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Is Elitism a Myth? A Study of NYC Specialized High Schools

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Is Elitism a Myth? A Study of NYC Specialized High Schools

A Capstone Project Submitted in Partial Fulfillment of the
Requirements of the Renée Crown University Honors Program at
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Honors Capstone Project in Economics

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<u>Abstract</u>

In New York City, specialized high schools exist in the public school system to educate the city's most gifted students. These schools are recognized nationally and have a strong focus on math, science, and technology. Benefits of attending these schools include a competitive peer group, challenging courses, and strong alumni networks. Admission to these schools is determined by individuals' score on the Specialized High School Admissions Test (SHSAT).

This paper measures the impact of attending these specialized high schools on graduation and results on New York State Regents examinations. A regression discontinuity design was used to study seven of the nine specialized high schools, comparing students who scored just above to students who scored just below the SHSAT cutoff score used to determine admissions. Although attending a specialized high school increased the probability that a student received an advanced diploma degree, students who attend one of these high schools performed equally as well on other academic outcomes as students who attended alternative, non-specialized high schools.

<u>Acknowledgements</u>

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I.   <u>Introduction</u>

The New York City Department of Education runs nine specialized high schools to accommodate academically gifted students. US News and World Report often rank these schools as the best high schools in America ("Best High Schools," 2012). Seven of these nine schools emphasize math and science in their curriculum and decide admissions exclusively on the basis of Specialized High School Admissions Test (SHSAT) examination scores. Over 26,000 NYC eighth graders take the SHSAT each year (Herzenhron, 2005). The proposed study aims to measure the extent to which admission to a specialized high school effects.

Specialized high schools offer numerous benefits including competitive peer groups and challenging courses. Additionally, these schools boast successful alumni groups, which include Nobel Prize winners, CEO's, and elected public officials Previous work on selective high schools has found positive effects of admission on standardized tests and the likelihood of attending a selective university (Berkowitz and Hoekstra, 2010). However, a recent study by Dobbie and Fryer (2011) found that attending one of New York City's specialized high schools had little impact on

Scholastic Aptitude Test Scores (SAT) scores, college enrollment, or graduation.

The lack of positive effects of specialized schools in Dobbie and Fryer's study is surprising. One potential reason for this result is that there are other high achieving schools in New York City, and students rejected from specialized schools have high quality alternatives. Another possible explanation for this result is that specialized schools are beneficial but in ways other than through higher test scores and increased likelihood of high school completion. Classes in specialized high schools are especially rigorous and may help to prepare students for college and the workforce. Graduates of specialized high schools attend prestigious universities and have strong alumni networks. Additionally, previous research has found that students who take challenging courses in high school have high earnings in their careers (Rose and Betts, 2001).

This paper examines New York City students who graduated from 2007 to 2010 will be studied. My research design will replicate that of Dobbie and Fryer and will use a regression discontinuity design, comparing the performance of students just above and just below each school's SHSAT cutoff scores. SHSAT test scores of all students who took the test between 2002 and 2005 were collected. Graduation rates, SAT scores, New York State

Regents Examinations, and four-year college enrollment were studied to compare the progress of students in the different schools. These are publicly available data provided by the NYC and NYS Departments of Education (DOEs). The rigor of courses in schools will also be taken into account. I also study the number of Advanced Placement courses available at the schools and the passing rate of the exams. I take into account the amount of Federal, state, and city school funding, as these funds are allocated by merit and represent the quality of a school's education.

II.   Key Factors: Profile of Schools

The schools in this study include Bronx High School of Science, Brooklyn Technical High School, High School for Math, Science and Engineering at City College, High School of American Studies at Lehman College, Queens High School for the Sciences at York College, and Stuyvesant High School. These schools were selected because of their data availability. Of the nine schools, the three original specialized high schools are Bronx Science, Brooklyn Tech, and Stuyvesant. HSMSE, Lehman, and QHSS were founded in 2002 to accommodate the increasing applicant pool.

Admission to each of these schools is based on a cutoff score and rank in the exam. Before the exam, students rank each

school in order of preference. Each student is placed into his or her most preferred school until there are no additional seats available for that school. The cutoff scores vary every year by the size of the applicant pool and the size of the school. Of the eight schools, Stuyvesant is the most selective, followed by Bronx Science. Lehman and QHSS follow in the selectivity succession and have similar scores. Brooklyn Tech and HSMSE are the least selective and have similar scores. Table 1 shows the cutoff scores of the schools between 2002 and 2005.

Application to the specialized schools is available to any eighth grade student who is a New York City resident. Some students take the exam in the ninth grade with intent to transfer to one of the specialized schools. If a student did not get into the school of his or her choice the first time the exam was taken, he or she may retake the exam. However, the ninth grade cutoff score is higher than the eighth grade score, as the applicant pool in smaller.

The SHSAT exam consists of a verbal and math section, where students are given 2 hours and 30 minutes to complete each section. The exam is amultiple-choice exam, where with 45 verbal questions and 50 math questions. The verbal section includes 5 logical paragraph order questions, 10 logical reasoning questions, and 30 reading comprehension questions. The math section

includes topics such as algebra, geometry, graph interpretations, basic math, and word problems.

This admissions process is similar to that of many national and international exam schools in the nation and internationally. In Boston, the Boston Latin School and the O'Bryant School of Mathematics and Science require students to take the Independent School Entrance Exam (ISEE), where admissions are based on the rank of the applicants. Internationally, admission to secondary schools in China, Turkey, and Romania, is based off of an entrance exam.

a. <u>Bronx High School of Science (Bronx Science)</u>

Established in 1938, Bronx Science was originally a specialized science and math school for boys. It is located in the Bedford Park neighborhood of the Bronx. Despite its emphasis on mathematics and science, the school attracts students with a variety of interests. Currently, approximately 2700 students are enrolled in the school.

Bronx Science has a wide selection of courses for students to take. Students may choose from 35 Advanced Placement courses, representative electives in nine different subjects, and eight different language courses. The school

follows a college preparatory curriculum, which includes four years of English, history, laboratory based sciences, mathematics, three years of a foreign language, and one semester of fine arts. Students also have the opportunity to do independent research to compete in the annual Intel Science Talent Search. Bronx Science has more Intel Science finalist than any other school in the nation. Some unique features of the building include a rooftop planetarium and weather station.

In regards to the school's prestige, Bronx Science ranked 58th in the 2010 U.S. News and World Report Best High Schools Gold List and has consistently been ranked in the publication. Its alumni network includes seven Nobel Prize winners and six Pulitzer Prize winners. Similar to Brooklyn Tech and Stuyvesant, Bronx Science has a strong alumni association, which began a $20 million capital campaign in 2008.

b. Brooklyn Technical High School (Brooklyn Tech)

Brooklyn Tech was founded in 1922 as a technical high school for Brooklyn boys, with an emphasis on math, science, and drafting courses. The school was meant to prepare students for technical careers and college. Today, although the school specializes in math, science, and engineering, there is a wide

variety of courses. Brooklyn Tech is located in the Fort Greene neighborhood of Brooklyn. It is the largest of the specialized high schools, with a student body of over 5000 students.

Unique to Brooklyn Tech's curriculum is that students are required to select a major at the end of their sophomore year, with concentrated studies in their junior and senior years. Students are able to choose from 17 majors, which range from Aerospace Engineering to Media Communications. Within many of these majors, students receive unique opportunities such as internships and research opportunities. Congruent to the initial mission of the school, students are required to take technology and drafting courses in their freshman and sophomore years. The school also offers over 20 Advanced Placement exams.

Brooklyn Tech is ranked 63rd in the 2010 US News and World Report Best High School Gold List. Similar to Stuyvesant and Bronx Science, the school has many notable alumni, which include two Nobel Laureates and two Olympics medalists. The Brooklyn Tech Alumni Association is the largest high school alumni network in the nation. The school is the first of the specialized high schools to initiate capital

campaigns, with the completion of a $10 million campaign in 2005 and the initiation of a $20 million campaign in 2008.

c. High School for Math, Science and Engineering at City College (HSMSE)

HSMSE was founded in 2002 as a small school with an emphasis on engineering. HSMSE has a partnership with The City College of New York (CCNY), where HSMSE uses the college's facilities as classrooms and other resources. Students are able to take courses at CCNY for college credit. Additionally, HSME offers enrichment classes such as astronomy, gastronomy, and web design. There are approximately 440 students enrolled at the school.

d. High School of American Studies at Lehman College (Lehman)

Similar to HSMSE and Queens High School for the Sciences (QHSS), American Studies was founded in 2002 and is based out of a CUNY campus. Unlike all of its peer schools, American Studies does not focus on math and sciences, but rather on history. All students are required to study American history chronologically for three years. The school receives supplementary funding from The Gilder Lehman Institute of

American History. In recent years, American Studies has

outranked the established schools in the US News and World

Report ranking. In 2010, it was ranked 19th in the Best Public

Schools list. There are approximately 400 students enrolled in

the school.

e. Queens High School for the Sciences at York College (QHSS)

QHSS is based out of York College in the Jamaica

neighborhood of Queens. It uses many of York College's

facilities such as classrooms, cafeteria, and gymnasium. The

curriculum is a college-preparatory curriculum that emphasizes

sciences and mathematics, similar to that of Stuyvesant and

Bronx Science. Other student opportunities include research

projects and internships. Similar to HSMSE and American

Studies, QHSS has a small student body, with enrollment at

approximately 400 students.

f. Stuyvesant High School (Stuyvesant)

Stuyvesant High School is the most coveted of the

specialized high schools. Founded in 1904, it was originally a

manual training school for boys. The school's focus shifted to

scholastic achievement in 1919 and has focused on

mathematics and science ever since. Stuyvesant was originally

in the Stuyvesant Town neighborhood of Manhattan but is currently located in the TriBeCa neighborhood. There are approximately 3295 students enrolled in the school.

Similar to Bronx Science, Stuyvesant's curriculum is based on a college preparatory curriculum, which includes four years of English, history, laboratory based sciences, mathematics, three years of a foreign language, and a semester of fine arts. Students are required to take two semesters of computer science and two lab-based technology courses. The school offers over 30 AP courses and a wide range of electives, including, "The History of New York City" and "The Mathematics of Financial Markets."

Stuyvesant is ranked 31st in the 2010 US News and World Report Best High School List. Notable alumni from Stuyvesant include four Nobel laureates, Senior Advisor to the US President David Axelrod, and jazz musician Thelonious Monk. The Stuyvesant Alumni Association includes multiple endowments and has initiated a capital campaign to raise $12 million.

III.   Data and Descriptive Statistics

Data were obtained from the New York City Department of Education. Student-level data included enrollment information

from 2003 to 2007, SHSAT results from 2002 to 2006, New York State Regents results from 2001 to 2011, and graduation indicators from 2006 2011. Data on graduation rates, school enrollment, student-to-teacher ratios were downloaded from NYC DOE's website.

The individual-level data were merged based on a student ID number generated by the Department of Education. From the enrollment data, information on which school students attended was used. Student demographic information, such as ethnicity, disability status, and poverty indicators, were obtained from the graduation data. Additionally, the level of degree (local, regents, or advanced regents degree) was also indicated in the graduation data. The SHSAT data provided test scores, as well as whether the student attended a public or private school in eighth grade.

The Regents data included test scores and the testing semester. As some students have taken an exam multiple times, the highest score was used in this study. The English Language Arts, Integrated Algebra, Global History, and Living Environment Regents were used as variables in this study.

a.   Student Characteristics

The demographic of the student body is diverse and is similar to that of citywide statistics (Table 1). The most

represented race at Stuyvesant, Bronx Science, QHSS, and Brooklyn Tech is Asian at around 60% of the student body, followed by White at around 25% of the student body. This is drastically higher than the citywide statistic, where the 60% of the students in the public school system are Black and Hispanic. Similarly, when looking at the demographics for all exam takers, the group with the most representation is Asian, which make up of 24% of all exam takers. Approximately 45% of all exam takers are Black and Hispanic, but they only make up 5% of the student body of Stuyvesant.

Poverty is also an important demographic indicator. As defined by the Department of Education, a student is considered to be a high-poverty student if he or she receives federal free lunch subsidies. Approximately 60% of all NYC students and all exam takers receive free lunch. However, for many of the specialized high schools, less than 40% of the students are considered to be in poverty. The exception is Brooklyn Tech, where the percentages of students who receive free lunch are on par with the city average.

b. School Characteristics

Stuyvesant, Bronx Science, and Brooklyn Tech are three of the largest schools in the city. Both Stuyvesant and

Bronx Science have a student enrollment of over 3000 and

Brooklyn Tech has a student enrollment of over 4000 (Table

2). QHSS, Lehman, and HSMSE have student enrollments of

approximately 400 students. Overcrowding issues exist in

Stuyvesant, Bronx Science, and Brooklyn Tech, where the

pupil-teacher ratio is over 20.0.

The per-pupil spending is highest in HSMSE, QHSS,

and Lehman. This is correlated with the student body

enrollment, where schools with fewer students will benefit. The

teacher salary is highest at Stuyvesant, where the average is

$82,805.20. This indicates that the teachers at Stuyvesant are

more experienced or have more advanced degrees ("The

Education Choice," 2011).

c. Specialized high school admissions test

The specialized high school admissions test results

included the 2002 to 2005 cohorts. The number of test takers

has increased; there were 25030 applicants in 2002 and 26716

applicants in 2003. Stuyvesant has the highest cutoff score and

the lowest rank, while Brooklyn Tech has the lowest cutoff

score and the highest rank. In many years, QHSS and Lehman

will have the same cutoff score; the same is true for Brooklyn

Tech and HSMSE.

In the study, the students who took the exam were matched with their high school enrollment information, graduation results, and Regents results by their cohort year. Each year was stacked to create a complete data set.

IV.   Model

I use a regression discontinuity design to compare the performance of students just above and below the SHSAT cutoff scores. This model replicates that of Dobbie and Fryer (2011). I model the relationship between future outcomes (y) and attendance in a school (S_i) is as follows:

$$y_i = \alpha_0 + \alpha_1 S_i + \varepsilon_i \qquad (1)$$

If attendance at a specialized high school were randomly assigned across students, then the parameter α_1 would measure the causal effect of attending one of these schools on future outcomes. However, ordinary least squares estimation of (1) would lead to a biased estimate of α_1 because attendance is not randomly assigned: students who attend such schools have higher baseline academic achievement. That is, students who have chosen to take the entrance exam are more motivated and have better skill sets than the students who do take the exam. Thus, it is important to

consider the characteristics of the students who scored just above

and below the cutoff scores for each school. The intuition is that

the students who scored just above the cutoff scores are almost

identical to students who scored just below the cutoff scores:

$$E[\varepsilon_i \mid score_i = c_s^* + \Delta]_{\Delta \to 0+} = E[\varepsilon_i \mid score_i = c_s^* - \Delta]_{\Delta \to 0+} \qquad (2)$$

Here, $score_i$ is a student's SHSAT score, c_s^* is the cutoff score of

school s, and ε_i represents the future outcome of students

marginally below and above the cutoff scores. In terms of a

regression, the first-stage results would indicate whether a student

attended the specialized high school if he or she scored just above

the cutoff score. I restrict the analysis to students with scores

twenty units above and twenty units below the cutoff score.

The following reduced-form regression equation is

estimated for students with scores ten units above and ten units

below the cutoff score:

$$y_i = \pi_0 + \pi_1(score_i \geq c_s^*) + \pi_2(score_i \geq c_s^*) + + \pi_4 X_i + \pi_t + \varepsilon_i \qquad (3)$$

Here, y_i represents future outcomes, $(score_i \geq c_s^*)$ indicates a

student scoring at or above the cutoff score, and parameter π_1 is the

average reduced form treatment effect of scoring above the cutoff.

The future outcomes measured in this study include graduation

results, diploma degree, and Regents results.

V.   Findings

Overall, I do not find a strong effect of attending a specialized high

school on academic outcome indicators.

a. Admission and enrollment in a specialized high school

The first stage results are the admission and enrollment

indicators of each specialized high school, as indicated

graphically in Figure 1. Here, the vertical axis represents the

cutoff score and students who score 20 points below and above

the cutoff score were plotted. The red points represent students

who choose to attend a non-specialized high school, while the

blue points represent students who choose to attend their

admitted specialized high school.

In many instances, students choose to attend another

school over their admitted specialized high school. The

exception is with Stuyvesant, where students who score just at

the cutoff are 0.564 percentage points more likely to attend

Stuyvesant over another school. For the two other older

schools, Brooklyn Tech and Bronx Science, the two sets of

points are close to each other, where 0.154 percentage points of the students who score at the Brooklyn Tech cutoff are more likely to attend another school over Brooklyn Tech, and 0.226 percentage points of the students who score at the Bronx Science cutoff are more likely to attend another school over Bronx Science.

In the case of the newer schools, almost every student who scores above that particular cutoff will choose to go to another school over his or her admitted school. For example, 0.996 percentage points of the students admitted to HSMSE at the cutoff will choose to attend another school, 0.943 percentage points will attend another school over QHSS, and 0.951 percentage points of the students will attend another school. This drastic difference between the newer schools and more established schools may be because the older schools are more recognized. As students are able to rank their preferences of schools, many of them may choose to rank a lower ranked school, like Brooklyn Tech, because of its history or location.

b. Impact of specialized high school eligibility on graduation outcome

The graduation outcomes are indicated in Figure 2a. Overall, students who scored just above the cutoff score are as

equally likely to graduate as students who scored just below the cutoff. In the case of Lehman, QHSS, and Bronx Science, an upward trend is displayed, where there is a positive correlation between student scores and graduation likelihood. This means that students who scored right above the cutoff score are marginally more likely to graduate than students who score right below the cutoff. Table 4 displays the effect of specialized high school eligibility on the likelihood of graduation for students that score within ten points of the score cutoff. With the exception of HSMSE, there is a positive and statistically significant effect on graduation. Of all of the schools, Stuyvesant has the strongest impact, where the estimate is at 0.137, followed by Bronx Science at 0.116. However, both coefficients indicate that they are weak effects because they are close to zero.

Students receive either a Local, Regents, or Advanced Regents diploma. The likelihood that a student receives a Regents or Advanced Regents diploma is analyzed in Figures 2b and 2c, as well as in Table 4. The requirements for a Regents diploma are to score at least a 65 out of 100 in English, Mathematics, Science, US History, Government, and Global History. The requirements for an Advanced Regents diploma include those requirements plus elective exams in

math, science, and foreign language ("NYS Regents requirements," 2011). For each school, there is a negative effect of specialized high school eligibility on the probability of receiving a Regents diploma but a positive impact on receiving an Advanced Regents diploma, as students can only receive one or the other. Similar to the likelihood of graduation, students who score just above the cutoff are more likely to receive an Advanced Regents diploma than their peers who score just below the cutoff. However, there is an upward trend, where students with a higher SHSAT score are more likely to receive higher Regents score. The strongest effect is for students who score within the Stuyvesant estimation window, where the estimated effect on the receipt of an Advanced Regents diploma is 0.561 percentage points. Brooklyn Tech has a small negative but statistically insignificant relationship, where the estimated effect is -0.001 percentage points.

Dropout indicators are represented in Figure 2d and column 4 of Table 4. There is a negative relationship between students who score within the estimation window of a cutoff scores and their likelihood to dropout. Students who score in the Stuyvesant window are the least likely to dropout.

c. Impact of specialized high school eligibility and Regents
    results

       The Regents examinations results are displayed in
Figures 3a-d and in Table 5. Similar to the graduation
indicators, students who score just above the cutoff score are
perform better than students who score just below the cutoff.
There is a positive relationship between scoring within the
school cutoff and all Regents exams.

       Of all of the schools, Stuyvesant has the strongest
impacts, where the estimates of eligibility are 6.686 for the
ELA Regents, 9.331 for the Math I, 11.007 for the Global
History, and 11.404 for the Living Environment. This is based
on the Regents test score scale, which ranges from 0 to 100.
Thus, although the impact is positive, there is a weak
correlation. HSMSE has the weakest effects, where the impacts
of eligibility are 1.678 for ELA, 2.05 for Math I, 2.241 for
Global History, and 2.68 for Living Environment.
Additionally, based on the graphs, students who score within
the Stuyvesant window have overall higher scores on the
Regents exams.

d. Effect of specialized high schools by student demographic
    subgroups

In Tables 6a-6b, I examine the impact of specialized high school eligibility on academic outcomes for three traditionally disadvantaged subgroups of students: Black students, Hispanic students, and higher-poverty students. Results for these subgroups are similar to the results for the entire sample of students, with mostly stronger effects of eligibility on outcomes.

VI. Conclusion

Students who attend a specialized high school are more likely to have higher Regents exam results and greater graduation outcomes. However, there is a positive trend between SHSAT scores and academic results, where students who have a higher SHSAT score will perform better without the effect of attending a specialized high school. A potential explanation for this is that students who chose to take the exams are already high achieving students.

Two additional surprising findings came from the study. One is that many students who score above an indicated cutoff score are more likely to attend another school over the admitted school. A possible explanation for this is there are other high-achieving schools in New York City. A 2011 Brookings Institute report has claimed that NYC is one of the best school districts for

school choice, which can be a driver for better school quality ("The Educational Choice," 2011). The second is that traditionally disadvantaged subgroups of students, such as Black, Hispanic, and high-poverty students perform equally, if not better, than their overall pool of students.

Other measures of success, such as career success and happiness, are long-term factors and cannot be measured with the available data. Thus, although I find small effects of specialized high school attendance on academic outcomes, there are several other effects that cannot be measured statistically.

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Table 1
School Summary Statistics

Student Characteristics	NYC	All Exam Takers	Stuyvesant	Bronx Science	QHSS	Lehman	HSMSE	Brooklyn Tech
Male	0.510	0.498	0.557	0.545	0.483	0.469	0.682	0.572
White	0.124	0.137	0.286	0.261	0.084	0.322	0.153	0.209
Asian	0.137	0.236	0.634	0.580	0.577	0.170	0.188	0.520
Black	0.337	0.245	0.018	0.042	0.177	0.197	0.177	0.133
Hispanic	0.388	0.194	0.029	0.068	0.090	0.286	0.388	0.801
Poverty	0.619	0.581	0.381	0.373	0.716	0.370	0.286	0.620

This table represents the demographic of NYC high school students from 2003 to 2007. Data was received from the New York City Department of Education. The characteristic of poverty indicates students who receive free lunch.

Table 2

Summary Statistics of Schools

School Characteristics	Stuyvesant	Bronx Science	QHSS	Lehman	HSMSE	Brooklyn Tech
Enrollment	3338	3018	419	386	410	4338
School Budget	$18,125,405	$15,025,770	$2,831,706	$2,809,369	$3,609,373	$26,325,239
Per-Pupil Spending	$5,430.02	$4,978.72	$6,758.25	$7,278.16	$8,803.35	$6,068.52
Teacher Salary	$82,805.20	$73,880.31	$78,846.26	$74,595.04	$73,020.23	$79,732.76
Pupil-Teacher Ratio	21.2	21.7	16.7	15.1	13.1	21.8
Pupil-Staff Ratio	16.204	17.051	13.094	12.063	9.762	14.364

This table represents the summary statistics of schools from the 2010-11 school year. The teacher salary is the average teaching salary at each indicated school. Data was retrieved from the NYC Department of Education website.

Table 3
SHSAT Cutoff Scores

HS Cohort	Applicants	Stuyvesant		Bronx Science		QHSS		Lehman		HSMSE		Brooklyn Tech	
		Rank Cutoff	Score Cutoff	Rank Cutoff	Score Cutoff	Rank Cutoff	Score Cutoff	Rank Cutoff	Score Cutoff	Rank Cutoff	Score Cutoff	Rank Cutoff	Score Cutoff
2002	25030	866	571	2046	531	2986	511	2986	511	3306	505	3211	507
2003	26324	876	576	2313	528	3206	512	3496	505	3770	499	3974	496
2004	26629	1088	567	2641	522	3744	501	3744	501	4182	493	4182	493
2005	26716	1175	562	2966	515	3548	505	4085	496	4788	485	4788	485

This table shows the cutoff score and rank cutoff for the 2002 to 2005 cohort of SHSAT exam takers. The number of applicants is also indicated. Data was received from the NYC Department of Education.

Table 4
Graduation Results of Specialized High Schools

	Graduated	Regents	Advance Regents	Dropout
Stuyvesant	0.137**	- 0.345**	0.561**	-0.033**
	(0.01)	(0.012)	(0.013)	(0.005)
Bronx Science	0.116**	-0.266**	0.455**	-0.030**
	(0.007)	(0.010)	(0.010)	(0.004)
QHSS	0.028*	-0.033*	0.078**	-0.010*
	(0.011)	(0.015)	(0.015)	(0.006)
Lehman	0.028*	-0.114**	0.172**	-0.003
	(0.013)	(0.016)	(0.016)	(0.006)
HSMSE	-0.002	- 0.074*	0.097**	-0.004
	(0.019)	(-0.025)	(0.025)	(0.010)
Brooklyn Tech	0.067*	-0.044	-0.001**	-0.016*
	(0.019)	-0.025	(0.025)	(0.010)
R^2	0.0102	0.0379	0.0895	0.0032
N	68766	68766	68766	68766

This table shows the reduced form estimates of high school graduation outcomes on students who scored within 10 points of the cutoff score for each school. The sample includes students from the 2002 to 2005 cohort of SHSAT exam takers. ** represents significant at 5 percent level and * represents significant at 1 percent level.

Table 5
Regents Exam Results of Specialized High Schools

	ELA	Math 1	Global History	Living Environment
Stuyvesant	6.686**	9.331**	11.007**	11.404**
	(0.376)	(0.362)	(0.404)	(0.335)
Bronx Science	6.907**	8.939**	7.939**	8.505**
	(0.294)	(0.283)	(0.318)	(0.264)
QHSS	0.953	2.113**	1.661**	1.665**
	(0.447)	(0.428)	(0.486)	(0.402)
Lehman	3.854**	3.413**	2.387**	2.566**
	(0.498)	(0.477)	(0.542)	(0.448)
HSMSE	1.678*	2.05**	2.241**	2.68**
	(0.761)	(0.727)	(0.822)	(0.683)
Brooklyn Tech	2.225**	3.508**	2.896**	2.25**
	(0.751)	(0.717)	(0.814)	(0.677)
R^2	0.029	0.089	0.032	0.049
N	67227	68766	65501	66436

This table shows the reduced form estimates of Regents exam results on students who scored within 10 points of the cutoff score for each school. The sample includes students from the 2002 to 2005 cohort of SHSAT exam takers. ** represents significant at 5 percent level and * represents significant at 1 percent level.

Table 6a
Academic Results for Black students

	Graduated	Regents	Advanced Regents	Dropout	ELA	Math 1	Global History	Living Environment
Stuyvesant	0.124*	-0.371**	0.618**	-0.038	9.470**	16.183**	11.955**	13.442**
	(0.050)	(0.061)	(0.049)	(0.024)	(1.675)	(1.584)	(0.019)	(1.722)
Bronx Science	0.144**	-0.235**	0.498**	-0.030*	6.907**	9.701**	9.511**	9.334**
	(0.026)	(0.031)	(0.025)	(0.264)	(0.859)	(0.821)	(1.003)	(0.895)
QHSS	-0.006	-0.011	0.042	-0.004	-0.124	2.757*	1.379	2.156
	(0.037)	(0.044)	(0.036)	(0.017)	(1.231)	(1.174)	(1.445)	(1.278)
Lehman	0.061	- 0.121*	0.214**	-0.019	5.478**	3.676*	2.462	2.439
	(0.040)	(0.048)	(0.039)	(0.019)	(1.340)	(1.277)	(1.575)	(1.389)
HSMSE	0.023	-0.040	0.107*	0.006	1.494	3.808*	2.675	3.433
	(0.053)	(0.064)	(0.052)	(0.025)	(1.768)	(1.686)	(2.080)	(1.859)
Brooklyn Tech	0.041	-0.073	0.168**	-0.03	2.998	2.604	3.333	3.055
	0.052	(0.063)	(0.051)	(0.024)	(1.735)	(1.654)	(2.048)	(1.831)
R^2	0.011	0.020	0.032	0.002	0.024	0.044	0.015	0.024
N	20699	20699	65501	20699	19531	19337	18924	18284

This table shows the reduced form estimates of graduation outcomes and Regents exam results for Black students, who scored within 10 points of the cutoff score for each school. The sample includes Black students from the 2002 to 2005 cohort of SHSAT exam takers. ** represents significant at 5 percent level and * represents significant at 1 percent level.

Table 6b
Academic Results for Hispanic students

|	Graduated	Regents	Advanced Regents	Dropout	ELA	Math 1	Global History	Living Environment
Stuyvesant	0.088	-0.353**	0.552**	-0.029	5.251**	9.116**	13.263**	13.263**
	(0.045)	(0.054)	(0.049)	(0.025)	(1.510)	(1.460)	(1.471)	(1.471)
Bronx Science	0.104**	-0.300**	0.499**	-0.049**	6.792**	10.470**	9.956**	9.956**
	(0.028)	(0.033)	(0.030)	(0.015)	(0.913)	(0.872)	(0.904)	(0.904)
QHSS	0.034	-0.010	0.072	-0.011	1.915	2.236	1.906	1.720
	(0.035)	(0.043)	(0.038)	(0.019)	(1.177)	(1.126)	(1.366)	(1.169)
Lehman	0.022	-0.120**	0.179**	-0.007	2.728*	3.315**	2.575	2.815*
	(0.038)	(0.046)	(0.041)	(0.021)	(1.265)	(1.206)	(1.474)	(1.262)
HSMSE	-0.034	-0.276**	0.262**	-0.039	4.191*	6.522**	1.592	3.212
	(0.059)	(0.071)	(0.064)	(0.032)	(1.973)	(1.916)	(2.253)	(1.970)
Brooklyn Tech	0.113	0.123	0.041	0.014	0.610	-0.224	4.314	2.666
	(0.058)	(0.071)	(0.063)	(0.032)	(1.960)	(1.892)	(2.233)	(1.965)
R^2	0.012	0.030	0.060	0.003	0.019	0.042	0.020	0.030
N	16398	16398	16398	16398	15158	15161	14719	14535

This table shows the reduced form estimates of graduation outcomes and Regents exam results for Hispanic students, who scored within 10 points of the cutoff score for each school. The sample includes Black students from the 2002 to 2005 cohort of SHSAT exam takers. ** represents significant at 5 percent level and * represents significant at 1 percent level.

Table 6c
Academic Results for Low Income students

|	Graduated	Regents	Advanced Regents	Dropout	ELA	Math 1	Global History	Living Environment
Stuyvesant	0.134**	-0.001**	0.613**	-0.032**	8.086	9.658**	11.839**	12.224**
	(0.015)	(0.001)	(0.019)	(0.007)	(0.559)	(0.576)	(0.627)	(0.528)
Bronx Science	0.114**	0.303**	-0.508**	-0.029**	7.726**	9.388**	8.748**	9.048**
	(0.011)	(0.014)	(0.014)	(0.005)	(0.412)	(0.426)	(0.463)	(0.391)
QHSS	0.024	0.045*	-0.090**	-0.006**	1.092	2.633**	2.330**	1.947**
	(0.016)	(0.021)	(0.021)	(0.008)	(0.613)	(0.630)	(0.694)	(0.585)
Lehman	0.033	0.137**	-0.204**	-0.003	4.494**	4.303**	2.281**	2.572**
	(0.017)	(0.024)	(0.023)	(0.009)	(0.677)	(0.696)	(0.772)	(0.650)
HSMSE	0.029	0.115*	-0.173**	-0.014	2.862*	3.319**	2.740*	3.558**
	(0.030)	(0.040)	(0.039)	(0.015)	(1.149)	(1.182)	(1.318)	(1.120)
Brooklyn Tech	0.032	-0.220	0.093*	-0.009	1.755	2.091*	2.462	1.922*
	(0.029)	(0.040)	(0.039)	(0.015)	(1.139)	(1.169)	(1.310)	(1.112)
R^2	0.014	0.038	0.093	0.004	0.036	0.053	0.033	0.048
N	39958	39958	39958	39958	37697	37393	35514	35411

This table shows the reduced form estimates of graduation outcomes and Regents exam results for low-income students, who scored within 10 points of the cutoff score of each school. Low-income students are students who receive free lunch and are labeled as "poverty" in the NYC DOE data. The sample includes Black students from the 2002 to 2005 cohort of SHSAT exam takers. ** represents significant at 5 percent level and * represents significant at 1 percent level.

Figure 1
First Stage Results: Enrollment in Schools
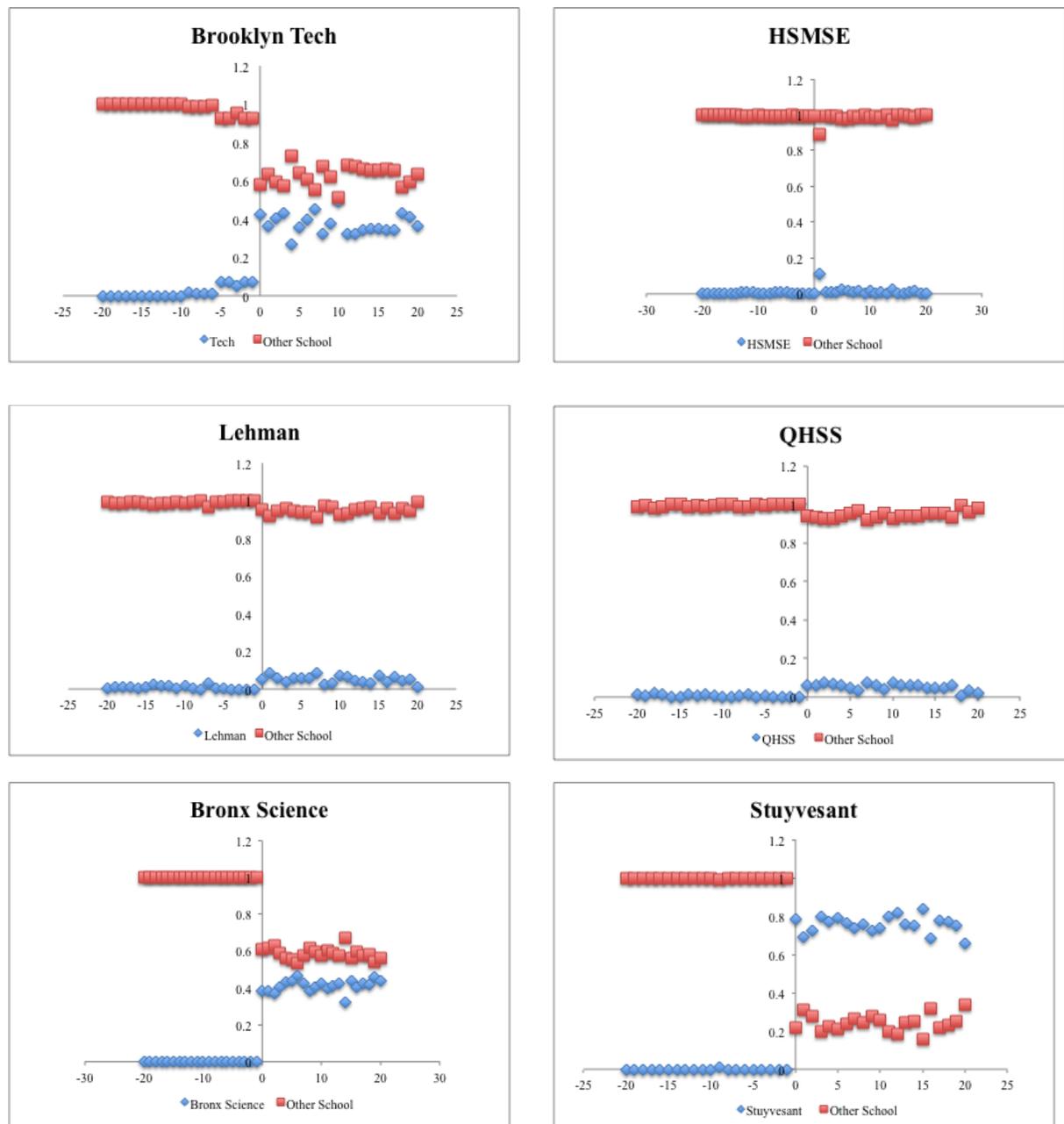
This figure shows the first stage results of student enrollment in schools from the 2002 to 2005 cohort of SHSAT exam takers. Results within 20 points of each school's cutoff are presented.
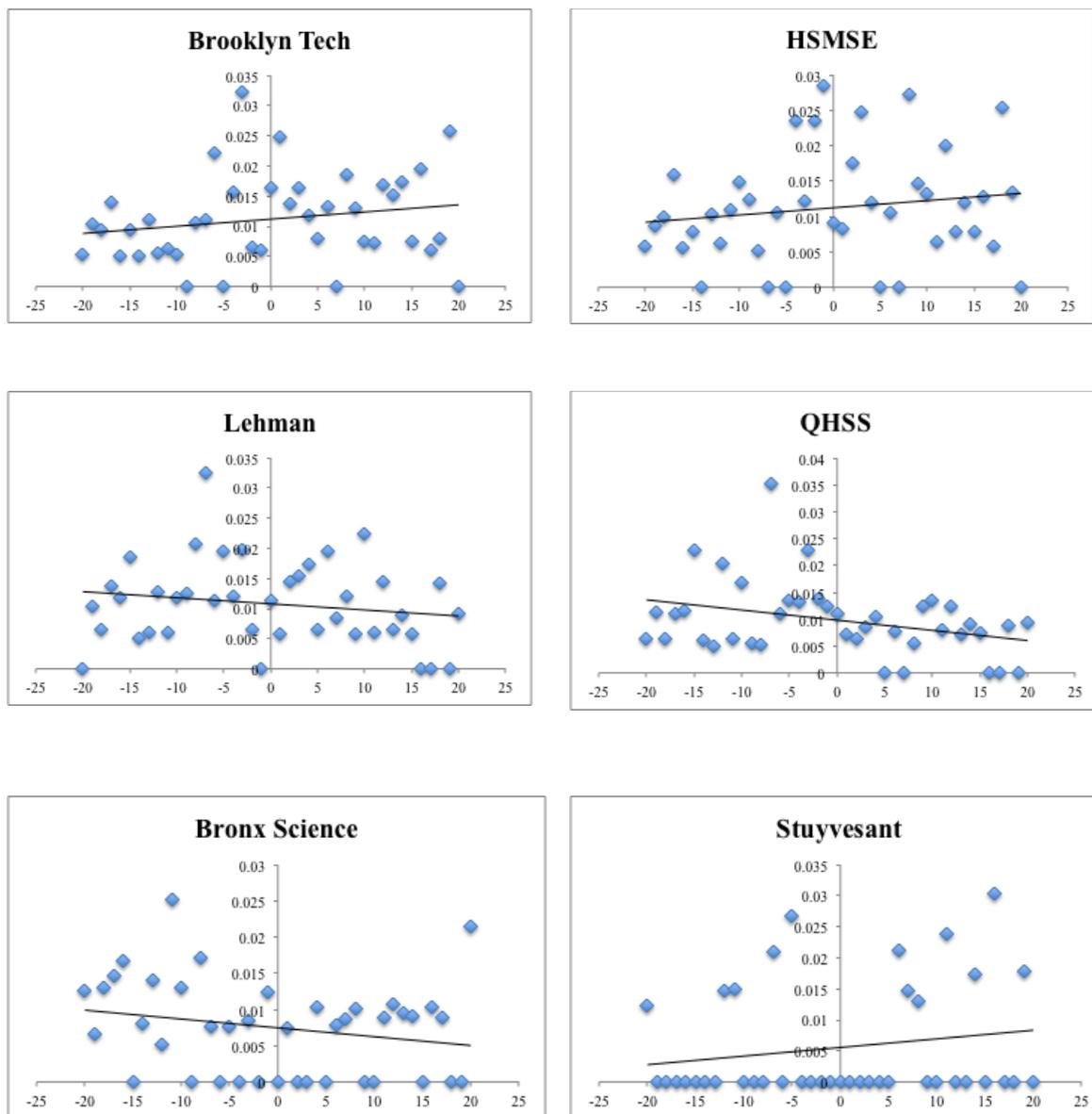
Figure 2a
Graduation Results
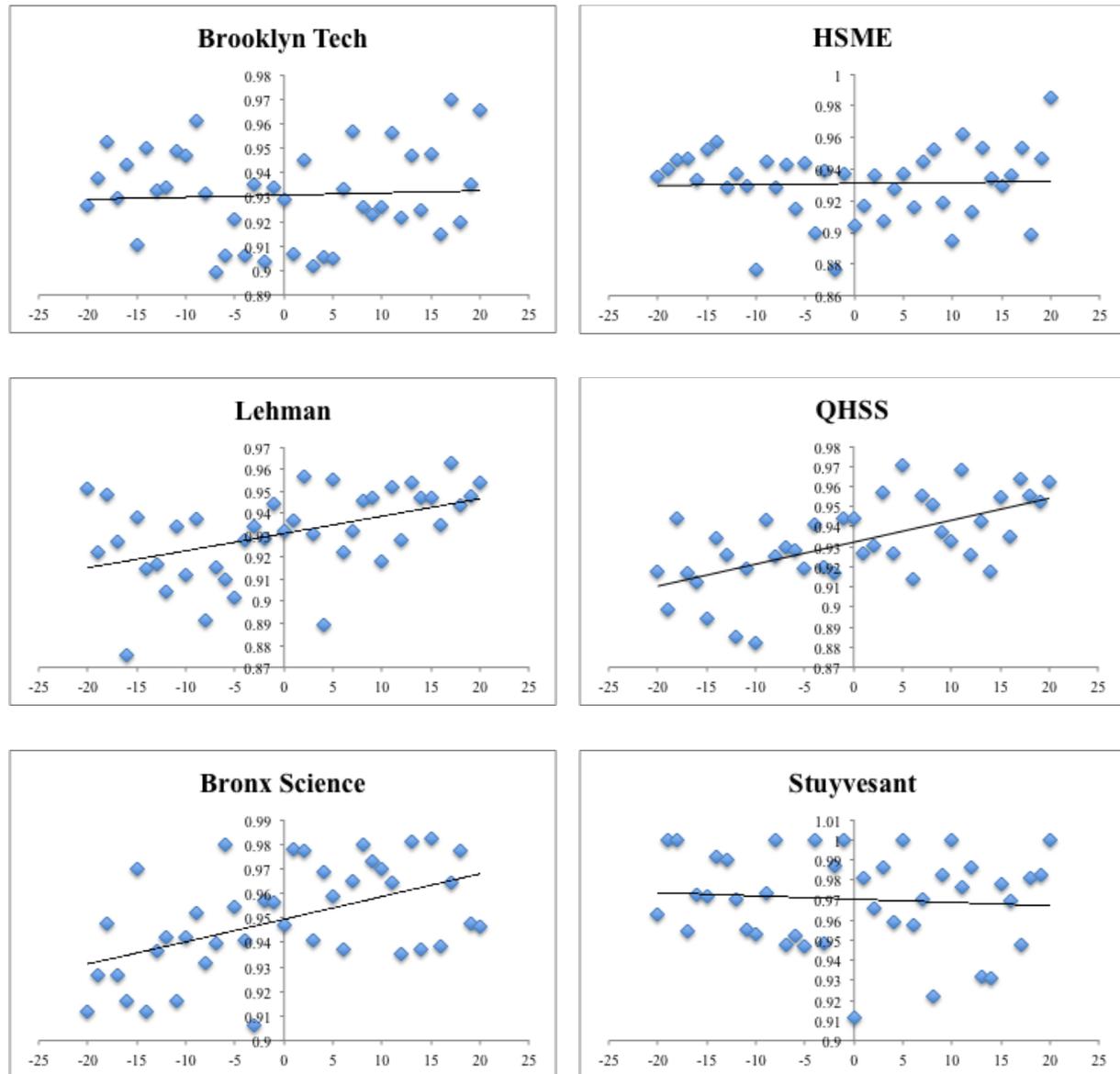
This figure shows the reduced form results of graduation outcomes in schools from the 2002 to 2005 cohort of SHSAT exam takers. Results within 20 points of each school's cutoff are presented.

Figure 2b
Regents Diploma Results
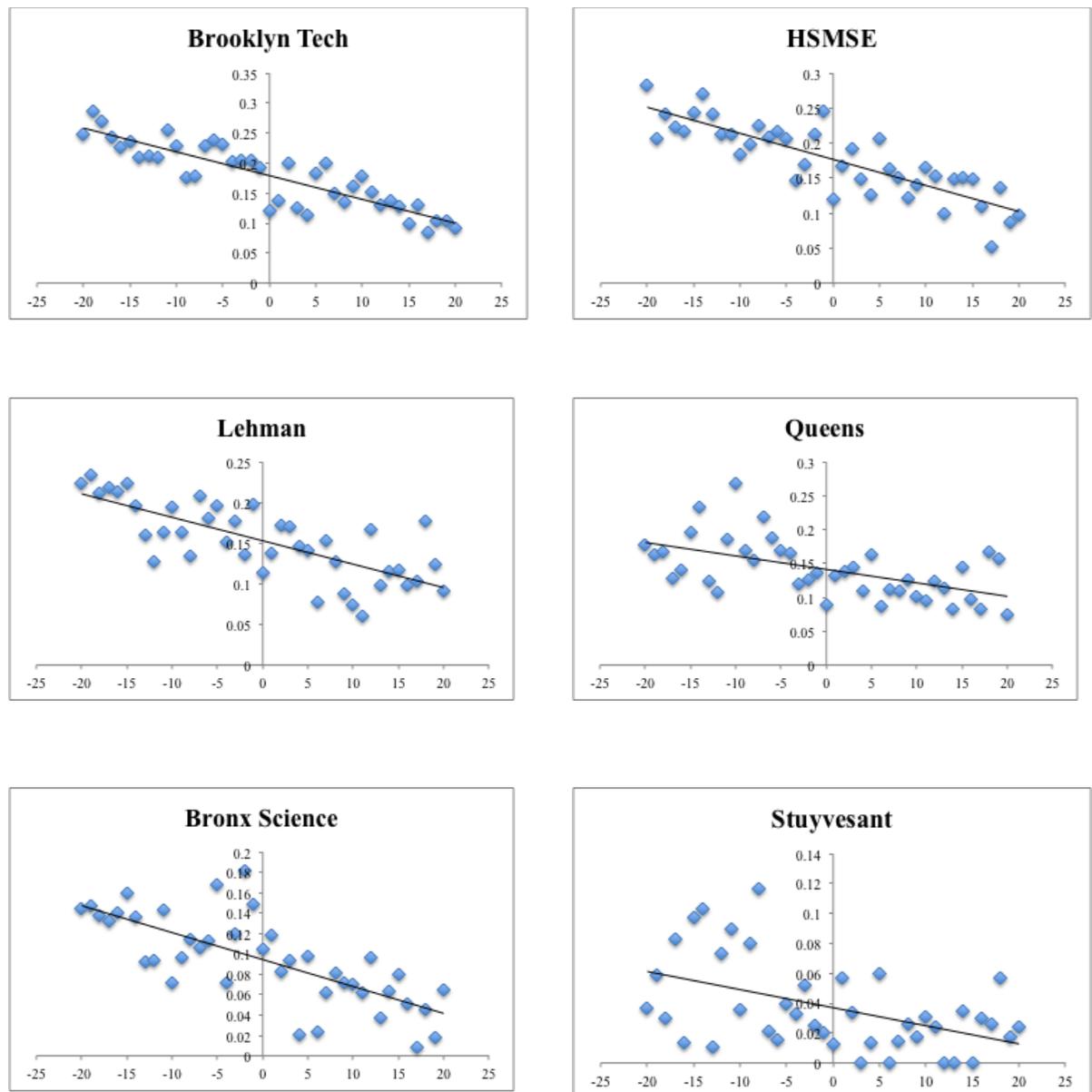
This figure shows the reduced form results of Regents diploma outcomes from
the 2002 to 2005 cohort of SHSAT exam takers. Results within 20 points of
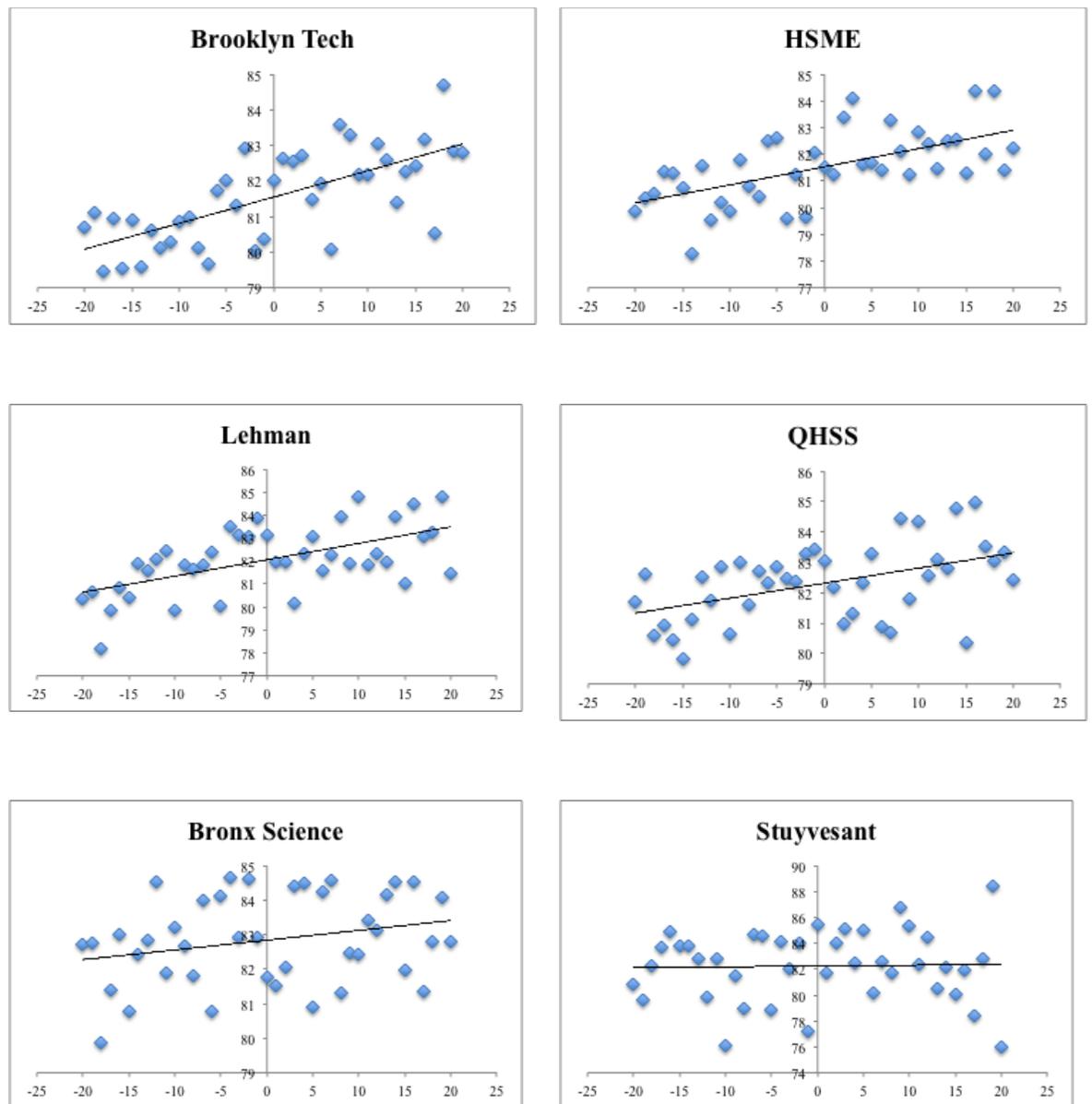each school's cutoff are presented.

Figure 2c
Advanced Regents Results
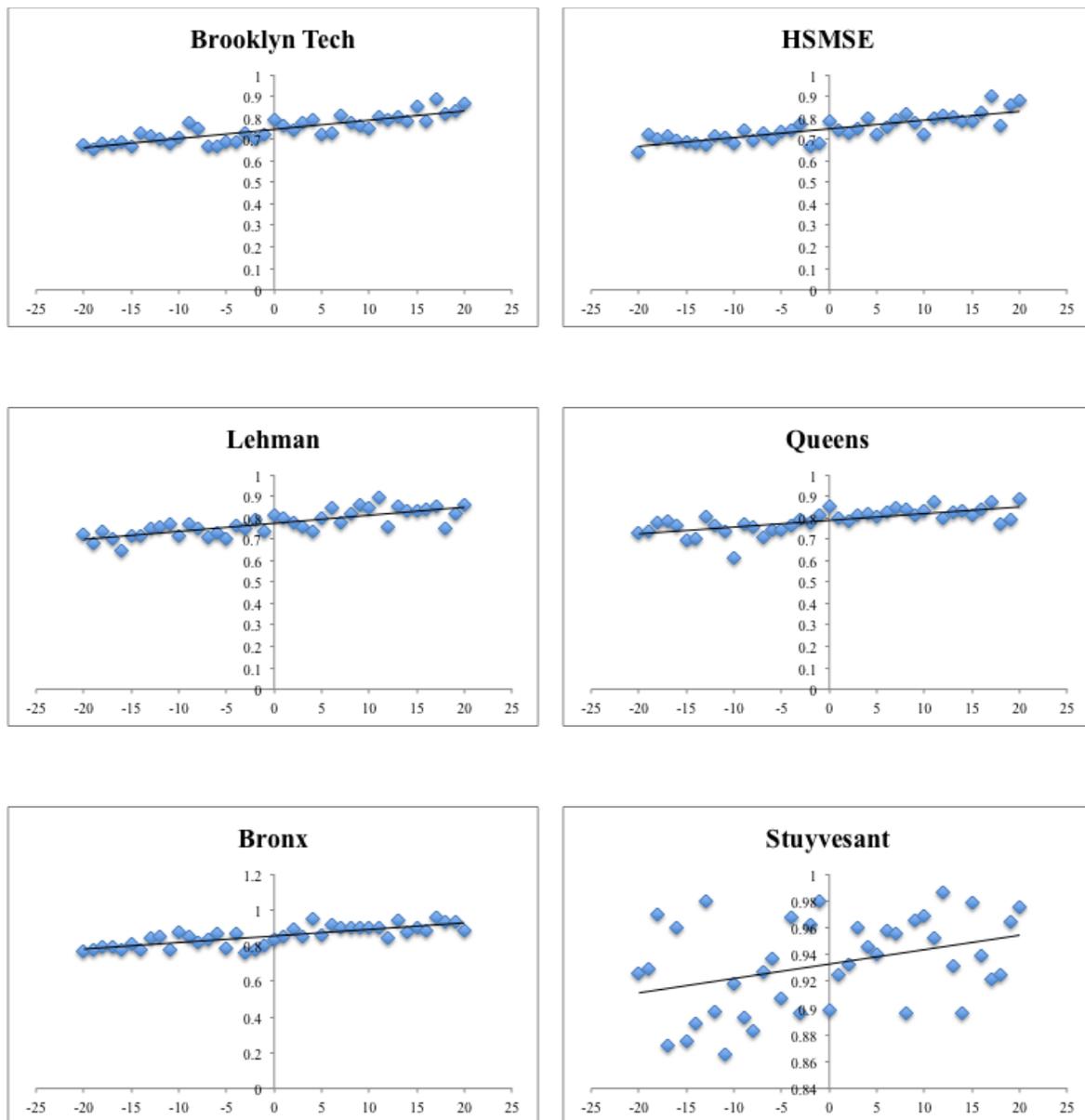
This figure shows the reduced form results of Advanced Regents diploma outcomes from the 2002 to 2005 cohort of SHSAT exam takers. Results within 20 points of each school's cutoff are presented.

Figure 2d
Dropout Results

This figure shows the reduced form results of dropout outcomes from the 2002 to 2005 cohort of SHSAT exam takers. Results within 20 points of each school's cutoff are presented.
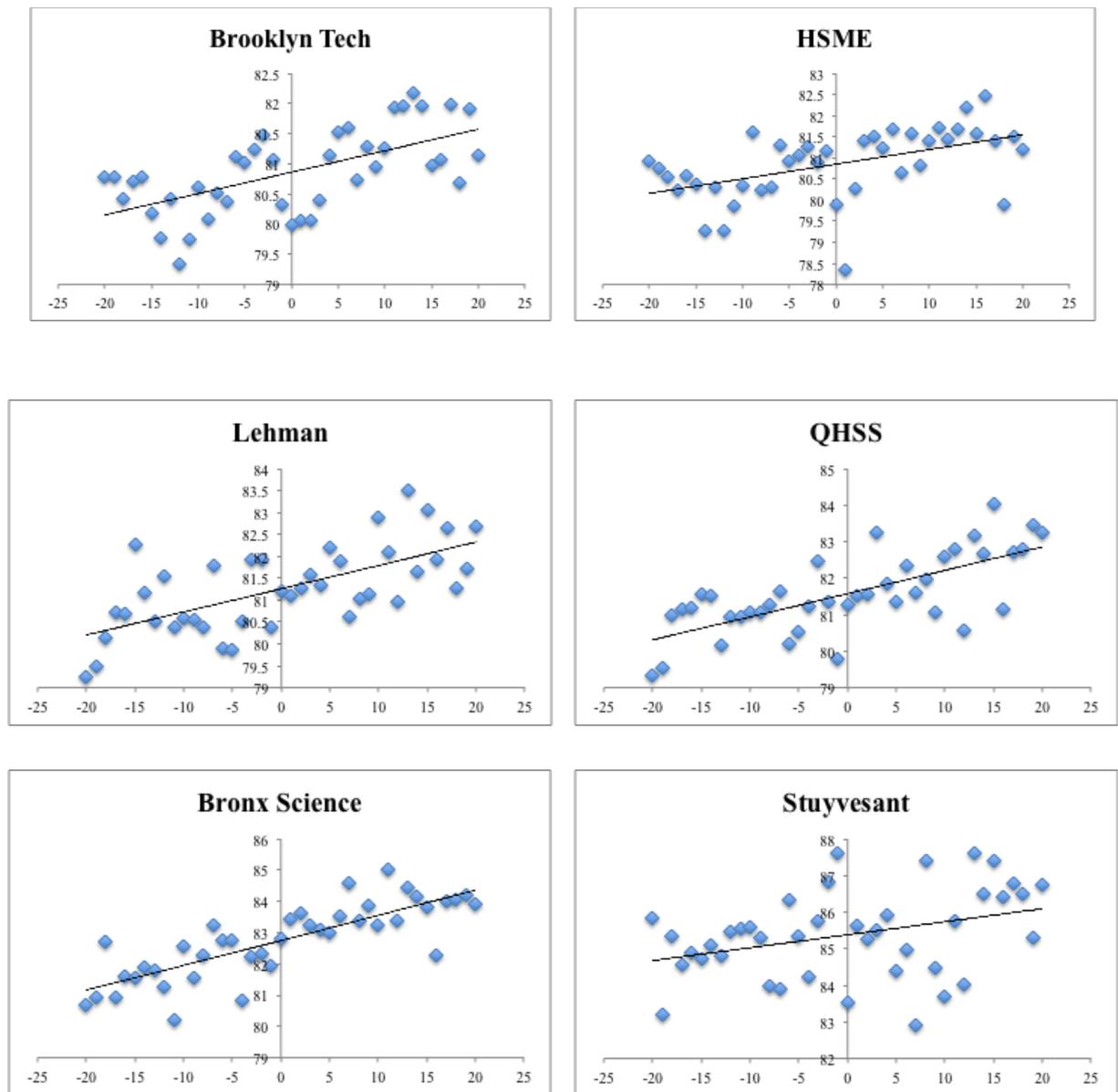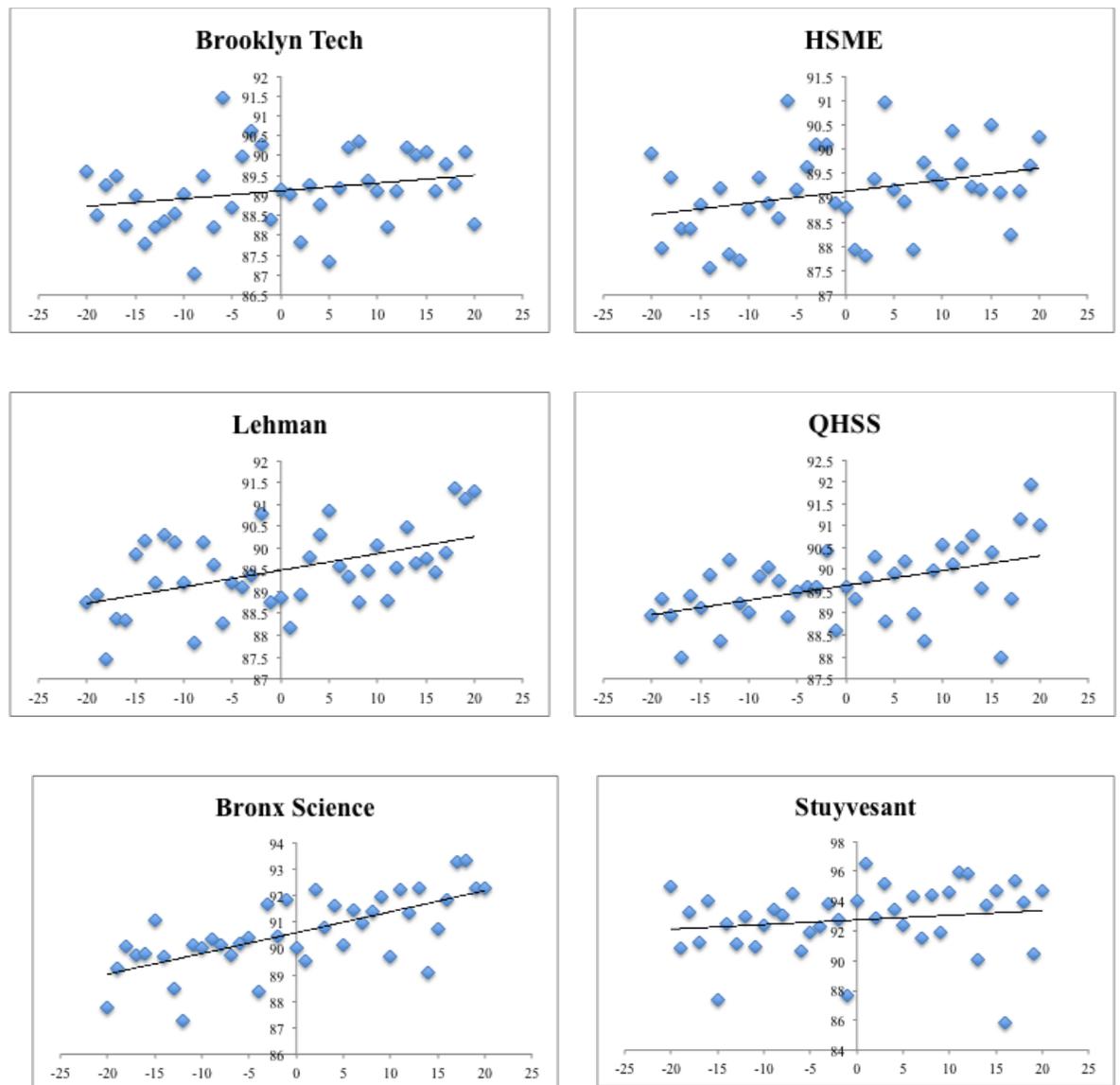
Figure 3a
English Regents Results

This figure shows the reduced form results of English Regents outcomes from the 2002 to 2005 cohort of SHSAT exam takers. Results within 20 points of each school's cutoff are presented.

Figure 3b
Math I Regents Results

This figure shows the reduced form results of Math I Regents outcomes from the 2002 to 2005 cohort of SHSAT exam takers. Results within 20 points of each school's cutoff are presented.

Figure 3c
Living Environment Regents Results

This figure shows the reduced form results of Living Environment Regents outcomes from the 2002 to 2005 cohort of SHSAT exam takers. Results within 20 points of each school's cutoff are presented.

Figure 3d
Global History

This figure shows the reduced form results of Global History Regents outcomes from the 2002 to 2005 cohort of SHSAT exam takers. Results within 20 points of each school's cutoff are presented.

Summary of Capstone Project

The purpose of this study was to examine the academic performance of students in specialized high schools compared to that of normal public school students. To gain admittance into one of these schools, students would have to take the Specialized High School Admissions Test, which is available to all eighth grade New York City students. The exam is the only measure for admittance into one of these schools and becomes the key variable of my analysis.

Specialized high schools are operated by the NYC Department of Education, making them public schools. They are recognized as some of the most prestigious schools in the country. Alumni of the schools attend eminent colleges and universities and are recognized leaders in their career field. There are nine specialized high schools and seven of them emphasize math and science. The three original specialized high schools were established in the 1970's and are Stuyvesant HS, Bronx Science, and Brooklyn Tech. Additional schools were introduced in 2002, as the applicant pool grew. Some benefits of attending one of these schools include having a competitive peer group, challenging courses, and strong alumni networks.

There were similar studies in the past that analyzed exam based schools. One of them was a study by Dobbie and Fryer in 2011, which emphasized the causal effect of students attending a NYC specialized high school and on SAT

scores and college enrollment. They found little effect of students attending one of these schools and on that performance. Another study was done by Abdulkadiroglu, Angrist, and Pathak, which examined both the exam schools in Boston and New York City. There analysis emphasized state exam results. Similar to Dobbie and Fryer, they found little causal effect with attending one of these schools and scores.

The instrument I used in my study was a regression discontinuity design on the individual scores of students. As each school has a unique cutoff score, I would control the scope of my analysis on students who score 20 points above and below the score. This allows me to compare the performance of students who score right above and below the cutoff score. With the scores as the dependent variable, I was able to apply other variables such as graduation degree and New York State Regents test score to the analysis. Both graduation degree and Regents scores were my measures for academic success. Additionally, to narrow my analysis, I controlled the data regression to traditionally underprivileged subgroups, such as Black, Hispanic, and students who receive free lunch. This is to see if the performance of these subgroups is affected by the admittance of these schools.

The results of my study were that students who score above the cutoff scores would perform better than students who score below the cutoff scores. When plotting the points, there was an upward trend. Thus, students who score

above the cutoff are likely to already be high achievers and students who score below the They are more likely to graduate with an Advanced Regents diploma and score higher on all Regents examinations. I studied four major Regents exams, which included English Language Arts, Math I, Living Environment, and Global History. The exams with the greatest causal effects were Math I and Living Environment. This may be because of the emphasis in math and science in the schools.

In regards to the effects of the subgroups, there were no strong effects of underprivileged students. What is notable about the specialized high schools is that they are predominantly Asian and White, where Asians make up the largest demographics of the schools at 60%. Black and Hispanic make up less than 5% of the student body at Stuyvesant High School. However, of all exam takers, 24.5% of the students are Black and 19.4% of the students are Hispanic. Thus, there is a large disproportion between the exam takers and the accepted students. As the minority students only make up a small percentage of the specialized high school student body, it explains why the effects are so small.

In conclusion, attending a specialized high school does not have significant impact on a student's short-term success. However, it would be interesting to measure the long-term impacts such as college enrollment and career success. If I were to add anything more to my study, I would have tried to get student

level data on SAT scores, college enrollment, and 8th grade statistics of students. However variables such as career success and overall student satisfaction cannot be measured statistically.