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MAKING SUMMER MATTER:
THE IMPACT OF YOUTH EMPLOYMENT ON ACADEMIC PERFORMANCE

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ABSTRACT

Holding a summer job is a rite of passage in American adolescence, a first rung towards adulthood and self-sufficiency. Summer youth employment has the potential to benefit high school students' educational outcomes and employment trajectories, especially for low-income youth. This paper examines New York City's Summer Youth Employment Program (SYEP). SYEP provides jobs to youth ages 14-24, and due to high demand for summer jobs, allocates slots through a random lottery system. We match student-level data from the SYEP program with educational records from the NYC Department of Education, and use the random lottery to estimate the effects of SYEP participation on a number of academic outcomes, including test taking and performance. We find that SYEP participation has positive impacts on student academic outcomes, and these effects are particularly large for students who participate in SYEP multiple times. These findings suggest substantial heterogeneity in program effects, and an important avenue for policy makers to target the program to those who might benefit from it the most.

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Introduction

Unemployment rates for youth jumped to historical highs after the recession of 2008 and have been slow to recover. An important component of this jobs crisis is the lack of available summer jobs for high school students—especially low-income youth.[1] This dearth of employment opportunities for youth may hamper their development, with lasting negative consequences. Prior research suggests that adolescent employment improves net worth and financial well-being as an adult (Painter, 2010; Ruhm, 1995). An emerging body of research indicates that summer employment programs also lead to decreases in violence and crime (Sum et al, 2013; Heller, 2013, 2014; Gelber et al 2014).[2] Work experience may also benefit youth, and high school students specifically, by fostering various non-cognitive skills, such as positive work habits, time management, perseverance, and self-confidence (Lillydahl, 1990; Mortimer, 2003; Duckworth et al, 2007).[3]

This paper studies the impact of summer youth employment on students' academic achievement. We utilize a large data set including nearly 200,000 applicants to New York City's Summer Youth Employment Program (SYEP) from 2005- 2008. We match the SYEP program data for each student to academic records from the New York City Department of Education (NYCDOE). Importantly, since the number of applicants substantially exceeds the number that can be served, positions are allocated through a random lottery, offering an unusual opportunity to derive robust estimates of the impact of the program. We use data on New York State's

[1] Summer jobs for low-income youth represented a major component of The American Recovery and Reinvestment Act (ARRA), which provided $1.2 billion for youth employment opportunities and funded 345,000 jobs during the summer of 2009 (Bellotti et al. 2010). However, these funds are no longer available, and many other publicly funded jobs have also experienced reductions in the number of youth they are able to employ.

[2] This is consistent with evidence that unstructured time with peers is associated with greater delinquent behavior (Anderson & Hughes, 2009).

[3] Heckman (2000); Cunha, Heckman, and Schennach (2010) argue that non-cognitive skills and motivation are critical for future skill development, and that these skills can be improved at later ages.

"Regents" exams designed to assess performance in a variety of high school subjects including Mathematics, Sciences, English, and History. Further, we examine the way in which the impact of SYEP varies with repeated program participation over multiple summers, and explore heterogeneity across key student subgroups.

Our estimates indicate that SYEP improves academic outcomes for the NYC public school students who participate: SYEP increases the number of exams students attempt, the number of exams students pass, and the average score students achieve. Further, we find that the improvements in test taking and passing increase with the number of years a student participates in SYEP – impacts are larger for second time participants and largest for those participating for the third time. These findings suggest substantial heterogeneity in program effects, and an important avenue for policy makers to target the program to those who might benefit from it the most.

Relevant Prior Research

Much of the previous research examining the impact of high school student employment on academic outcomes has been limited to work during the school year, focusing on the potential tradeoffs between the developmental and financial benefits of working and the possible crowding out of time devoted to academics (Rothstein, 2007; Sabia, 2009; Kalenkoski & Pabilonia, 2009). This research largely suggests that working a moderate number of hours (i.e., less than 20 hours per week) during the school year has either a small positive effect or no effect on outcomes such as school attendance, time spent on homework, and GPA, and that working more than a moderate number of hours (i.e., more than 20 hours per week) has negative effects on these outcomes (Lillydahl, 1990; Monahan, Lee, & Steinberg, 2011; Rothstein, 2007; Stern & Briggs, 2001). Most previous research, however, has explicitly excluded work experiences during the

summer when there is considerably less risk of detracting attention from school responsibilities (Painter, 2010; McNeal, 1997).

Walker and Vilella-Velez's (1992) evaluation of the Summer Training and Education Program (STEP) is one study that directly examines summer employment. They find that STEP improved reading and mathematics test scores for academically behind 14- and 15-year-olds from poor urban families who participated in the program. STEP consisted of half-day summer jobs combined with half-days of academic coursework (specially designed remedial reading and mathematics curricula). In addition to higher test scores, participating students had better grade point averages, showed more knowledge about responsible sexual and social behavior, and had higher attendance rates than students from a control group. SYEP is similar to STEP, with employment combined with some classroom instruction, although SYEP's classroom instruction is considerably less (about 10 percent of program hours, as described more fully below).

In the first research to study SYEP using the randomized admission lottery, Leos-Urbel (2014) estimates the impact of SYEP on student attendance for the 2007 cohort of students. He finds a significant increase in school attendance in the school year following SYEP participation, with larger effects among students likely to be at greater risk of low attendance—students 16 years and older with low attendance rates in the previous year. We expand on these findings by considering a broader range of academic outcomes including test taking and performance on a wide range of exam subjects. Further, we use data for four SYEP cohorts, constituting nearly 200,000 SYEP applicants, allowing us to study effects of the program on individuals who participate multiple times.

The plan for the remainder of the paper is as follows. The next section describes the institutional background and some key details of the administration of NYC's SYEP program.

The following section describes the matched SYEP and NYC Department of Education data. Next we discuss the econometric framework and the estimation results. We conclude by discussing the size of the effects relative to the cost of the program and important policy lessons suggested by the empirical analysis.

1) Institutional Background

New York City's Summer Youth Employment Program (SYEP) is designed to introduce and prepare youth for future careers, foster skills important for success in the labor market, and provide supplemental income to families. SYEP participants work in a variety of entry-level jobs at community-based organizations (CBOs), government agencies and private sector businesses; most common worksites include summer camps and day care, followed by social or community service agencies and retail. Participants are paid for up to 25 hours per week for up to six (or, in some years, seven) weeks at minimum wage, currently $8.75 per hour. In addition to work experience, 10 percent of participant hours are dedicated to education and training on topics related to time management, financial literacy, workplace readiness and etiquette, and career planning and finding employment.

The NYC Department of Youth and Community Development (DYCD) administers the program and contracts with a variety of CBOs to conduct intake and enrollment, as well as provide training and supervise job placement. All NYC residents ages 14-24 are eligible to apply to SYEP.[4] To apply to the program, youth submit an application directly online or through a

[4] SYEP also includes a few separate programs targeted at special populations, including one that serves only youth with disabilities through a separate lottery competition, a special program targeting vulnerable youth in foster care, court-involved or who are runaway/homeless youth that was added in 2009, and a school-year program funded through the Workforce Investment Act that does not use a lottery and guarantees admission. The results presented here focus on the larger general SYEP program and lottery only.

paper application and select a CBO service provider. Both types of applications are entered into the central SYEP data system. The system cross-checks across all service provider applications for duplication by matching the Social Security number and name of the applicant to ensure that each youth submits only one application for the program. Each complete application is randomly assigned an identification number. After the application deadline, DYCD assigns each service provider the number of SYEP slots that they are contracted to serve. DYCD then runs a lottery using the data system for each provider. The computerized system, using a random selection algorithm, selects applicants using the identification numbers for each provider according to the number of slots they have been allocated. The system sees each application as an ID number belonging to a provider and does not use any applicant information to determine their selection into the program, with the exception of those who have self-identified as having a disability. We exclude these students from the analysis.

SYEP is funded through a combination of federal (including Workforce Investment Act, Community Services Block Grant and American Recovery and Reinvestment Act funds), state (state TANF and general funds), city (through a city tax levy) and private funds, and changes in the availability of program funding have dictated fluctuations in the number of participants served over time. Specifically, the increase in city and state funding after 2005 allowed DYCD to increase the number of participants from 33,739 in 2005 to 43,113 participants by 2008. Expansion has not met demand, however, as the number of applications has almost doubled. SYEP received 69,328 applications in 2005; this number grew to 103,189 in 2008.

2) Data and Sample

Student-level data for this study come from two primary sources: SYEP files from the

DYCD and New York City Department of Education (NYCDOE) administrative data files. We matched students from each of these files for the 2005-2008 program years, encompassing 195,289 student SYEP applications. Data from DYCD include an indicator of SYEP lottery result, the CBO provider the student applied to, and, for those students who participated, the type of SYEP work placement, the specific worksite, and number of hours worked. Variables from NYCDOE files include student demographics, school attendance and information about standardized test-taking and performance.

Data Matching

DYCD and NYCDOE files do not contain a common identifying number (e.g. Social Security number). Therefore, data were matched on participant name and date of birth with a match rate of between 77 and 81 percent depending on the year. In order to maintain confidentiality, the match was conducted by an approved consultant, and the data provided to investigators does not include participants' names. Even with a common and unique identifier, we do not expect even close to a 100 percent match rate because, as described above, the SYEP program is open to non-students and students not enrolled in NYC public schools (students enrolled in private religious and private non-religious schools). Unmatched students then include students enrolled in private or parochial schools or enrolled in schools outside of New York City, as well as non-students. The match rate only for NYCDOE students, if we were able to identify them directly from the SYEP data, is likely considerably higher, but we cannot directly test this. We do conduct a number of tests of the relationship between probability of being matched and random lottery results. We find that student files matched to a NYCDOE data have a similar proportion of lottery winners and losers. We conduct additional tests on the match rate as described below.

NYCDOE Data

The NYCDOE data includes student level demographic information, as well as an academic record for each year in the NYC public schools. Student demographics include gender, race\ethnicity, English proficiency, participation in special education and ESL services, free and reduced price lunch eligibility, grade level, and age.

Each student record includes information on test-taking and performance on New York State standardized tests in a variety of subjects, including English, various mathematics exams (Math A, Math B, and Integrated Algebra and Geometry, which replaced Math A and B in later years), Global History, Earth Science, Biology, Physics and Chemistry. These tests, known as the "Regents Examinations," are a series of tests aligned with New York State's Learning Standards, and designed and administered by the New York State (NYS) Department of Education, under the authority of the Board of Regents of the University of The State of New York and prepared by teacher examination committees and testing specialists. Examination scores range from 0–100%. Although the specific requirements change over time and students have some flexibility in choosing which exam to take, starting with students who entered 9th grade in 2001, earning a NYS high school diploma ("Regents' Diploma") requires passing a set of these exams including mathematics, English, Global History and Geography, US History and Government, and at least one science (e.g. Biology, Chemistry, Physics, Earth Science). More specifically, in order to graduate with a high school diploma, students must score 65 or higher on any one math exam—usually Math A,[5] English, Global History and Geography and US History and Government, and one science exam. To earn an Advanced Regents Diploma, students must

[5] Math A was last administered in January, 2009 and replaced by Integrated Algebra beginning in June 2008 and Geometry beginning in June 2009.

pass an additional mathematics exam, Math B,[6] and one additional science (at least one life science and one physical science). Additionally, students entering 9th grade in 2007 and prior had the option of graduating with a "Local Diploma," which required passing any one of five Regents exams with a score of at least 55. This option was gradually phased-out,[7] and the Local Diploma was not available for students entering 9th grade in 2008 and later. Regents exams in all subjects are offered in June each year, and a limited number of Regents are offered in January and August. There are no mandated grades in which students are eligible or required to take a specific exam, but they typically take the exam at the end of the related course. Because the graduation requirements reward passing but do not penalize failing, it is in a student's best interest to take these exams as early as possible. The majority of students elect to take the exams in June at the end of the school year.

Our analyses focus on the impact of SYEP participation on academic outcomes, including test-taking and test-performance. To assess student performance, we examine three test-related outcomes in turn: test taking, passing at various levels, and the level of the actual test score. We construct an indicator variable for whether the student took the Regents exam in a particular subject and variables measuring performance as z-scores for each exam.[8] We also include indicator variables for whether the student passed the exam at three cut points: 55 (the score required for a Local Diploma available to a subset of students in our sample); 65 (required for a Regents diploma), and 75 (required on English and Math A for admission to CUNY four-year colleges). From these exam-specific indicators, we create seven measures to capture general

[6] Math B was last administered in June 2010, replaced by Algebra 2 and Trigonometry in June 2009.
[7] Students entering grade 9 in 2005 were required to score 65 or above on two of the five required Regents exams and score 55 or above on the remaining three; 2006 9th graders were required to score 65 or above on three of the five required exams, and 2007 9th graders were required to score 65 or above on four of the five required exams.
[8] Z-scores are standardized to have a mean of zero and a standard deviation of one across all students taking that Regents exam in that particular year.

performance on Regents exams: whether attempted any Regents exams in the school year following SYEP application and the total number of Regents exams attempted, whether passed any exams and total number of exams passed in that school year, the total number of exams passed with a score of 55 or above, the total number of exams passed with a score of 65 or above, the total number of exams passed with a score of 75 or above, and the average (mean) score on all exams taken that year.

Sample: SYEP Applicants

Our sample includes all SYEP applicants who were matched to the NYC public school records and were enrolled public school students, representing 134,059 applicants to the program from 2005- 2008.[9] Table 1 includes the number of SYEP applicants in each year as well as the number selected ("Lottery Winners"), and not selected ("Lottery Losers"), by the lottery. Note that the number of applicants increased in each year, and that the percentage of applicants selected to participate decreased. Importantly, as discussed below, some students applied to SYEP more than one time during this time frame, and these 134,059 applications consist of 95,948 unique individuals.

Table 2 provides descriptive statistics on the population of SYEP applicants from NYC public schools. The modal grade during which a student first applied to SYEP was 9th grade (40 percent of the applicants), with 22 percent applying in 8th grade, and 25 percent applying in 10th grade for the first time. Compared to non-applicants, SYEP applicants are more likely to be female. Reflecting the substantially more disadvantaged background of the applicants, SYEP

[9]We exclude duplicate observations for students who submit multiple SYEP applications within a year, and a subgroup who applied to vulnerable youth programs, WIA programs or programs that guaranteed summer jobs and did not use a lottery. We also exclude students who were unlikely to attend high school in the school year following SYEP and for which we do not have high school outcomes. We exclude students currently in grade 7 and lower, students currently in grade 12, and students in ungraded special education.

applicants are more likely to be receiving free or reduced price lunch. In addition, the applicants are much more likely to be black.

Table 3 provides descriptive statistics for the outcomes of interest related to student Regents exam attempts and performance. Two-thirds of the sample attempted at least one Regents exam, with an average of 1.33 exams attempted each year. Roughly half of the sample passed at least one Regents exam, with students passing an average of 0.80 exams per year. The average z-score of -0.09 indicates that this sample performed 0.09 standard deviations below the city average.

Finally, Table 4 provides the "take-up" rate of SYEP placement offers. Depending on the year, between 73-83 percent of participants offered an SYEP placement (i.e. they won the SYEP lottery for the CBO they applied to) actually participated in the program and worked at their summer job.

3) Empirical Strategy

This paper investigates the impact of SYEP on student academic success in the school year following SYEP participation, exploiting the random assignment of program participants. By comparing academic outcomes of students offered SYEP placements (the treatment group) to outcomes of students not offered placements (control group), we derive intent-to-treat (ITT) estimates of the impact of SYEP. Since we also have data on whether the student actually participated in an SYEP program and the extent of this involvement, we can also estimate treatment effects of program participation among those who apply (average effect of the treatment on the treated). Our key outcomes are student level measures of attempting, passing, and performance (test scores) on the New York State standardized high school exams, including

exams in Mathematics, English, History, and Science. Importantly, because SYEP participation is allocated via lottery, we are able to obtain causal estimates. If each SYEP lottery is random and there is no differential attrition, within any individual lottery, a simple comparison of sample means on the outcome of interest between those offered an opportunity to participate in SYEP (treatment group) and those not (control group) provides unbiased estimates of the intent-to-treat effect, where the treatment is participating in SYEP. In our analyses, the comparison group is the set of students who applied to SYEP in a particular summer, but who were not offered a placement. These students should be otherwise similar to the students in the treated group across all dimensions and, most importantly, similar in the distribution of unobserved characteristics, such as motivation and other non-cognitive attributes. Below we conduct several tests of the randomization of the lottery, including a standard test based on comparing observed characteristics of the lottery winners and losers, and a second test, a falsification test, using whether a lottery win predicts *prior* year outcomes. In all of our tests, we cannot reject the hypothesis that the lottery is random.

Intent-to-Treat (OLS)

We begin with an analysis using an indicator for winning the lottery as the variable of interest to estimate an intent-to-treat effect. To construct the estimating equations it is important to recall that there is not just one SYEP lottery each year, but that each Community Based Organization (CBO) has a separate lottery. As described above, each CBO is associated with a potentially different set of jobs and programs.

Let Y_{itgbc} be the outcome of interest for student *i,* year *t,* grade level g, who applied to CBO *b*, and from an initial application cohort *c*. The initial application cohort *c* is defined as the grade *x*

year of initial application.[10] Each of our outcomes is specified as

$$Y_{itgbc} = \beta win_{ibt} + X'_{ig}\alpha + \delta_{bt} + \gamma_c + \mu_g + \upsilon_{itgbc} \quad (1)$$

where win_{ibt} takes a value of 1 if student *i* won CBO *b*'s lottery in period *t* and was made an offer to participate in SYEP and 0 if he/she was not. Note the timing: the lottery in calendar year t associated with the win_{ibt} variable is for the summer *before* the academic year over which the outcome Y_{itgbc} occurs.[11] X_{ig} is a vector of student characteristics, including a constant, which may influence student performance, such as gender, race/ethnicity, free and reduced price lunch eligibility, limited English proficiency, special education status, and ESL status. X_{ig} is potentially grade varying as students change their free lunch eligibility, ESL and other statuses as they progress through the school system. δ_{bt} are fixed effects for each CBO interacted by calendar year. These fixed effects index each individual lottery and program offered by each CBO allowing us to control for potential differences in the selection rates and applicant pools across CBOs and years. γ_c are cohort fixed effects, based on a student's first year of applying to SYEP and grade in the school year prior to applying to SYEP. These fixed effects absorb any mean differences in cohort "quality" across the various application cohorts. μ_g are grade specific fixed effects which absorb any grade level differences in academic outcomes as students progress through school. υ_{itgbc} is the remaining residual error.[12]

In this model, β is the primary parameter of interest and captures the effect of being randomly offered (via lottery) a placement in SYEP. We estimate β using OLS. Below we

[10] There are 27 unique first time application cohort, e.g. first time applicants who were in 9th grade in year 2005 is one cohort, 10th grade in year 2005 is another, and so on.

[11] For the test score outcomes, which are mainly recorded in May-June at the end of the academic year, the spacing between SYEP participation, in the summer before, and these outcomes is 9-11 months.

[12] Note that although covariates are not necessary to derive unbiased impact estimates when treatment is randomly assigned, including additional covariates can improve the small sample properties if the reduction in residual error variance outweighs the increase in imprecision due to the estimation of additional parameters. Given our very large sample sizes, it would seem clear that the reduction in residual error variance is the far more important factor. See Bloom (2006) for some discussion of this issue.

consider various forms of heterogeneity in the impacts of SYEP, where the effects of SYEP vary by characteristics of the student, by the type of summer work and program, and by the number of times applied to and participated in SYEP.

Treatment on the Treated (2SLS)

Because our data includes not only lottery results (whether the student wins the lottery and is offered an SYEP placement), but also whether the lottery winners in fact participated in SYEP, we can estimate a second set of models using SYEP participation as the treatment variable and the lottery win variable as an instrument:

$$Y_{itgbc} = \breve{\beta} SYEP_{itgbc} + X'_{ig}\breve{\alpha} + \breve{\delta}_{bt} + \breve{\gamma}_c + \breve{\mu}_c + \breve{\upsilon}_{itgbc} \quad (2)$$

$$SYEP_{itgbc} = \varphi win_{ibt} + X'_{ig}\omega + \xi_{bt} + \theta_c + \lambda_c + \upsilon_{itgbc} \quad (3)$$

where $SYEP_{itgbc}$ is an indicator variable equal to 1 if student *i*, in year *t*, grade *g*, cohort *c* participated in SYEP through CBO *b*, and 0 otherwise. Win_{itb}, as defined above, is the indicator of winning the lottery and being offered admission into SYEP. Equations (2) and (3) form a Two Stage Least Squares (2SLS) system, with equation (3) the first stage for the second stage given in equation (2). If the lottery is random, then winning the lottery serves as a valid instrument for participating in SYEP.

Given that about 73-83 percent of participants actually participated in the SYEP program if they won the lottery, the 2SLS estimate of SYEP participation $\breve{\beta}$ should be about a third larger than the intent-to-treat effect estimate beta in equation (1). Because some individuals may not participate in SYEP even if they are offered admission (win the lottery), $\breve{\beta}$ identifies the average effect of the SYEP program on the treated (the treatment-on-the-treated, TOT), rather than the average effect in the population of applicants. β from the intent-to-treat analysis, on the other

hand, identifies the average effect of being offered an SYEP placement. Both treatment parameters are average effects over the same complier population but differ in their relative magnitudes. We return to the issue of interpreting the magnitude of the estimates below.

4) Results

In this section we present our baseline results. We first present a test of the randomization of the lottery. We then proceed to examine the effects of SYEP using OLS (ITT) estimates with the lottery randomization variable directly and using the lottery as an instrument in an instrumental variables 2SLS (TOT) analysis. The next section examines heterogeneity in the effects of SYEP participation.

Testing Lottery Randomization

In order to evaluate the possibility that admission to the program is not random, we estimated the effect of winning the lottery on each pre-existing student characteristic (8^{th} grade test scores, gender, race, free lunch status). If winning the lottery is random, it should be uncorrelated with any characteristic of the student at the time of application. Specifically, for each program year, and for each observed characteristic, we regress each characteristic on a full set of indicators for CBOs and indicators for winning the lottery interacted with CBO. Table 5 provides the results from a joint cross-equation cross-model F-test that all treatment-by-CBO interaction coefficients are equal to zero. The results indicate that we cannot reject the hypothesis that the lottery was random at conventional significance levels.

We also conducted a second test of lottery randomization by testing whether winning the lottery predicts *pre*-SYEP academic outcomes. Because this falsification test uses the same

outcomes as in our main analysis, we discuss the results of this test below, after the presentation of the main results. In short, on the basis of this falsification test, we cannot reject the hypothesis that the lottery was in fact random.

OLS (Intent-to-Treat) Results

Table 6 presents results for models in which we estimate the impact of winning the SYEP lottery on Regents exam outcomes in the following school year. Because the variable of interest we use is the randomized lottery result, the OLS estimator is unbiased and consistent for the intent-to-treat effect. All models also include demographic controls including free and reduced-price lunch eligibility, race/ethnicity, gender, special education status and Limited English Proficiency, as well as CBO, grade, and cohort fixed effects, as described above.

We use seven key measures of academic success related to test-taking and test-performance (passing and z-scores). Our initial models examine performance across all Regents exams in the school year following SYEP application. These outcomes all capture important measures of educational progress, effort, and ultimately success. In addition to being a necessary pre-condition for graduation, attempting the Regents exams may also be a signal of academic interest, engagement, and effort. If participation in SYEP encourages students to increase their school effort, they may elect to take more Regents exams than the minimum required for graduation, potentially improving their chances at graduating from high school and improving their preparation for post-secondary study. Further, to the degree that participation in SYEP encourages academic effort, there may be an improvement in student performance on these exams – both in terms of passing and the actual score – if students are more attentive in class or

spend more time studying and preparing for exams. [13]

Column 1 of Table 6 indicates that winning the SYEP lottery has a small positive but significantly different from zero effect on whether students attempt at least one Regents exam. Winning the SYEP lottery increases the probability of attempting any Regents exam in the following year by 0.4 percentage points. To get a sense of the magnitude of this effect, Table 3 indicates that in years following SYEP application, the average probability a student attempted any Regents exam was 66 percent. Column 2 indicates a small statistically significant positive effect of winning the SYEP lottery on the number of exams attempted - an increase of 0.012 exams from a baseline of 1.33 exams attempted on average (Table 3).

In addition to a positive effect of increasing the Regents exam attempts, we also find that SYEP improved test performance. Columns 3 and 4 indicates that SYEP lottery winners experienced a small significant increase in passing any Regents exam, as well as in the number of exams passed. Column 5 finds a small significant increase in the number of exams with a score of 55 or higher, and column 6 indicates a small marginally significant effect on the number of exams with a score of 75 or higher, which constitute a high level of achievement. Finally, column 7 indicates a small increase in the mean standardized scores on these exams by about 0.008 standard deviations, although this effect is not significantly different from 0 at the 10 percent level (p-value 0.114). Taken together, these results suggest that SYEP has a small positive effect on taking and passing Regents exams.

[13] In interpreting these results, note that the effects of SYEP on test taking performance comes through two channels. First, SYEP induces more students to take tests. Second, SYEP can improve performance on tests for two groups of students: infra-marginal students who would have taken the test anyway, even in the absence of SYEP; and for marginal students who are induced to attempt the test by SYEP. If this marginal group of test takers is of sufficiently low ability relative to the infra-marginal students who would always take the tests, then the SYEP effect of inducing lower ability students to attempt more tests could result in a 0 or negative average effect of SYEP on test performance.

2SLS (Treatment on the Treated) Results

The results in Table 6 are OLS estimates for the intent-to-treat effect. Given that about 73-83 percent of students who are offered an SYEP placement (won the lottery) take-up the program and actually participate, the effects of program participation are higher than the OLS results above indicate. We next turn to instrumental variable estimates using winning the lottery as an instrument for SYEP participation, as described above. Table 7 displays the 2SLS estimates of the TOT impact on test taking and performance. These results indicate that the average effect of participating in SYEP are small and positive, and these effects are approximately 1.2-1.4 times greater than the OLS (ITT) estimates reported in Table 6.

6) Effect Heterogeneity

The models estimated above assume a constant effect of SYEP on academic outcomes. We next explore heterogeneity in the effects of SYEP participation by the number of times previously participated in SYEP.

An important feature of the SYEP program is that students are allowed to participate in multiple years and access to the program through the lottery process does not depend on past participation; each lottery is unrelated to lotteries in the previous and subsequent years. Thus, there are a group of students who participate in t and apply again in $t+1$, and among this group of previous participants, a randomly assigned group will be offered a placement in $t+1$. We can exploit this feature of the lottery randomization to estimate the effect of multiple years of SYEP participation, conditional on having participated the year before.

Table 8 provides information regarding patterns in application to and selection by the

SYEP lottery over the four-year study period. While 63 percent of the sample applied in only one year, 37 percent applied more than once, with 27 percent applying twice, 9 percent applying three times, and 1.3 percent applying four times. Among these applicants, 37 percent never won the SYEP lottery, 47 percent won once, 13 percent twice, and 3 percent three times.

In general, the impact of SYEP may vary for those who had applied (and participated) in previous years. First, for those who apply, win the lottery, and participate in multiple years, there may be a dosage effect, in which participating in SYEP for more than one summer has a different effect than participating once. Second, although the SYEP lottery does not take into account whether a student had applied or participated before, the decision to apply for multiple years itself is not random, and it may be that the types of students who choose to apply for multiple years have different benefits from the program, even in the first year of participation.

To estimate the impact of the second year of SYEP, we first re-estimate our baseline model (1) but limit the sample based on year of application. Ignoring the other control variables, we divide the sample into three groups by application status and whether they participated in SYEP: Group 1 (first time applicants), Group 2 (one time past participators and second-time applicants), and Group 3 (two-time past participators and third time applicants). To be clear, Groups 2 and 3 are students that had previously applied for SYEP, won the lottery, and participated in SYEP (once in the case of Group 1 and twice in the case of Group 2). To simplify the notation, we ignore the other control variables and drop the CBO, grade, and cohort effects in the equation specifications, but include all of these variables in the models we estimate. For the sample of first time applicants, the outcome for student i in period t is

$$Y_{it} = \beta_{11} win_{it} + \beta_{12} apply_{it+1} + \beta_{13} win_{it} * apply_{it+1} + \upsilon_{it} \quad (4)$$

where win_{it} is the dummy variable for winning the lottery in summer t, and Y_{it} is the outcome in

the academic year following that summer (e.g. if win_{it} is for Summer 2005, then Y_{it} is for the following academic year, Fall 2005-Spring 2006). This sample of first time applicants is therefore the sample for which $apply_{it} = 1$ and $apply_{it+1}$ is an indicator for whether student i applies again in a later year (e.g. if t is Summer 2005, then $t+1$ is for Summers 2006 and forward),

The coefficients in (4) provide the effects for three groups of students: β_{11} captures the effect of winning the lottery ($win_{it} = 1$) for the sub-sample of students who do not apply for a second time ($apply_{it+1} = 0$). β_{12} captures the average outcome for the sample that does not win the lottery in period t ($win_{it} = 0$) but applies for a second time in period $t+1$ ($apply_{it+1} = 1$). And, β_{13}, the coefficient on the interaction term, is the effect of an SYEP participation offer ($win_{it} = 1$) for the sub-sample who will apply again for SYEP in the future ($apply_{it+1} = 1$).

Following (4), we then estimate the same types of models for the sample of second-time applicants:

$$Y_{it} = \beta_{21} win_{it} + \beta_{22} apply_{it+1} + \beta_{23} win_{it} * apply_{it+1} + \upsilon_{it} \quad (5)$$

where $apply_{it+1}$ for this sample of second-time applicants is applying again for the third time.

And, finally, we estimate this model for third-time applicants:

$$Y_{it} = \beta_{31} win_{it} + \beta_{32} apply_{it+1} + \beta_{33} win_{it} * apply_{it+1} + \upsilon_{it} \quad (6)$$

where $apply_{it+1}$ for this sample of third time applicants is applying again for the fourth-time.

The coefficients on the win_{it} variables, β_{11}, β_{21}, β_{31}, provide the "dosage" effect of being offered additional SYEP placements after having previously participated in SYEP. β_{11} provides the effect of winning the SYEP lottery once, β_{21} provides the effect of winning twice, and β_{31} the

effect of winning three times. The $\beta_{13}, \beta_{23}, \beta_{23}$ coefficients, on the other hand, indicate the degree of heterogeneity in the effect of SYEP by *future* application choice.

Table 10 presents results from the heterogeneous effects model (4) using the sample of first time applicants only. First, to provide some comparison to the heterogeneous effects analysis, Panel A estimates the overall effect of an SYEP offer on all applicants. Panel B estimates the heterogeneous effect of an SYEP offer using future application status.

Table 10, Panel A indicates no significant effect of winning the lottery for all first-time applicants, with one exception—a small marginally significant increase in the number of exams with a score of 55 or higher. In contrast, Panel B indicates substantial effects of winning the SYEP lottery for the group who *will* apply for SYEP in the following year. That is, while by and large there is no significant effect of winning the lottery for those who do not apply again in the future, among those that do apply to SYEP again in the future, the effect of participating for the first time is significant, and larger than above.

Table 11 provides the estimates for Group 2: students who previously participated one-time in SYEP and applied for SYEP a second time. For this group, students that had participated in SYEP in a prior year, winning the lottery for a second year results in significant increases in the likelihood that they ever attempt a Regents exam and ever pass an exam with a score of 65, as well as significant increases in the number of exams attempted and the number passed with a score of 55 and 75. These coefficients are considerably larger in magnitude compared to those for first time participants, although not always statistically significant. These second time lottery winners see significant increases in the number of attempts and passes (with a score of 55), of approximately three times the magnitude as for first time winners.

Finally, Table 12 presents models estimating the impact of winning the SYEP lottery for

students that had participated in two prior years. For these students, a considerably smaller group, the coefficients for ever attempting and the number of exams attempted are positive but not significant, while those for ever passing with a score of 65, the number of exams passed at the 55 and 65 thresholds, as well as the actual standardized test score (z-score)- an increase of 0.066 standard deviations- are significant, and larger than for those who won the lottery after having participated in only one prior year.

7) Robustness Checks

Match Rates

As described above, the SYEP program is open to non-students and students not enrolled in NYC public schools (enrolled in private religious and non-religious schools), and therefore the match rate in the data is about 77-81 percent depending on the year.

We test for whether winning the lottery and being offered a SYEP placement directly affected the match rate by using the full sample of all NYC public school students (matched SYEP applicants and unmatched students). We consider only the sample of first time applicants to SYEP because, as estimated above, winning the lottery is correlated with second and third applications. Our test consists of replacing our dependent variable in the main specification (Equation 1) with a dummy variable for whether the student is matched to the SYEP data, 0 if unmatched. The estimated coefficient on the indicator for whether the student won a SYEP lottery is not statistically significant at conventional levels (p-value = 0.679) and the estimated coefficient is small in magnitude at -0.001 (see Appendix). This result indicates that the match rate of SYEP and NYCDOE data is unrelated to the student winning the lottery.

Attrition

We also tested whether winning the SYEP lottery affected whether students remain in the NYC public schools and therefore continue to appear in our matched DOE-SYEP data. We define "attrition" as a student who was in the DOE records in the year prior to applying to SYEP, not appearing in the DOE data in the year following the SYEP lottery. Appendix Table A reports results from a test of whether winning the SYEP lottery is related to student attrition in the DOE records by replacing the outcome variable in our main estimating equation (1) with an indicator for attrition. Our estimates indicate that winning the lottery is unrelated to attrition at conventional significance levels across all grade levels (p-values range from 0.212 to 0.716).

Falsification Test

If the SYEP lottery is truly random, then winning the lottery should be uncorrelated with *past* student outcomes. Using our main specification (1), we replace the future outcomes for the academic year following the summer of SYEP lottery offer with past outcomes for the academic year prior to SYEP application. Table 13 reports results from this falsification test. Across the outcomes we examine, we find that winning the lottery has a statistically insignificant effect on past outcomes, with p-values ranging from 0.124 to 0.963, and coefficient estimates small in magnitude. These results provide additional evidence in favor of the validity of our research design.

8) Discussion

Our estimates suggest that participation in SYEP has, on average, a positive, albeit small, effect on taking and passing the standardized tests administered by New York State to measure

progress in high school subjects. The results offer evidence that SYEP improves educational outcomes that have proven stubbornly resistant to interventions. As an example, New York City's Conditional Cash Transfer program offered high school students $600 incentive for *each* Regents exam passed–up to five–but yielded no significant effect (Riccio et al., 2013).[14]

Policy Implications of Effect Heterogeneity

These average effects mask the considerable difference in the impact of participating in SYEP the first time and participating the second (or third) time. Disentangling these effects reveals, in fact, little effect of a single year of participation, but larger, positive effects for the second and third year of participation.[15] This finding of larger effects of SYEP on test taking and performance warrants further discussion.

It may be that students experience a dosage effect by which they realize larger benefits with additional years of participation, for a variety of possible reasons. Alternatively, these larger effects for those who have participated in the past may be due to self-selection. As described above, although the SYEP lottery is random in any given year, the decision to apply in subsequent years is not. Thus, students who do not have access to alternate activities or means of finding employment, might be more likely to apply for an additional year of SYEP participation. Or, more motivated students may apply year after year, and may benefit more from SYEP. Additionally, the decision to apply to SYEP for a second or third year may be due to a positive

[14] Interestingly, larger effects were found for students who were deemed proficient in English Language Arts and Mathematics at the time they enrolled in high school, suggesting this is a subgroup worthy of future investigation in the SYEP analysis.
[15] We do, however, find small positive effects for those first year participants who will ultimately participate multiple times.

experience after the first year of SYEP.[16]

Given these two channels, a finding of positive or stronger effects for multiple participators could be because there are increasing returns to participants for each year students participate, or simply because the estimates reflect the self-selection of students who are most likely to benefit from SYEP in any year. For policy makers, it may not necessarily be crucial to distinguish the two types of effects, at least for some types of policy questions. A finding of a large effect on multiple participators, regardless of the mechanism, may indicate that SYEP's decision to allow repeat participators is simply beneficial.

Effect Sizes

How large are the effect sizes we estimate? One simple way to measure the effect sizes is to compare them to differences in the same outcomes by salient socioeconomic differences – the disparity in outcomes between white and black students and the disparity between poor (free lunch eligible) and not-poor students. As an example, our intent-to-treat estimate that SYEP improves the likelihood of passing any exam at the 65 threshold by .06% is roughly one third the size of the black-white gap of 1.7% and one fifth of the poverty gap of 3.8%. In a hypothetical allocation of SYEP to the disadvantaged group only, SYEP would reduce both the black-white gap and the poverty gap in the number of exams passed (at 65) by one eighth. The average effects on the treated group (TOT) are even larger. SYEP would close the race gap in pass rates by almost 20% and the poverty gap by almost 45% with similar effects on the number of exams taken. The larger effects of second time participants are large enough to eliminate or

[16] These differences in the effects of SYEP by years of participation do not appear to be driven by observable student characteristics. For example, although students applying to SYEP for the second or third time are, on average, older than those applying for the first time, there is no significant difference in effects between older and younger students within the number of years of participation.

substantially reduce the race gap and the poverty gap. Thus, these effects are substantively important as well as statistically significant.

What does SYEP cost to provide?

We can obtain a rough estimate of the direct cost of the program as the sum of the wages paid to participants, administrative costs and the costs for additional program features, such as education components. Drawing on features and experiences from SYEP and other social programs, we estimate each of these factors: SYEP participants are paid New York State minimum wage, set at $8.75 per hour. Program participants generally work twenty five hours per week for six weeks, or 150 hours. Thus, payments to SYEP participants may be as high as $1312.50. Estimates of administrative overhead costs vary, although 15 percent is commonly used by local governments. (This is, for example, the overhead rate that the California Department of Education allows for public after-school programs.) Finally, the cost of the supplementary education and training will likely vary by provider or CBO, but previous work has estimated the per participant cost of an educational program at $650 (Schwartz & Leos-Urbel, 2014).

Taken together, we estimate a cost of slightly more than $2,150 per participant – less than 15% of annual per pupil education spending in NYC. To be clear, this is an estimate of the budgetary cost – that is, the direct outlays paid by the government or funder of the program, the majority of which is essentially a transfer to (predominately low-income) youth participants. Although a comprehensive cost-benefit analysis is outside the scope of this paper, much of the program costs may be offset by the value of work provided to organizations that youth work for and the communities they work in, as well as by the value of the associated improvement in

participants' educational outcomes (see, for example, Chetty et al. 2014).

9) Conclusions

We use the randomized lottery design of the SYEP to estimate that participation in SYEP has a small positive effect on a variety of test taking and passing outcomes for New York City high school students. The effects of SYEP on test taking are considerably larger for students who had participated in SYEP in prior years, compared to those applying for the first time. This suggests that there may be dosage effects associated with SYEP participation and/or those students most likely to benefit from the program self-select by applying to SYEP for multiple years. Regardless, this analysis indicates that participating in summer jobs programming for multiple years pays dividends for high school students well beyond the paycheck itself. Indeed, the benefits of this relatively low cost intervention are likely to substantially exceed the costs, suggesting SYEP may be an important addition to the toolkit for policy makers seeking to improve academic outcomes for high school students. Additional work exploring the persistence of the effects beyond high school, the spillover effects for peers and communities and, in a different vein, the heterogeneity in impacts across job placements and features, is clearly warranted to provide guidance to policymakers adopting summer youth employment programs across the country.

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Table 1: Sample by lottery outcome, 2005-2008

	Lottery winners	Lottery losers	Total
2005	15,543	9,124	24,667
2006	17,110	11,603	28,713
2007	19,284	19,343	38,627
2008	19,859	22,193	42,052
Total	**71,796**	**62,263**	**134,059**

Notes: Sample includes all students expected to be in high school following SYEP, and excludes duplicate observations for students who submit multiple SYEP applications, are in ungraded special education, and a subgroup who applied to vulnerable youth programs, programs based out of the city, or programs that guaranteed summer jobs and did not use a lottery.

Table 2: Comparison of applicants and non-applicants

	First Time Applicants	Non-applicants	Difference	P-value
Female	0.556	0.484	0.072	0.000
Asian	0.118	0.149	-0.031	0.000
Black	0.504	0.315	0.189	0.000
Hispanic	0.320	0.392	-0.072	0.000
White	0.052	0.140	-0.088	0.000
Free	0.700	0.640	0.059	0.000
Reduced	0.116	0.096	0.020	0.000
Full	0.148	0.154	-0.006	0.000
LEP	0.047	0.105	-0.058	0.000
ESL	0.065	0.155	-0.090	0.000
Graded Spec ed	0.095	0.086	0.009	0.000
zRead	-0.031	-0.017	-0.015	0.001
zMath	-0.014	-0.017	0.003	0.488
Grade of First Application				
8th grade	0.219	-	-	-
9th grade	0.403	-	-	-
10th grade	0.249	-	-	-
11th grade	0.124	-	-	-
Alt specialized program	0.005	-	-	-
N	**68,563**	**459,510**		

Notes: This table excludes 2005 since we do not know whether a student is a first time applicant in this year. Sample excludes students in exclusively special education schools and charter schools. Limited English Proficiency (LEP) is determined by score on the Language Assessment Battery exam. zMath and zRead are students' 8th grade state test scores, which are standardized by grade and year of administration.

Table 3: Regents exam outcomes in school year following SYEP, SYEP applicants, 2005-2008

Variable	Mean	Std. Dev.	Min	Max
Attempt any regents exams	0.66	0.47	0	1
Number of regents attempted	1.33	1.24	0	7
Pass any exams (65+)	0.48	0.50	0	1
Number of exams passed (65+)	0.79	1.00	0	7
Number of exams with score 55+	1.00	1.09	0	7
Number of exams with score 75+	0.40	0.75	0	5
Average z-score	-0.10	0.83	-6.06	2.37
N	**134,059**			

Notes: Sample includes all students expected to be in high school following SYEP, and excludes duplicate observations for students who submit multiple SYEP applications, are in ungraded special education and a subgroup who applied to vulnerable youth programs, programs based out of the city, or programs that guaranteed summer jobs and did not use a lottery.

Table 4: SYEP Take-up rates, 2005-2008

	% of lottery winners that worked	Number of winners
2005	82.1	15,543
2006	83.5	17,110
2007	73.4	19,284
2008	74.4	19,859
Total	**78.0**	**71,796**

Notes: Sample includes all students expected to be in high school following SYEP, and excludes duplicate observations for students who submit multiple SYEP applications, are in ungraded special education, and a subgroup who applied to vulnerable youth programs, programs based out of the city, or programs that guaranteed summer jobs and did not use a lottery.

Table 5: Lottery randomization results

	2005	2006	2007	2008
F	1.00	1.04	1.04	0.99
Prob > F	0.4749	0.1490	0.2076	0.5420

Notes: We are testing if the treatment is uncorrelated with each observed characteristic for each CBO. We implement the test of randomization by regressing each characteristic on a full set of indicators for the CBO and indicators for receiving treatment interacted with CBO attendance.

Table 6: SYEP and Academic Outcomes (OLS, Intent-to-Treat Estimates)

	Any attempt	Number attempts	Any pass 65	Number pass 65	Number pass 55	Number pass 75	z score
Win SYEP Lottery	0.004*	0.012*	0.006**	0.010**	0.018***	0.003	0.008
	(0.002)	(0.006)	(0.003)	(0.005)	(0.005)	(0.004)	(0.005)
Free lunch	-0.030***	-0.062***	-0.038***	-0.083***	-0.080***	-0.066***	-0.072***
	(0.003)	(0.009)	(0.004)	(0.007)	(0.008)	(0.006)	(0.007)
Reduced lunch	-0.001	0.018	-0.003	-0.009	0.002	-0.019**	-0.018**
	(0.005)	(0.012)	(0.005)	(0.010)	(0.011)	(0.008)	(0.008)
Female	0.019***	0.049***	0.014***	0.017***	0.039***	0.011***	0.004
	(0.002)	(0.006)	(0.002)	(0.005)	(0.005)	(0.004)	(0.005)
Asian	0.016***	0.117***	0.055***	0.226***	0.186***	0.289***	0.213***
	(0.005)	(0.014)	(0.006)	(0.012)	(0.013)	(0.011)	(0.010)
White	-0.010	-0.009	0.017**	0.081***	0.049***	0.130***	0.122***
	(0.007)	(0.016)	(0.007)	(0.014)	(0.015)	(0.012)	(0.013)
Hispanic	-0.007**	-0.014*	0.008**	0.021***	0.019***	0.024***	0.041***
	(0.003)	(0.008)	(0.003)	(0.006)	(0.007)	(0.004)	(0.006)
LEP	0.116***	0.321***	0.043***	0.088***	0.167***	0.005	-0.100***
	(0.012)	(0.032)	(0.013)	(0.024)	(0.027)	(0.017)	(0.027)
ESL	0.019*	0.026	0.022**	0.034*	0.027	0.038***	0.066***
	(0.011)	(0.026)	(0.011)	(0.020)	(0.022)	(0.014)	(0.024)
Graded Spec ed	-0.015***	-0.056***	-0.097***	-0.157***	-0.172***	-0.054***	-0.301***
	(0.004)	(0.011)	(0.004)	(0.007)	(0.008)	(0.004)	(0.010)
Age	-0.109***	-0.249***	-0.106***	-0.188***	-0.212***	-0.080***	-0.095***
	(0.002)	(0.005)	(0.002)	(0.004)	(0.004)	(0.003)	(0.004)
zRead	-0.000	-0.015***	0.052***	0.118***	0.065***	0.150***	0.230***
	(0.002)	(0.005)	(0.002)	(0.004)	(0.004)	(0.003)	(0.004)
zMath	0.044***	0.109***	0.096***	0.215***	0.195***	0.185***	0.293***
	(0.002)	(0.005)	(0.002)	(0.004)	(0.004)	(0.003)	(0.004)
CBO by year FX	Y	Y	Y	Y	Y	Y	Y
Cohort FX	Y	Y	Y	Y	Y	Y	Y
Current grade FX	Y	Y	Y	Y	Y	Y	Y
Observations	134,059	134,059	134,059	134,059	134,059	134,059	88,469
R-squared	0.185	0.269	0.228	0.285	0.262	0.292	0.367

Notes: Heteroskedastic robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Students in 12th grade, below 8th grade, and ungraded special education are excluded. Cohort is an indicator for the year of first application to SYEP interacted with the grade of the student when first applied to SYEP. There are 24 unique cohorts in the data sample. Limited English Proficiency (LEP) is determined by score on the Language Assessment Battery exam. zMath and zRead are students' 8th grade state test scores, which are standardized by grade and year of administration. Grade is current grade level in school which includes 8-11th grade and an additional category for alternative specialized programs (for example GED programs).

Table 7: SYEP and Academic Outcomes (2SLS, Treatment-on-the-Treated Estimates)

VARIABLES	Any attempt	Number attempts	Any pass 65	Number pass 65	Number pass 55	Number pass 75	z score
Participate SYEP	0.005*	0.016*	0.008**	0.013**	0.023***	0.004	0.010
	(0.003)	(0.008)	(0.003)	(0.006)	(0.007)	(0.005)	(0.006)
Free lunch	-0.030***	-0.062***	-0.038***	-0.083***	-0.080***	-0.066***	-0.072***
	(0.003)	(0.009)	(0.004)	(0.007)	(0.008)	(0.006)	(0.007)
Reduced lunch	-0.001	0.018	-0.003	-0.009	0.002	-0.019**	-0.018**
	(0.005)	(0.012)	(0.005)	(0.010)	(0.011)	(0.008)	(0.008)
Female	0.019***	0.049***	0.014***	0.017***	0.039***	0.011***	0.004
	(0.002)	(0.006)	(0.002)	(0.005)	(0.005)	(0.004)	(0.005)
Asian	0.016***	0.118***	0.055***	0.227***	0.187***	0.289***	0.214***
	(0.005)	(0.014)	(0.006)	(0.012)	(0.013)	(0.011)	(0.010)
White	-0.010	-0.008	0.018**	0.081***	0.050***	0.131***	0.123***
	(0.007)	(0.016)	(0.007)	(0.014)	(0.015)	(0.012)	(0.013)
Hispanic	-0.007**	-0.013*	0.008***	0.022***	0.019***	0.024***	0.041***
	(0.003)	(0.008)	(0.003)	(0.006)	(0.007)	(0.004)	(0.006)
LEP	0.116***	0.321***	0.043***	0.088***	0.167***	0.005	-0.100***
	(0.012)	(0.032)	(0.013)	(0.024)	(0.027)	(0.017)	(0.027)
ESL	0.019*	0.026	0.022**	0.034*	0.027	0.038***	0.066***
	(0.011)	(0.026)	(0.011)	(0.020)	(0.022)	(0.014)	(0.023)
Graded Spec ed	-0.015***	-0.057***	-0.097***	-0.157***	-0.172***	-0.054***	-0.301***
	(0.004)	(0.011)	(0.004)	(0.007)	(0.008)	(0.004)	(0.010)
Age	-0.109***	-0.248***	-0.106***	-0.187***	-0.212***	-0.080***	-0.095***
	(0.002)	(0.005)	(0.002)	(0.004)	(0.004)	(0.002)	(0.004)
zRead	0.000	-0.015***	0.052***	0.118***	0.065***	0.150***	0.230***
	(0.002)	(0.005)	(0.002)	(0.004)	(0.004)	(0.003)	(0.004)
zMath	0.044***	0.109***	0.096***	0.215***	0.195***	0.185***	0.293***
	(0.002)	(0.005)	(0.002)	(0.004)	(0.004)	(0.003)	(0.004)
CBO by year FX	Y	Y	Y	Y	Y	Y	Y
Cohort FX	Y	Y	Y	Y	Y	Y	Y
Current grade FX	Y	Y	Y	Y	Y	Y	Y

Observations	134,059	134,059	134,059	134,059	134,059	134,059	88,469
R-squared	0.116	0.139	0.165	0.190	0.167	0.199	0.298

Notes: Heteroskedastic robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Students in 12th grade, below 8th grade, and ungraded special education are excluded. Cohort is an indicator for the year of first application to SYEP interacted with the grade of the student when first applied to SYEP. There are 24 unique cohorts in the data sample. Limited English Proficiency (LEP) is determined by score on the Language Assessment Battery exam. zMath and zRead are students' 8th grade state test scores, which are standardized by grade and year of administration. Grade is current grade level in school which includes 8-11th grade and an additional category for alternative specialized programs (for example GED programs).

Table 8: Number of applications

	Applications		Wins	
	%	N	%	N
0	-	-	37.2	35,677
1	63.4	60,785	47.0	45,135
2	26.6	25,517	12.9	12,416
3	8.8	8,414	2.6	2,504
4	1.3	1,232	0.2	216
Total	**100.0**	**95,948**	**100.0**	**95,948**

Notes: Sample includes all students expected to be in high school following SYEP, and excludes duplicate observations for students who submit multiple SYEP applications, students in ungraded special education, and a subgroup of students who applied to vulnerable youth programs, programs based out of the city, or programs that guaranteed summer jobs and did not use a lottery.

Table 9: Characteristics of Multiple Time SYEP Applicants, 2005-2008

	(1) 1 or more	(2) 2 or more	(3) 3 or more
Female	0.035***	0.016***	0.005***
	(0.001)	(0.001)	(0.000)
Free	0.029***	0.012***	0.003***
	(0.001)	(0.001)	(0.001)
Reduced	0.031***	0.018***	0.007***
	(0.002)	(0.001)	(0.001)
Asian	-0.110***	-0.048***	-0.015***
	(0.001)	(0.001)	(0.001)
Hispanic	-0.108***	-0.053***	-0.018***
	(0.001)	(0.001)	(0.000)
White	-0.182***	-0.079***	-0.025***
	(0.001)	(0.001)	(0.000)
LEP	-0.022***	-0.013***	-0.004***
	(0.002)	(0.001)	(0.000)
ESL	-0.078***	-0.034***	-0.012***
	(0.001)	(0.001)	(0.000)
Graded Spec ed	0.052***	0.027***	0.012***
	(0.002)	(0.001)	(0.001)
9th Grade Cohort FX	Y	Y	Y
Observations	671,708	671,708	671,708
R-squared	0.085	0.053	0.025

Notes: Heteroskedastic robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Sample includes NYC 8th through 11th grade students as well as students in GED completion programs from 2004-2008. Student observations in charter schools and exclusively special education schools are excluded. 9th grade cohort is the first year a student was in ninth grade or the imputed year a student should have been in ninth grade assuming regular academic progress.

Table 10: SYEP and Academic Outcomes (OLS, Intent-to-Treat Estimates), first time SYEP applicants

	Any attempt	Number attempts	Any pass 65	Number pass 65	Number pass 55	Number pass 75	z score
Panel A							
Win lottery (t)	-0.001	0.011	0.003	0.009	0.014*	0.004	0.006
	(0.003)	(0.009)	(0.004)	(0.007)	(0.008)	(0.005)	(0.007)
R-squared	0.184	0.276	0.231	0.295	0.275	0.305	0.386
Panel B							
Win lottery (t)	-0.011***	-0.008	-0.007	-0.006	-0.002	-0.004	0.007
	(0.004)	(0.010)	(0.004)	(0.008)	(0.009)	(0.006)	(0.008)
Apply again (t+1)	0.115***	0.222***	0.083***	0.138***	0.182***	0.047***	0.028**
	(0.006)	(0.014)	(0.006)	(0.012)	(0.013)	(0.009)	(0.012)
Win x apply again	0.019***	0.037**	0.021***	0.031**	0.032**	0.020*	-0.005
	(0.007)	(0.017)	(0.008)	(0.015)	(0.016)	(0.011)	(0.014)
R-squared	0.193	0.281	0.236	0.298	0.280	0.306	0.386
CBO by year FX	Y	Y	Y	Y	Y	Y	Y
Cohort FX	Y	Y	Y	Y	Y	Y	Y
Current grade FX	Y	Y	Y	Y	Y	Y	Y
Observations	67,175	67,175	67,175	67,175	67,175	67,175	45,722

Notes: Heteroskedastic robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Students in 12th grade, below 8th grade, and ungraded special education are excluded. All models control for lunch eligibility status, gender, ethnicity, language proficiency, special education status, age, and 8th grade test scores. Cohort is an indicator for the year of first application to SYEP interacted with the grade of the student when first applied to SYEP. Limited English Proficiency (LEP) is determined by score on the Language Assessment Battery exam. zMath and zRead are students' 8th grade state test scores, which are standardized by grade and year of administration. Grade is current grade level in school which includes 8-11th grade and an additional category for alternative specialized programs (for example GED programs).

Table 11: SYEP and Academic Outcomes (OLS, Intent-to-Treat Estimates), second time SYEP applicants, one-time previous participants

	Any attempt	Number attempts	Any pass 65	Number pass 65	Number pass 55	Number pass 75	z score
Panel A							
Win lottery (t)	0.016**	0.029*	0.015**	0.014	0.034**	0.013	0.002
	(0.007)	(0.017)	(0.007)	(0.014)	(0.015)	(0.010)	(0.013)
R-squared	0.215	0.291	0.251	0.309	0.278	0.316	0.354
Panel B							
Win lottery (t)	0.006	-0.006	0.006	-0.001	0.007	0.007	0.005
	(0.008)	(0.020)	(0.008)	(0.016)	(0.018)	(0.012)	(0.015)
Apply again (t+1)	0.020	0.094***	0.020	0.035	0.071**	0.013	-0.012
	(0.014)	(0.036)	(0.015)	(0.029)	(0.032)	(0.022)	(0.026)
Win x apply again	0.112***	0.217***	0.083***	0.154***	0.190***	0.074***	0.031
	(0.012)	(0.030)	(0.012)	(0.025)	(0.027)	(0.018)	(0.023)
R-squared	0.224	0.298	0.256	0.313	0.284	0.317	0.354
CBO by year FX	Y	Y	Y	Y	Y	Y	Y
Cohort FX	Y	Y	Y	Y	Y	Y	Y
Current grade FX	Y	Y	Y	Y	Y	Y	Y
Observations	17,648	17,648	17,648	17,648	17,648	17,648	12,001

Notes: Heteroskedastic robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Students in 12th grade, below 8th grade, and ungraded special education are excluded. All models control for lunch eligibility status, gender, ethnicity, language proficiency, special education status, age, and 8th grade test scores. Cohort is an indicator for the year of first application to SYEP interacted with the grade of the student when first applied to SYEP. Limited English Proficiency (LEP) is determined by score on the Language Assessment Battery exam. zMath and zRead are students' 8th grade state test scores, which are standardized by grade and year of administration. Grade is current grade level in school which includes 8-11th grade and an additional category for alternative specialized programs (for example GED programs).

Table 12: SYEP and Academic Outcomes (OLS, Intent-to-Treat Estimates), third-time SYEP applicants, two-time previous participants

	Any attempt	Number attempts	Any pass 65	Number pass 65	Number pass 55	Number pass 75	z score
Win lottery (t)	0.017	0.046	0.032*	0.061**	0.068*	0.010	0.066**
	(0.017)	(0.042)	(0.017)	(0.030)	(0.035)	(0.020)	(0.033)
CBO by year FX	Y	Y	Y	Y	Y	Y	Y
Cohort FX	Y	Y	Y	Y	Y	Y	Y
Current grade FX	Y	Y	Y	Y	Y	Y	Y
Observations	3,088	3,088	3,088	3,088	3,088	3,088	1,844
R-squared	0.239	0.341	0.256	0.327	0.308	0.310	0.337

Notes: Heteroskedastic robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Students in 12th grade, below 8th grade, and ungraded special education are excluded. All models control for lunch eligibility status, gender, ethnicity, language proficiency, special education status, age, and 8th grade test scores. Cohort is an indicator for the year of first application to SYEP interacted with the grade of the student when first applied to SYEP. Limited English Proficiency (LEP) is determined by score on the Language Assessment Battery exam. zMath and zRead are students' 8th grade state test scores, which are standardized by grade and year of administration. Grade is current grade level in school which includes 8-11th grade and an additional category for alternative specialized programs (for example GED program.

Table 13: Falsification Test

Dependent Variables are Academic Outcomes Last Year (t-1)

	Ever attempt	Number attempts	Ever pass 65	Number pass 65	Number pass 55	Number pass 75	z score
Win lottery	0.002	0.000	-0.005	-0.008	-0.003	-0.001	-0.011
current year (t)	(0.003)	(0.007)	(0.003)	(0.006)	(0.007)	(0.005)	(0.009)
CBO by year FX	Y	Y	Y	Y	Y	Y	Y
Cohort FX	Y	Y	Y	Y	Y	Y	Y
Grade FX	Y	Y	Y	Y	Y	Y	Y
Observations	66,516	66,516	66,516	66,516	66,516	66,516	34,489
R-squared	0.356	0.398	0.286	0.310	0.358	0.224	0.215

Notes: Heteroskedastic robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Students in 12th grade, below 8th grade, and ungraded special education are excluded. All models control for lunch eligibility status, gender, ethnicity, language proficiency, special education status, age, and 8th grade test scores. Cohort is an indicator for the year of first application to SYEP interacted with the grade of the student when first applied to SYEP. Limited English Proficiency (LEP) is determined by score on the Language Assessment Battery exam. zMath and zRead are students' 8th grade state test scores, which are standardized by grade and year of administration. Grade is current grade level in school which includes 8-11th grade and an additional category for alternative specialized programs (for example GED programs).

APPENDIX TABLES

Table A1: Likelihood of winning SYEP lottery by matching to DOE data

	Matched	Not matched	Total
2005	77.1	77.3	77.2
2006	81.3	81.5	81.4
2007	77.4	77.8	77.6
2008	81.4	81.1	81.2

Notes: Sample excluded a subgroup who applied to vulnerable youth programs, programs based out of the city, or programs that guaranteed summer jobs and did not use a lottery

Table A2: Regression models, probability of being matched to DOE data, 2006-2008 first-time SYEP applicants

Win Lottery	-0.001
	(0.003)
Grade FX	Y
CBO by year FX	Y
Observations	132,459
R-squared	0.017

Notes: Heteroskedastic robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Sample excludes a subgroup who applied to vulnerable youth programs, programs based out of the city, or programs that guaranteed summer jobs and did not use a lottery

Table A3: Attrition in year following application to SYEP, Grade 8-11 and alternative program, 2005-08

Grade	% attrition, selected students	% attrition, not selected	% attrition, all SYEP students	N
Grade 8	5.9	5.7	5.8	20,826
Grade 9	7.0	7.5	7.2	50,546
Grade 10	5.2	5.6	5.4	42,181
Grade 11	6.9	6.9	6.9	23,309
Alternative program	50.5	49.1	49.8	1,120
Total	**6.6**	**6.9**	**6.7**	**137,982**

Notes: Attrition is characterized as not appearing in DOE administrative data in the year following the SYEP lottery. Students in alternative grades are those students that are enrolled in GED completion programs. Sample excludes a subgroup who applied to vulnerable youth programs, programs based out of the city, or programs that guaranteed summer jobs and did not use a lottery.

Table A4: Impact of winning lottery on attrition, by grade

	All grades (1)	Grade 8 (2)	Grade 9 (3)	Grade 10 (4)	Grade 11 (5)	Alt program (6)
Win lottery current year (t)	0.001 (0.001)	0.004 (0.003)	-0.003 (0.002)	0.001 (0.002)	0.001 (0.004)	0.042 (0.034)
CBO by year FX	Y	Y	Y	Y	Y	Y
Cohort FX	Y	Y	Y	Y	Y	Y
Current grade FX	Y	N	N	N	N	N
Observations	137,982	20,826	50,546	42,181	23,309	1,120
R-squared	0.055	0.048	0.038	0.042	0.066	0.250

Notes: Attrition is characterized as not appearing in DOE administrative data in the year following the SYEP lottery. Heteroskedastic robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Students in 12th grade, below 8th grade, and ungraded special education are excluded. Cohort is an indicator for the year of first application to SYEP interacted with the grade of the student when first applied to SYEP. Grade is current grade level in school which includes 8-11th grade and an additional category for alternative specialized programs (for example GED programs)

Table A5: Percent of NYC DOE students attempting at least one Regents exam, 2006-2009

Grade	% attempting 1+ exams
8	9.8
9	48.6
10	78.7
11	85.3
12	45.7
Alternative program	23.4