

# A Statistical Analysis of the Newark Public Schools\*

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## Abstract

This paper performs a statistical analysis of the Newark public school district using N.J. Report Card data for the 2002-03 school year. In particular, two questions are investigated: What are the determinants of student performance on standardized exams, and do charter schools in Newark perform differently than public schools? We find that charter schools perform worse on fourth grade exams, but better on eighth grade exams. Using regression analysis we identify which variables affect performance, and which schools exceed expectations.

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# 1 Introduction

This paper reports the results of a statistical analysis regarding the performance and characteristics of fourth and eighth grade students in the Newark public schools. In particular, two questions are investigated: (1) What are the determinants of student performance on standardized exams, and (2) Are charter schools qualitatively different than public schools in terms of student composition and performance? These questions are investigated using student Report Card Data collected by the New Jersey Department of Education (see <http://education.state.nj.us/rc/>). This data set contains school-level information about student performance, racial and economic characteristics, and school quality.

This paper reports four types of statistical analyses:

1. Basic descriptive statistics of fourth and eighth graders across schools to demonstrate the composition of the 'average' school in Newark, and how schools vary from this average;
2. A comparison of the averages of several variables for charter and public schools to investigate whether charter schools are qualitatively different than public schools;
3. Regression analysis to investigate which variables determine student performance on standardized tests; and
4. Rankings of schools based on two criteria: (1) how they perform on standardized exams, and (2) how they over- or under-achieve relative to a prediction based on the regression analysis. These predictions help to identify those schools that might be excelling (or failing) due to better organizational or institutional characteristics.

The aim of this work is to aid researchers, administrators and other interested parties to better understand the characteristics of the Newark public schools, to see which schools are currently succeeding and which are not, and to help isolate those factors that do indeed make a difference. Clearly, statistical snapshots of a school district does not tell the whole story, but this type of investigation can shed light on larger patterns and overall outcomes.

**Findings** Listed below are some of the main findings:

1. The demographic composition of charter school students is different than public schools for both fourth and eighth grades. The average charter school is more likely to have a higher Black population, more female students, and fewer students in poverty.
2. Though charter schools have longer school days and school years, there are mixed findings regarding student performance in charter schools. There is some evidence that Fourth graders perform worse on standardized tests, while eighth grade charter school students tend to perform better than public school students.
3. Regression analysis shows that race, English proficiency and poverty status account for roughly half of the variation in test scores across schools. School characteristics can help explain only an additional 20% of the variation in student performance.
4. In terms of school characteristics, we find evidence that school characteristics, such as class size and teacher education, do matter, but these effects are relatively small, in general.
5. Finally, so-called residual analysis identifies several predominantly Black schools that exceed expectations. For example, using regression analysis, we would predict that the Fourteenth Street School would have 69% of its students at or above proficiency for language arts in 2003. However, they, in fact, score 88%, indicating the possibility of a more effective organization and/or curriculum.

## 2 The Newark Public Schools

The Newark school district is the largest school system in New Jersey. There are 76 public schools; 59 have elementary and/or intermediate grades, 12 have high school grades, and 5 are special education schools. In addition, there are currently 10 charter schools. During the 2002-03 school year, total student enrollment was 42,395. Table 1 provides some basic statistics for the Newark Public School system as compared to the state of New Jersey.

In terms of standardized test scores, the percentage of students in Newark at or above proficiency is lower than the state as a whole, both at the 4th

Variable	Newark	N.J.
% Students Proficient or Above - ASK 4 Language	53	78
% Students Proficient or Above - ASK 4 Math	43	68
% Students Proficient or Above - GEPA Language	43	74
% Students Proficient or Above - GEPA Math	26	57
% Students Proficient or Above - GEPA Science	33	73
Student-Faculty Ratio	10	12
Per Pupil Expenditures (\$)	14,961	11,313
% Black Students	59	18
% Hispanic Students	32	17
% White Students	8	59
% Asian Students	1	7
% Native Am. Students	0.1	0.2
Median HH Income (\$)	27,539	54,226

Table 1: Comparison of Newark and New Jersey selected statistics, 2003. (Sources: N.J. Dept. of Education website, Census Bureau.) Note: Newark's median income is in 2002 dollars, New Jersey's is in 2000 dollars.

and 8th grade levels, and across subject matter.<sup>1</sup> However, Newark has a lower student-faculty ratio and higher expenditures per pupil. Newark has a larger minority population compared to the state, with roughly 92% of its students being in a minority category, compared to 41% for the state. Newark's median household income is roughly half that of New Jersey's.<sup>2</sup>

## 2.1 Charter Schools

The charter school movement has its roots in the school reform movement of the 1960's and 70's, where parents, teachers, and community activists have sought new approaches to education that increase community and parental involvement. In 1991, Minnesota passed the first charter school law; by 2003, 40 states plus Puerto Rico and Washington DC had charter school laws ([www.uscharterschools.org](http://www.uscharterschools.org), 2004).

As is similar to other states, a 'charter school' in New Jersey is a public school that operates independently of the district board of education under a charter granted by the Commissioner of the New Jersey Department of Edu-

<sup>1</sup>Fourth graders take the New Jersey Assessment of Skills and Knowledge (NJ ASK 4) exams; Eighth graders take the Grade Eight Proficiency Assessment (GEPA) exams.

<sup>2</sup>New Jersey has the highest median household income in the country (source: <http://www.courierpostonline.com/census2000/m080601d.htm>)

cation. The charter school, however, must conform to all regulations regarding assessment, special education, civil rights and student health and safety. A charter school is supervised by an approved board of trustees. Funding for the school comes from the state and local funds through the district board of education. The district is also responsible for student transportation (FAQ About Charter Schools, 2003).

The New Jersey Charter School Program Act of 1995 authorized the creation of a charter school program. The first charter schools began their operations in 1997, and by 2003, New Jersey had 48 operating charter schools, with over 10,000 students (KPMG, 2001; FAQ About Charter Schools, 2003).

## 3 Analysis of Fourth Grade Students

### 3.1 Descriptive Statistics

The data set comes from the New Jersey Department of Education (DOE) Report Card for the 2002-03 school year. The Report Card data set contains many variables *at the school level* about the students, faculty, and the school organization. Table 2 presents the descriptive statistics.

There are a total of 55 schools that have fourth grade students, including six charter schools (the schools are listed in Table 5). The table presents the averages, the standard deviations, and the minimum and maximum values for each of the schools. The averages give a measure of central tendency, and the standard deviation, minimum and maximum are measures of variation across schools.<sup>3</sup>

The table is divided into five sections: test scores, faculty data, student data, school data, and neighborhood data. The first section gives the descriptive statistics for each school's performance on the language and mathematics test scores for general education students (the ASK 4 exams). The variables are the percentage of students that fall into one of three categories: above proficiency level, at proficiency level, or below proficiency level.<sup>4</sup> The DOE administers the statewide exam and determines the scores for each category.<sup>5</sup>

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<sup>3</sup>The standard deviation measures the average deviation from the mean. As a rule of thumb, 68% of students fall within plus or minus one standard deviation of the average.

<sup>4</sup>The state refers to this category as 'partially proficient.'

<sup>5</sup>For a historical overview of standardized testing in New Jersey see <http://www.nj.gov/njded/assessment/history.shtml>.

The average school in Newark (both charter and public) has 60.12% of its students at proficiency level for language arts, but only 31.58% at proficiency for mathematics. For language arts, the average school has 38.26% of its students below proficiency and 54.2% in mathematics.

In terms of faculty composition, the average school has 71.2% of its teachers having only a Bachelor's degree, and 24.28% also having a Master's degree. In the average school, 42.05% of its teachers are Black, and roughly 52% are minority in general.<sup>6</sup>

For student characteristics, we see that in the average school 64.43% of its students are Black and 29.35% are Hispanic; 74% of students qualify for the federal government's Free Lunch program, which is based on economic need.

In terms of school characteristics, 49% of schools are classified as a 'Predominantly Black School.' A school is given this designation (by the author) if at least 50% of the students and at least 50% of the teachers are Black. Student mobility is the percentage of students who either entered or left during the school year. The average school had a mobility of 29.17%.

Finally, information is also presented for neighborhood characteristics. A 'neighborhood' here is defined as a zip code area that contains at least one elementary and/or charter school. In Newark there are nine designated neighborhoods. The average population in a neighborhood is 30,373, with a median household income of \$24,263, and 17.8% of households with children have a female head.

### 3.2 Charter Versus Public Schools

In this section, we ask the question: How are the characteristics of 4th graders in charter schools different than public schools? In order to make this comparison, we perform a statistical test that compares the averages of variables for the two groups. In statistical parlance, we perform a two-sided t-test with the assumption that the two groups have different variances. If the difference of the averages is large relative to how the variable varies, then we conclude that there is a statistically significant difference. For example, the average public school has 12.5% more teachers with a Master's degree; since

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<sup>6</sup>The N. J. Department of Education designates five racial categories: White, Black, Hispanic, Asian and Native American. These categories are used in the analysis in this paper.

Variable	Mean	St. Dev.	Min	Max
Test Scores (ASK 4) General Education				
% Proficient Language	60.12	17.30	30.9	93.6
% Above Proficient Language	1.62	3.36	0.0	18.8
% Below Proficient Language	38.26	19.02	0.0	69.1
% Proficient Math	31.58	13.48	8.3	68.8
% Above Proficient Math	14.23	17.38	0.0	84.8
% Below Proficient Math	54.20	25.31	0.0	89.5
Faculty				
% Teachers w. Bachelor's	71.19	9.08	50.0	100.0
% Teachers w. Master's	24.28	7.84	0.0	45.5
% Teachers w. PhD/ED	3.90	3.53	0.0	16.7
% Teachers Asian	1.77	2.81	0.0	13.3
% Teachers Black	42.05	26.24	0.0	84.6
% Teachers Hispanic	13.39	11.74	1.3	45.7
% Teachers White	42.75	21.04	0.0	86.6
% Administration Black	51.97	35.58	0.0	100.0
% Administration Minority	59.85	34.11	0.0	100.0
% Administration White	40.15	34.11	0.0	100.0
Students				
% Asian	0.79	2.37	0.0	13.1
% Black	64.43	35.58	1.4	99.8
% Hispanic	29.35	29.69	0.1	87.9
% Native American	0.08	0.24	0.0	1.3
% White	5.35	15.57	0.0	73.3
% LEP	8.15	10.09	0.0	35.0
% Free Lunch	74.04	19.68	0.0	99.4
% Chapter 1	91.42	25.26	0.0	100.0
% Male	51.73	4.28	44.2	65.9
School				
% Student Mobility	29.17	10.84	2.0	47.6
Student-Faculty Ratio	10.38	2.46	5.2	18.1
Student-Admin. Ratio	212.72	76.10	31.0	490.0
School Enrollment	522.82	243.40	75.0	1108.0
Avg. Class Size 4th grade	18.54	3.88	11.0	32.5
Avg. Attendance 4th grade	93.29	1.86	89.2	98.9
% Charter Schools	11			
% Predom. Black School	49			
Neighborhood (n=9)				
Population	30,373	13,185	11,792	51,358
Median HH. Income (\$)	24,362	7,897	13,421	35,044
% HH w. Female Head	17.8	5.6	7.7	26.4

Table 2: Descriptive statistics for schools with 4th grades ( $n = 55$ ), 2002-03

the variation of Master’s teachers across schools is relatively small (i.e., the standard error is 4.2%), we can conclude that this difference is statistically significant.

Table 3 presents the results of this analysis. In column 5, the word ‘Yes’ is listed if the mean difference is statistically significant. Based on this test we can conclude the following. Public schools have more Master’s teachers, lower student-faculty ratios, more free lunch and Chapter 1 students (not mutually exclusive), more Limited English Proficiency (LEP) students, and more male students. They also have higher student mobility rates, shorter school days and school years, more 4th graders per school, lower attendance and more predominantly Black schools.

The rest of the variables do not have statistically significant differences. But a caveat in order. If a variable is not statistically different it may be due to one of two factors: either the sample is too small (and hence there is a higher measured variance) or there is, in fact, no true difference. Thus, when looking at mean differences, if we see a large difference that is not statistically significant, common sense should also provide some guidance. For example there is some weak evidence (from a statistical point of view) that charter school students do worse in math since the difference is relatively large;<sup>7,8</sup> the mean difference for percent at or above proficiency in math is  $-15.5\%$ . This finding indicates that charter schools appear to do worse. Furthermore, in sections 3.3 and 3.4 we discuss other evidence that charter schools perform worse on exams *vis a vis* public schools.

To summarize, charter schools tend to have more females, Blacks, native English speakers, and students who are not in the lowest income groups. Aside from the demographics, there is no evidence at this point that charter school students are performing better on their exams, and in fact appear to do worse in math.

### 3.3 Regressions

In this section, we attempt to answer the question: What are the determinants of standardized test performance across schools? From Table 2 we see

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<sup>7</sup>The p-values for two-tailed test for Math % Proficient, Math % Above Prof., and Math % Below Prof. are 0.24, 0.38, and 0.27, respectively. For one-tailed tests the p-value would be halved.

<sup>8</sup>For the remainder of the paper, when referring to evidence regarding a particular outcome, the word ‘weak’ will denote weak *statistical* significance.

Charter (n=6)		Public (n=49)		
Variable	Mean	Mean	Diff	Stat. Sig.*
<b>Test Scores (ASK 4)</b>				
% At or Above Prof. - Lang.	61.5	61.8	-0.3	
% Below Prof. - Lang.	38.5	38.2	0.3	
% At or Above Prof. - Math	32.0	47.5	-15.5	
% Below Prof. - Math	68.0	52.5	15.5	
<b>Faculty</b>				
% Bachelor's	80.4	70.1	10.4	
% Master's	13.1	25.6	-12.5	Yes
% Teachers White	55.7	41.2	14.5	
% Teachers Black	27.4	43.8	-16.4	
% Teachers Hisp.	12.6	13.5	-0.9	
% Teachers Asian	4.3	1.5	2.8	
% Admin. White	41.7	40.0	1.7	
% Admin. Black	58.3	51.2	7.1	
% Admin. Minority	58.3	60.0	-1.7	
<b>Students</b>				
% Asian	1.3	0.7	0.6	
% Black	80.7	62.4	18.3	
% Free Lunch	44.1	77.7	-33.6	Yes
% Chapter 1	38.1	97.96	-59.9	Yes
% Hispanic	17.2	30.8	-13.7	
% Limited English Prof.	0.23	9.1	-8.9	Yes
% Male	46.8	52.3	-5.5	Yes
% Native American	0.15	0.1	0.1	
<b>School</b>				
School Year (days)	194.7	180.0	14.7	Yes
School Day (hours)	7.7	6.33	1.42	Yes
% Student Mobility	8.3	31.7	-23.4	Yes
Student-Faculty Ratio	13.6	10.0	3.6	Yes
Avg. Class Size	19.5	18.3	1.3	
Number of 4th Graders	288.0	551.6	-263.6	Yes
Attendance 4th Gr.	95.1	93.1	2.0	Yes
% Predom. Black School	16.7	53.1	-36.4	Yes

Table 3: Comparison of averages for charter and public schools with 4th graders (Charter  $n = 6$ ; Public  $n = 49$ ), 2002-03. \* 'Yes' means statistically significant at the 90% or greater confidence level.

that the average school has 60.12% of its students at proficiency level. Yet the standard deviation is 17.30%, and the range is roughly 60%; thus there is quite a bit of variation in student performance across schools.

Regression analysis is a statistical procedure that accounts for this variation by looking at the variables that determine student performance. Table 4 presents the results. For each of the two exams, the dependent variable (the variable to be explained) is the percentage of general education students in each school that are at or above proficiency.

How well a school performs is a function of several variables that can be broken down into three general categories: student characteristics, such as race, poverty and native tongue; teacher and administration variables, such as the percentage of teachers with a Master's degree; and general school characteristics, such as the student-faculty ratio, whether the school is a charter or not, and the length of the school day.

For each subject two regression equations are given. Equation (1) looks at student performance simply as a measure of the students' socio-economic composition. Equation (2) includes all relevant student, teacher and school variables.

Finally, the last row of the table presents the so-called R-squared ( $R^2$ ) value. This number takes on a value between 0 and 1 and measures the 'explanatory power' of the regression. The closer  $R^2$  is to one, the more the included variables are able to explain the variation in test scores across schools. A value of one means the regression explains 100% of the variation in test scores. Looking at language equation (1), which only includes socio-economic variables of the students, we see that these variables can account for roughly half (51%) of the variation in test scores. In other words, student characteristics go a long way in explaining student performance.

**How to Interpret the Table** Each variable in each equation has two numbers. The top number measures the effect of that variable on student performance. For example, the '% Black' variable in eq. (2) for language is  $-0.65$ . This means that, holding the other variables constant for a particular school, if there was a 10% increase in the number of Black students (relative to the number of White students), then we would predict a drop off of student achievement in the school by 6.5%. The variables 'Charter' and 'Predominantly Blackschool' take on values of either 1 or 0 ('yes' or 'no'). For language eq. (2) we see that charter schools, all else equal, are associated

with a -43.85% drop in test scores compared to public schools, while predominantly Black schools are associated with an increase of 5.08% compared to non black schools (however, the statistical significance for these variables are low, meaning there is low confidence that the true values are different than zero). The variable ' $\ln(Enrollment)$ ' is a transformation of the enrollment variable that allows us to interpret the effect of enrollment size as the change in performance with a 1% increase in enrollment.

The smaller number below each measured effect is called the t-statistic; it measures the degree of 'statistical confidence.' As a rule of thumb, numbers greater than two (in absolute value) indicate a strong statistical significance; numbers below one indicate practically no statistical significance. Furthermore, a \* next to a number also indicates strong statistical significance.

Since there are many variables, the following list highlights some of the most important findings:

- Race, poverty status and native tongue account for about half of the variation in student performance across schools.
- While an increase in the number of Black students (relative to White students) is associated with a decline in performance, there is evidence that Black students in predominantly Black schools perform better in schools when a majority of the teachers are also Black. This finding lends evidence to the fact that there are perhaps cultural differences that are better understood by teachers of a similar race.
- The effects of longer school days and school years (for charter school students) on performance is inconclusive. There is weak evidence that longer school days helps with the language arts exam, but does not help with mathematics; while a longer school year appears to be positive for both exams.
- The variable 'Charter' measures the performance of charter schools *controlling for other factors that determine performance*. In general, charter schools show lower performance on test scores, though these findings are not statistically significant. Interestingly, the regressions show that charter schools perform worse on the language arts exam relative to math.
- School characteristics do matter to some degree, but there is not a *statistically* strong effect for most variables. Looking only at the signs

of the measured effects, however, we see larger schools, larger class sizes and more students per teacher are negative. Increasing the number of teachers with Master's degrees increases performance.

## **3.4 Rankings and Residual Analysis**

### **3.4.1 Rankings**

Tables 5 and 6 present the rankings of schools in terms of performance on exams. Racial characteristics and whether the school is a charter or not are also presented. From these tables we can conclude:

- Predominantly Hispanic schools take four out of the five top slots on the language arts exam.
- Only one charter school (Robert Treat Academy) is in the top five for both categories. Charter school performance for language varies widely, while for math, performance is mostly at the bottom.
- Predominantly Black schools tend to do worse than Hispanic schools in both math and language.
- By comparing the two tables, we can see a large gap between language and math performance overall. For language, eight schools score at 90% or above; while for math, only six schools score 90% or above. Looking at the bottom of the list, we see that six schools get 40% or below in language, yet 27 schools perform 40% or below in math.

### **3.4.2 Residual Analysis**

Looking only at the 'raw' rankings does not present the whole picture. In this section we discuss another kind of rating method based on 'residual' analysis. Section 3.3 presented regression results which are able to account for the variation in student performance as a function of several 'independent' variables. In language equation (2), for example, the regression can account for roughly 70% of the variation in student performance. That means, conversely, that 30% of the variation in student performance cannot be accounted for.

Variable	Langauage		Math	
	(1)	(2)	(1)	(2)
% Black Students	-0.76*	-0.65*	-1.05*	-1.00*
	-5.12	-2.03	-5.18	-2.33
% Hispanic Students	-0.44*	-0.52	-0.52*	-0.34
	-3.54	-1.72	-2.92	-0.79
% Asian Students	1.90*	1.78*	1.29	1.01
	3.56	3.50	1.68	1.39
% Nat. Am. Students	-0.69	4.67	-4.28	-7.62
	-0.13	0.72	-0.69	-0.61
% Free Lunch Students	0.07	-0.11	0.11	-0.08
	0.51	-0.55	0.80	-0.31
% Male Students	-0.22	-0.85*	0.21	-0.40
	-0.40	-2.08	0.27	-0.66
% Limited English Prof.	-0.60	-0.81	-0.82	-0.57
	-1.59	-1.81	-1.83	-1.15
Charter		-43.85		-19.16
		-1.76		-0.54
Student -Faculty Ratio		-1.37		-0.29
		-0.73		-0.10
% Teachers w. Master's		0.43		0.24
		1.41		0.48
% Teachers w. PhD/ED		-0.47		0.12
		-0.88		0.15
Ln(Enrollment)		-5.80		-10.20
		-0.81		-0.90
Grade 4 Class Size		-0.26		-0.24
		-0.40		-0.24
% Teachers Black		-0.18		0.16
		-0.74		0.42
% Teachers Hisp.		0.34		-0.21
		0.71		-0.33
% Teachers Asian		-0.48		1.45
		-0.49		1.23
% Teachers Nat. Am.		-8.19*		-4.28
		-3.96		-1.35
% Admin. Minority		-0.16*		-0.19
		-1.89		-1.40
Predom. Black school		5.08		6.89
		0.48		0.44
Length School Day		4.20		-11.77
		0.39		-0.88
Length School Year		2.05*		1.46
		2.65		1.28
Constant	133.7*	-162.6	115.4*	29.9
	4.11	-1.03	2.44	0.14
N	55	55	55	55
R <sup>2</sup>	0.51	0.71	0.54	0.69

Table 4: Grade 4 regressions. Dependant variable: % at or above proficiency for ASK 4, general education, 2002-03.\*Denotes statistically significant at the 90% level or greater.

Rank	ASK 4 L	% Black	% Hisp.	Charter	School
1	100.0	15.3	80.4		BRANCH BROOK
2	98.5	13.4	75.3		ABINGTON AVE
3	97.6	19.4	76.0	Yes	ROBERT TREAT ACADEMY CS
4	94.9	1.4	24.1		ANN ST
5	93.6	6.1	76.9		FIRST AVENUE
6	93.4	10.4	85.0		RIDGE ST
7	92.6	1.8	47.3		LAFAYETTE ST
8	90.6	1.5	31.3		WILSON AVE
9	87.5	84.8	14.6		FOURTEENTH AVENUE
10	85.7	64.4	14.0		MT VERNON
11	83.0	10.8	45.5		OLIVER ST
12	82.2	40.6	47.6		HAWKINS ST
13	78.6	89.3	4.0	Yes	DISCOVERY CS
14	76.3	96.5	3.5		ALEXANDER ST
15	69.7	11.4	86.6		ROBERTO CLEMENTE
16	68.9	93.5	6.5		SOUTH SEVENTEENTH ST
17	68.4	93.0	6.0		HARRIET TUBMAN
18	65.4	91.5	8.2		QUITMAN COMMUNITY SCHOOL
19	64.1	96.4	3.2		SPEEDWAY AVE
20	63.9	8.8	87.9		ELLIOTT ST
21	63.6	73.8	26.2		SUSSEX AVE
22	60.7	77.4	22.4		BURNET ST
22	60.7	80.0	19.2		WARREN ST
24	60.6	35.8	63.5		SOUTH ST
25	57.9	98.4	1.5		MAPLE AVE SCHOOL
25	57.9	88.6	9.4		CLEVELAND
27	57.6	97.5	2.5		MADISON ELEM.
28	56.9	97.1	2.6		CHANCELLOR AVE
29	56.4	88.6	11.4		LOUISE A. SPENCER
29	56.4	28.3	69.0		DR WILLIAM H HORTON
31	55.6	93.0	6.1		EIGHTEENTH AVE
32	55.3	95.7	4.3	Yes	NEW HORIZONS COMM. CS
33	55.0	36.1	63.9		MCKINLEY
34	54.8	37.9	62.1		BROADWAY
35	53.6	30.3	68.8		RAFAEL HERNANDEZ SCHOOL
36	53.1	91.8	7.6	Yes	LADY LIBERTY ACADEMY CS
37	51.5	91.3	8.7		FIFTEENTH AVE
38	50.0	93.0	7.0	Yes	GRAY CS
38	50.0	93.6	6.4		NEWTON ST
38	50.0	95.4	4.6		THIRTEENTH AVE
41	49.5	99.8	0.1		GEORGE WASHINGTON CARVER
42	49.3	97.7	1.6		LINCOLN
43	49.2	44.9	55.1		DR E ALMA FLAGG
44	47.7	11.5	85.4		FRANKLIN
45	47.2	83.6	16.4		CAMDEN ST
46	46.3	46.3	53.5		MILLER ST
47	44.6	89.3	10.6		MARTIN LUTHER KING JR
48	42.9	93.2	6.8		PESHINE AVE
49	40.7	54.1	44.4		ROSEVILLE AVE SCHOOL
50	40.0	95.1	4.9		BELMONT RUNYON
51	35.7	72.7	26.6		DAYTON ST
52	34.3	94.9	4.1	Yes	MARION P. THOMAS CS
53	32.5	93.9	6.1		BRAGAW AVE
54	32.3	98.6	1.4		HAWTHORNE AVE
55	30.9	93.8	6.2		AVON AVE

Table 5: Rankings of schools, ASK 4 Language: % at or above proficiency, general education, 2002-03.

Rank	ASK 4 M	% Black	% Hisp	Charter	School
1	100.0	15.3	80.4		BRANCH BROOK
2	98.4	13.4	75.3		ABINGTON AVE
3	91.0	1.4	24.1		ANN ST
4	90.7	1.8	47.3		LAFAYETTE ST
4	90.7	19.4	76.0	Yes	ROBERT TREAT ACADEMY CS
6	90.0	10.4	85.0		RIDGE ST
7	87.2	10.8	45.5		OLIVER ST
8	87.1	6.1	76.9		FIRST AVENUE
9	86.9	84.8	14.6		FOURTEENTH AVENUE
10	73.5	1.5	31.3		WILSON AVE
11	73.3	40.6	47.6		HAWKINS ST
12	67.1	64.4	14.0		MT VERNON
13	62.3	93.5	6.5		SOUTH SEVENTEENTH ST
14	59.0	96.4	3.2		SPEEDWAY AVE
15	58.4	93.0	6.0		HARRIET TUBMAN
16	56.6	96.5	3.5		ALEXANDER ST
17	54.6	91.3	8.7		FIFTEENTH AVE
18	53.8	28.3	69.0		DR WILLIAM H HORTON
19	51.8	93.0	6.1		EIGHTEENTH AVE
20	50.9	8.8	87.9		ELLIOTT ST
21	48.5	11.4	86.6		ROBERTO CLEMENTE
22	48.4	36.1	63.9		MCKINLEY
23	46.4	30.3	68.8		RAFAEL HERNANDEZ SCHOOL
24	44.6	11.5	85.4		FRANKLIN
25	44.4	54.1	44.4		ROSEVILLE AVE SCHOOL
26	42.4	35.8	63.5		SOUTH ST
27	41.2	99.8	0.1		GEORGE WASHINGTON CARVER
28	39.3	88.6	11.4		LOUISE A. SPENCER
29	38.1	91.5	8.2		QUITMAN COMMUNITY SCHOOL
30	36.4	97.5	2.5		MADISON ELEM.
31	35.5	91.8	7.6	Yes	LADY LIBERTY ACADEMY CS
32	32.8	97.1	2.6		CHANCELLOR AVE
33	32.2	93.2	6.8		PESHINE AVE
34	32.2	37.9	62.1		BROADWAY
35	31.5	88.6	9.4		CLEVELAND
36	30.5	44.9	55.1		DR E ALMA FLAGG
37	29.9	97.7	1.6		LINCOLN
38	28.0	93.6	6.4		NEWTON ST
39	26.8	89.3	10.6		MARTIN LUTHER KING JR
39	26.8	46.3	53.5		MILLER ST
41	25.0	77.4	22.4		BURNET ST
41	25.0	80.0	19.2		WARREN ST
43	24.6	98.4	1.5		MAPLE AVE SCHOOL
44	22.7	83.6	16.4		CAMDEN ST
45	22.6	98.6	1.4		HAWTHORNE AVE
46	21.4	72.7	26.6		DAYTON ST
46	21.4	89.3	4.0	Yes	DISCOVERY CS
48	21.2	73.8	26.2		SUSSEX AVE
49	21.1	95.1	4.9		BELMONT RUNYON
50	17.9	93.8	6.2		AVON AVE
50	17.9	93.9	6.1		BRAGAW AVE
52	17.2	94.9	4.1	Yes	MARION P. THOMAS CS
53	16.6	93.0	7.0	Yes	GRAY CS
54	15.0	95.4	4.6		THIRTEENTH AVE
55	10.5	95.7	4.3	Yes	NEW HORIZONS COMM. CS

Table 6: Rankings of schools, ASK 4 Math: % at or above proficiency, general education, 2002-03.

Thus we can look at that part of test scores that remains after we 'remove' the explained part; that part left over is known as the 'residual.' If we rank the schools by the size of their residuals, we rank the schools by their performance that we haven't been able to account for, and thus schools with large residual values are performing above what we would expect them to do based on what we can measure. In other words, these schools are achieving a higher performance above expectations, given their measurable qualities.

For each table we have three related variables. First is the residual, which is equal to the difference of what a school actually does minus what we would have predicted from the regression equation. Second is the actual performance (i.e., the percent of students at or above proficiency), and third is the predicted performance based on the second regression equation for each subject.

For example, in the case of Abington Ave., we see that 98.5% of its general education students scored at or above proficiency, yet given its racial, economic, and school characteristics, we predict that they would have only achieved a level of only 74.4%. Thus they achieve a proficiency roughly 24% greater than what we would have predicted. This indicates that there are unmeasured qualities to Abington Ave. that makes it excel; these might include such variables as better organizational structure, curriculum and perhaps general student preparedness.

To highlight a few results, we see that:

- Unlike the raw rankings of Tables 5 and 6, 14th Avenue and Ridge St., predominately Black schools, achieve much higher performance than we would have predicted given what we can measure. Thus there are unmeasurable organizational and student characteristics at work that make them, relatively speaking, higher performing schools.
- Looking at the Speedway Avenue school for math, we see an actual performance of 59%, with a predicted performance of 29.6%. Though 41% of its students are below proficiency in math, they are actually doing much better than what we would predict; which indicates that the school is perhaps doing something right in terms of organizational and other institutional factors.
- Conversely, Roseville Ave. has a residual for language of -27.3% and for math -25.8%, indicating a much lower performance than we would predict, suggesting possible organizational problems.

- Charter schools have relatively small residuals, which indicates little *unmeasured* deviation from expected performance. However, charter schools appear to have lower rankings both in the raw and residual rankings.

## 4 Analysis of Eighth Grade Students

### 4.1 Descriptive Statistics

Here we present the descriptive statistics for schools that have eighth grade students. Including charter schools, there are 41 schools that have eighth graders. As can be seen from Table 9, the average school has 38.4% proficiency in science, 55.2% in language, and 27.5% in math. The average school has 65.7% Black students and 26.6% Hispanic, with 71.6% of its students receiving free lunches. In the average school, 44.6% of its teachers are Black, 13.6% Hispanic and 40% White. On average, teachers with a Master's degree make up less than 25% of the faculty. 50% of the schools are 'predominantly Black schools' and 10% are charters.

### 4.2 Charter Versus Public Schools

In this section we perform a similar analysis as in section 3.2 by comparing the averages of charter and public schools for various statistics. We seek to determine if charter schools are qualitatively different than public schools.

Looking at Table 10, we can say the following:

- 8th graders in charter schools do, in fact, perform better on language and sciences exam and about the same on math.
- Charter schools have a higher Black population, but lower Hispanic population; there is weak evidence that charter school students are not as poor as their public school counterparts, on average. They also have relatively fewer male students.
- Charter schools have lower populations of minority administrators, as well as a lower population of Black teachers.

Rank	Residual	ASK 4 L	Predicted	% Black	Charter	School
1	24.1	98.5	74.4	13.4		ABINGTON AVE
2	18.8	87.5	68.7	84.9		FOURTEENTH AVENUE
3	18.8	68.9	50.1	93.5		SOUTH SEVENTEENTH ST
4	13.9	93.4	79.5	10.4		RIDGE ST
5	13.4	64.1	50.7	96.4		SPEEDWAY AVE
6	12.3	76.3	64.0	96.5		ALEXANDER ST
7	11.6	60.7	49.1	77.4		BURNET ST
8	11.3	69.7	58.4	11.4		ROBERTO CLEMENTE
9	10.4	49.5	39.1	99.8		GEORGE WASHINGTON CARVER
10	9.8	57.6	47.8	97.5		MADISON ELEM.
11	9.6	83.0	73.4	10.9		OLIVER ST
12	6.5	82.2	75.7	40.6		HAWKINS ST
13	6.2	63.6	57.4	73.8		SUSSEX AVE
14	6.2	51.5	45.3	91.3		FIFTEENTH AVE
15	5.5	68.4	62.9	93.0		HARRIET TUBMAN
16	5.0	100.1	95.1	15.3		BRANCH BROOK
17	4.8	94.9	90.1	1.4		ANN ST
18	4.6	97.6	93.1	19.4	Yes	ROBERT TREAT ACADEMY CS
19	4.4	65.4	601.0	91.6		QUITMAN COMMUNITY SCHOOL
20	3.4	55.6	52.2	93.0		EIGHTEENTH AVE
21	2.3	50.0	47.7	93.0	Yes	GRAY CS
22	1.9	78.6	76.8	89.3	Yes	DISCOVERY CS
23	1.8	60.7	58.9	80.0		WARREN ST
24	1.3	49.2	47.9	44.9		DR E ALMA FLAGG
25	0.9	60.6	59.7	35.8		SOUTH ST
26	0.6	49.3	48.7	97.7		LINCOLN
27	0.6	53.1	52.6	91.9	Yes	LADY LIBERTY ACADEMY CS
28	0.0	56.4	56.4	88.6		LOUISE A. SPENCER
29	0.0	32.3	32.3	98.6		HAWTHORNE AVE
30	-0.3	46.3	46.6	46.3		MILLER ST
31	-0.4	55.0	55.4	36.1		MCKINLEY
32	-1.1	92.6	93.7	1.8		LAFAYETTE ST
33	-2.3	85.7	88.0	64.4		MT VERNON
34	-2.5	93.6	96.1	6.1		FIRST AVENUE
35	-2.6	57.9	60.5	88.6		CLEVELAND
36	-2.6	42.9	45.5	93.2		PESHINE AVE
37	-2.7	56.9	59.6	97.1		CHANCELLOR AVE
38	-2.9	50.0	52.9	93.6		NEWTON ST
39	-2.9	47.2	50.1	83.6		CAMDEN ST
40	-4.3	44.6	48.9	89.3		MARTIN LUTHER KING JR
41	-4.4	57.9	62.3	98.4		MAPLE AVE SCHOOL
42	-4.6	34.3	38.9	94.9	Yes	MARION P. THOMAS CS
43	-4.6	55.3	59.9	95.7	Yes	NEW HORIZONS COMM. CS
44	-6.3	53.6	59.9	30.3		RAFAEL HERNANDEZ SCHOOL
45	-7.3	50.0	57.3	95.4		THIRTEENTH AVE
46	-7.5	56.4	63.9	28.3		DR WILLIAM H HORTON
47	-8.6	54.8	63.4	37.9		BROADWAY
48	-9.1	63.9	73.0	8.8		ELLIOTT ST
49	-14.5	90.6	105.1	1.5		WILSON AVE
50	-16.3	35.7	52.0	72.8		DAYTON ST
51	-16.4	32.5	48.9	94.0		BRAGAW AVE
52	-16.7	40.0	56.7	95.1		BELMONT RUNYON
53	-18.7	47.7	66.4	11.5		FRANKLIN
54	-23.2	30.9	54.1	93.8		AVON AVE
55	-27.3	40.7	68.0	54.2		ROSEVILLE AVE SCHOOL

Table 7: Ranking of ASK 4 Language residuls, 2002-03.

Rank	Residual	ASK 4 M	Predicted	% Black	Charter	School
1	38.2	98.4	60.2	13.4		ABINGTON AVE
2	35.1	86.9	51.8	84.8		FOURTEENTH AVENUE
3	29.4	59.0	29.6	96.4		SPEEDWAY AVE
4	22.1	90.0	67.9	10.4		RIDGE ST
5	21.2	41.2	20.0	99.8		GEORGE WASHINGTON CARVER
6	19.5	62.3	42.8	93.5		SOUTH SEVENTEENTH ST
7	19.2	54.6	35.4	91.3		FIFTEENTH AVE
8	14.6	87.2	72.6	10.8		OLIVER ST
9	14.3	100.1	85.8	15.3		BRANCH BROOK
10	13.9	56.6	42.7	96.5		ALEXANDER ST
11	11.7	58.4	46.7	93.0		HARRIET TUBMAN
12	9.6	36.4	26.8	97.5		MADISON ELEM.
13	7.4	91.0	83.6	1.4		ANN ST
14	7.0	17.2	10.2	94.9	Yes	MARION P. THOMAS CS
15	5.5	35.5	30.0	91.8	Yes	LADY LIBERTY ACADEMY CS
16	5.4	32.2	26.8	93.2		PESHINE AVE
17	5.4	51.8	46.4	93.0		EIGHTEENTH AVE
18	4.9	42.4	37.5	35.8		SOUTH ST
19	2.3	90.7	88.4	1.8		LAFAYETTE ST
20	2.2	73.3	71.1	40.6		HAWKINS ST
21	1.6	16.6	15.0	93.0	Yes	GRAY CS
22	1.5	38.1	36.6	91.5		QUITMAN COMMUNITY SCHOOL
23	1.1	39.3	38.2	88.6		LOUISE A. SPENCER
24	1.0	48.5	47.5	11.4		ROBERTO CLEMENTE
25	0.1	87.1	87.0	6.1		FIRST AVENUE
26	0.0	22.6	22.6	98.6		HAWTHORNE AVE
27	-0.5	53.8	54.3	28.3		DR WILLIAM H HORTON
28	-1.4	90.7	92.1	19.4	Yes	ROBERT TREAT ACADEMY CS
29	-1.8	29.9	31.7	97.7		LINCOLN
30	-1.8	31.5	33.3	88.6		CLEVELAND
31	-2.7	25.0	27.7	77.4		BURNET ST
32	-2.8	10.5	13.3	95.7	Yes	NEW HORIZONS COMM. CS
33	-3.1	67.1	70.2	64.4		MT VERNON
34	-3.5	28.0	31.5	93.6		NEWTON ST
35	-4.6	26.8	31.4	89.3		MARTIN LUTHER KING JR
36	-6.0	24.6	30.6	98.4		MAPLE AVE SCHOOL
37	-6.5	46.4	52.9	30.3		RAFAEL HERNANDEZ SCHOOL
38	-7.3	48.4	55.7	36.1		MCKINLEY
39	-7.8	32.8	40.6	97.1		CHANCELLOR AVE
40	-8.1	30.5	38.6	44.9		DR E ALMA FLAGG
41	-8.6	50.9	59.5	8.8		ELLIOTT ST
42	-10.0	21.4	31.4	89.3	Yes	DISCOVERY CS
43	-10.1	26.8	36.9	46.3		MILLER ST
44	-10.9	44.6	55.5	11.5		FRANKLIN
45	-11.4	22.7	34.1	83.6		CAMDEN ST
46	-12.2	32.2	44.4	37.9		BROADWAY
47	-12.7	17.9	30.6	93.8		AVON AVE
48	-15.0	21.1	36.1	95.1		BELMONT RUNYON
49	-17.0	25.0	42.0	80.0		WARREN ST
50	-17.3	21.4	38.7	72.7		DAYTON ST
51	-18.8	15.0	33.8	95.4		THIRTEENTH AVE
52	-19.4	17.9	37.3	93.9		BRAGAW AVE
53	-21.8	21.2	43.0	73.8		SUSSEX AVE
54	-25.4	73.5	98.9	1.5		WILSON AVE
55	-25.8	44.4	70.2	54.1		ROSEVILLE AVE SCHOOL

Table 8: Ranking of ASK4 Math residuals, 2002-03.

Variable	Mean	Std. Dev.	Min	Max
<b>Test Scores (GEPA) Gen. Ed.</b>				
% Proficient - Science	38.4	19.3	9.2	77.6
% Above Prof.- Science	4.1	9.8	0	48.3
% Below Prof. - Science	57.4	24.6	0	89.7
% Proficient - Lang.	55.2	21.7	8.8	100.0
% Above Prof. - Lang.	2.1	4.6	0	23.1
% Below Prof. - Lang.	42.7	23.9	0	91.3
% Proficient - Math	27.5	17.5	2.4	71.7
% Above Prof. - Math	5.9	8.9	0	32.1
% Below Prof. - Math	66.6	24.1	13.3	97.6
<b>Students</b>				
% Asian	0.7	1.9	0.0	10.1
% Black	65.7	34.8	1.4	99.8
% Hispanic	26.6	26.5	0.1	85.0
% Native American	0.0	0.1	0.0	0.8
% White	7.0	17.8	0.0	73.3
% Chapter 1	92.5	24.9	0.0	100.0
% Free Lunch	71.6	16.5	33.3	99.4
% Reduced or Free Lunch	82.2	13.0	42.6	99.4
% Male	50.5	4.4	34.0	57.8
<b>Faculty</b>				
% Teachers Asian	1.7	2.7	0.0	13.3
% Teachers Black	44.6	26.9	0.0	80.0
% Teachers Hispanic	13.6	12.5	0.0	50.0
% Teachers White	40.0	22.0	11.9	86.6
% Admin. Minority	60.5	33.0	0.0	100.0
% Teach. w. Bachelor's	70.1	9.2	43.3	100.0
% Teach. w. Master's	24.8	8.6	0.0	53.3
% Teach. w. Ph.D./E.D	5.1	4.7	0.0	25.0
<b>School</b>				
Student - Faculty Ratio	11.1	5.1	6.5	40.3
Student - Admin. Ratio	201.3	84.3	16.0	484.0
Grade 8 Enrollment	74.1	49.3	10.0	250.0
Student Mobility Rate	27.7	13.6	2.7	84.1
Avg. Attendance	91.8	2.6	83.0	96.4
Avg. Class Size	19.0	3.1	12.4	26.5
% Predom. Black School	50			
% Charter	10			

Table 9: Descriptive statistics for schools with eighth grades ( $n = 40$  or  $41$ ), 2002-03.

- Charter schools have longer school days and school years, and lower total enrollments.

In summary, charter schools demonstrate some strong differences. On average, charter schools have students with a different socio-economic background; they have a different racial mix of teachers and administrators. Students are in school for more hours, and the schools have smaller enrollments. Finally 8th grade charter school students perform better on language and science exams.

### 4.3 Regressions

Similar to the regressions in section 3.3, this section reports the results of regressions for 8th grade exam performance. The dependent variable is the percentage of students in each school who score at or above proficiency level. For each exam—language, math and science—two regressions are presented: the first looks at test performance as a function of just socio-economic variables, the second includes the relevant school and faculty characteristics. Unlike the 4th grade regressions, data are available for two years for the GEPA (Grade Eight Proficiency Assessments) for each school. Using two years of data adds two advantages: (1) it increases the sample size from 40 to 80, which allows for more precise measurement and increased statistical confidence, and (2) it allows us to test for overall improvement over time, and if charter schools are improving faster than public schools.<sup>9</sup>

Most of the variables in the 8th grade regressions are the same as the 4th grade regressions. Here we note the differences. The variable 'Year 2003' measures performance in the 2002-03 school year relative to the 2001-02 school year, holding constant the other variables. Looking at the eq. (2) for the three exams, we can conclude that, in general, there was an across-the-board increase in test scores, with science and language showing the most gains. The variable 'Year\*Charter' measures whether charter schools have shown greater improvements or not compared to public schools from school year 2001-02 to 2002-03. Though not statistically significant, there is weak evidence that charter schools have had faster improvement in language and science. Unlike the 4th graders, there is a positive 'charter school effect,'

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<sup>9</sup>Note that though there are 41 schools with eighth graders, for 2001-02, there is no test score data for Renaissance Academy, and for 2002-03, there is no test score data for Gray Charter School.

	<b>Charter</b>	<b>Public</b>		
<b>Variable</b>	<b>Mean</b>	<b>Mean</b>	<b>Diff.</b>	<b>Stat. Sig.*</b>
<b>Test Scores (GEPA)</b>				
% At or Above Prof. - Lang.	84.3	55.1	29.2	Yes
% At or Above Prof. - Math	38.7	33.1	3.8	
% At or Above Prof. - Science	73.9	40.0	33.9	Yes
% Below Prof. - Science	26.1	60.0	-33.9	Yes
% Below Prof. - Lang.	15.7	44.9	-29.2	Yes
% Below Prof. - Math	61.9	66.9	-5.0	
<b>Students</b>				
% Asian	1.7	0.6	1.1	
% Black	86.0	63.5	22.5	Yes
% Hispanic	10.5	28.3	-17.8	Yes
% Nat. Am.	0.0	0.04	-0.04	Yes
% White	1.9	7.6	-5.7	
% LEP	0.5	7.3	-6.8	Yes
% Male	44.8	51.1	-6.3	Yes
% Free Lunch	56.3	73.2	-17.0	
% Chapter 1	73.5	94.6	-21.1	
<b>Faculty</b>				
% Admin. Minority	12.5	65.7	-53.2	Yes
% Teachers w. Bachelor's	72.3	69.8	2.4	
% Teachers w. Mater's	26.9	24.6	2.3	
% Teachers w. Ph.D./E.D.	0.8	5.6	-4.7	Yes
% Teachers Asian	4.3	1.4	2.8	
% Teachers Black	14.9	47.9	-33.0	Yes
% Teachers Hispanic	21.1	12.8	8.3	
% Teachers Native Am.	0.0	0.1	-0.1	
% Teachers White	59.8	37.8	21.9	
<b>School</b>				
School Day (hours)	8.1	6.4	1.7	Yes
Student-Faculty Ratio	10.7	11.2	-0.5	
Student Mobility	7.0	29.9	-22.9	Yes
Class Size	16.1	19.3	-3.2	
Total School Enrollment	147.5	619.1	-471.6	Yes
School Year (days)	197.0	180.0	17.0	Yes

Table 10: Comparison of averages for charter and public schools with eighth graders (Charter  $n = 3$  or  $4$ ; Public  $n = 37$ ), 2002-03. \* 'Yes' means statistically significant at the 90% or greater confidence level.

meaning that else equal, 8th grade performance in charter schools is (weakly) better than public schools.

Here we highlight some findings:

- As with 4th graders, race and socio-economic characteristics explains roughly half of the performance across schools. Furthermore, Black and Hispanic students consistently perform worse than White students, however, there is a positive 'predominantly Black school' effect which appears to make up some of this difference for Black students.
- School characteristics explain roughly 15 to 20% of the variation in student performance, but most of the variables are statistically insignificant. However looking only at the signs of the measured effects shows that larger schools perform better, but schools with larger student-teacher ratios perform worse.
- The variable 'Charter,' which measures charter school performance after controlling for the other variables that affect performance, shows that charter school students tend to perform better on their exams, though this evidence is weak from a statistical point of view.
- Charter schools appear to be improving faster than public schools, and an increased school days is quite beneficial, while an increased school year is negative.

## 4.4 Rankings and Residual Analysis

### 4.4.1 Rankings

Tables 12 through 14 present the performance rankings for the 41 eighth grade schools, in terms of percentage of students achieving at or above proficiency for each of the three exams. Interestingly, charter schools, for the language exam, tend to rank in the top third, with Discovery Charter school tied for first with University High and Abington Ave.

In terms of math, we see that Abington Ave. places first, and Thirteenth Street has the highest ranking for a predominately Black school. As is similar to 4th graders, there is a sizeable gap between math and language performance. Again charter schools tend to be clustered around the middle third of the distribution.

Variable	Langauge		Math		Science	
	(1)	(2)	(1)	(2)	(1)	(2)
Year 2003	8.36*	9.48*	0.79	4.30	5.82	7.26*
	2.05	2.44	0.18	1.00	1.44	1.93
% Black	-0.72*	-0.68*	-0.76*	-1.64*	-0.66*	-0.64*
	-4.43	-2.55	-4.33	-3.64	-4.11	-2.80
% Hispanic	-0.56*	-0.36	-0.60*	-0.59*	-0.48*	-0.29
	-3.66	-1.61	-3.87	-2.05	-3.22	-1.42
% Asian	2.61*	2.11	2.64*	2.58	2.64*	2.15
	2.14	2.09	2.19	2.19	2.32	2.10
% NatAm	5.19	10.24	-3.74	4.71	6.85	13.37
	0.61	1.06	-0.4	0.47	0.53	0.90
% Free Lunch	0.002	0.17	0.17	0.53	-0.26	-0.08
	0.01	0.72	0.93	2.24	-1.22	-0.37
% Male	-1.96*	-0.81	-1.80*	-0.73	-1.56*	-1.87
	-3.91	-1.27	-3.52	-1.08	-3.38	-1.72
% LEP	-0.49	-0.18	-0.25	-0.16	-0.47	-0.24
	-1.20	-0.41	-0.53	-0.31	-1.22	-0.54
Year*Charter		7.78		-0.024		9.33
		0.59		1.15		0.76
Charter		15.43		31.14		23.78
		0.90		0.52		1.56
School day (hours)		25.71		39.78		19.76
		2.74		3.44		2.09
School year (days)		-1.19		-2.65*		-0.574
		-1.81		-3.74		-0.16
ln(Enrollment)		8.10		10.02		11.38*
		1.38		1.40		2.19
% Teach. Black		-0.03		0.41		-0.09
		-0.13		1.75		-0.58
% Teach Hisp.		-0.062		-0.03		0.074
		-0.22		0.11		-0.28
% Teach Asian		-0.19		-0.98		-1.12
		-0.20		-0.10		-1.21
% Admin Minority		-0.10		-0.12		-0.07
		-1.35		-1.45		-0.81
Stud.-Fac. ratio		-2.51*		-2.24*		-2.32*
		-3.41		-2.75		-3.31
% Master's		0.12		0.49		-0.08
		0.38		1.46		-0.28
% Ph.D./E.D.		0.91		-0.02		0.51
		0.15		-0.04		1.04
Black school		7.31		8.01		11.60
		0.89		0.97		1.38
Constant	211*	154.6	177*	274	191*	66.59
	7.93	0.89	5.47	2.591	7.51	0.78
<i>N</i>	80	80	80	80	80	80
<i>R</i> <sup>2</sup>	0.53	0.71	0.47	0.65	0.57	0.72

Table 11: Grade 8 regressions. Dependent variable: % at or above proficiency GEPA, general education, 2001 to 2003. \*Denotes statistically significant at the 90% level or greater.

Rank	GEPA L	% Black	% Hisp	Charter	School
1	100.0	89.3	4.0	Yes	DISCOVERY CS
1	100.0	87.2	10.7		UNIVERSITY HIGH
1	100.0	13.4	75.3		ABINGTON AVE
4	91.4	6.1	76.9		FIRST AVENUE
5	90.9	95.4	4.6		THIRTEENTH AVE
6	90.1	1.4	24.1		ANN ST
7	88.1	1.5	31.3		WILSON AVE
8	86.8	1.8	47.3		LAFAYETTE ST
9	81.5	82.4	16.3	Yes	NORTH STAR ACAD. CS OF NE
10	78.8	16.5	81.7		LUIS MUNOZ MARIN MIDDLE
11	71.4	79.2	14.6	Yes	MARIA L. VARISCO-ROGERS C
11	71.4	90.9	7.8	Yes	GRAY CS*
13	70.5	10.8	45.5		OLIVER ST
14	70.4	98.4	1.5		MAPLE AVE SCHOOL
15	68.2	73.8	26.2		SUSSEX AVE
16	66.7	80.0	19.2		WARREN ST
17	61.7	40.6	47.6		HAWKINS ST
18	60.4	93.3	6.7		MORTON ST
19	60.0	10.4	85.0		RIDGE ST
20	58.8	28.3	69.0		DR WILLIAM H HORTON
21	51.9	35.3	64.4		GLADYS HILLMAN-JONES SCH
22	51.5	46.3	53.5		MILLER ST
23	48.5	98.6	1.4		HAWTHORNE AVE
24	45.8	30.3	68.8		RAFAEL HERNANDEZ SCHOOL
25	45.4	90.9	9.1		CAMDEN MIDDLE
26	45.0	72.7	26.6		DAYTON ST
27	41.9	93.2	6.8		PESHINE AVE
28	40.7	94.4	5.6		HAROLD WILSON
29	40.5	93.9	6.1		BRAGAW AVE
30	40.4	93.6	6.4		NEWTON ST
31	40.0	97.1	2.6		CHANCELLOR AVE
32	38.3	44.9	55.1		DR E ALMA FLAGG
32	38.3	93.5	6.5		SOUTH SEVENTEENTH ST
34	36.0	77.4	22.4		BURNET ST
35	35.2	80.7	8.9		VAILSBURG MIDDLE SCHOOL
36	34.1	89.3	10.6		MARTIN LUTHER KING JR
37	32.3	93.8	6.2		AVON AVE
38	30.4	88.6	11.4		LOUISE A. SPENCER
39	26.7	99.8	0.1		GEORGE WASHINGTON CARVER
40	25.5	96.1	3.9		WILLIAM H BROWN ACADEMY
41	8.8	78.7	19.4		RENAISSANCE ACADEMY

Table 12: Ranking of schools, GEPA Language: % at or above proficiency, 2002-03. \*Data only available for 2001-02.

Rank	GEPA M	% Black	% Hisp	Charter	School
1	86.7	13.4	75.3		ABINGTON AVE
2	79.1	1.5	31.3		WILSON AVE
3	76.6	1.4	24.1		ANN ST
4	75.7	95.4	4.6		THIRTEENTH AVE
5	73.6	1.8	47.3		LAFAYETTE ST
6	73.1	87.2	10.7		UNIVERSITY HIGH
7	69.2	16.5	81.7		LUIS MUNOZ MARIN MIDDLE
8	60.4	6.1	76.9		FIRST AVENUE
9	54.6	89.3	4.0	Yes	DISCOVERY CS
10	50	90.9	7.8	Yes	GRAY CS*
11	47.3	82.4	16.3	Yes	NORTH STAR ACAD. CS OF NE
12	46.1	10.8	45.5		OLIVER ST
13	44.1	46.3	53.5		MILLER ST
14	39.6	93.6	6.4		NEWTON ST
15	35.5	10.4	85.0		RIDGE ST
16	34.0	93.5	6.5		SOUTH SEVENTEENTH ST
17	33.8	28.3	69.0		DR WILLIAM H HORTON
18	30.7	97.1	2.6		CHANCELLOR AVE
19	30.4	73.8	26.2		SUSSEX AVE
20	28.3	93.3	6.7		MORTON ST
21	27.7	40.6	47.6		HAWKINS ST
22	25.6	93.2	6.8		PESHINE AVE
23	24.2	90.9	9.1		CAMDEN MIDDLE
24	24.0	77.4	22.4		BURNET ST
25	21.6	93.9	6.1		BRAGAW AVE
26	20.2	35.3	64.4		GLADYS HILLMAN-JONES SCH
27	20.0	80.0	19.2		WARREN ST
28	18.8	80.7	8.9		VAILSBURG MIDDLE SCHOOL
28	18.8	98.4	1.5		MAPLE AVE SCHOOL
30	14.3	79.2	14.6	Yes	MARIA L. VARISCO-ROGERS C
31	12.7	30.3	68.8		RAFAEL HERNANDEZ SCHOOL
32	12.3	88.6	11.4		LOUISE A. SPENCER
33	12.2	72.7	26.6		DAYTON ST
34	12.1	98.6	1.4		HAWTHORNE AVE
35	11.9	94.4	5.6		HAROLD WILSON
36	11.6	44.9	55.1		DR E ALMA FLAGG
37	9.7	93.8	6.2		AVON AVE
38	9.3	89.3	10.6		MARTIN LUTHER KING JR
39	8.2	99.8	0.1		GEORGE WASHINGTON CARVER
40	2.7	96.1	3.9		WILLIAM H BROWN ACADEMY
41	2.4	78.7	19.4		RENAISSANCE ACADEMY

Table 13: Ranking of schools, GEPA Math: % at or above proficiency, 2002-03. \*Data only available for 2001-02.

With science we see Abington Ave., again in first place, with Discovery in second place. Charter schools are grouped, in general, in the top half of the distribution.

#### 4.4.2 Residual Analysis

Here we perform a similar analysis as in section 3.4.2, where we rank the residuals from the regressions (equation (2) for each subject) from section 4.3. Looking at the language arts scores, we see that the Thirteenth Avenue school has the highest residual, meaning it performs better than predicted given its measurable characteristics. Similarly, the Maple Avenue school scores 21.3% higher than would be predicted based on its measurable characteristics.

## 5 Conclusion

In conclusion, this paper has investigated the characteristics of 4th and 8th grade students in the Newark public school system. We find that charter schools have different characteristics, in terms of student composition and standardized test performance, as compared to public schools. 4th graders tend to perform worse in charter schools, while 8th graders tend to perform better in charter schools. In general, charter schools tend to have more Black students, fewer Black teachers, smaller schools, longer school days and school years.

Using regression analysis, we identify those variables that determine student performance. We find student characteristics explain roughly half the variation in student performance, with school characteristics explaining another 20%. Comparing predicted performance from regressions to actual performance allows us to identify those schools performing above or below expectations.

This work has offered a statistical snapshot of the Newark schools. Future work will look into the reasons that charter schools vary in their performance, and the reasons why schools have particularly large or small residuals.

Rank	GEPA S	% Black	% Hisp	Charter	School
1	100.0	13.4	75.3		ABINGTON AVE
2	90.9	89.3	4.0	Yes	DISCOVERY CS
3	90.1	1.4	24.1		ANN ST
4	82.1	1.5	31.3		WILSON AVE
5	79.0	6.1	76.9		FIRST AVENUE
6	73.7	82.4	16.3	Yes	NORTH STAR ACAD. CS OF NE
7	73.0	87.2	10.7		UNIVERSITY HIGH
8	72.7	95.4	4.6		THIRTEENTH AVE
9	64.3	90.9	7.8	Yes	GRAY CS*
10	64.1	10.8	45.5		OLIVER ST
10	64.1	1.8	47.3		LAFAYETTE ST
12	57.1	79.2	14.6	Yes	MARIA L. VARISCO-ROGERS C
13	51.4	16.5	81.7		LUIS MUNOZ MARIN MIDDLE
14	50.0	80.0	19.2		WARREN ST
15	47.8	73.8	26.2		SUSSEX AVE
16	44.4	10.4	85.0		RIDGE ST
17	43.1	97.1	2.6		CHANCELLOR AVE
18	40.6	98.4	1.5		MAPLE AVE SCHOOL
19	38.5	35.3	64.4		GLADYS HILLMAN-JONES SCH
20	36.4	98.6	1.4		HAWTHORNE AVE
21	35.8	30.3	68.8		RAFAEL HERNANDEZ SCHOOL
22	35.3	46.3	53.5		MILLER ST
22	35.3	28.3	69.0		DR WILLIAM H HORTON
24	32.2	94.4	5.6		HAROLD WILSON
25	31.9	40.6	47.6		HAWKINS ST
26	31.7	44.9	55.1		DR E ALMA FLAGG
27	31.3	90.9	9.1		CAMDEN MIDDLE
28	29.7	80.7	8.9		VAILSBURG MIDDLE SCHOOL
29	26.8	72.7	26.6		DAYTON ST
30	25.9	93.2	6.8		PESHINE AVE
31	22.6	93.8	6.2		AVON AVE
31	22.6	93.3	6.7		MORTON ST
33	21.6	93.9	6.1		BRAGAW AVE
34	19.5	99.8	0.1		GEORGE WASHINGTON CARVER
35	18.6	89.3	10.6		MARTIN LUTHER KING JR
36	16.0	77.4	22.4		BURNET ST
37	15.2	93.6	6.4		NEWTON ST
38	14.6	93.5	6.5		SOUTH SEVENTEENTH ST
39	14.0	88.6	11.4		LOUISE A. SPENCER
40	12.8	96.1	3.9		WILLIAM H BROWN ACADEMY
41	10.3	78.7	19.4		RENAISSANCE ACADEMY

Table 14: Ranking of schools, GEPA Science: % at or above proficiency, 2002-03. \*Data only available for 2001-02.

Rank	Residual	GEPA L	Predicted L	% Black	Charter	School
1	35.6	90.9	55.3	95.4		THIRTEENTH AVE
2	21.3	70.4	49.1	98.4		MAPLE AVE SCHOOL
3	19.5	78.8	59.3	16.5		LUIS MUNOZ MARIN MIDDLE
4	19.2	100.0	80.8	13.4		ABINGTON AVE
5	19.0	60.4	41.4	93.3		MORTON ST
6	17.6	68.2	50.6	73.8		SUSSEX AVE
7	14.2	66.7	52.5	80.0		WARREN ST
8	8.5	8.8	0.3	78.7		RENAISSANCE ACADEMY
9	7.5	100.0	92.5	89.3	Yes	DISCOVERY CS
10	6.1	48.5	42.4	98.6		HAWTHORNE AVE
11	2.8	51.9	49.1	35.3		GLADYS HILLMAN-JONES SCH
12	2.6	90.1	87.5	1.4		ANN ST
13	2.4	91.4	89.0	6.1		FIRST AVENUE
14	2.4	100.0	97.6	87.2		UNIVERSITY HIGH
15	2.4	86.8	84.4	1.8		LAFAYETTE ST
16	2.0	40.5	38.5	93.9		BRAGAW AVE
17	-0.5	45.0	45.5	72.7		DAYTON ST
18	-1.2	51.5	52.7	46.3		MILLER ST
19	-2.5	81.5	84.0	82.4	Yes	NORTH STAR ACAD. CS OF NE
20	-2.8	41.9	44.7	93.2		PESHINE AVE
21	-4.4	40.7	45.1	94.4		HAROLD WILSON
22	-5.0	71.4	76.4	79.2	Yes	MARIA L. VARISCO-ROGERS C
23	-5.1	88.1	93.2	1.5		WILSON AVE
24	-5.3	70.5	75.8	10.8		OLIVER ST
25	-5.5	61.7	67.2	40.6		HAWKINS ST
26	-5.5	38.3	43.8	93.5		SOUTH SEVENTEENTH ST
27	-6.1	58.8	64.9	28.3		DR WILLIAM H HORTON
28	-6.9	45.8	52.7	30.3		RAFAEL HERNANDEZ SCHOOL
29	-6.9	36.0	42.9	77.4		BURNET ST
30	-7.3	45.4	52.7	90.9		CAMDEN MIDDLE
31	-7.5	40.0	47.5	97.1		CHANCELLOR AVE
32	-7.6	60.0	67.6	10.4		RIDGE ST
33	-7.9	35.2	43.1	80.7		VAILSBURG MIDDLE SCHOOL
34	-8.8	40.4	49.2	93.6		NEWTON ST
35	-9.4	38.3	47.7	44.9		DR E ALMA FLAGG
36	-10.2	81.6	71.4	90.9	Yes	GRAY CS*
37	-13.0	34.1	47.1	89.3		MARTIN LUTHER KING JR
38	-13.2	26.7	39.9	99.8		GEORGE WASHINGTON CARVER
39	-14.5	32.3	46.8	93.8		AVON AVE
40	-16.2	25.5	41.7	96.1		WILLIAM H BROWN ACADEMY
41	-19.9	30.4	50.3	88.6		LOUISE A. SPENCER

Table 15: Ranking for GEPA Language residuals, 2002-03. \*Data only available for 2001-02.

Rank	Residual	GEPA M	Predicted M	% Black	Charter	School
1	38.0	75.7	37.7	95.4		THIRTEENTH AVE
2	30.2	86.7	56.5	13.4		ABINGTON AVE
3	24.1	69.2	45.1	16.5		LUIS MUNOZ MARIN MIDDLE
4	14.4	73.6	59.2	1.8		LAFAYETTE ST
5	12.0	76.6	64.6	1.4		ANN ST
6	10.2	2.4	-7.8	78.7		RENAISSANCE ACADEMY
7	10.1	28.3	18.2	93.3		MORTON ST
8	9.6	21.6	12.0	93.9		BRAGAW AVE
9	8.6	54.6	46.0	89.3	Yes	DISCOVERY CS
10	7.9	39.6	31.7	93.6		NEWTON ST
11	6.8	30.7	23.9	97.1		CHANCELLOR AVE
12	5.8	34.0	28.2	93.5		SOUTH SEVENTEENTH ST
13	5.1	30.4	25.3	73.8		SUSSEX AVE
14	3.1	44.1	41.0	46.3		MILLER ST
15	2.0	24.0	22.0	77.4		BURNET ST
16	2.0	79.1	77.1	1.5		WILSON AVE
17	0.7	20.0	19.3	80.0		WARREN ST
18	0.5	18.8	18.3	98.4		MAPLE AVE SCHOOL
19	0.4	25.6	25.2	93.2		PESHINE AVE
20	-1.8	11.9	13.7	94.4		HAROLD WILSON
21	-2.6	73.1	75.7	87.2		UNIVERSITY HIGH
22	-4.1	14.3	18.4	79.2	Yes	MARIA L. VARISCO-ROGERS C
23	-4.5	47.3	51.8	82.4	Yes	NORTH STAR ACAD. CS OF NE
24	-4.6	35.5	40.1	10.4		RIDGE ST
25	-5.0	18.8	23.8	80.7		VAILSBURG MIDDLE SCHOOL
26	-5.5	12.2	17.7	72.7		DAYTON ST
27	-6.6	60.4	67.0	6.1		FIRST AVENUE
28	-7.2	20.2	27.4	35.3		GLADYS HILLMAN-JONES SCH
29	-8.2	27.7	35.9	40.6		HAWKINS ST
30	-8.3	46.1	54.4	10.8		OLIVER ST
31	-8.3	24.2	32.5	90.9		CAMDEN MIDDLE
32	-9.6	12.1	21.7	98.6		HAWTHORNE AVE
33	-9.8	8.2	18.0	99.8		GEORGE WASHINGTON CARVER
34	-11.4	12.7	24.1	30.3		RAFAEL HERNANDEZ SCHOOL
35	-13.0	11.6	24.6	44.9		DR E ALMA FLAGG
36	-13.4	33.8	47.2	28.3		DR WILLIAM H HORTON
37	-15.9	9.7	25.6	93.8		AVON AVE
38	-16.3	9.3	25.6	89.3		MARTIN LUTHER KING JR
39	-17.0	2.7	19.7	96.1		WILLIAM H BROWN ACADEMY
40	-18.5	12.3	30.8	88.6		LOUISE A. SPENCER
41	-19.3	69.3	50.0	90.9	Yes	GRAY CS*

Table 16: Ranking of GEPA Math residuals, 2002-03. \*Data only available for 2001-02.

Rank	Residual	GEPA S	Predicted S	% Black	Charter	School
1	35.7	72.7	37.0	95.4		THIRTEENTH AVE
2	32.9	100.0	67.1	13.4		ABINGTON AVE
3	14.6	47.8	33.2	73.8		SUSSEX AVE
4	12.9	50.0	37.1	80.0		WARREN ST
5	12.6	36.4	23.8	98.6		HAWTHORNE AVE
6	9.2	51.4	42.2	16.5		LUIS MUNOZ MARIN MIDDLE
7	8.1	90.1	82.0	1.4		ANN ST
8	6.5	10.3	3.8	78.7		RENAISSANCE ACADEMY
9	5.9	90.9	85.0	89.3	Yes	DISCOVERY CS
10	5.7	43.1	37.4	97.1		CHANCELLOR AVE
11	5.3	32.2	26.9	94.4		HAROLD WILSON
12	4.8	38.5	33.7	35.3		GLADYS HILLMAN-JONES SCH
13	4.6	26.8	22.2	72.7		DAYTON ST
14	3.8	35.3	31.5	46.3		MILLER ST
15	3.8	73.7	69.9	82.4	Yes	NORTH STAR ACAD. CS OF NE
16	3.4	40.6	37.2	98.4		MAPLE AVE SCHOOL
17	3.2	82.1	78.9	1.5		WILSON AVE
18	0.9	73.0	72.1	87.2		UNIVERSITY HIGH
19	0.2	29.7	29.5	80.7		VAILSBURG MIDDLE SCHOOL
20	0.2	21.6	21.4	93.9		BRAGAW AVE
21	-1.2	64.1	65.3	10.8		OLIVER ST
22	-2.1	31.7	33.8	44.9		DR E ALMA FLAGG
23	-2.9	79.0	81.9	6.1		FIRST AVENUE
24	-3.5	16.0	19.5	77.4		BURNET ST
25	-3.9	35.8	39.7	30.3		RAFAEL HERNANDEZ SCHOOL
26	-4.2	22.6	26.8	93.3		MORTON ST
27	-5.4	25.9	31.3	93.2		PESHINE AVE
28	-5.9	31.3	37.2	90.9		CAMDEN MIDDLE
29	-6.3	14.6	20.9	93.5		SOUTH SEVENTEENTH ST
30	-7.1	22.6	29.7	93.8		AVON AVE
31	-7.6	71.9	64.3	90.9	Yes	GRAY CS*
32	-8.4	64.1	72.5	1.8		LAFAYETTE ST
33	-9.8	57.1	66.9	79.2	Yes	MARIA L. VARISCO-ROGERS C
34	-10.8	19.5	30.3	99.8		GEORGE WASHINGTON CARVER
35	-11.0	35.3	46.3	28.3		DR WILLIAM H HORTON
36	-12.4	18.6	31.0	89.3		MARTIN LUTHER KING JR
37	-13.1	31.9	45.0	40.6		HAWKINS ST
38	-13.8	44.4	58.2	10.4		RIDGE ST
39	-14.0	12.8	26.8	96.1		WILLIAM H BROWN ACADEMY
40	-15.9	15.2	31.1	93.6		NEWTON ST
41	-22.9	14.0	36.9	88.6		LOUISE A. SPENCER

Table 17: Ranking of GEPA Science residuals, 2002-03. \*Data available for 2001-02.

## References

- [1] KPMG (2001). "Evaluation of the New Jersey Charter Program," report available from the New Jersey Department of Education.
- [2] Newark Public Schools Website (2004) <http://www.nps.k12.nj.us/>
- [3] New Jersey Department of Education (2004). "Vital Education Statistics," <http://www.state.nj.us/njded/data/vitaled/0203/>
- [4] New Jersey Department of Education (2003). "FAQ About Charter Schools," <http://www.nj.gov/njded/chartsch/app/app.pdf>