NATIONAL
CENTER *for* ANALYSIS *of* LONGITUDINAL DATA *in* EDUCATION RESEARCH

TRACKING EVERY STUDENT'S LEARNING EVERY YEAR

A program of research by the American Institutes for Research with Duke University, Northwestern University, Stanford University, University of Missouri-Columbia, University of Texas at Dallas, and University of Washington

AIR

A Closer Look at the Student Achievement Trends in the District of Columbia between 2006-07 and 2012-13

UMUT ÖZEK

WORKING PAPER 119 • NOVEMBER 2014

A Closer Look at the Student Achievement Trends in the District of Columbia between 2006-07 and 2012-13

Umut Özek
American Institutes for Research

Contents

Acknowledgements

I would like to thank Jane Hannaway, Dan Goldhaber, Heather Harding, and the members of the National Academy of Sciences Committee for the Five Year (2009-2013) Summative Evaluation of the District of Columbia Public Schools for useful comments. All errors are mine.

This research was supported by the National Center for the Analysis of Longitudinal Data in Education Research (CALDER) funded through Grant R305C120008 to the American Institutes for Research from the Institute of Education Sciences, U.S. Department of Education. CALDER working papers have not gone through final formal review and should be cited as working papers. They are intended to encourage discussion and suggestions for revision before final publication. The views expressed are those of the authors and should not be attributed to the American Institutes for Research, its trustees, or any of the funders or supporting organizations mentioned herein.

CALDER • American Institutes for Research
1000 Thomas Jefferson Street N.W., Washington, D.C. 20007
202-403-5796 • http://www.caldercenter.org/

A Closer Look at the Student Achievement Trends in the District of Columbia between 2006-07 and 2012-13

Umut Özek

CALDER Working Paper No. 119
November 2014

Abstract

In this paper, we present a closer look at the student achievement trends in the District of Columbia between 2006-07 and 2012-13. We have three main conclusions. First, we find that overall, math scores in the District have improved. The improvements in reading scores during this time frame, however, were primarily limited to the first year after the PERAA implementation. While almost all student subgroups have experienced test score gains in math, these improvements were higher among the more affluent black and Hispanic students. Second, we find that these observed trends in math scores persist even after controlling for the cross-cohort differences in observed student characteristics. In particular, the estimates indicate that less than 10 percent of the year-to-year improvements in test scores can be attributed to the changing student composition in the District over this time frame. Finally, we show that existing students have also experienced gains in math even though the students who are new to the District's public school system score at higher levels on standardized tests when compared to existing students.

1. Overview

This report is the fourth part of a larger study overseen by the National Research Council that is examining the effects of PERAA (Public Education Reform Amendment Act) of 2007 in the District of Columbia. The first two reports examined the outcomes in 2010-11 and 2011-12 (Education Consortium for Research and Evaluation, 2013a and 2013b), whereas the third report documented the trends in outcomes related to human resources and human capital strategies between 2008-09 and 2012-13 school years (Education Consortium for Research and Evaluation, 2014).

In this report, we present a closer look at the student achievement trends in the District between 2006-07 and 2012-13. We first provide a detailed overview of the reading and math test score trends in the District using DC CAS scale scores, looking at progress among various student subgroups of interest (e.g. by socioeconomic status, race/ethnicity, gender, students in DCPS versus charter schools, and students in different school wards). We then examine the contribution of socioeconomic and demographic shifts on these student achievement trends in the District during this time frame.

This report has three main conclusions. First, we find that overall, math scores in the District have improved. The improvements in reading scores during this time frame, however, were primarily limited to the first year after the PERAA implementation. While almost all student subgroups have experienced test score gains in math, these improvements were higher among the more affluent black and Hispanic students.

Second, we find that these observed trends in math scores persist even after controlling for the cross-cohort differences in observed student characteristics. In particular, the estimates indicate that less than 10 percent of the year-to-year improvements in test scores can be attributed to the changing student composition in the District over this time frame.

Finally, we show that existing students have also experienced gains in math even though the students who are new to the District's public school system score at higher levels on standardized tests when compared to existing students.

It is important to note two important limitations of this report that inhibit our ability to make strong causal inferences about the effects of PERAA legislation. First, we cannot rule out the role of previous student performance trends or student compositional changes that we were unable to control for statistically, or concurrent policies or conditions outside of PERAA, as explanations for the results.

Second, it is important to remember that our baseline period, school year 2006-2007, was the second year that students in the District took the DC CAS exam. The observed improvement, especially the improvement occurring in the first few years, is consistent with an "adjusting to a new test" hypothesis, and may suggest some fraction of the improvement in the earlier years is due to teachers and students becoming accustomed to the new test. We have no way of assessing the validity of this explanation with our current data.

2. Research Design

The research reported here is based on student-level administrative data that cover all PS-12 public school students attending traditional public and charter schools in the District. In these data, we observe the DC Comprehensive Assessment System (DC CAS) scores in reading and math for all students in tested grades (3 through 8 and 10) for academic years between 2006-07 and 2012-13, and student characteristics including race/ethnicity, gender, free or reduced lunch eligibility, limited English proficiency status, and special education status. We supplement these data with Multi-year Enrollment Audit Data (MEAD), which includes enrollment information for all students between 2001-02 and 2011-12. In what follows, we detail our empirical strategy for each question we address in this report.

Achievement Trends in the District between 2006-07 and 2012-13

First, we explore the achievement trends in the District between 2006-07 and 2012-13, looking at the overall progress as well as the progress for various subgroups of interest. For this purpose, we use DC-CAS scale scores in reading and math, standardized to zero mean and unit variance at the test grade level over all available years. Hence, for each student, this standardized score represents the relative position of his/her test score in a given year compared to all other students at the same grade level between 2006-07 and 2012-13. We then compare how later cohorts performed in standardized tests relative to students at the same grade levels in 2006-07, the school year before PERAA took effect, using year and grade indicators.[1] Hence, our estimates represent the within-grade, across cohort differences in average test scores, with the 2006-07 test scores as the baseline group.

To better understand the magnitudes of these test score changes, it is important to remember that one standard deviation in DC CAS reading or math score corresponds to approximately 15 to 18 DC CAS scale score points, depending on the tested grade. This is roughly equivalent to the score width of the 'basic' and 'proficient' categories under DC CAS.[2] Therefore, one-standard deviation improvement from one cohort to the next would roughly move the average student from the basic category to the proficient (or from the proficient category to the advanced) in both reading and math.

The Role of Socioeconomic and Demographic Shifts in Achievement Trends

Over the last three decades, the District of Columbia has experienced significant shifts in its demographic and socioeconomic composition, which accelerated further over the last decade (Tatian and Lei, 2014). To explore how much these shifts have contributed to changes in student achievement,

[1] Formally, we estimate the following equation using OLS: $Y_{it} = \beta_0 + \beta_1 Y07_t + \beta_2 Y08_t + \beta_3 Y09_t + \beta_4 Y10_t + \beta_5 Y11_t + \beta_6 Y12_t + \delta_g + \varepsilon_{it}$ where Y_{it} is the test score in reading or math, standardized to zero mean and unit variance at the test grade level over all years, and δ_g is the grade fixed-effects. In this specification, β_1 through β_6 reflect the within-grade, across-cohort differences in average test scores, compared to the 2006-07 school year.

[2] See http://osse.dc.gov/publication/dc-cas-technical-reports, accessed 9/2/2014.

we follow three approaches. First, we introduce a vector of student characteristics, which includes FRPL eligibility, race/ethnicity, gender, special education status, and limited English proficiency status, into the regressions. In this way, we compare the achievement levels of students in later cohorts with the levels of comparable students (along observed student attributes) who attended the same grade in 2006-07 school year. Second, we utilize Oaxaca-Blinder decomposition to investigate how much of the year-to-year changes in student achievement are explained by these differences in observed student characteristics.

Another explanation to the observed achievement trends in the District over this time period is the cross-cohort discrepancies in unobserved student characteristics such as educational motivation and parental involvement. While this hypothesis is not directly testable, we present indirect evidence, comparing the achievement levels of 'new' students with observationally comparable 'existing' students who attended kindergarten in the DC public school system. [3]

In this exercise, we restrict the sample to cohorts in tested grades for whom we can identify the grade of entry into the DC public school system using our enrollment data. These cohorts include the 3rd, 4th and 5th graders between 2006-07 and 2012-13, 6th graders between 2007-08 and 2012-13, 7th graders between 2008-09 and 2012-13, and 8th graders between 2009-10 and 2012-13. In the analysis we use DC CAS scale scores that are standardized at the grade-year-subject level, which gives us how well each student performs compared to his/her peers at the same grade level in a given year. Using this sample,

[3] Another exercise that would be helpful in assessing the extent to which population shifts have led to the changes in test scores is to look at the progress of individual students over time. However, this is not feasible with our current data, since DC CAS scale scores are not vertically-aligned and do not facilitate cross-grade comparisons of test scores.

we compare the achievement levels of 'existing' students who attended a DC public school since kindergarten with the newcomers who entered the DC public school system after kindergarten.[4]

3. Results

3.1. Achievement Trends in the District

Test scores have improved between 2006-07 and 2012-13 in math. Reading scores also improved, but improvements are primarily limited to the first year after PERAA took effect. Table 1 and Figure 1 present an overview of the achievement trends in the District between 2006-07 and 2012-13. The findings suggest an upward trend in student achievement in math, with students in later years outperforming students at the same grade level in 2006-07 school year. Specifically, students in later years outscore their peers who were at the same grade level in 2006-07 by about 0.18 to 0.43 of the standard deviation in math. In reading, however, achievement improves in 2007-08, and remains almost unchanged until 2012-13 when we see another jump in student performance.

These trends are in agreement with the District's average National Assessment of Educational Progress (NAEP) scores during this time frame, presented in Figure A1 (Appendix A). The figures in the two panels portray the average NAEP scores in reading and math between 2003 and 2013 (the latest year available) for the 4th and the 8th graders respectively. Math scores have steadily increased during this time frame in the District, with a statistically significant increase in the slope for the 8th graders in 2007 (no such break exists for the 4th graders). Similar to the analysis using DC CAS scores given above, NAEP scores in reading follow a relatively flatter trajectory between 2007 and 2013.

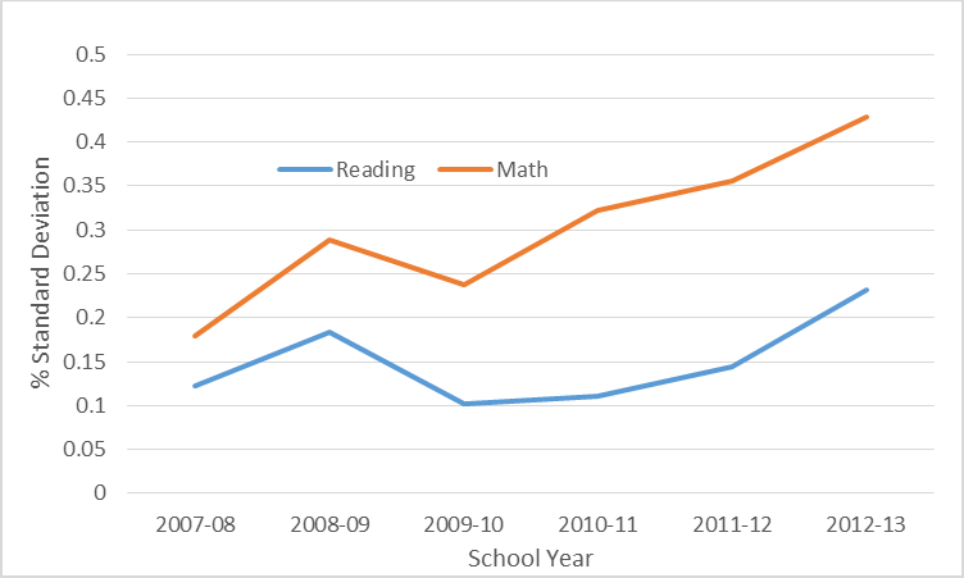
[4] Formally, using OLS, we estimate $Y'_{it} = \beta_0 + \beta_1 Late_{it} + \gamma_t + \varepsilon_{it}$ where Y'_{it} represents reading or math scores standardized to zero mean and unit variance at the grade-year level, and $Late_{it}$ indicates entry into the DC public school system after kindergarten. We supplement this model with observed student covariates, and school fixed-effects to take into account the observed differences in student attributes and schools attended between existing and new students.

Table 1 – Student Achievement in the District, compared to 2006-07 School Year

	Reading	Math
Year: 2007-08	0.123***	0.179***
	(0.006)	(0.006)
Year: 2008-09	0.184***	0.289***
	(0.006)	(0.006)
Year: 2009-10	0.102***	0.238***
	(0.008)	(0.007)
Year: 2010-11	0.110***	0.322***
	(0.008)	(0.007)
Year: 2011-12	0.144***	0.355***
	(0.007)	(0.007)
Year: 2012-13	0.231***	0.429***
	(0.007)	(0.008)
2006-07 average score	-0.128	-0.260
N	219,286	219,894

Notes: In this table, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Figure 1 – Student Achievement in the District, compared to 2006-07 School Year



Limitation: It is important to note that the baseline period in our study, school year 2006-07, was the second year that students in the District took the DC CAS exam. As such, some fraction of the observed improvement, especially in the earlier years, may be due to teachers and students becoming accustomed to the new test. In fact, when we exclude the 2006-07 school year from the above analysis, and use the 2007-08 as the baseline, the estimated achievement trends become significantly flatter for both subjects, especially in reading where the average test scores in 2009-10 and 2010-11 are no longer statistically distinguishable from the baseline year. We cannot disentangle the effects of PERAA legislation from these adjustment effects since the two events affected the entire public school student population simultaneously. We are also unable to fully capture the pre-PERAA trends in student achievement due to the timing of the DC CAS implementation.

Student test scores have improved for both economically advantaged and disadvantaged students, with larger gains for the former group. Table 2 breaks down the trend analysis by student socioeconomic status, as measured by free or reduced priced lunch (FRPL) eligibility. The estimates, all of which are statistically significant at conventional levels, indicate improvements in test scores for both FRPL eligible and ineligible students. These gains are much larger among the latter group, and in math. For instance, compared to FRPL ineligible students at the same grade level in 2006-07, FRPL ineligible students in 2012-13 score roughly 67 and 87 percent of the standard deviation better in reading and math respectively, whereas these numbers are 18 and 38 for less affluent students. FRPL ineligible students experienced steadier gains in both reading and math during this time frame while the improvements for ineligible students were mainly concentrated in the first two years. Figure 2 presents a graphical representation of these estimates, reaching the same conclusions.

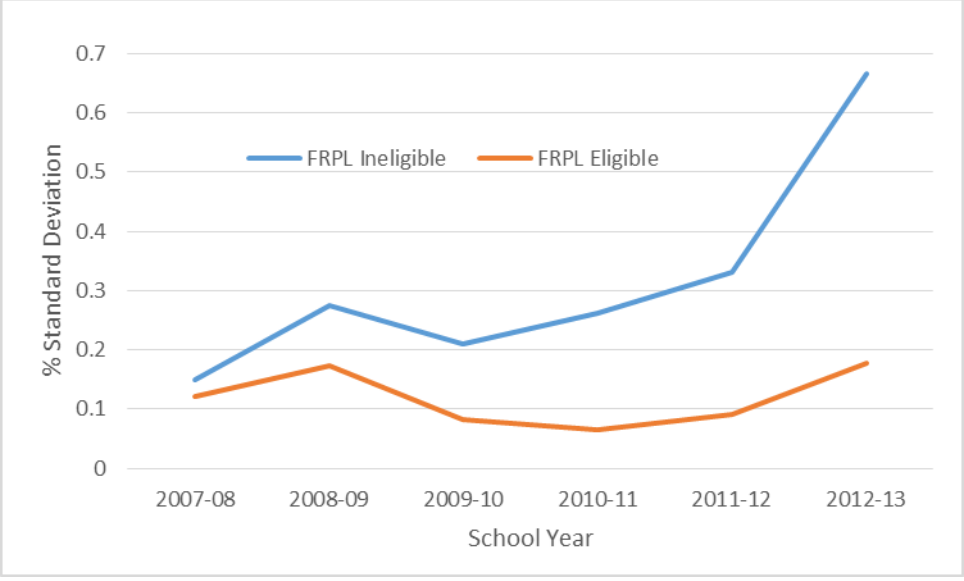
Table 2 – Student Achievement in the District compared to 2006-07 School Year, by Socioeconomic Status

	Reading		Math	
	FRPL ineligible	FRPL eligible	FRPL ineligible	FRPL eligible
Year: 2007-08	0.150***	0.121***	0.210***	0.176***
	(0.011)	(0.007)	(0.011)	(0.007)
Year: 2008-09	0.275***	0.172***	0.359***	0.286***
	(0.011)	(0.008)	(0.012)	(0.008)
Year: 2009-10	0.210***	0.083***	0.292***	0.242***
	(0.016)	(0.009)	(0.015)	(0.009)
Year: 2010-11	0.262***	0.064***	0.427***	0.296***
	(0.015)	(0.009)	(0.013)	(0.008)
Year: 2011-12	0.331***	0.091***	0.501***	0.321***
	(0.013)	(0.008)	(0.013)	(0.008)
Year: 2012-13	0.666***	0.177***	0.870***	0.375***
	(0.014)	(0.008)	(0.014)	(0.009)
2006-07 average score	0.067	-0.237	-0.058	-0.372
N	65,632	153,654	65,870	154,024

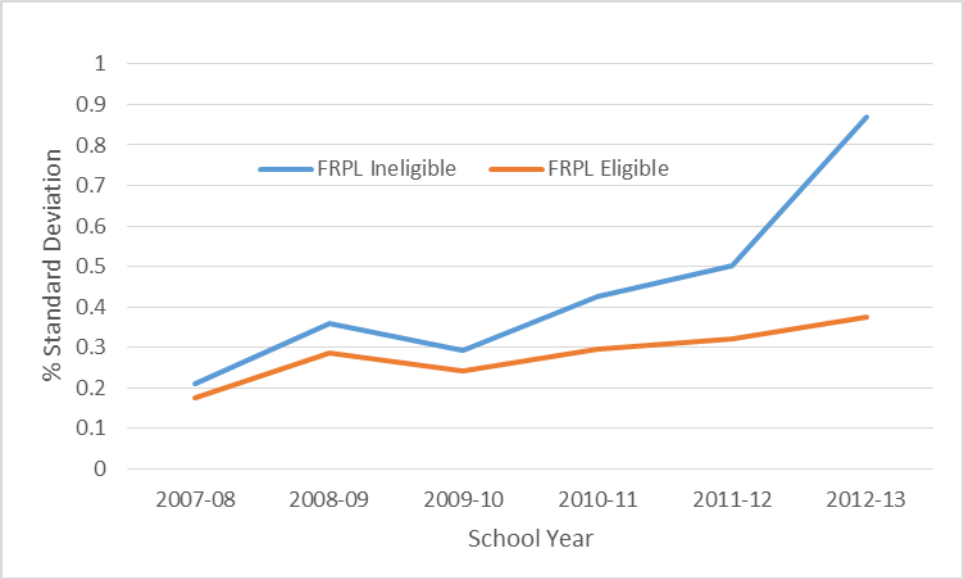
Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Figure 2 – Student Achievement in the District compared to 2006-07 School Year, by Socioeconomic Status

(I) Reading



(II) Math



Student test scores have improved for all major races/ethnicities in the District, with larger improvements among blacks and Hispanics. Table 3 and Figure 3 break down the trend analysis by the three major races/ethnicities in the District. The findings suggest that all three subgroups have improved their test scores over this time frame, but larger improvements are observed for blacks and Hispanics. This is most likely driven by the fact that these two student groups had more room to improve compared to whites (evidenced by higher baseline scores for whites in 2006-07), which increases the likelihood of 'ceiling effects' among white students. In fact, of the white students in the 8th grade, almost 50 percent score within 30 points of the maximum scale score in both reading and math, whereas this number is less than 10 percent among black students.[5]

[5] DC CAS 8th grade scale scores range from 800 to 899 in both reading and math.

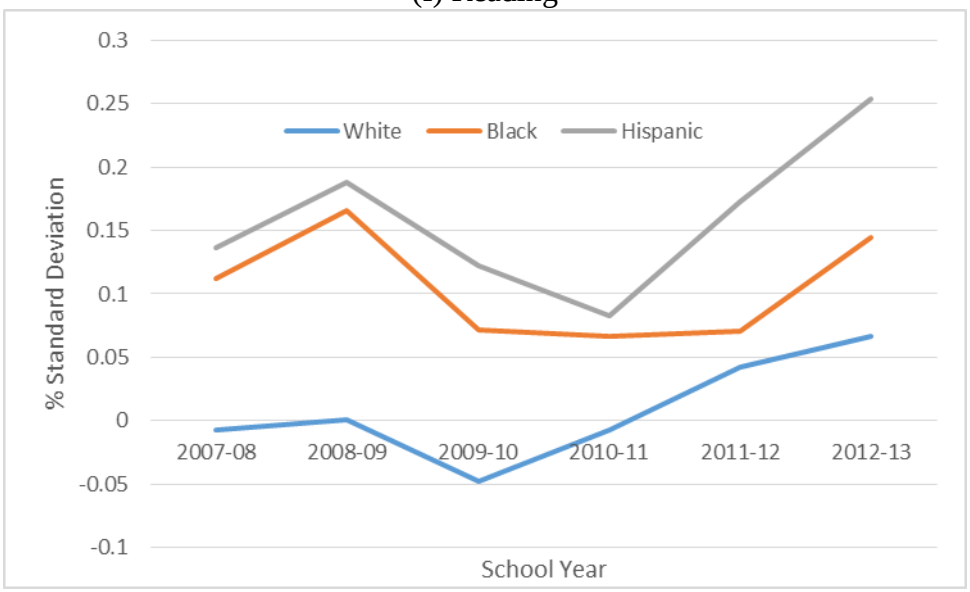
Table 3 – Student Achievement in the District compared to 2006-07 School Year, by Race/Ethnicity

	Reading		
	White	Black	Hispanic
Year: 2007-08	-0.007	0.112***	0.136***
	(0.023)	(0.006)	(0.021)
Year: 2008-09	0.001	0.166***	0.188***
	(0.022)	(0.006)	(0.022)
Year: 2009-10	-0.048	0.072***	0.122***
	(0.037)	(0.008)	(0.024)
Year: 2010-11	-0.007	0.067***	0.083**
	(0.032)	(0.008)	(0.028)
Year: 2011-12	0.042	0.071***	0.173***
	(0.025)	(0.008)	(0.023)
Year: 2012-13	0.067**	0.144***	0.254***
	(0.024)	(0.008)	(0.023)
2006-07 average score	1.027	-0.172	-0.113
	Math		
Year: 2007-08	0.086***	0.163***	0.222***
	(0.021)	(0.006)	(0.017)
Year: 2008-09	0.082***	0.271***	0.304***
	(0.023)	(0.007)	(0.019)
Year: 2009-10	-0.026	0.224***	0.192***
	(0.035)	(0.008)	(0.021)
Year: 2010-11	0.125***	0.280***	0.287***
	(0.024)	(0.007)	(0.021)
Year: 2011-12	0.073**	0.300***	0.314***
	(0.025)	(0.008)	(0.021)
Year: 2012-13	0.179***	0.349***	0.367***
	(0.025)	(0.008)	(0.021)
2006-07 average score	0.995	-0.329	-0.116
N	12,819	175,991	23,387

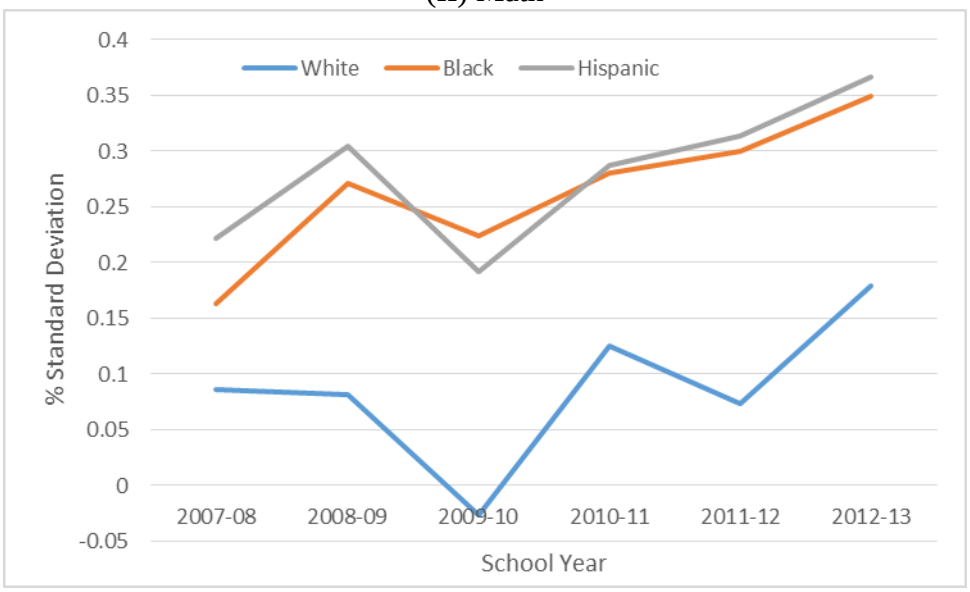
Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Figure 3 – Student Achievement in the District compared to 2006-07 School Year, by Race/Ethnicity

(I) Reading



(II) Math



Student test scores have improved more among economically advantaged black students. Female black students experienced higher gains in reading scores, but performed at comparable levels as their male black peers in math. Tables 4 and 5 break down the trend analysis by FRPL eligibility and gender among black students (graphical representations given in Figures 4 and 5) - the largest student racial group in the DC public school system. Similar to the findings presented in Table 2, FRPL ineligible black students experienced larger test score improvements over this time frame. Reading scores have

improved more among female black students compared to males. There are no statistically significant differences in math gains between male and female black students (Table 5).

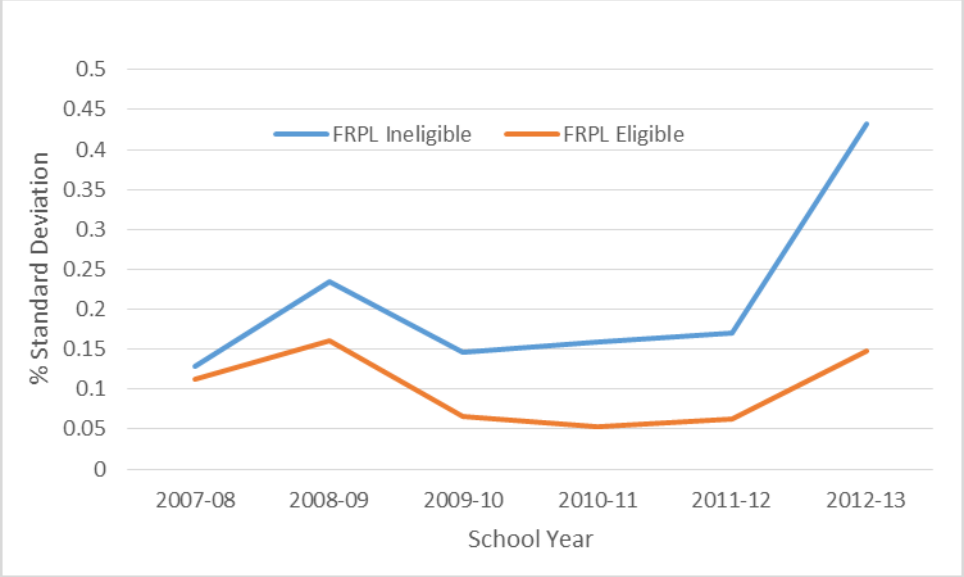
Table 4 – Black Student Achievement in the District compared to 2006-07 School Year, by FRPL Eligibility

	Reading	
	FRPL Ineligible	FRPL Eligible
Year: 2007-08	0.128***	0.112***
	(0.012)	(0.007)
Year: 2008-09	0.234***	0.161***
	(0.012)	(0.008)
Year: 2009-10	0.146***	0.066***
	(0.016)	(0.010)
Year: 2010-11	0.159***	0.053***
	(0.016)	(0.009)
Year: 2011-12	0.171***	0.063***
	(0.015)	(0.009)
Year: 2012-13	0.432***	0.148***
	(0.018)	(0.009)
2006-07 average score	-0.028	-0.239
	Math	
Year: 2007-08	0.174***	0.166***
	(0.012)	(0.008)
Year: 2008-09	0.320***	0.273***
	(0.013)	(0.008)
Year: 2009-10	0.250***	0.235***
	(0.016)	(0.009)
Year: 2010-11	0.328***	0.282***
	(0.015)	(0.009)
Year: 2011-12	0.361***	0.305***
	(0.015)	(0.009)
Year: 2012-13	0.650***	0.354***
	(0.019)	(0.009)
2006-07 average score	-0.177	-0.401
N	44,283	131,208

Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Figure 4 – Black Student Achievement in the District compared to 2006-07 School Year, by FRPL Eligibility

(I) Reading



(II) Math

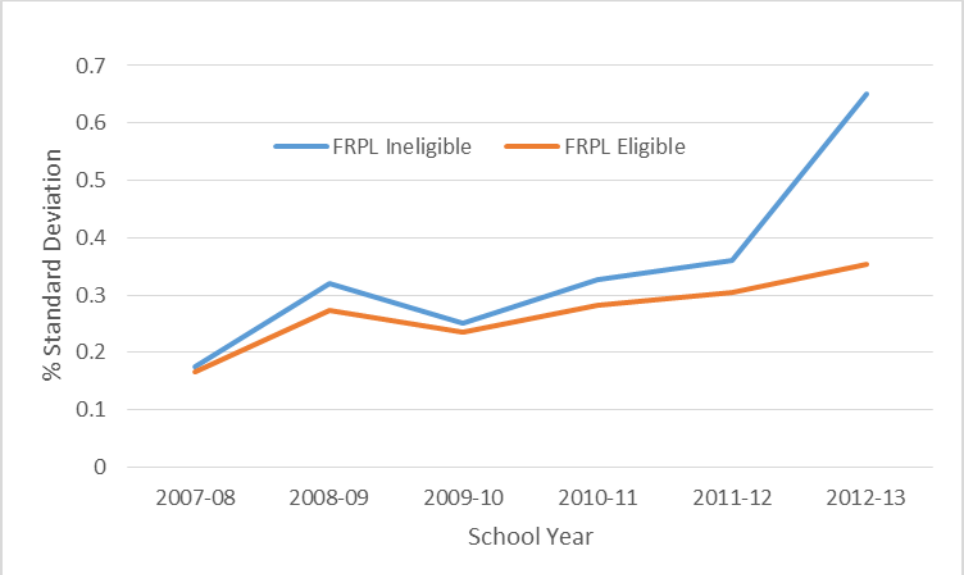


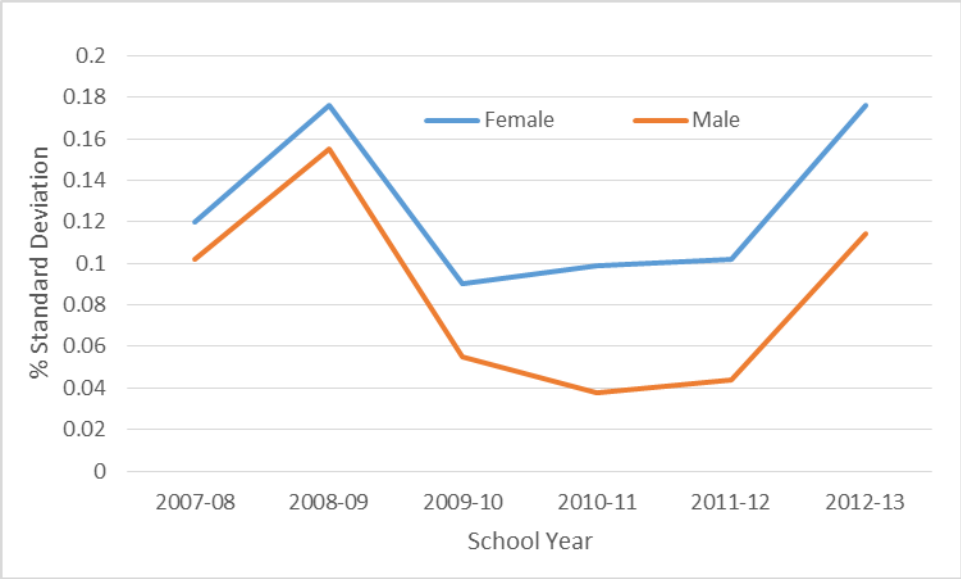
Table 5 – Black Student Achievement in the District compared to 2006-07 School Year, by Gender

	Reading	
	Female	Male
Year: 2007-08	0.120***	0.102***
	(0.008)	(0.009)
Year: 2008-09	0.176***	0.155***
	(0.008)	(0.010)
Year: 2009-10	0.090***	0.055***
	(0.010)	(0.012)
Year: 2010-11	0.099***	0.038**
	(0.010)	(0.012)
Year: 2011-12	0.102***	0.044***
	(0.010)	(0.011)
Year: 2012-13	0.176***	0.114***
	(0.010)	(0.011)
2006-07 average score	-0.054	-0.294
	Math	
Year: 2007-08	0.169***	0.158***
	(0.008)	(0.009)
Year: 2008-09	0.268***	0.274***
	(0.009)	(0.010)
Year: 2009-10	0.217***	0.231***
	(0.010)	(0.012)
Year: 2010-11	0.286***	0.275***
	(0.010)	(0.011)
Year: 2011-12	0.313***	0.288***
	(0.010)	(0.011)
Year: 2012-13	0.356***	0.345***
	(0.011)	(0.012)
2006-07 average score	-0.262	-0.400
N	89,257	86,732

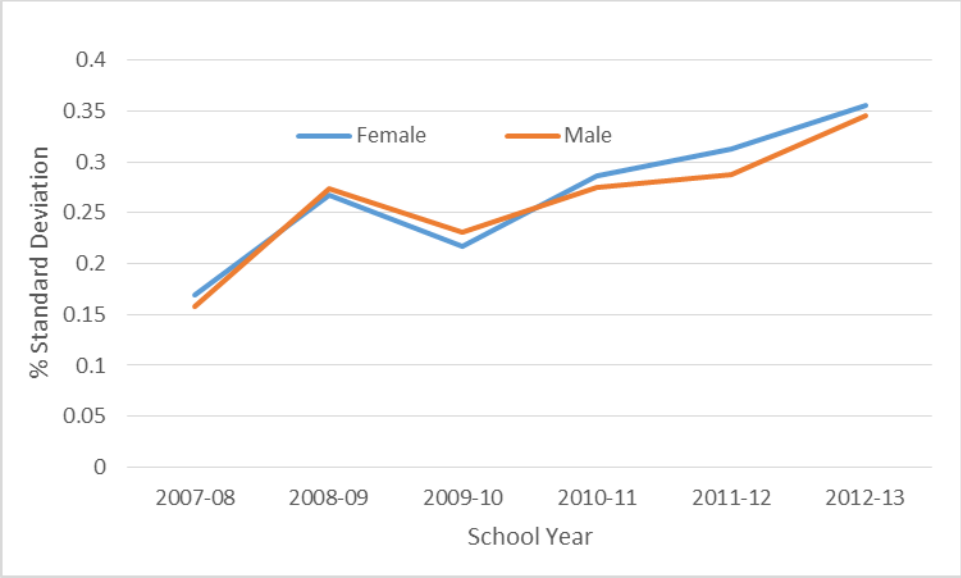
Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Figure 5 – Black Student Achievement in the District compared to 2006-07 School Year, by Gender

(I) Reading



(II) Math



Test scores in math have improved for all tested grades. There is no consistent improvement in reading scores for all grades. Tables 6 and 7 break down the trend analysis by grade level for reading and math respectively. The results reveal improvements in math between 2006-07 and 2012-13 for all grades. There is no clear pattern for reading scores during this time frame, with scores consistently increasing only for the 4th, 7th and 8th graders.

Table 6 – Reading Achievement in the District compared to 2006-07 School Year, by Test Grade

	Reading						
	3rd Grade	4th Grade	5th Grade	6th Grade	7th Grade	8th Grade	10th Grade
Year: 2007-08	0.115***	0.136***	0.094***	0.009	0.135***	0.178***	0.115***
	(0.018)	(0.019)	(0.015)	(0.017)	(0.017)	(0.016)	(0.018)
Year: 2008-09	0.126***	0.169***	0.125***	0.161***	0.185***	0.281***	0.126***
	(0.017)	(0.019)	(0.014)	(0.016)	(0.018)	(0.016)	(0.017)
Year: 2009-10	-0.056**	0.076***	0.023	-0.054**	0.249***	0.230***	-0.056**
	(0.019)	(0.020)	(0.020)	(0.020)	(0.020)	(0.025)	(0.019)
Year: 2010-11	-0.118***	0.077***	-0.058*	-0.029	0.276***	0.306***	-0.118***
	(0.018)	(0.018)	(0.024)	(0.021)	(0.017)	(0.017)	(0.018)
Year: 2011-12	-0.108***	0.124***	0.130***	-0.060***	0.295***	0.290***	-0.108***
	(0.018)	(0.018)	(0.014)	(0.016)	(0.018)	(0.017)	(0.018)
Year: 2012-13	-0.001	0.251***	0.191***	-0.019	0.428***	0.420***	-0.001
	(0.018)	(0.018)	(0.014)	(0.016)	(0.017)	(0.017)	(0.018)
2006-07 average score	-0.007	-0.145	-0.082	-0.015	-0.237	-0.242	-0.161
N	33213	32022	32056	31280	31277	31113	28325

Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Table 7 – Math Achievement in the District compared to 2006-07 School Year, by Test Grade

	Math						
	3rd Grade	4th Grade	5th Grade	6th Grade	7th Grade	8th Grade	10th Grade
Year: 2007-08	0.089***	0.186***	0.266***	0.157***	0.216***	0.133***	0.089***
	(0.019)	(0.018)	(0.017)	(0.017)	(0.017)	(0.016)	(0.019)
Year: 2008-09	0.243***	0.333***	0.341***	0.229***	0.358***	0.226***	0.243***
	(0.019)	(0.019)	(0.017)	(0.017)	(0.018)	(0.017)	(0.019)
Year: 2009-10	0.060***	0.188***	0.295***	0.187***	0.405***	0.240***	0.060***
	(0.018)	(0.019)	(0.022)	(0.019)	(0.019)	(0.024)	(0.018)
Year: 2010-11	0.049**	0.233***	0.329***	0.269***	0.505***	0.469***	0.049**
	(0.018)	(0.018)	(0.016)	(0.020)	(0.018)	(0.017)	(0.018)
Year: 2011-12	0.023	0.275***	0.400***	0.318***	0.555***	0.423***	0.023
	(0.017)	(0.018)	(0.017)	(0.017)	(0.018)	(0.017)	(0.017)
Year: 2012-13	0.172***	0.406***	0.444***	0.395***	0.546***	0.639***	0.172***
	(0.017)	(0.018)	(0.017)	(0.017)	(0.018)	(0.017)	(0.017)
2006-07 average score	-0.112	-0.261	-0.315	-0.239	-0.383	-0.303	-0.183
N	33213	32022	32056	31280	31277	31113	28325

Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Both DCPS and charter school students have experienced improvements in test scores. Table 8 and Figure 6 separate the trend analysis by school type, suggesting that students in both sectors enjoyed test score gains over this time frame. However, there are two important distinctions. First, gains were higher in reading among DCPS students. Second, math gains among DCPS students were mainly concentrated in the first two years compared to charter school students who experienced a more gradual improvement in math performance. We repeat the same analyses separately for FRPL eligible and ineligible students by school type (results available upon request) and reach the same conclusion for both student subgroups.

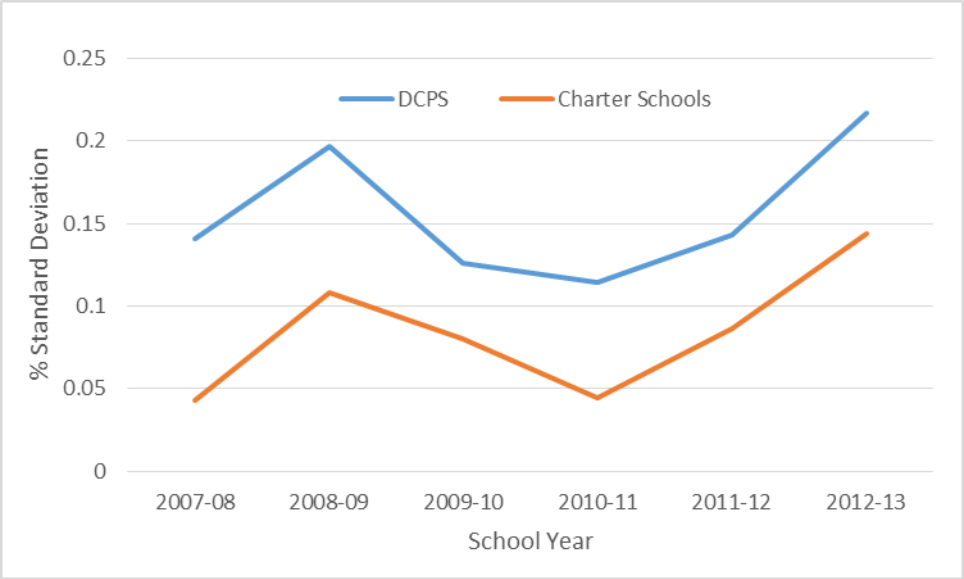
Table 8 – Student Achievement in the District compared to 2006-07 School Year, by School Type

	Reading		Math	
	DCPS	Charter	DCPS	Charter
Year: 2007-08	0.141***	0.043***	0.198***	0.096***
	(0.007)	(0.009)	(0.007)	(0.010)
Year: 2008-09	0.197***	0.108***	0.325***	0.162***
	(0.008)	(0.010)	(0.008)	(0.011)
Year: 2009-10	0.126***	0.080***	0.260***	0.186***
	(0.010)	(0.012)	(0.009)	(0.012)
Year: 2010-11	0.114***	0.044**	0.303***	0.268***
	(0.010)	(0.014)	(0.009)	(0.011)
Year: 2011-12	0.143***	0.086***	0.346***	0.284***
	(0.009)	(0.011)	(0.009)	(0.012)
Year: 2012-13	0.217***	0.144***	0.396***	0.348***
	(0.010)	(0.011)	(0.010)	(0.012)
2006-07 average score	-0.153	0.018	-0.069	-0.295
N	139,389	75,298	139,389	75,298

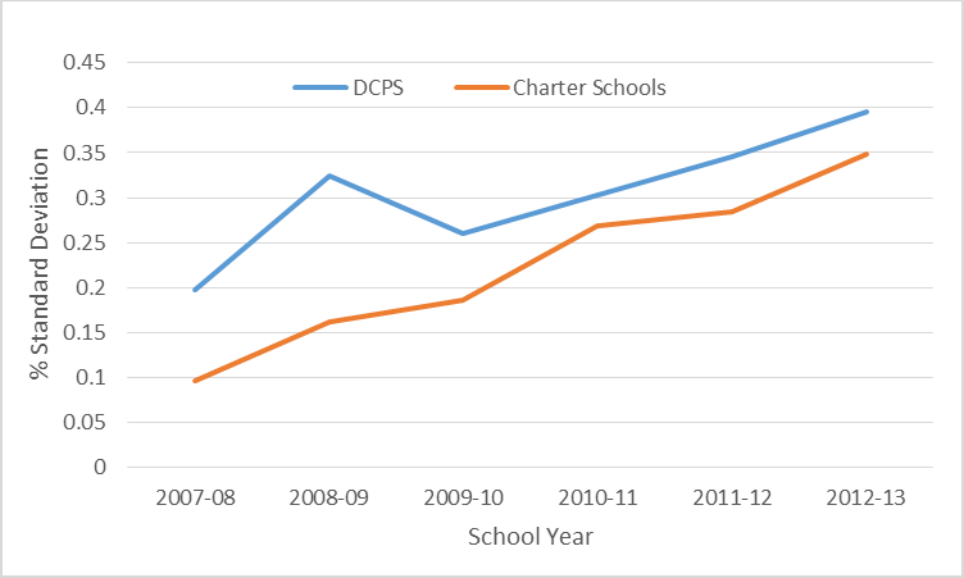
Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Figure 6 – Student Achievement in the District compared to 2006-07 School Year, by School Type

(I) Reading



(II) Math



In order to better assess the achievement trends in DCPS and charter schools, it is important to consider the role of student mobility between the two sectors. Over the time frame we examine in this report, charter school enrollment in the District has soared from 27 percent in 2006 to 42 percent in 2012. Of the 'sector switching' school moves in the District between 2006-07 and 2012-13 school years,

60 percent were from a traditional public school to a charter school.[6] Further, most charter schools in the District operate in less affluent neighborhoods where the demand for alternative schooling options is higher, and hence attract DCPS students that are lower performing than the average DCPS student (Ozek, 2011). In particular, students who move to a charter school score roughly 17 percent of the standard deviation worse in math (12 percent in reading) during the year(s) prior to the move compared to the average DCPS student who remains in the traditional public school system. [7] Therefore, the departure of low performing students might lead to an increase in average test scores among DCPS students, and a decline in average achievement in charter schools. To assess the impact of student mobility between DCPS and charter schools on achievement trends in the two sectors, we repeat the analysis in Table 8 excluding sector switchers. The estimates reported in Table 9 are almost identical to the results reported in Table 8, suggesting that the effect of sector switchers on sector-specific achievement trends is minimal.

[6] Source: Authors' calculations using student-level administrative data.
[7] Source: Authors' calculations using student-level administrative data.

Table 9 – Student Achievement in the District compared to 2006-07 School Year, by School Type, Stable Students

	Reading		Math	
	DCPS	Charter	DCPS	Charter
Year: 2007-08	0.128***	0.071***	0.192***	0.092***
	(0.007)	(0.011)	(0.007)	(0.013)
Year: 2008-09	0.177***	0.142***	0.324***	0.191***
	(0.008)	(0.012)	(0.009)	(0.014)
Year: 2009-10	0.090***	0.102***	0.255***	0.175***
	(0.010)	(0.013)	(0.010)	(0.014)
Year: 2010-11	0.087***	0.051**	0.301***	0.259***
	(0.010)	(0.016)	(0.010)	(0.014)
Year: 2011-12	0.115***	0.102***	0.349***	0.270***
	(0.010)	(0.013)	(0.010)	(0.014)
Year: 2012-13	0.199***	0.157***	0.410***	0.330***
	(0.010)	(0.013)	(0.010)	(0.014)
N	125,158	57,464	125,158	57,464

Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Limitation: The entry of charter schools into the DC public school system might also improve overall student achievement in the District by introducing innovative teaching and leadership strategies, providing better student-school matches via increased parental choices, and inducing competition between schools for limited resources. For instance, recent studies of lottery-based admissions to urban, oversubscribed charter schools find large and positive impacts of charter attendance (Hoxby and Murarka (2009); Dobbie & Fryer (2011); and Abdulkadiroglu et al. (2011)). Ozek and Austin (2010) further show positive effects of attending a DC charter school on student achievement. On the other hand, charter schools might be detrimental for struggling traditional public schools if they attract good students and take away much-needed resources as enrollments decline. Using the administrative data we currently have, we cannot credibly assess the extent to which these competing mechanisms contribute to the achievement trends observed in Table 1.

Student test scores have improved in all wards, especially in math. Tables 10 and 11 break down the trend analysis by school ward. The findings suggest that students in all eight wards have experienced test score improvements. Between 2006-07 and 2012-13 school years, reading scores have increased by 10 (ward 5) to 37 (ward 1) percent of the standard deviation, and math scores have improved by 23 (ward 5) to 47 (ward 1) percent of the standard deviation. Once again, reading gains are mainly concentrated in the earlier years, presenting evidence of adjustment effects to the new test, whereas the math gains have taken place more gradually.

Table 10 – Reading Achievement in the District compared to 2006-07 School Year, by School Ward

	Reading							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year: 2007-08	0.194***	0.087***	0.025	0.097***	0.135***	0.063***	0.111***	0.135***
	(0.02)	(0.024)	(0.020)	(0.016)	(0.017)	(0.016)	(0.012)	(0.014)
Year: 2008-09	0.319***	0.050	0.135***	0.171***	0.164***	0.161***	0.156***	0.179***
	(0.022)	(0.027)	(0.020)	(0.017)	(0.018)	(0.018)	(0.013)	(0.016)
Year: 2009-10	0.258***	0.120***	0.184***	0.093***	0.086***	0.097***	0.096***	0.039*
	(0.024)	(0.028)	(0.023)	(0.019)	(0.019)	(0.029)	(0.014)	(0.019)
Year: 2010-11	0.024	0.137***	0.145***	0.047*	0.084***	0.123***	0.067***	0.078***
	(0.041)	(0.028)	(0.022)	(0.023)	(0.019)	(0.021)	(0.015)	(0.017)
Year: 2011-12	0.283***	0.164***	0.144***	0.050**	0.107***	0.143***	0.047**	0.068***
	(0.024)	(0.028)	(0.023)	(0.019)	(0.020)	(0.021)	(0.016)	(0.017)
Year: 2012-13	0.367***	0.231***	0.171***	0.112***	0.103***	0.191***	0.102***	0.163***
	(0.024)	(0.029)	(0.022)	(0.020)	(0.020)	(0.021)	(0.016)	(0.017)
2006-07 average score	-0.218	0.190	0.610	0.017	-0.155	-0.149	-0.195	-0.368
Observations	20168	12004	20719	29829	28984	24097	39608	37114

Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Table 11 – Math Achievement in the District compared to 2006-07 School Year, by School Ward

	Math							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year: 2007-08	0.251***	0.147***	0.101***	0.175***	0.131***	0.105***	0.204***	0.180***
	(0.020)	(0.024)	(0.020)	(0.016)	(0.018)	(0.016)	(0.013)	(0.014)
Year: 2008-09	0.448***	0.111***	0.223***	0.238***	0.161***	0.273***	0.336***	0.323***
	(0.022)	(0.028)	(0.021)	(0.018)	(0.019)	(0.019)	(0.014)	(0.016)
Year: 2009-10	0.329***	0.188***	0.214***	0.179***	0.123***	0.262***	0.320***	0.243***
	(0.022)	(0.029)	(0.023)	(0.018)	(0.019)	(0.028)	(0.015)	(0.019)
Year: 2010-11	0.446***	0.245***	0.245***	0.201***	0.173***	0.339***	0.331***	0.327***
	(0.022)	(0.029)	(0.022)	(0.022)	(0.019)	(0.021)	(0.016)	(0.017)
Year: 2011-12	0.430***	0.375***	0.230***	0.234***	0.218***	0.380***	0.331***	0.376***
	(0.023)	(0.029)	(0.022)	(0.019)	(0.020)	(0.021)	(0.016)	(0.017)
Year: 2012-13	0.472***	0.465***	0.308***	0.293***	0.227***	0.399***	0.342***	0.439***
	(0.024)	(0.030)	(0.022)	(0.021)	(0.022)	(0.022)	(0.018)	(0.018)
2006-07 average score	-0.234	0.040	0.557	-0.091	-0.228	-0.299	-0.362	-0.574
Observations	20168	12004	20719	29829	28984	24097	39608	37114

Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

3.2. The Role of Socioeconomic and Demographic Shifts in Achievement Trends

Cross-cohort differences in observed student attributes explain only a small portion of the achievement trends in the District. One possible explanation to these achievement trends is that the students in later cohorts are significantly different than the students in our baseline year (2006-07) along observable measures. To see how much such demographic shifts contribute to the observed improvements in achievement, we present in Table 12 the estimates obtained using models that control for observed student attributes such as race/ethnicity, socioeconomic status (as measured by free or reduced priced lunch eligibility), limited English proficiency, and special education status. In this table, columns labeled as (I) repeat the findings presented in Table 1 with no controls, and columns labeled as (II) introduce the observed student covariates. The achievement trends become slightly flatter when differences in student characteristics across cohorts are accounted for; however, improvements in both reading in math are still observed. Appendix B presents the subgroup analysis accounting for the observed differences across cohorts, yielding similar results.

Table 12 – Student Achievement in the District, compared to 2006-07 School Year

	Reading		Math	
	(I)	(II)	(I)	(II)
Year: 2007-08	0.123***	0.119***	0.179***	0.175***
	(0.006)	(0.006)	(0.006)	(0.006)
Year: 2008-09	0.184***	0.191***	0.289***	0.291***
	(0.006)	(0.006)	(0.006)	(0.006)
Year: 2009-10	0.102***	0.0960***	0.238***	0.230***
	(0.008)	(0.007)	(0.007)	(0.007)
Year: 2010-11	0.110***	0.099***	0.322***	0.308***
	(0.008)	(0.007)	(0.007)	(0.006)
Year: 2011-12	0.144***	0.125***	0.355***	0.333***
	(0.007)	(0.006)	(0.007)	(0.006)
Year: 2012-13	0.231***	0.221***	0.429***	0.412***
	(0.007)	(0.007)	(0.008)	(0.007)
Student covariates	No	Yes	No	Yes
N	219,286	219,286	219,894	219,894

Notes: In this table, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07, holding observed student characteristics (FRPL eligibility, ELL and SPED status, race/ethnicity, and gender) constant. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and

0.001 respectively.

We also conduct Oaxaca-Blinder decomposition to examine whether differences in student characteristics across years explain the year-to-year changes in student achievement. Table 13 presents the findings. Each column in this table presents (1) the base year average score (for years between 2007-08 and 2012-13); (2) prior year average test score; (3) the difference between the two averages; (4) the year-to-year change in average test scores explained by the year-to-year changes in observed student characteristics; (5) the year-to-year change in average test scores unexplained by the observed student characteristics. The results suggest that the demographic/socioeconomic shifts along observed student attributes do not play a significant role in year-to-year changes in student test performance. For instance, only 7 percent of the change in reading scores between 2006-07 and 2007-08 can be explained by differences in student covariates, whereas that number is 5 percent for math. This reinforces our earlier finding that students in later cohorts outperform their observationally comparable peers in earlier cohorts.

Table 13 – Oaxaca-Blinder Decomposition, Year-to-Year Changes in Student Achievement in the District

			Reading			
Base year:	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Base year average	-0.005	0.056***	-0.026	-0.018	0.016	0.103
	(0.005)	(0.005)	(0.007)	(0.006)	(0.005)	(0.005)
Prior year average	-0.128	-0.005	0.056	-0.026	-0.018	0.015
	(0.005)	(0.005)	(0.005)	(0.007)	(0.006)	(0.006)
Difference	0.123***	0.061***	-0.082***	0.008	0.034***	0.088***
	(0.006)	(0.006)	(0.007)	(0.008)	(0.007)	(0.006)
Due to differences in student covariates	0.008***	-0.007***	0.010***	0.004	0.007*	-0.011***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Due to differences in returns to covariates	0.118***	0.069***	-0.094***	0.003	0.026***	0.116***
	(0.006)	(0.005)	(0.006)	(0.007)	(0.006)	(0.005)
			Math			
Base year average	-0.080	0.029	-0.022	0.062	0.095	0.169***
	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)
Prior year average	-0.260***	-0.080	0.029	-0.022	0.062	0.095***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)
Difference	0.179***	0.109***	-0.051	0.084***	0.033***	0.075***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)
Due to differences in student covariates	0.009***	-0.001	0.008***	0.005*	0.008***	-0.008**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Due to differences in returns to covariates	0.172***	0.111***	-0.061***	0.078***	0.025***	0.103***
	(0.005)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)

Notes: Standard errors are given in parentheses. *, **, *** imply statistical significance at 0.05, 0.01 and 0.001 levels respectively. Standard errors are given in parentheses.

There is an influx of higher performing students into the DC public school system. However, this influx explains only a small portion of the test score improvement between 2006-07 and 2012-13. The findings we present above suggests that the differences in observed student characteristics across cohorts fail to explain a significant portion of the test score differences. However, it is still possible that the new students, albeit comparable to existing students along observed dimensions, differ along unobserved traits such as educational motivation and parental involvement. While this hypothesis is not directly testable, we present indirect evidence, comparing the achievement levels of 'new' students with 'existing' students who attended kindergarten in the DC public school system. Table 14 presents the findings of this exercise where we compare the test scores of newcomers who entered the District's public school system after kindergarten with the existing students who attended kindergarten in the District.

The results in columns (I) suggest that the newcomers perform significantly better than existing students in both reading and math. In particular, students who entered the school system after kindergarten score about 0.05 of the standard deviation better in reading, and 0.06 of the standard deviation better in math than the students who attended kindergarten in DC. Differences in observed student attributes explain about 20 to 25 percent of these achievement gaps (columns (II)), yet the gaps remain significant in both reading and math. These findings indicate that higher performing students have indeed entered the DC public school system during this time frame, and the differences in observed characteristics of students only partially explain why these new students are performing better than the existing students. We also check to see whether the test score differences are driven by new students attending different schools than others using school-by-year fixed-effects. Thus, we compare the achievement levels of 'new' students with their 'existing' peers at the same school in a given year. The results, presented in columns (III) of Table 14, indicate that newcomers outperform comparable KG entrants even after across-school differences are accounted for. In particular, differences in schools

attended only explain about 10 percent of the achievement gaps between observationally comparable new and existing students.

Table 14 – Existing versus Entering Student Performance

	Reading			Math		
	(I)	(II)	(III)	(I)	(II)	(III)
Entered after KG	0.052***	0.038***	0.034***	0.060***	0.039***	0.035***
	(0.012)	(0.009)	(0.006)	(0.012)	(0.010)	(0.006)
Student covariates	No	Yes	Yes	No	Yes	Yes
School-year FE	No	No	Yes	No	No	Yes
N	172,211	172,211	172,211	172,211	172,211	172,211

Notes: Standard errors are given in parentheses. *, **, *** imply statistical significance at levels of 0.05, 0.01 and 0.001 respectively.

It is important to note two factors that might bias the estimates provided above. First, since the baseline group in this exercise consists of long-time residents of DC and students who entered DC right before kindergarten, the results presented in Table 14 might underestimate the actual achievement gaps if newcomers are indeed higher performing than existing students. Second, given the well-documented negative effects of student mobility during non-promotional grades, it is possible that the newcomers will perform even better than existing students once they get accustomed to the new school system. [8] Nevertheless, both these factors would imply downward bias in the estimates presented in Table 14, and our conclusions would remain unchanged.

Having said that, the important question that remains is whether the observed trends in achievement persist when we account for this influx of high-performing students. Table 15 addresses this question, examining the relative achievement of the cohorts included in this analysis between 2007-08 and 2012-13, compared to the 2006-07 cohorts. The estimates suggest that the exclusion of new students from the analysis flattens the achievement trajectories slightly, but the difference is quite small.

[8] See Hanushek et al. (2004) and Xu et al. (2009).

Table 15 – Student Achievement in the District compared to 2006-07 School Year, Excluding New Students

	Reading		Math	
	All	Existing	All	Existing
Year: 2007-08	0.113***	0.111***	0.182***	0.169***
	(0.008)	(0.008)	(0.007)	(0.009)
Year: 2008-09	0.150***	0.144***	0.289***	0.286***
	(0.008)	(0.009)	(0.008)	(0.009)
Year: 2009-10	0.056***	0.037***	0.214***	0.201***
	(0.009)	(0.010)	(0.009)	(0.010)
Year: 2010-11	0.051***	0.021*	0.291***	0.265***
	(0.009)	(0.010)	(0.008)	(0.010)
Year: 2011-12	0.087***	0.074***	0.317***	0.303***
	(0.008)	(0.009)	(0.008)	(0.009)
Year: 2012-13	0.185***	0.169***	0.398***	0.388***
	(0.008)	(0.009)	(0.009)	(0.010)
N	172,211	128,319	172,211	128,319

Notes: Standard errors are given in parentheses. *, **, *** imply statistical significance at levels of 0.05, 0.01 and 0.001 respectively.

4. Concluding Remarks

In this study, we provide a closer look at the test score trends in the District of Columbia since the enactment of PERAA. We find that overall, even when accounting for changes in student demographics, test scores in the District have improved substantially, especially in math. Less than 10 percent of the year-to-year improvements in test scores are attributable to changing student characteristics. Additionally, while new students score significantly higher on standardized tests when compared to existing students, existing students have also experienced substantial gains in test scores, especially in math.

While these analyses present a useful first step to better understand the achievement trends in the District, more research is needed to fully disentangle the mechanisms behind these trends for several reasons. First, we are not able to make precise claims about what has caused the improvements in DC test scores over the past seven years. Starting in 2007, the District enacted a number of reforms

as part of PERAA. The reforms included expanding school choice, eliminating teacher tenure, tying teacher evaluations to student test scores, and closing schools with low enrollment. Our study is not able to distinguish which reforms, if any, are responsible for the improvements to DC test scores. Further research in this area would help inform future policy makers about which of the recent education reforms are worthy of expansion.

Second, it is always the case that test scores only provide estimates of the complex process that is teaching and learning. Test scores are not a clear measure of learning in a classroom, and increased test scores do not necessary indicate improvements in student outcomes. Research on additional student outcomes, such as high school graduation, college entrance and completion, and employment is needed to fully measure whether DC public schools are making meaningful improvements for students.

Finally, allegations of security breaches raise special concerns. The fact that our findings mirror the trends in NAEP scores, in which test security is very high, somewhat alleviates this concern. Nevertheless, we urge readers to recognize that until a more in-depth analysis of the scope and magnitude of the allegations is completed, the results presented here should be handled cautiously.

References

Abdulkadiroglu, A., Angrist, J.D., Dynarski, S.M., Kane, T.J., & Pathak, P.A. (2011). Accountability and flexibility in public schools: Evidence from Boston's charters and pilots. *Quarterly Journal of Economics*, *126*(2), 699–748. http://dx.doi.org/10.3386/w15549

Dobbie, W., & Fryer, R.G. (2011). Are high quality schools enough to close the achievement gap among the poor? Evidence from the Harlem children's zone. *American Economic Journal: Applied Economics*, *3*, 158–187. http://dx.doi.org/10.1257/app.3.3.158

Education Consortium for Research and Evaluation. (2013). *Evaluation of the DC Public Education Amendment Act (PERAA) Report No.1, School Year 2010-2011. July 2013a.* Retrieved from http://dcauditor.org/sites/default/files/DCA132013.pdf

Education Consortium for Research and Evaluation. (2013). *Evaluation of the DC Public Education Amendment Act (PERAA) Report No.2, school year 2011-2012. September 2013b.* Retrieved from http://dcauditor.org/sites/default/files/DCA172013.pdf

Education Consortium for Research and Evaluation. (2014). *DC Public Education Amendment Act (PERAA) Report No.3, Part I: Trends in teacher effectiveness in the District of Columbia public schools, school years 2008-2009 through 2012-13. July 2014.* Retrieved from http://dcauditor.org/sites/default/files/DCA202014.pdf

Hanushek, E. A., Kain, J. F., & Rivkin, S.G. (2004). Disruption versus Tiebout improvement: the costs and benefits of switching schools. *Journal of Public Economics*, *88*, 1721-46. http://dx.doi.org/10.1016/S0047-2727(03)00063-X

Hoxby, C. M., & Murarka, S. (2009*). Charter schools in New York City: Who enrolls and how they affect their students' achievement* (NBER Working Paper 14852). Retrieved from http://www.nber.org/papers/w14852

Nichols, A., & Ozek, U. (2010). *Public school choice and student achievement in the District of Columbia.* Working Paper 53, National Center for Analysis of Longitudinal Data in Education Research. Washington, DC. Retrieved from http://www.urban.org/UploadedPDF/1001499-working-paper-53.pdf

Tatian, P., & Lei, S. (2014). *Washington, DC: Our changing city, Chapter 1: Demographics.* Retrieved from http://datatools.urban.org/features/OurChangingCity/demographics/#index

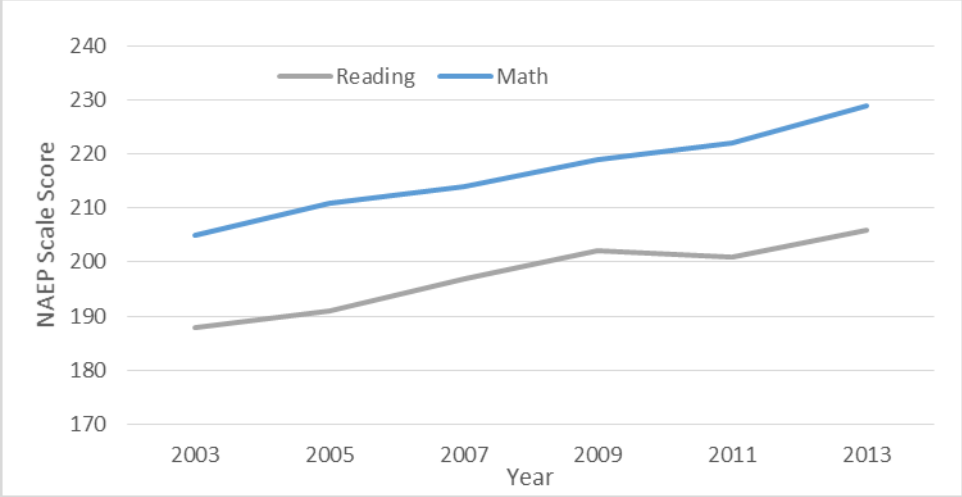
Umut, O. (2011). *Public School Choice in the District of Columbia*. Policy Brief 13, National Center for Analysis of Longitudinal Data in Education Research. Washington, DC. Retrieved from http://www.urban.org/uploadedpdf/1001535-Public-School-Choice-in-DC.pdf

Xu, Z., Hannaway, J., & D'Souza, S. (2009). *Student transience in North Carolina: The effect of school mobility on student outcomes using longitudinal data*. Working Paper 22, National Center for Analysis of Longitudinal Data in Education Research. Retrieved from http://files.eric.ed.gov/fulltext/ED509673.pdf

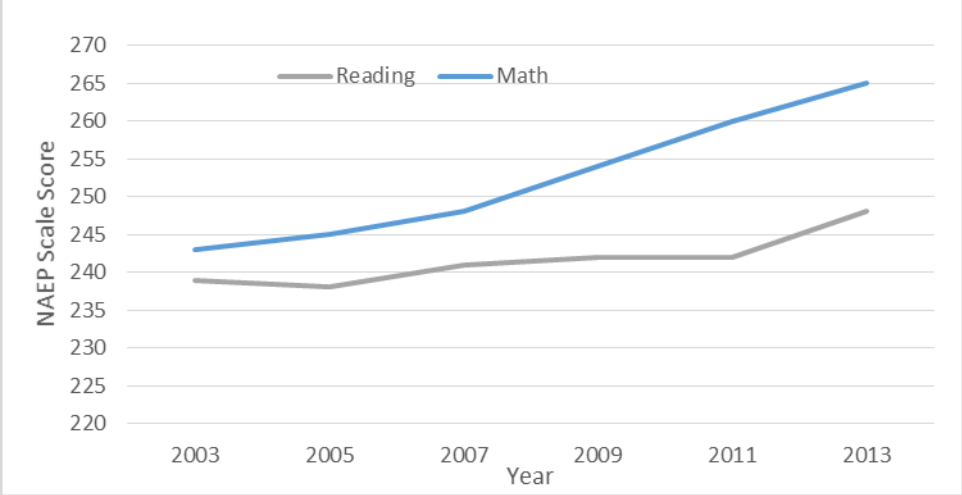
Appendix A

Figure A1 – Average NAEP Scores in the District between 2003 and 2013

(I) 4th Grade



(II) 8th Grade



Appendix B: Subgroup Analysis with Student Covariates

Table B1 – Student Achievement in the District compared to 2006-07 School Year, by Socioeconomic Status

	Reading		Math	
	FRPL ineligible	FRPL eligible	FRPL ineligible	FRPL eligible
Year: 2007-08	0.114***	0.117***	0.173***	0.173***
	(0.010)	(0.007)	(0.010)	(0.007)
Year: 2008-09	0.229***	0.166***	0.306***	0.279***
	(0.010)	(0.007)	(0.011)	(0.007)
Year: 2009-10	0.129***	0.072***	0.212***	0.231***
	(0.014)	(0.009)	(0.014)	(0.008)
Year: 2010-11	0.168***	0.059***	0.331***	0.291***
	(0.013)	(0.009)	(0.012)	(0.008)
Year: 2011-12	0.215***	0.079***	0.379***	0.308***
	(0.011)	(0.008)	(0.011)	(0.008)
Year: 2012-13	0.392***	0.159***	0.590***	0.356***
	(0.012)	(0.008)	(0.013)	(0.008)
N	65,632	153,654	65,870	154,024

Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07, holding observed student characteristics constant. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Table B2 – Student Achievement in the District compared to 2006-07 School Year, by Race/Ethnicity

	Reading		
	White	Black	Hispanic
Year: 2007-08	-0.013	0.113***	0.155***
	(0.022)	(0.006)	(0.021)
Year: 2008-09	0.032	0.176***	0.249***
	(0.022)	(0.006)	(0.021)
Year: 2009-10	-0.048	0.087***	0.118***
	(0.036)	(0.008)	(0.022)
Year: 2010-11	-0.005	0.087***	0.065*
	(0.031)	(0.008)	(0.026)
Year: 2011-12	0.055*	0.101***	0.109***
	(0.023)	(0.007)	(0.021)
Year: 2012-13	0.065**	0.200***	0.186***
	(0.022)	(0.007)	(0.021)
		Math	
Year: 2007-08	0.081***	0.165***	0.237***
	(0.021)	(0.006)	(0.017)
Year: 2008-09	0.110***	0.280***	0.355***
	(0.022)	(0.006)	(0.019)
Year: 2009-10	-0.019	0.237***	0.188***
	(0.033)	(0.008)	(0.020)
Year: 2010-11	0.138***	0.297***	0.273***
	(0.023)	(0.007)	(0.020)
Year: 2011-12	0.097***	0.327***	0.261***
	(0.023)	(0.007)	(0.019)
Year: 2012-13	0.192***	0.402***	0.310***
	(0.023)	(0.008)	(0.020)
N	12,819	175,991	23,387

Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07, holding observed student characteristics constant. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Table B3 – Black Student Achievement in the District compared to 2006-07 School Year, by FRPL Eligibility

	Reading	
	FRPL Ineligible	FRPL Eligible
Year: 2007-08	0.116***	0.108***
	(0.011)	(0.007)
Year: 2008-09	0.227***	0.152***
	(0.012)	(0.008)
Year: 2009-10	0.141***	0.061***
	(0.015)	(0.009)
Year: 2010-11	0.157***	0.055***
	(0.015)	(0.009)
Year: 2011-12	0.185***	0.067***
	(0.014)	(0.008)
Year: 2012-13	0.437***	0.148***
	(0.016)	(0.008)
	Math	
Year: 2007-08	0.163***	0.163***
	(0.012)	(0.007)
Year: 2008-09	0.312***	0.265***
	(0.013)	(0.008)
Year: 2009-10	0.245***	0.229***
	(0.015)	(0.009)
Year: 2010-11	0.326***	0.283***
	(0.014)	(0.008)
Year: 2011-12	0.374***	0.308***
	(0.014)	(0.009)
Year: 2012-13	0.655***	0.354***
	(0.017)	(0.009)
N	44,283	131,208

Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07, holding observed student characteristics constant. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Table B4 – Black Student Achievement in the District compared to 2006-07 School Year, by Gender

	Reading	
	Female	Male
Year: 2007-08	0.115***	0.099***
	(0.008)	(0.009)
Year: 2008-09	0.171***	0.150***
	(0.008)	(0.009)
Year: 2009-10	0.083***	0.058***
	(0.010)	(0.012)
Year: 2010-11	0.097***	0.046***
	(0.010)	(0.011)
Year: 2011-12	0.107***	0.057***
	(0.009)	(0.010)
Year: 2012-13	0.178***	0.130***
	(0.010)	(0.011)
	Math	
Year: 2007-08	0.164***	0.154***
	(0.008)	(0.009)
Year: 2008-09	0.263***	0.268***
	(0.009)	(0.010)
Year: 2009-10	0.211***	0.233***
	(0.010)	(0.011)
Year: 2010-11	0.284***	0.283***
	(0.010)	(0.011)
Year: 2011-12	0.317***	0.301***
	(0.010)	(0.011)
Year: 2012-13	0.358***	0.360***
	(0.010)	(0.011)
N	89,257	86,732

Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07, holding observed student characteristics constant. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Table B5 – Student Achievement in the District compared to 2006-07 School Year, by School Type

	Reading		Math	
	DCPS	Charter	DCPS	Charter
Year: 2007-08	0.133***	0.053***	0.189***	0.104***
	(0.007)	(0.010)	(0.007)	(0.010)
Year: 2008-09	0.206***	0.118***	0.326***	0.168***
	(0.007)	(0.010)	(0.008)	(0.011)
Year: 2009-10	0.115***	0.083***	0.244***	0.186***
	(0.009)	(0.011)	(0.009)	(0.011)
Year: 2010-11	0.079***	0.066***	0.259***	0.282***
	(0.009)	(0.013)	(0.008)	(0.011)
Year: 2011-12	0.083***	0.117***	0.281***	0.304***
	(0.008)	(0.011)	(0.008)	(0.011)
Year: 2012-13	0.175***	0.197***	0.346***	0.387***
	(0.008)	(0.011)	(0.009)	(0.011)
N	139,389	75,298	139,389	75,298

Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07, holding observed student characteristics constant. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Table B6 – Student Achievement in the District compared to 2006-07 School Year, by School Ward

	Reading							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year: 2007-08	0.202***	0.079***	0.024	0.128***	0.119***	0.061***	0.102***	0.118***
	(0.020)	(0.023)	(0.018)	(0.016)	(0.016)	(0.016)	(0.011)	(0.014)
Year: 2008-09	0.340***	0.061**	0.166***	0.215***	0.144***	0.163***	0.156***	0.164***
	(0.022)	(0.024)	(0.018)	(0.016)	(0.017)	(0.017)	(0.013)	(0.015)
Year: 2009-10	0.250***	0.103***	0.162***	0.114***	0.075***	0.082**	0.097***	0.029
	(0.022)	(0.025)	(0.021)	(0.017)	(0.018)	(0.028)	(0.014)	(0.019)
Year: 2010-11	0.039	0.105***	0.116***	0.080***	0.071***	0.103***	0.080***	0.069***
	(0.040)	(0.024)	(0.019)	(0.021)	(0.018)	(0.019)	(0.014)	(0.016)
Year: 2011-12	0.285***	0.085***	0.102***	0.078***	0.097***	0.104***	0.083***	0.065***
	(0.022)	(0.024)	(0.019)	(0.017)	(0.018)	(0.019)	(0.014)	(0.016)
Year: 2012-13	0.392***	0.182***	0.117***	0.155***	0.123***	0.195***	0.150***	0.171***
	(0.022)	(0.025)	(0.019)	(0.018)	(0.019)	(0.019)	(0.015)	(0.017)
	Math							
Year: 2007-08	0.258***	0.137***	0.099***	0.200***	0.118***	0.110***	0.195***	0.164***
	(0.019)	(0.022)	(0.017)	(0.015)	(0.017)	(0.015)	(0.012)	(0.014)
Year: 2008-09	0.462***	0.116***	0.241***	0.272***	0.144***	0.275***	0.336***	0.311***
	(0.021)	(0.024)	(0.019)	(0.017)	(0.017)	(0.018)	(0.014)	(0.015)
Year: 2009-10	0.318***	0.170***	0.193***	0.194***	0.113***	0.249***	0.324***	0.235***
	(0.021)	(0.025)	(0.020)	(0.017)	(0.018)	(0.026)	(0.014)	(0.019)
Year: 2010-11	0.452***	0.210***	0.221***	0.223***	0.160***	0.321***	0.344***	0.320***
	(0.021)	(0.024)	(0.019)	(0.020)	(0.018)	(0.018)	(0.015)	(0.016)
Year: 2011-12	0.419***	0.288***	0.191***	0.248***	0.208***	0.341***	0.367***	0.374***
	(0.021)	(0.025)	(0.019)	(0.017)	(0.018)	(0.018)	(0.015)	(0.017)
Year: 2012-13	0.486***	0.404***	0.259***	0.325***	0.243***	0.399***	0.393***	0.449***
	(0.022)	(0.026)	(0.019)	(0.019)	(0.020)	(0.019)	(0.017)	(0.018)
Observations	20168	12004	20719	29829	28984	24097	39608	37114

Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07, holding observed student characteristics constant. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.

Table B7 – Student Achievement in the District compared to 2006-07 School Year, by Test Grade

	3rd Grade	4th Grade	5th Grade	6th Grade	7th Grade	8th Grade	10th Grade
				Reading			
Year: 2007-08	0.115***	0.136***	0.094***	0.009	0.135***	0.178***	0.153***
	(0.018)	(0.019)	(0.015)	(0.017)	(0.017)	(0.0161)	(0.0204)
Year: 2008-09	0.126***	0.169***	0.125***	0.161***	0.185***	0.281***	0.285***
	(0.017)	(0.019)	(0.014)	(0.016)	(0.018)	(0.0161)	(0.0202)
Year: 2009-10	-0.056**	0.076***	0.023	-0.054**	0.249***	0.230***	0.203***
	(0.019)	(0.020)	(0.020)	(0.020)	(0.020)	(0.0247)	(0.0207)
Year: 2010-11	-0.118***	0.077***	-0.058*	-0.029	0.276***	0.306***	0.252***
	(0.018)	(0.018)	(0.024)	(0.021)	(0.017)	(0.0168)	(0.0213)
Year: 2011-12	-0.108***	0.124***	0.130***	-0.060***	0.295***	0.290***	0.195***
	(0.018)	(0.018)	(0.014)	(0.016)	(0.018)	(0.0166)	(0.0210)
Year: 2012-13	-0.001	0.251***	0.191***	-0.019	0.428***	0.420***	0.278***
	(0.018)	(0.018)	(0.014)	(0.0163)	(0.017)	(0.0165)	(0.0208)
				Math			
Year: 2007-08	0.089***	0.186***	0.266***	0.157***	0.216***	0.133***	0.166***
	(0.019)	(0.018)	(0.017)	(0.017)	(0.017)	(0.016)	(0.021)
Year: 2008-09	0.243***	0.333***	0.341***	0.229***	0.358***	0.226***	0.273***
	(0.019)	(0.019)	(0.017)	(0.017)	(0.018)	(0.017)	(0.021)
Year: 2009-10	0.060***	0.188***	0.295***	0.187***	0.405***	0.240***	0.210***
	(0.018)	(0.019)	(0.022)	(0.019)	(0.019)	(0.024)	(0.020)
Year: 2010-11	0.049**	0.233***	0.329***	0.269***	0.505***	0.469***	0.285***
	(0.018)	(0.018)	(0.016)	(0.020)	(0.018)	(0.017)	(0.020)
Year: 2011-12	0.023	0.275***	0.400***	0.318***	0.555***	0.423***	0.315***
	(0.017)	(0.018)	(0.017)	(0.017)	(0.018)	(0.017)	(0.020)
Year: 2012-13	0.172***	0.406***	0.444***	0.395***	0.546***	0.639***	0.264***
	(0.017)	(0.018)	(0.017)	(0.017)	(0.018)	(0.017)	(0.021)
Observations	33,213	32,022	32,056	31,280	31,277	31,113	28,325

Notes: In this table, for every subgroup, each row represents the difference between the average standardized test score in the corresponding school year and 2006-07, holding observed student characteristics constant. Standard errors are given in parentheses. *, **, *** imply that the average in the corresponding year is statistically different than the average in 2006-07 at significance levels of 0.05, 0.01 and 0.001 respectively.