AN EARLY LOOK AT THE EFFECTS OF SUCCESS ACADEMY CHARTER SCHOOLS

Rebecca Unterman

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Contents

List of Exhibits

Table

Box

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An Early Look at the Effects of Success Academy Charter Schools

Success Academy is a rapidly expanding charter school network in New York City, with schools located in the Bronx, Brooklyn, Manhattan, and Queens. In the 2016-2017 school year, Success Academy served roughly 14,000 students across 41 elementary, middle, and high schools, which at the time was about 13 percent of the students attending charter schools in the city and equivalent to about 1.2 percent of all New York City Department of Education (NYCDOE) students.[1]

In this paper, MDRC looks back to the beginning of Success Academy and uses naturally occurring lotteries for the seven Success Academy schools in operation during the 2010-2011 school year to estimate the difference in students' academic achievement caused by the opportunity to enroll in a Success Academy school. This work is part of an independent analysis that MDRC conducted for Success Academy's 2015 Investing in Innovation (i3) federal grant application. The educational outcomes of elementary students who received placements in their local Success Academy schools by being selected in lotteries are compared with the outcomes of students who entered these lotteries but were not selected for their local Success Academy schools. Because not all students selected in lotteries enrolled in Success Academy schools and some of those not selected through lotteries for their local (or closest) Success Academy school ended up enrolling in a different Success Academy school, MDRC also estimates the effects of *enrolling* in a Success Academy school (for the lottery sample). A statistical adjustment makes it possible to compare those who won their lotteries and did enroll in Success Academy schools with those who lost their lotteries and did not enroll in Success Academy schools.

The preliminary analysis in this paper focuses on the 4,710 students (3,804 students entering kindergarten and 906 entering first grade) who applied to oversubscribed Success Academy schools in the spring of 2010 for the 2010-2011 school year and who therefore participated in lotteries. Only applicants from this round of admissions could be followed long enough to measure their academic achievement using New York State's third- and fourth-grade mathematics and reading exams at the time the analysis was conducted. While 4,710 students is a relatively large sample, because the number of applicants greatly exceeded the number of

[1]Data on Success Academy schools are taken from the organization's website. See Success Academy (2017). According to the New York City Charter School Center (2017), a total of 106,600 students were enrolled in New York City charter schools in the fall of 2016. According to the New York City Department of Education (2017), a total of 1,133,963 students were enrolled in public schools citywide in 2015-2016, excluding charter schools. For current information about Success Academy and its educational offerings see www.successacademies.org.

seats available for the 2010-2011 school year, the sample only includes about 700 students who were offered admission. The resulting low ratio of lottery "winners" to all applicants limits the statistical precision of the estimates presented.[2]

Within the constraints of this analysis, MDRC finds that for the subset of students who were selected through a lottery and then enrolled in a Success Academy school, enrollment had large, positive effects on students' math achievement in third grade, roughly equivalent in magnitude to between one and one and a half typical years of learning for this age group. Effects on reading did not reach conventional levels of statistical significance but are positive and promising. A larger sample size would be necessary to obtain more precise estimates. As explained below, the program's effect was also estimated for all lottery winners, not just those who enrolled, and these estimates were similar but of a smaller magnitude.

The remainder of this paper explains these findings in more detail. Appendix A describes how the lotteries occur within the Success Academy admission process and how the analytic models are estimated.

Estimating the Effects of Success Academy

When considering the effects of social policies and educational programs, researchers often estimate both the effect of receiving an offer to participate in a particular program and the effect of actually receiving the program. Policymakers may be interested in the effects of offering a program, since that is within their control, while others may be more interested in the effects of the program on the people who chose to respond to the offer. Here MDRC estimates both (1) the effect of winning the opportunity to attend a Success Academy school and (2) the effect of winning the offer to attend a Success Academy school and enrolling the following fall. Both of these estimates are important, and, in fact, the effect of enrolling is estimated by performing a statistical adjustment on the effect estimated using the original random lottery sample. Box 1 describes the two different approaches in greater detail.

Estimating the Effect of the Opportunity to Enroll in a Success Academy School

To estimate the effect of the offer of a seat at a Success Academy school, MDRC used naturally occurring lotteries for oversubscribed Success Academy schools to identify two

[2]Because of the preliminary nature of this analysis and the limited power arising from the unusual ratio of lottery winners to nonwinners in the sample, this paper treats findings with p-values of 0.10 or less as statistically meaningful when they are part of a pattern of positive effects.

Box 1

Methods Used in This Analysis to Estimate Effects

The method used in this analysis is based on a lottery, which, like a randomized controlled trial (widely considered to be the gold standard for studying the effects of educational, social, or medical innovations), randomly determines who is assigned to a program and who is not and creates two groups that are the same on average in all ways, except for their assignment to the program. Any future differences in the average outcomes of the two groups thus can be attributed to the program or innovation. Comparing the outcomes of lottery winners and lottery losers is called an "intent-to-treat" analysis. Such an analysis meets the U.S Department of Education's highest standard of evidence. Because the winner of a lottery could decide not to receive the intervention (in this case, attending a Success Academy school), or a lottery loser could receive the intervention by other means (in this case, by attending a different Success Academy school or later being admitted from the waiting list), it is also useful to estimate the average effect of winning a lottery and receiving the intervention, which in this study means enrolling in a Success Academy school, compared with not winning a lottery and not receiving the intervention. This latter estimate is called the complier average causal effect (CACE).

groups of comparable students: those who randomly won the opportunity to attend a Success Academy school (which in evaluation research would typically be referred to as a study's "program group") and those who randomly lost the opportunity to attend a Success Academy school (which would typically be referred to as the study's control group). Because students were randomly assigned to these two groups, any difference in average outcomes between the two groups following the lottery can be attributed to the offer of attending a Success Academy school. (See Appendix A for a more detailed description of this analytic approach.)

Estimating the Effect of Enrolling in a Success Academy School

Students' "local lottery" assignment results (that is, as explained in Appendix A, the results for their nearest Success Academy schools) were not the final factor determining whether they actually attended Success Academy schools. Fifty percent of the Success Academy program group students decided not to attend Success Academy schools. There are various reasons why a student who won a Success Academy lottery may not have enrolled. For example, the Success Academy school may have been located too far from his or her home. (Sometimes a lottery took place before a school's final location was determined.) A student may have applied to multiple charter schools and received an offer from a more preferred school. A student may have decided to attend a traditional elementary school. Or a student and his or her family may have decided not to enroll for another reason. Similarly, roughly 25 percent of the control group students enrolled in Success Academy schools, either by being assigned as part of

the typical assignment process (to schools farther away, after losing lotteries for their nearest schools) or by coming off local schools' waiting lists to fill available spaces. Thus it is also useful to estimate the average effect of enrolling in a Success Academy school. This enrollment effect — the complier average causal effect (CACE) mentioned in Box 1 — is estimated using a standard application of two-stage least squares (2sLs) instrumental variables analysis,[3] an approach often applied in randomized experiments and lottery-based studies.[4] (See Appendix A for a more detailed description of the CACE approach.)

It is important to note that while the intent-to-treat approach meets the U.S. Department of Education's highest standard of evidence, the CACE approach provides weaker evidence, in part because it rests on untestable assumptions.[5] In addition, a note of caution should be heeded when interpreting the estimated effects of enrolling in a Success Academy school reported in this study. The effects of enrollment only apply to students who won lotteries and chose to enroll in Success Academy schools; the CACE analysis does not address whether or how Success Academy would have affected students who were offered the opportunity to attend but went elsewhere.

Success Academy Applicants and Enrollees

On average, Success Academy students are predominantly Black and Hispanic; the majority of the students qualified for free or reduced-price lunches. The sections below describe the characteristics of four samples of students relevant to the estimation of Success Academy's effects: the students who applied to Success Academy schools, the students in the lottery sample used in this analysis, the students in the lottery sample who won seats in Success Academy schools and enrolled, and the students in the lottery sample for whom follow-up test scores are available.

Applicants

Students who applied to Success Academy schools in 2010 were largely economically disadvantaged. Specifically, roughly 70 percent of the Success Academy first-grade applicants in the sample qualified for free or reduced-price lunches. In comparison, 87 percent of all NYCDOE students in the neighborhoods surrounding Success Academy schools receive free or

[3]Angrist, Imbens, and Rubin (1996); Gennetian, Morris, Bos, and Bloom (2005).

[4]Abdulkadiroğlu et al. (2011); Bloom and Unterman (2014); Gennetian, Morris, Bos, and Bloom (2005); Ludwig and Kling (2007).

[5]What Works Clearinghouse (2014a).

reduced-price lunches.[6] Like the students in the neighborhoods surrounding Success Academy schools, the majority of the students are Hispanic (53 percent) or Black (42 percent).[7]

Lottery Participants

MDRC capitalized on the Success Academy admissions process to identify a spring 2010 lottery sample of 4,710 students from 14 lotteries held for seven Success Academy elementary schools (3,804 students entering kindergarten and 906 entering first grade). When MDRC requested school records from NYCDOE those records were only available through the 2013-2014 school year, so the present analysis could follow those 2010 applicants for four years after they participated in Success Academy lotteries (through third grade for students who participated in lotteries to enter kindergarten and through fourth grade for students who participated in lotteries to enter first grade). The present analysis could not follow students who applied in later years. Table 1 provides more detail about the follow-up period for these two groups of applicants.

Across all measurable background characteristics, on average, the Success Academy program group members (referred to in these tables as "lottery winners") and their control group counterparts appear equivalent.[8] When there are small differences between the groups, these differences are not statistically significant at the 0.05 level, and do not warrant further sensitivity analyses.[9] Tables 2 and 3 indicate that, like the overall applicant sample, students in the sample are primarily Black and Hispanic and over half qualified for free or reduced-price lunches.[10] About half of the sample is male and half is female. At least 20 percent of the students in the sample of Success Academy lottery participants also applied to at least one other charter school (not shown).[11]

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[6]This comparison relies on data from the Success Academy first-grade-entrant sample. A little over half of the Success Academy kindergarten applicants were reported as qualifying for free or reduced-price lunches. However, because Success Academy provides free lunch to all of its students, the families of Success Academy kindergarteners may be less motivated to turn in the required free lunch forms than the families of other students across the district. In contrast, NYCDOE collected the baseline data on free or reduced-price lunch for the sample of first-grade applicants while those students were attending non-Success Academy kindergartens.

[7]"Students in the neighborhoods surrounding Success Academy schools" are defined as the students living in the areas identified by Success Academy as the schools' "community school districts."

[8]These results come from an omnibus test that regressed a binary indicator for program group status on all of the characteristics in the table.

[9]What Works Clearinghouse (2014a).

[10]As mentioned in footnote 6, the families of Success Academy kindergartners may be less motivated to turn in the required free lunch forms than the families of other students in the district.

[11]Roughly equal percentages of students in the kindergarten and first-grade control groups enrolled in charter schools run by another network (about 20 percent in each case).

Table 1

Evaluation Follow-Up Period

Applicant group	Baseline Year	Follow-Up Year 1	Follow-Up Year 2	Follow-Up Year 3	Follow-Up Year 4
Kindergarten entrants	NA	K	Grade 1	Grade 2	Grade 3
First-grade entrants	K	Grade 1	Grade 2	Grade 3	Grade 4

NOTES: Students competed in lotteries for Success Academy schools in the spring of 2010. Follow-Up Year 1 is the 2010-2011 school year. This study tracks students through the 2013-2014 school year.

NA = not applicable.

Table 2

Baseline Characteristics of Kindergarten Entrants

Characteristic	Lottery Winners	Control Group Counterparts	Estimated Difference	P-Value for Estimated Difference
Race/ethnicity (%)				
Hispanic	53.0	53.9	-0.9	0.761
Black	41.8	38.9	2.8	0.345
Multiracial	1.1	2.4	-1.3	0.241
White	1.9	2.2	-0.3	0.707
Asian	2.2	1.9	0.3	0.729
Male (%)	57.3	52.5	4.8	0.117
Eligible for free/reduced-price lunch (%)	50.7	44.9	5.8	0.114
Age	4.2	4.2	0.0	0.460
Sample size	400	3,001		

SOURCES: MDRC's calculations use Success Academy school assignment data and New York City Department of Education school records and state test data for Success Academy applicants in the spring of 2010.

NOTES: Values for Success Academy lottery winners are the simple means for all lottery winners. Values for the difference between Success Academy lottery winners and control group members are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and control group members. The value for control group members equals the corresponding value for Success Academy lottery winners minus the estimated difference between lottery winners and control group members.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

Table 3

Baseline Characteristics of First-Grade Entrants

Characteristic	Lottery Winners	Control Group Counterparts	Estimated Difference	P-Value for Estimated Difference
Race/ethnicity (%)				
Hispanic	51.1	53.7	-2.7	0.513
Black	42.8	39.2	3.6	0.368
Multiracial	1.8	0.6	1.2	0.184
White	2.5	3.5	-1.0	0.511
Asian	1.8	1.3	0.5	0.666
Male (%)	51.1	55.8	-4.8	0.058
Eligible for free/reduced-price lunch	97.2	96.3	0.8	0.528
Age	5.3	5.3	0.0	0.568
Sample size	314	592		

SOURCES: MDRC's calculations use Success Academy school assignment data and New York City Department of Education school records and state test data for Success Academy applicants in the spring of 2010.

NOTES: Values for Success Academy lottery winners are the simple means for all lottery winners. Values for the difference between Success Academy lottery winners and control group members are obtained from a regression of a given baseline characteristic on a series of indicator variables that identify each lottery plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers. The coefficient on the latter indicator variable equals the difference in the mean baseline characteristic for lottery winners and control group members. The value for control group members equals the corresponding value for Success Academy lottery winners minus the estimated difference between lottery winners and control group members.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

Enrollees

To examine enrollment rates for students who won Success Academy lotteries, MDRC looked at participation in various Success Academy preenrollment activities that students (and their parents/guardians) who were offered a seat were told to attend. Specifically, after winning the lottery and before the school year started, students and their families were informed of a welcome meeting, student registration, a uniform fitting, and a dress rehearsal. In addition,

before enrollment (as is common among many charter networks), parents/guardians signed a contract highlighting the education-related activities offered throughout the year and outlining the various ways the Success Academy staff communicates with families.

Of the lottery winners in the sample (both kindergarten and first-grade entrants), about 82 percent attended a welcome meeting. Approximately 61 percent of lottery winners attended student registration, 54 percent attended a uniform fitting, and 50 percent attended a dress rehearsal. With few exceptions, lottery winners who did not attend an activity did not attend subsequent activities. Ultimately, about 50 percent of lottery winners enrolled in Success Academy schools in the 2010-2011 school year.[12] (As explained above, there are various reasons why a student might not have enrolled.)

Students for Whom Test Scores Were Available

While the Success Academy program and control group appear similar at the time of the lottery, this analysis focuses on the students within each group for whom test scores are available in third grade. As shown in Table 4, among both the kindergarten- and first-grade-entrant samples, math and reading test scores were available for at least 75 percent of both the Success Academy program group and control group members, and any differences in the rates of data availability were not statistically significant.[13] Based on standards set by the What Works Clearinghouse, the overall and differential levels of attrition (missing data) reported here are not substantial and do not warrant further sensitivity analyses.[14] In addition, the baseline equivalence seen after random assignment has been sustained for each follow-up analysis sample.

In each follow-up year, students' academic achievement was measured by their performance on the New York State reading and math exams. To facilitate comparisons over time, each student's exam score was standardized as a z-score using each year's New York State mean and standard deviation of test scores by grade and subject.[15] This standardization results in

[12]About 97 percent of those who enrolled in Success Academy schools attended all four of these preenrollment activities. Compared with Success Academy lottery winners as a whole, on average fewer Hispanic students (by 6 percentage points) and more Black students (by 3 percentage points) attended Success Academy schools.

[13]When a sample member is missing test score data, it is probably because the student was held back, moved out of the New York City school district, or enrolled in a private or parochial school.

[14]What Works Clearinghouse (2014b).

[15]A z-score is a measure of the distance between a student's test score and the New York State average, in standard deviations. For example, if a student's exam score were exactly the same as the New York State mean score for that grade and subject, that student's z-score value would be zero; if a student scored exactly one

(continued)

Table 4

Test Score Availability

Data Available (%)	Lottery Winners	Control Group Counterparts	Estimated Difference	P-Value for Estimated Difference
Kindergarten entrants				
Third-grade mathematics	75.61	73.29	2.32	0.231
Third-grade reading	75.61	71.18	4.43	0.301
First-grade entrants				
Third-grade mathematics	77.80	74.70	3.10	0.241
Third-grade reading	78.80	76.20	2.60	0.311
Fourth-grade mathematics	78.34	78.86	-0.52	0.856
Fourth-grade reading	78.34	78.86	-0.52	0.856

SOURCES: MDRC's calculations use Success Academy school assignment data and New York City Department of Education school records and state test data for Success Academy applicants in the spring of 2010.

NOTES: Values for Success Academy lottery winners are the simple means for all lottery winners. Values for the difference between Success Academy lottery winners and control group members are obtained from a regression of a given outcome on a series of indicator variables that identify each lottery, plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers, plus a set of covariates: gender, age, free/reduced-price lunch status, race, and number of days absent in the baseline school year. The coefficient on the latter indicator variable equals the difference in the mean follow-up outcome for lottery winners and control group members. The value for control group members equals the corresponding value for Success Academy lottery winners minus the estimated difference between lottery winners and control group members.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

estimated effects being reported in standard deviations, a measure often used to compare findings across studies that can be translated into months of regular school-year instruction based on the benchmarks in Hill, Bloom, Black, and Lipsey (2008).

standard deviation higher than the New York State mean for the grade and subject, the student's z-score would be one.

The Effects of Success Academy

As mentioned above, this section first describes the effect of being offered the opportunity to enroll in a Success Academy school (the intent-to-treat effect), then describes the effect of actually enrolling in a Success Academy school (the complier average causal effect).

The Effect of Being Offered the Opportunity to Enroll

Findings for the kindergarten-entrant sample in the first row of Table 5 indicate that, on average, in the fourth year of follow-up (that is, for most students, in third grade — the first year that students take state exams), being offered the opportunity to attend a Success Academy school increased students' academic achievement in math; the effect on students' academic achievement in reading is promising, though less clear. Specifically, winning a lottery produces an effect in math that is roughly equivalent in magnitude to an additional four months of learning for this age group (effect size = 0.179, p-value = 0.086).[16] Said differently, at the end of the fourth follow-up year, Success Academy program group members were roughly a third of a year ahead of students in the control group. Success Academy program group members in the kindergarten-entrant sample also appear to make substantial gains in reading (effect size = 0.109, p-value = 0.185), but these estimates are not close to statistically significant, as reflected in the nonsignificant p-value, and it is not possible to rule out the possibility that the program did not have an effect. More precise estimates would require larger sample sizes.

For the first-grade-entrant sample (Table 6), winning a lottery produces consistent third-grade and fourth-grade effects in math that are roughly equivalent in magnitude to an additional one-third to one-half of a year of learning for this age group (effect size = 0.185, p-value = 0.040; and effect size = 0.267, p-value= 0.003, respectively).[17] Said differently, at the end of the third follow-up year, Success Academy program group members' math scores were roughly a third of a year ahead of control group students' scores; at the end of the fourth follow-up year they were roughly half a year ahead. The estimate of Success Academy's effect on reading scores for the first-grade-entrant sample is positive but not statistically significant, and thus is less reliable (effect size = 0.148, p-value = 0.097). The estimate is especially unreliable in the fourth grade where the result is far from statistically significant (effect size = 0.078, p-value = 0.362).

[16] According to Hill, Bloom, Black, and Lipsey (2008), the typical annual gain for third-graders in math is 0.52 standard deviations; in reading it is 0.36 standard deviations.

[17] According to Hill, Bloom, Black, and Lipsey (2008), the typical annual gain for fourth-graders in math is 0.56 standard deviations; in reading it is 0.40 standard deviations.

Table 5

The Effects of Winning a Success Academy Lottery on Kindergarten Entrants After Four Years

Outcome (%)	Estimated Difference in Standard Deviations	P-Value for Estimated Difference
Third-grade test		
Mathematics	0.179	0.086
Reading	0.109	0.185

SOURCES: MDRC's calculations use Success Academy school assignment data and New York City Department of Education school records and state test data for Success Academy applicants in the spring of 2010.

NOTES: This sample contains 400 lottery winners and 3,001 control group members.

Values for the difference between lottery winners and control group members are obtained from a regression of a given outcome on a series of indicator variables that identify each lottery, plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers, plus a set of covariates: gender, age, free/reduced-price lunch status, race, and number of days absent in the baseline school year. The coefficient on the lottery winners indicator equals the difference in the mean follow-up outcome for lottery winners and control group members.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

The Effect of Enrolling

As explained earlier, only about half of the Success Academy lottery winners enrolled in Success Academy schools, and about a quarter of the students who lost their "local" Success Academy lotteries enrolled in different Success Academy schools.[18]

Table 7 presents the effects of enrolling in a Success Academy school on kindergarten entrants; on average they are between three to four times the effects of winning the opportunity to attend. For the kindergarten-entrant sample, the estimated enrollment effect was roughly

[18]Approximately 50 percent of the lottery winners did enroll in a Success Academy school and roughly 25 percent of those not selected crossed over into a Success Academy school (these rates are the same for kindergarten and first-grade applicants). The difference between these two estimates produces an estimated compliance rate for both kindergarten and first-grade applicants of between 25 and 30 percent.

Table 6

The Effects of Winning a Success Academy Lottery on First-Grade Entrants After Three Years and After Four Years

Outcome (%)	Estimated Difference in Standard Deviations	P-Value for Estimated Difference
Third-grade test		
Mathematics	0.185 *	0.040
Reading	0.148	0.097
Fourth-grade test		
Mathematics	0.267 **	0.003
Reading	0.078	0.362

SOURCES: MDRC's calculations use Success Academy school assignment data and New York City Department of Education school records and state test data for Success Academy applicants in the the spring of 2010.

NOTES: This sample contains 314 lottery winners and 592 control group members.

Values for the difference between lottery winners and control group members are obtained from a regression of a given outcome on a series of indicator variables that identify each lottery, plus an indicator variable that equals 1 for lottery winners and 0 for lottery losers, plus a set of covariates: gender, age, free/reduced-price lunch status, race, and number of days absent in the baseline school year. The coefficient on the lottery winners indicator equals the difference in the mean follow-up outcome for lottery winners and control group members.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

equivalent to an additional 1.1 years of math learning for this age group (effect size = 0.560, p-value = 0.086).[19] Said differently, at the end of the fourth follow-up year, Success Academy program group enrollees were a little over one year ahead of their control group counterparts in math. Kindergarten-entrant sample program group enrollees may also experience sizable improvements in reading (effect size = 0.3421, p-value = 0.185), but because there is considerable uncertainty around this estimated effect, as reflected in the nonsignificant p-value, one cannot rule out the possibility that the program did not have an effect in reading.

[19]Again, according to Hill, Bloom, Black, and Lipsey (2008), the typical annual gain for third-graders in math is 0.52 standard deviations; in reading it is 0.36 standard deviations.

Table 7

The Effects of Enrolling in a Success Academy School on Kindergarten Entrants After Four Years

Outcome (%)	Estimated Difference in Standard Deviations	P-Value for Estimated Difference
Third-grade test		
Mathematics	0.560	0.086
Reading	0.341	0.185

SOURCES: MDRC's calculations use Success Academy school assignment data and New York City Department of Education school records and state test data for Success Academy applicants in the spring of 2010.

NOTES: This sample contains 400 lottery winners and 3,001 control group members.

Values for the difference between lottery winners and control group members are obtained from a 2sLs regression.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

For the first-grade-entrant sample (Table 8), winning a lottery and enrolling in a Success Academy produces consistent third-grade and fourth-grade effects in math that are roughly equivalent in magnitude to an additional year to a year and a half of learning for this age group (effect size = 0.529, p-value = 0.040; and effect size = 0.763, p-value = 0.003, respectively).[20] Said differently, at the end of the third follow-up year, Success Academy program group enrollees were roughly a year ahead of their control group counterparts in math; at the end of the fourth follow-up year they were 1.5 years ahead of their counterparts. These early math findings are comparable to some of the largest effects found in the charter field.[21] Success Academy's effects on reading for the first-grade-entrant sample are promising but cannot be precisely estimated (effect size = 0.422, p-value = 0.097), especially in the fourth grade where, as discussed above, the result is far from statistically significant (effect size = 0.223, p-value = 0.362).

Success Academy produced these gains in the context of a control group that was already performing well. Sixty percent of the control group members who did not attend Success

[20]Again, according to Hill, Bloom, Black, and Lipsey (2008), the typical annual gain for fourth-graders in math is 0.56 standard deviations; in reading it is 0.40 standard deviations.

[21]Charbier, Cohodes, and Oreopoulos (2016).

Table 8

The Effects of Enrolling in a Success Academy School on First-Grade Entrants After Three Years and After Four Years

Outcome (%)	Estimated Difference in Standard Deviations	P-Value for Estimated Difference
Third-grade test		
Mathematics	0.529 *	0.040
Reading	0.422	0.097
Fourth-grade test		
Mathematics	0.763 **	0.003
Reading	0.223	0.362

SOURCES: MDRC's calculations use Success Academy school assignment data and New York City Department of Education school records and state test data for Success Academy applicants in the the spring of 2010.

NOTES: This sample contains 314 lottery winners and 592 control group members.

Values for the difference between lottery winners and control group members are obtained from a 2sLs regression.

A two-tailed t-test was applied to the estimated difference. Statistical significance levels are indicated as: ** = 1 percent; * = 5 percent.

Academy schools performed at or above grade level on their third-grade New York State math exams, and 44 percent performed at or above grade level on their third-grade New York State reading exams. These percentages are at least 10 points higher than the percentage of students scoring at or above grade level in the New York City district schools in the neighborhoods surrounding Success Academy schools.

Conclusion

Enrolling in a Success Academy school has positive effects on students' math achievement and promising, though less clear, effects on students' reading achievement. While the majority of the math effects are statistically significant at or near the level commonly used by education researchers (a p-value of 0.05 — or 5 percent), Success Academy's effect on students' reading achievement appears to be positive but cannot be precisely estimated. However, as previously discussed, the lottery sample available at the time of this analysis was relatively small, and had a low ratio of lottery "winners" to all applicants, which limits the sample's statistical power; this

limited power may explain why the reading findings fall short of conventional standards of statistical significance. Additional research is necessary to better reveal Success Academy's effects on students' achievement in reading, and its effects on both reading and math in more recent years.

Thus, there is a strong case for following students who applied in subsequent years and for adding a larger number of Success Academy schools to the sample. If the findings are sustained in a larger analysis, they would place Success Academy's effects in the upper range of other charter schools.[22] Important questions MDRC has identified that have yet to be answered include: Once additional years of students are added to the sample and the statistical power of the analysis is increased, will the positive math findings be sustained and will there be a statistically significant effect in reading? As Success Academy opens more schools across the district, will the characteristics of the students they serve change and will the effects at these newer schools be similar?

[22]Charbier, Cohodes, and Oreopoulos (2016).

Appendix A

The Success Academy Admissions Process and the Models Applied in This Analysis

Admission to every Success Academy school is managed centrally by the network's director of enrollment. In the spring of 2010, Success Academy used four ranked "admissions priorities" based on whether applicants had siblings in Success Academy schools and based on where they lived.[1] From an applicant's perspective, it may appear that there is one general admissions "lottery." This appendix discusses the application process as it pertains to the lotteries MDRC has identified for research purposes, then describes the models used to estimate effects.

When the school matching process begins in April, each student is assigned a random number that is used for all Success Academy schools to which she applies. Then, for each of these schools, she is placed in the admission-priority group that applies to her for that school and grade level. Within each admission-priority group for each Success Academy school, applicants are ordered by their random numbers.

Each Success Academy school admits students, by grade level, in the order of their admissions-priority groups until all seats in a school are filled. Once a priority group is reached that is oversubscribed — that is, where the number of students in the priority group exceeds the number of remaining open seats in that grade at that school — the students in this priority group are admitted in the order of their random numbers until no more seats remain.[2] This process produces the statistical equivalent of a randomized lottery for students in that priority group for that school. As a result, the estimates of the effect of winning a Success Academy lottery are statistically equivalent to those of a randomized experiment.

Since students can apply to multiple Success Academy schools, in any given year applicants may be in multiple Success Academy lotteries. For example, families in the study sample applied to an average of six Success Academy schools (there were seven in operation that year). If an applicant was selected based on her random number in multiple Success Academies in school year 2010-2011, then she was offered a spot in the Success Academy

[1]Each year these admissions priorities are predetermined and are the same for all Success Academy schools. According to its 2010 New York State charter application, Success Academy's admission priorities were to admit applicants (in rank order): (1) who had siblings who already attended the Success Academy schools to which they were applying; (2) who were zoned to failing New York City Department of Education schools in the same school zones as the Success Academy schools to which they were applying; (3) who were zoned to failing New York City Department of Education schools outside of the school zones of the Success Academy schools to which they were applying; (4) whose parents' addresses were within the zones of the Success Academy schools to which they were applying (also called those schools' "Community School Districts").

[2]The remaining students are placed on a waiting list, to be admitted in the order of their priority groups, and within each priority group in the order of their random numbers. Students are admitted from this waiting list as seats in the school become available.

school closest to her home address — that is, her "local" Success Academy school.[3] The present analysis is based on the results of the random selection for each student's "local" Success Academy school.[4] This paper refers to students who competed in lotteries for their closest — "local" — Success Academy schools as "the sample of Success Academy lottery participants" and the lotteries they competed in as "Success Academy lotteries."

Estimating the Intent-to-Treat and Complier Average Causal Effects

The intent-to-treat effect is estimated using the following ordinary least squares regression model:

$$Y_i = \sum_{j=1}^{J} \alpha_j * \boldsymbol{Lottery}_{ji} + \beta_w * Win_i + \delta_x * \boldsymbol{X}_i + \varepsilon_i \quad (1)$$

where Y is student i's third- or fourth-grade New York State standardized mathematics or reading test score (depending on the outcome for which effects are being estimated), Win is a lottery winner indicator equal to 1 if student i wins lottery j and 0 otherwise, **Lottery** is a vector of lottery indicators equal to 1 for lottery j and 0 otherwise, **X** is a vector of student-level covariates for student i (included for precision), and ε is a random error for student i that is clustered by the first school that a student entered after a lottery. The parameter of interest, β_w, identifies the effect of winning a lottery on student outcomes, and its standard error and associated t-statistic identify its statistical significance.

The first stage of this two-stage least squares estimation process is specified as:

$$E_i = \sum_{j=1}^{J} \alpha_j * \boldsymbol{Lottery}_{ji} + \beta_w * Win_i + \delta_x * \boldsymbol{X}_i + w_i \quad (2)$$

where E_i is a Success Academy enrollment indicator equal to 1 if student i enrolled in a Success Academy school at any time before she took the state test used as an outcome for the analysis

[3]Beginning in 2013, applicants had the opportunity to rank the Success Academy schools to which they applied, and if an applicant was selected based on her random number in multiple Success Academy schools, she was offered a spot in the school that she ranked highest among those schools for which she won a lottery.

[4]As discussed in the section below, in the main analysis, if a student lost a lottery for the Success Academy school closest to where she lived, the student is considered a control group member, even if she won a lottery for a different Success Academy school or came off the waiting list for the nearest school at a later time. In the analysis of the effects of enrolling in a Success Academy school, if a student won a lottery for a different Success Academy school and enrolled there, that student would be considered a "control group crossover."

Another commonly applied approach to analyzing extant lottery data — grouping students based on the set of schools they applied to — is not possible in this context because there are too many possible combinations of the seven schools selected by applicants.

and 0 otherwise. All other terms are defined as in equation (1). The second-stage equation is specified as:

$$Y_i = \delta \cdot \hat{E}_i + \sum_{j=1}^{J} \alpha_j \cdot \boldsymbol{Lottery}_{ji} + \theta \cdot \boldsymbol{X}_i + e_i \qquad (3)$$

where $\widehat{E}_i$ equals the fitted value of the enrollment outcome from the first-stage equation, and e_i is a random error that is clustered by the schools that students entered after their lotteries. The estimated value of δ is a consistent estimate of the average effect of enrolling in Success Academy schools for target Success Academy enrollees.

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