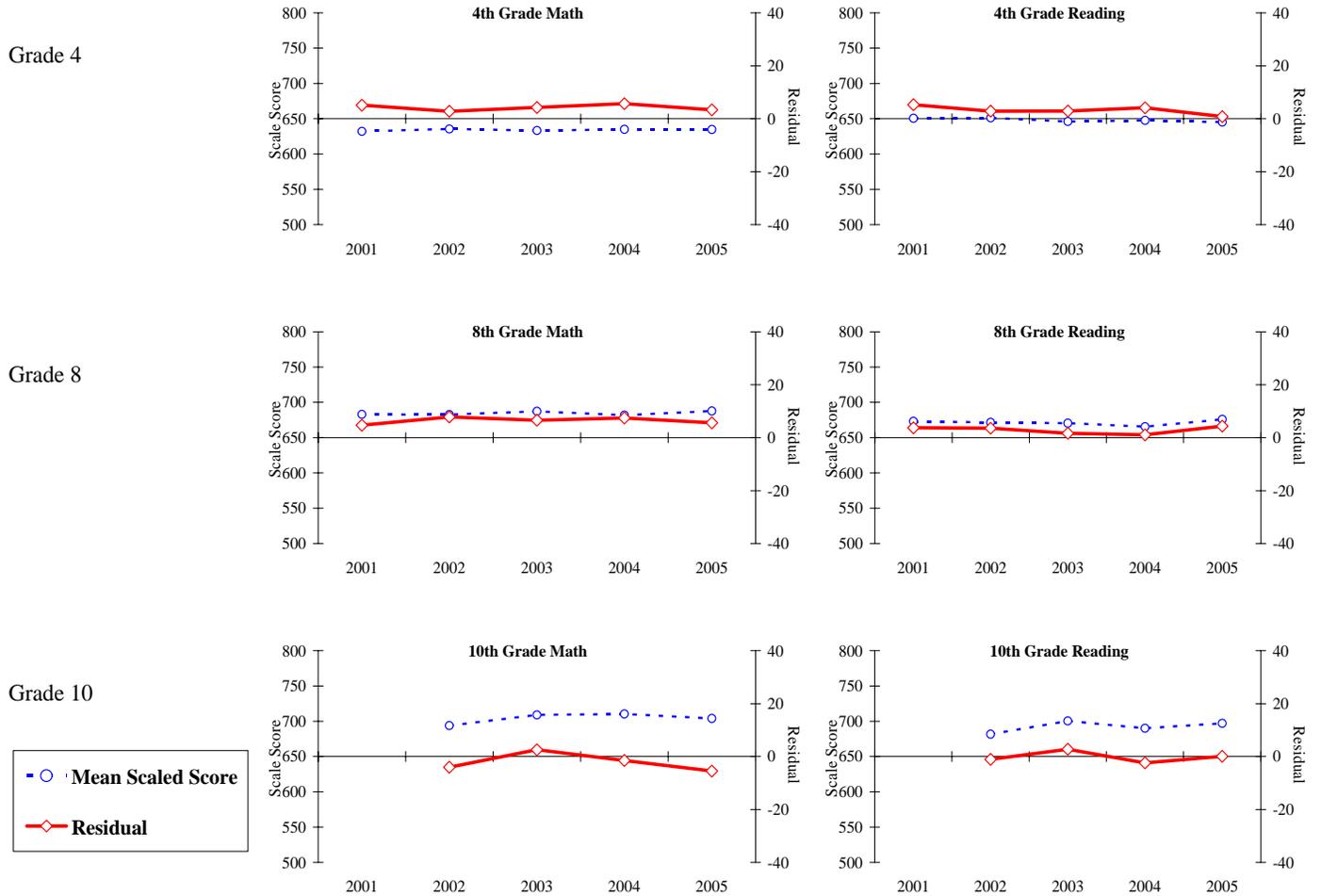|	Year	Math					Reading				
		Schools	Students	Actual	Predicted	Residual	Schools	Students	Actual	Predicted	Residual
Grade 4	2001	21	884	631.98	626.89	5.09	21	873	650.66	645.36	5.30
	2002	21	839	635.49	632.66	2.83	21	836	651.15	648.26	2.89
	2003	21	765	633.18	628.94	4.24	21	756	646.11	643.18	2.93
	2004	21	728	634.91	629.20	5.71	21	728	647.54	643.41	4.13
	2005	21	658	634.72	631.35	3.36	21	658	645.21	644.42	0.79
Average annual change				0.68	1.12	-0.43			-1.36	-0.24	-1.13
Grade 8	2001	16	1,577	682.80	678.15	4.66	16	1,583	673.16	669.46	3.70
	2002	16	1,601	682.67	674.88	7.79	16	1,609	671.60	668.06	3.54
	2003	16	1,536	687.29	680.71	6.58	16	1,534	670.52	668.85	1.67
	2004	16	1,566	681.89	674.43	7.46	16	1,567	665.56	664.51	1.05
	2005	16	1,541	687.62	682.05	5.57	16	1,539	675.84	671.51	4.33
Average annual change				1.20	0.97	0.23			0.67	0.51	0.16
Grade 10	2001										
	2002	8	320	693.78	697.80	-4.02	8	324	681.70	682.75	-1.05
	2003	8	265	708.98	706.42	2.56	8	265	700.43	697.66	2.78
	2004	8	320	710.38	711.85	-1.47	8	320	690.11	692.50	-2.39
	2005	8	303	704.01	709.46	-5.45	8	300	696.95	696.84	0.11
Average annual change				3.41	3.88	-0.48			5.08	4.70	0.39

Grade 4 — 4th Grade Math, 4th Grade Reading

Grade 8 — 8th Grade Math, 8th Grade Reading

Grade 10 — 10th Grade Math, 10th Grade Reading

- - ○ - Mean Scaled Score
- � - Residual

Figure 2. Wisconsin School Cohort Results: Residual Scores and Mean Scale Scores

Summary of Findings

The evaluation questions in this study were: (1) How does student achievement in charter schools compare to demographically similar public schools? (2) Are charter schools an effective strategy for improving student achievement over time? Results for these two questions are summarized in Tables 5 and 6. Table 5 presents a cross-sectional comparison of six mean test residuals by grade for Wisconsin charter schools using the most recent year of available data (2005). Results revealed 77 instances in which charter school residuals are positive (i.e., student achievement is higher than expected) and 107 instances in which they are negative (i.e., student achievement is lower than predicted). In other words, only 40 percent of the comparisons favored charter schools. Therefore, one can conclude the charter schools in Wisconsin are currently performing at levels that are slightly lower than predicted and lower than demographically similar traditional public schools.

Table 5. Cross-Sectional Comparison Test Residuals by Grade for Charter Schools Using the Most Recent Year of Available Data

	Grade 5 Math	Grade 5 Reading	Grade 8 Math	Grade 8 Reading	Grade 11 Math	Grade 11 Reading	Totals
# Schools with Positive Residuals	16	14	18	20	4	5	77
# Schools with Negative Residuals	20	22	19	17	15	14	107

Table 6 presents a comparison of the average annual change in test residuals by grade for Wisconsin charter and cohort charter schools over five years. Results revealed that the residuals for charter schools overall are relatively unchanged overtime. The average annual change in residuals across all schools was +0.20. On the other hand, when we look at a cohort of same schools over time, the average annual change score in residuals is -0.20. This means that over a five year period, the trend in student achievement is relatively unchanged.

Table 6. Comparison of Average Annual Change (AAC) in Test Residuals by Grade for Charter Schools and Charter School Cohorts Over Five Years (2001 to 2005)

	Grade 5 Math	*Grade 5 Reading*	*Grade 8 Math*	*Grade 8 Reading*	*Grade 11 Math*	*Grade 11 Reading*	*Mean AAC across all tests*
Average Annual Change in Residual Scores for All Schools with Available Data	-2.61	-3.09	-0.18	-0.19	3.77	3.54	0.20
Average Annual Change in Residual Scores for Cohort of Same Schools	-0.43	-1.13	0.23	0.16	-0.48	0.39	-0.21

As the results in this section reveal, Wisconsin's charter schools are not performing better than demographically similar public schools. Rather, the charter schools in Wisconsin are performing at levels that are rather similar to what would be predicted given the performance levels of demographically similar public schools.

When looking at change over time for either the aggregate of schools or cohorts of same schools we found little or no change on average. The findings from Wisconsin are somewhat unique in the Great Lakes states. In the other states, the charter schools tend to be further behind their comparisons groups, but are making more improvements over time.

Notes and References

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