The Elite Illusion: Achievement Effects at Boston and New York Exam Schools

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What's an Exam School?

- A public school with a competitive admissions exam
- A magnet school, focused on academics, with selective admissions
- Boston and New York run the most famous and longstanding exam programs; Also found in Chicago, San Francisco, Buffalo, and VA
- Often seen as the flagship of a public school system, vigorously defended by teachers and alumni
- Selective exam schools admissions are controversial, generating concerns about elitism, segregation, and racial achievement gaps
- As at elite colleges and universities, exam school students are clearly higher-achieving than most public school peers
- Our question:

  What's the causal effect of Boston and New York exam school attendance on student achievement?

- RD provides the answer

Boston Exam Schools

- Three traditional exam schools spanning grades 7-12
  - ✓ Boston Latin School (1635)
  - ✓ Boston Latin Academy (1877)
  - ✓ John D. O'Bryant School of Math and Science (1893)
- BLS is America's oldest public high school
  - ✓ Roots of public high school movement (Goldin and Katz 2008); Imitators include Brooklyn Latin, opened in 2006
  - ✓ BLS boasts that Harvard was created for its graduates
  - ✓ BLS appears in *U.S. News and World Report* top 20
- Racial preferences in exam school admissions
  - ✓ Began with Judge Garrity in 1974
  - ✓ After *McLaughlin vs. Boston School Committee* in 1996, exam school admissions made race-blind
- Exams offer more advanced courses, but have larger classes
- Traditional exam schools compared to regular BPS in Table 1

Table 1. Boston School Characteristics

	Traditional Boston Schools		Exam Schools				
	Middle School	*High School*	*Middle School*	*High School*	O'Bryant	Latin Academy	Latin School
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Baseline Peer Mean in Math	-0.251	-0.346	1.508	1.345	0.850	1.159	1.864
Baseline Peer Mean in English	-0.252	-0.274	1.371	1.096	0.731	1.050	1.565
Student/Teacher ratio	12.4	15.2	21.3	21.1	19.6	21.2	22.0
Teachers licensed to teach assignment	87.7%	89.2%	96.3%	96.6%	97.4%	95.9%	96.4%
Core academic teachers identified as highly qualified	84.7%	85.0%	94.0%	93.9%	92.7%	93.8%	94.7%
Teachers above age 40	46.6%	47.4%	54.4%	55.3%	63.4%	51.7%	52.9%
Teachers above age 48	31.9%	35.3%	42.0%	43.0%	51.3%	38.3%	41.2%
Teachers above age 56	11.8%	13.8%	21.4%	22.1%	27.1%	18.7%	21.3%
Number of teachers	46.1	63.1	91.5	89.0	64.5	79.0	110.3
Total number of teachers in core academic areas	37.9	51.7	77.4	76.1	55.7	64.7	95.2
Number of schools	47	40	3	3	1	1	1

Notes: This table shows student weighted average characteristics of teachers and schools using data posted on the Mass DOE website at http://profiles.doe.mass.edu/state_report/teacherdata.aspx. Peer baseline means are enrollment-weighted scores on 4th grade MCAS Math and English for middle school covering Fall 2000 to Fall 2008 for middle school and middle school MCAS scores covering years Fall 2002 to Fall 2008 for high school. Teachers licensed in teaching assignment is the percent of teachers who are licensed with Provisional, Initial, or Professional licensure to teach in the area(s) in which they are teaching. Core classes taught by highly qualified teachers is the percent of core academic classes (defined as English, reading or language arts, mathematics, science, foreign languages, civics and government, economics, arts, history, and geography) taught by highly qualified teachers (defined as teachers not only holding a Massachusetts teaching license, but also demonstrating subject matter competency in the areas they teach). All teacher characteristics are from Fall 2003 to Fall 2008, except information on core academic teachers which is from Fall 2003-2006 and teacher age which is only available from Fall 2007-2008. Middle schools include all schools with positive enrollment in at least one of grades 6, 7, and 8. High schools include all schools with positive enrollment in at least one of grades 9, 10, 11, and 12.

New York Exam Schools

- Three original academic exam schools, opened early 20th Century
  - ✓ Stuyvesant High School
  - ✓ The Bronx High School of Science
  - ✓ Brooklyn Technical High School
- Three new exam schools opened in 2002; 1 more opening and 1 conversion since
  - ✓ New exams are much smaller, younger, some too young for us to have good coverage, and in any case, arguably a different animal
  - ✓ Our NYC design parallels Boston in focusing on the 3 most established schools (similar metrics)
- Stuyvesant is most competitive (Stuy students 2σ above NYC), followed by Bronx Science, then Brooklyn Tech; these schools offer a rich and advanced curriculum
- Admissions controversies
  - ✓ 1972 Hecht-Calandra Act legislated exam-only admits
  - ✓ Specialized High School Institute (SHSI) opened in 1995 to prep minority applicants

What's the Exam School Treatment?

1) Peer Effects
   - Exam school students study with peers who have similarly high levels of achievement
2) Tracking
   - Advanced courses, links with local scientists, math and science competitions, other academic enrichment activities
3) Resources
   - Some have modern science labs and well-equipped athletic facilities
   - Alumni networks and donations
   - More senior teaching staff (though not necessarily the best teachers)
   - Exam classes are larger (21 vs. 15 in Boston; 31 vs. 27 in NYC), exam schools sometimes said to be crowded

- Because the resource comparison is mixed, we see the exam school experiment as most informative about a combination of peer and tracking effects

Boston Data and Samples

- We start with registration and demographic data for Boston residents attending BPS schools
- MCAS scores are from 1998-2008; standardized to Boston mean/SD by test and year
- Our sample includes 7th grade applicants from 1997-2008; 9th grade applicants from 2001-2007
  - ✓ Racial preferences ended in 1997
- We focus on applicants enrolled in regular BPS schools, drop 9th grade transfer applicants
  - ✓ We ask: how does exam school achievement compare to regular BPS?
  - ✓ Reduced form offer effects can be interpreted as incremental: O'Bryant vs no offer; BLA offer vs O'Bryant; BLS offer vs. BLA
  - ✓ Fuzzy RD puts some structure on this (not much!)

Descriptive Statistics

Table 2 shows demographics and baseline scores for all BPS students and Boston exam school samples

- ✓ Like other large urban districts, BPS is majority black/Hispanic and low income
- ✓ Many black and Hispanic students apply to and enroll in exam school, more so at 9th grade
- ✓ Many low income and limited english proficient students apply and receive offers
- ✓ But fewer minority/LEP in exams than in general BPS population
- ✓ Baseline scores show substantial positive selection into applicant and offer samples
- ✓ Offer rates are much lower in 9th grade than 7th

Table 2. Boston Descriptive Statistics

	7th Grade				9th Grade			
	All Boston (1)	Exam Applicants (2)	Offered Students (3)	Enrolled Students (4)	All Boston (5)	Exam Applicants (6)	Offered Students (7)	Enrolled Students (8)
				A. Demographics				
Female	0.479	0.536	0.559	0.562	0.476	0.540	0.614	0.602
Black	0.478	0.386	0.245	0.239	0.505	0.493	0.361	0.367
Hispanic	0.301	0.199	0.158	0.149	0.331	0.243	0.233	0.215
Free Lunch	0.725	0.717	0.630	0.626	0.762	0.805	0.783	0.799
LEP‡	0.201	0.139	0.110	0.110	0.181	0.130	0.117	0.133
SPED¥	0.232	0.045	0.009	0.009	0.250	0.079	0.019	0.015
N	61,161	13,730	6,418	5,652	30,484	5,540	1,461	1,095
				*B. Baseline Scores**				
Math	-0.017	0.758	1.399	1.436	-0.313	0.227	1.036	1.058
English	-0.020	0.725	1.286	1.315	-0.246	0.275	0.835	0.824
N	37,780	9,423	4,577	4,055	27,505	5,461	1,436	1,081

Notes: This table reports sample means for 1997-2008. The All Boston sample includes 6th and 8th grade students in Boston public schools who had not previously enrolled in any exam school. Exam Applicants are students with a valid application; offered students are applicants who receive an offer at any exam school; enrolled students are applicants who enrolled at any exam school in the following school year. Baseline Math and English scores for 7th grade applicants are from 4th grade. Baseline scores for 9th grade applicants are from middle school. N is the number of observations with at least one non-missing value for the variable listed.

‡ Limited English Proficient (LEP) only available beginning in year 1998.

¥ Special Education (SPED) status only available for years 1998-2004.

* Baseline scores available from 2000 onward for 6th grade and from 2002 onward for grade 8.

Exam School Assignment

- Applicants for spots in grade 7 and 9 submit a ranking of up to three exam schools
- Applicants are ranked by the schools they apply to based on a GPA and ISEE composite
  - ✓ Each school ranks its own applicants, generating rank variable R_{ik} for student i applying to school k
  - ✓ Students who apply to 3 schools have three rank variables
  - ✓ Schools offer down their ranks until full (offers by *deferred acceptance*); this defines cutoff, C_k, the lowest rank offered at k
- We construct school-specific **standardized running variables**:

$$r_{ik} = 100 \times \frac{R_{ik} - C_k}{\max_{j \in \mathcal{I}_k}\{R_{jk}\} - \min_{j \in \mathcal{I}_k}\{R_{jk}\}},$$

  where $\mathcal{I}_k$ are students who ranked school k.
- This normalization facilitates graphical analyses and school-pooling

OLS Estimates

- How much better are those offered a seat, with and without control for the running variables? OLS gives a descriptive benchmark
- OLS estimates also serve as a reference point for comparison with the 2SLS estimates to come later

- Model for standardized score of student i tested in year t:

$$y_{it} = \alpha_t + \sum_j \delta_j d_{ij} + \gamma' X_i + \rho M_{it} + \lambda' I_i + \epsilon_{it}$$

  - ✓ α_t: test year effect; d_{ij} controls for app cohort (year·grade)
  - ✓ X_i: gender, race, free lunch
  - ✓ M_{it}: measures exam school exposure (enrollment, years, peer mean)
  - ✓ I_i: ISEE verbal, quantitative, reading and math scores

- This model pools applicant cohorts and test grades
- Results in **Table 3**

Table 3. Boston OLS Estimates for Enrollment, Years in Exam School, and Peer Means

	Math						English					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Enrollment	0.990***			0.272***			0.788***			0.247***		
	(0.049)			(0.032)			(0.043)			(0.028)		
Exam Years		0.361***			0.088***			0.314***			0.121***	
		(0.012)			(0.016)			(0.012)			(0.010)	
Peer Mean			0.610***			0.110***			0.558***			0.154***
			(0.015)			(0.021)			(0.014)			(0.023)
N	24349	24368	20650	24349	24368	20650	22737	22750	21453	22737	22750	21453
ISEE Controls	NO	NO	NO	YES	YES	YES	NO	NO	NO	YES	YES	YES

Notes: This table reports first-stage estimates for three measures of exam school exposure. Enrollment is an indicator of enrollment at an exam school in the year following application; exam years is the number of years enrolled at an exam school prior to test; peer mean is the average baseline score of peers in the year following application. Models control for application cohort and grade, test year, and demographics (race, gender, free lunch). ISEE controls are raw scores from the verbal, quantitative, reading, and math sections of the test. Robust standard errors, clustered on year and school at the time of testing, * significant at 10%; ** significant at 5%; *** significant at 1%

Boston RD

Boston Plots

- Plots show raw and smoothed CEF estimates, $\hat{E}[y_i|r_{ik}]$, in the neighborhood of admissions cutoffs
  - Raw CEFs are estimated by the mean of y_i in a one-unit binwidth
  - Smoothed CEFs use local linear regression, weighted by edge kernel:

$$K(u_{ik}) = \mathbf{1}_{|u_{ik}|\leq 1}(1 - |u_{ik}|),$$

    where $u_{ik} = \frac{r_{ik}}{h}$ and h is the IK (2010) bandwidth
- Details
  - The *Boston window* is [-10,+10] for estimation: this eliminates those far away from cut-offs, keeps enough data for reasonable precision
  - The Boston plot window is [-20,+20]; this shows some of the action outside the estimation window
  - IK bandwidths are estimated for each school and outcome separately
- The plots start with exam-school exposure first-stages, then move on to reduced forms

Boston First Stage Plots

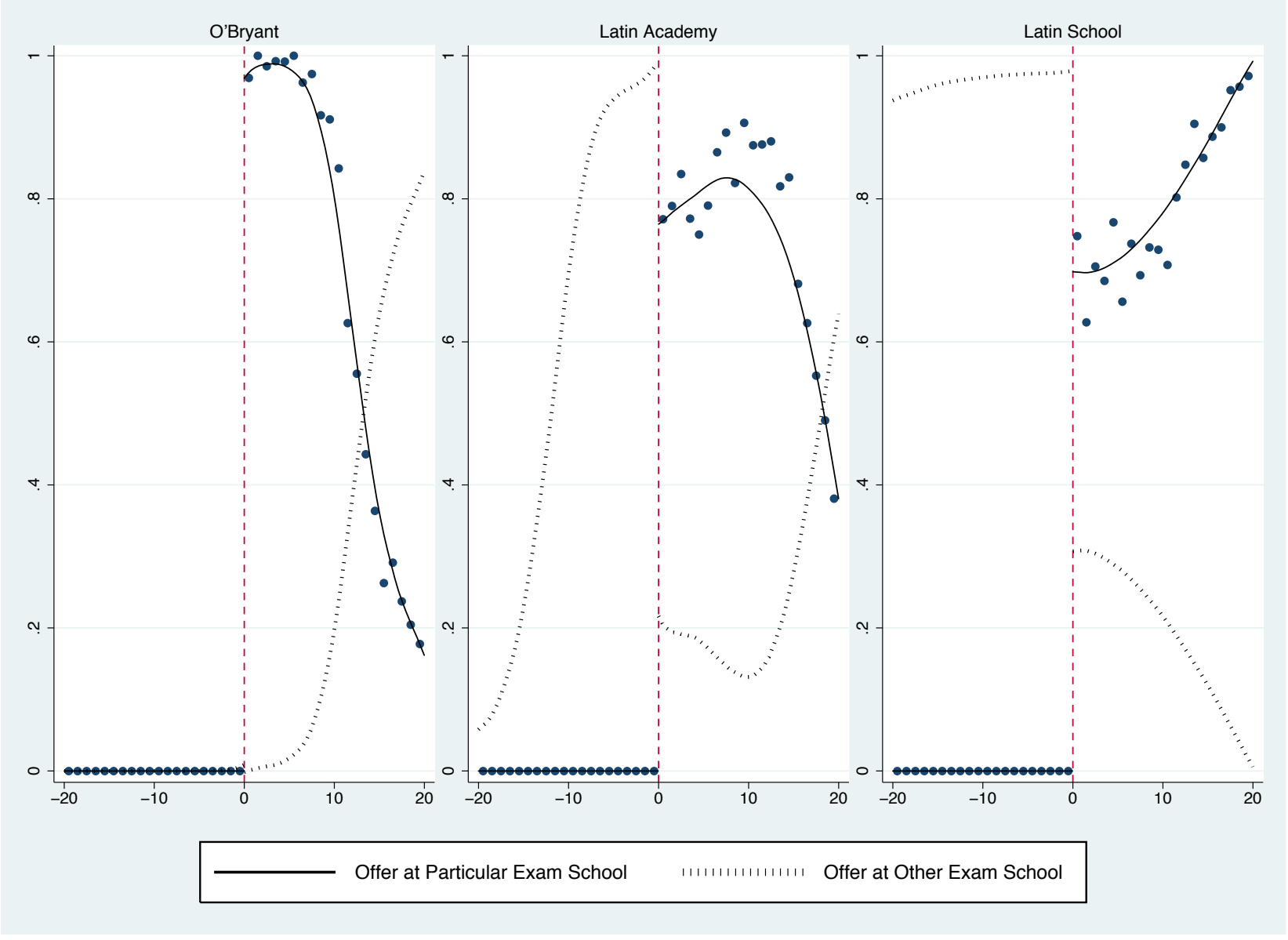

Figure 1. Offers at Each Boston Exam School for 7th Grade Applicants (1997-2008)

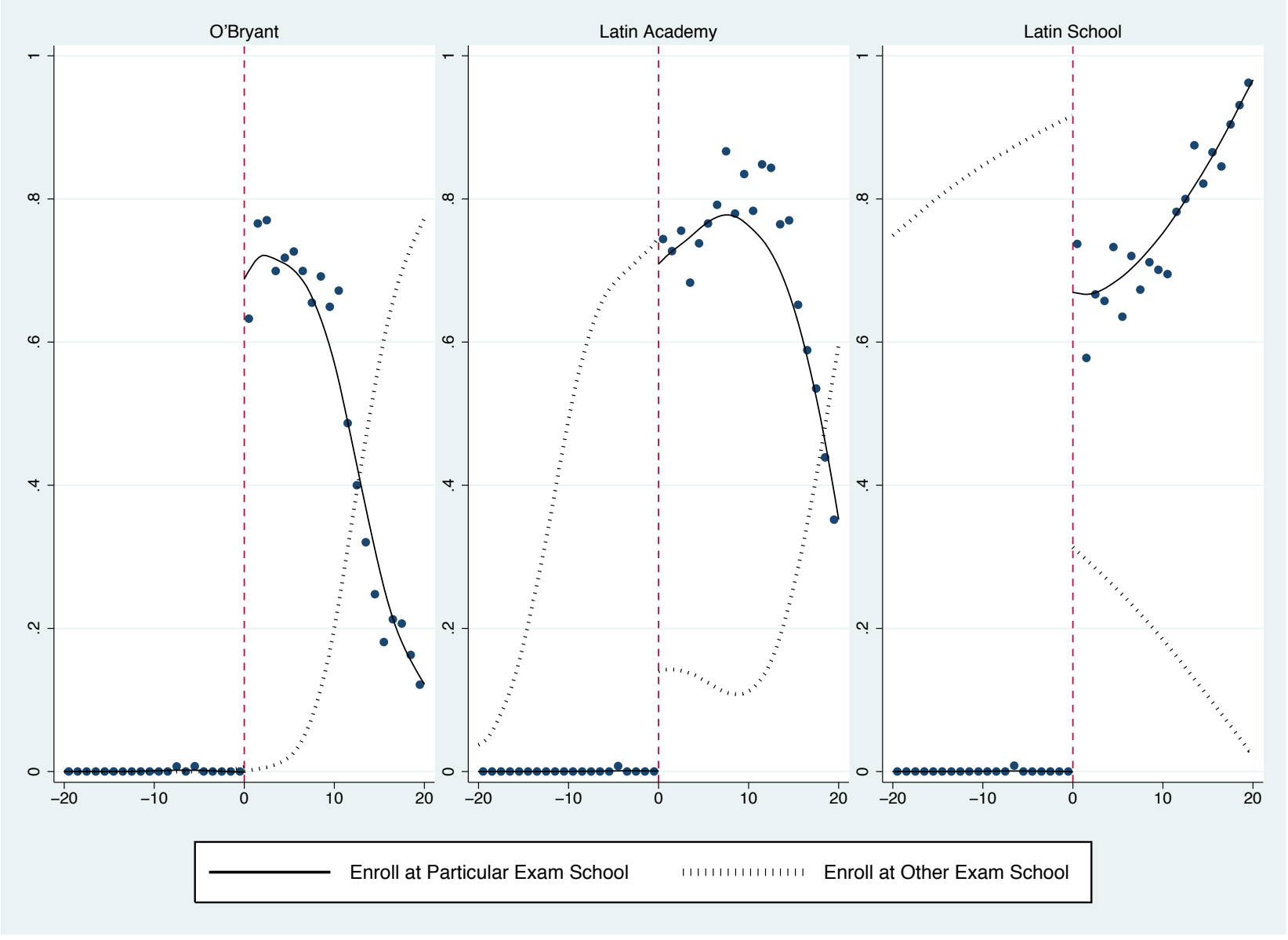

Figure 2. Enrollment at Each Boston Exam School for 7th Grade Applicants (1997-2008)

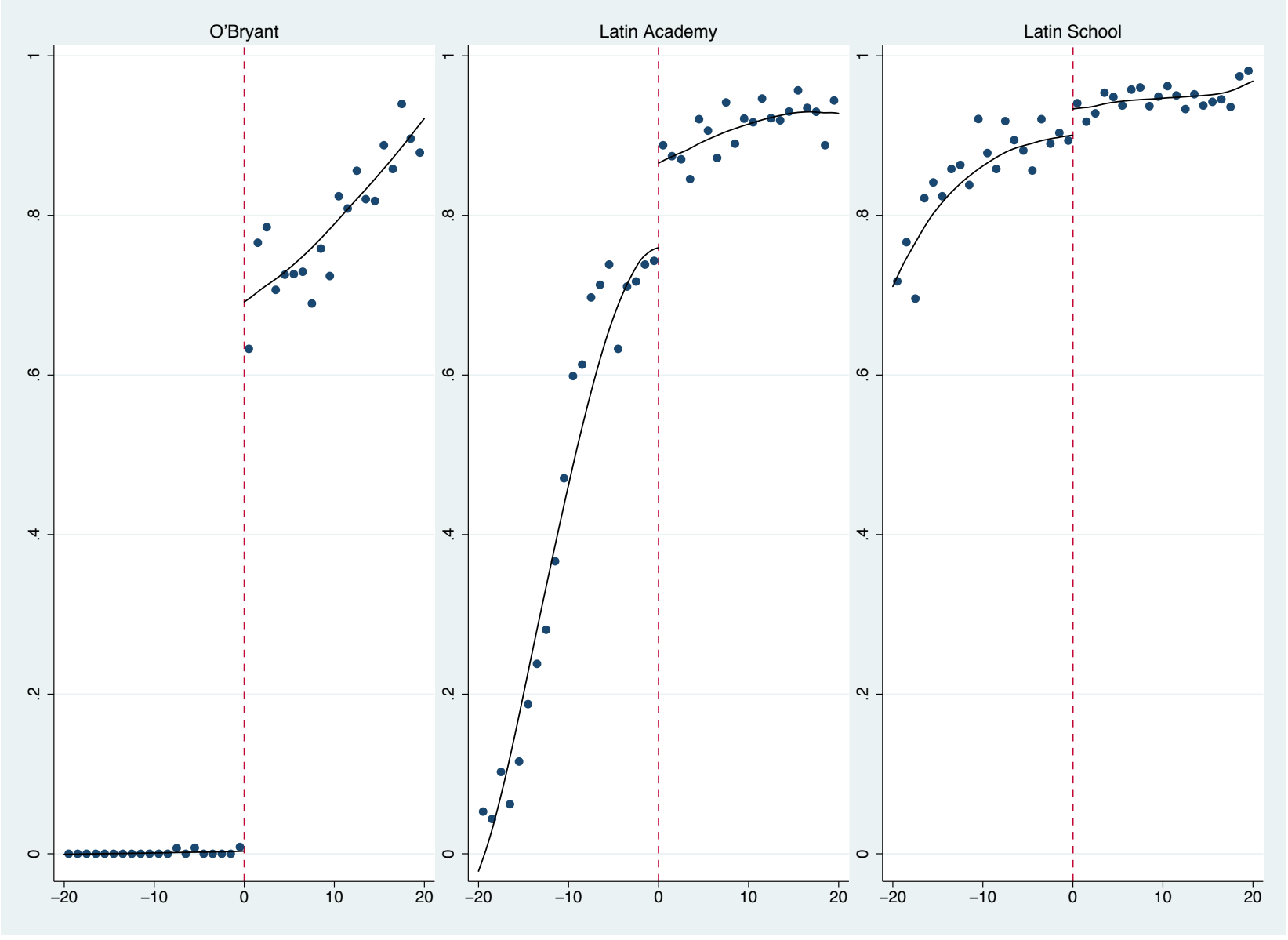

Figure 3. Enrollment at Any Boston Exam School for 7th Grade Applicants (1997-2008)

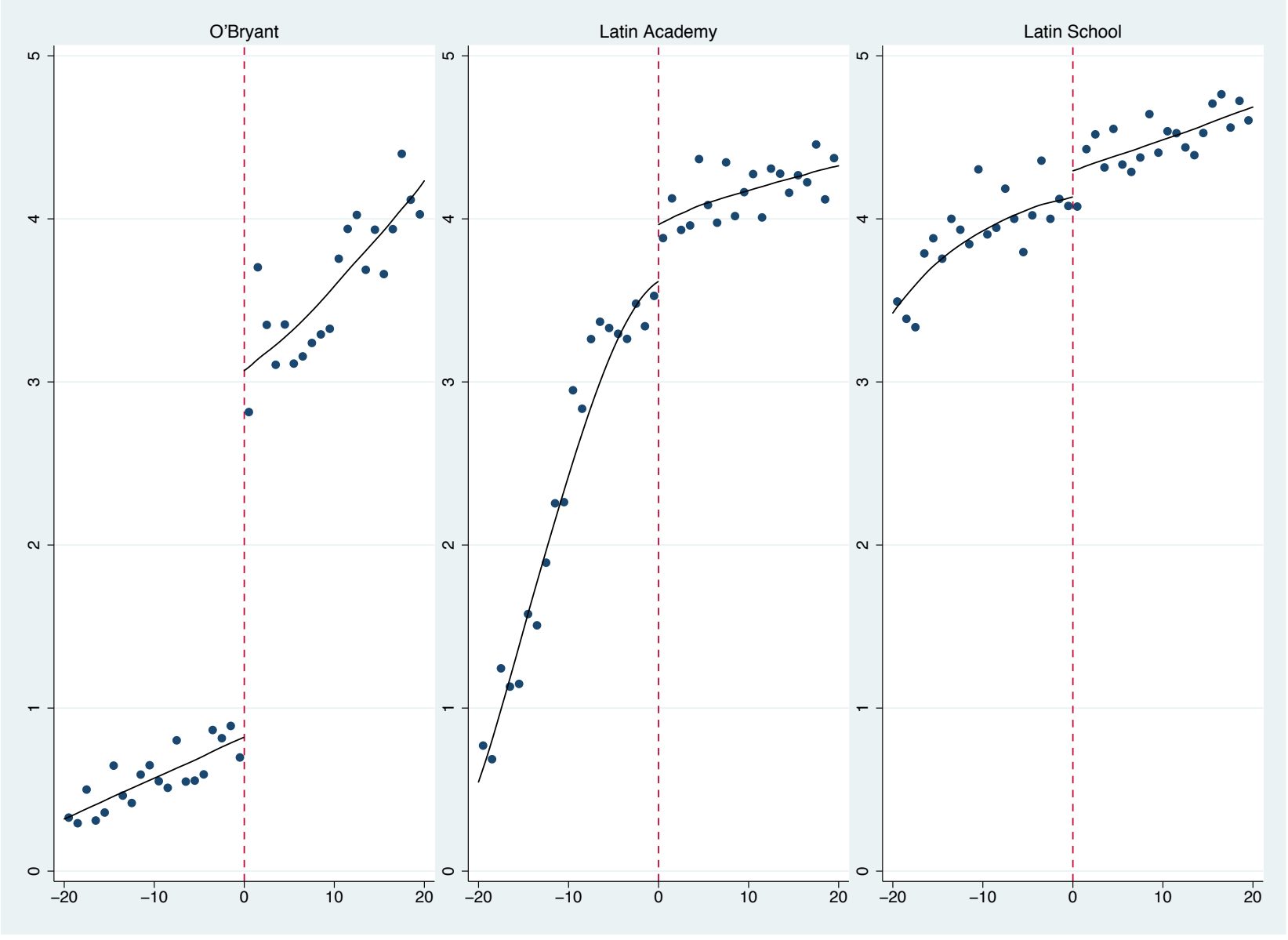

Figure 4. Years at Any Boston Exam School for 7th Grade Applicants (1997-2008)

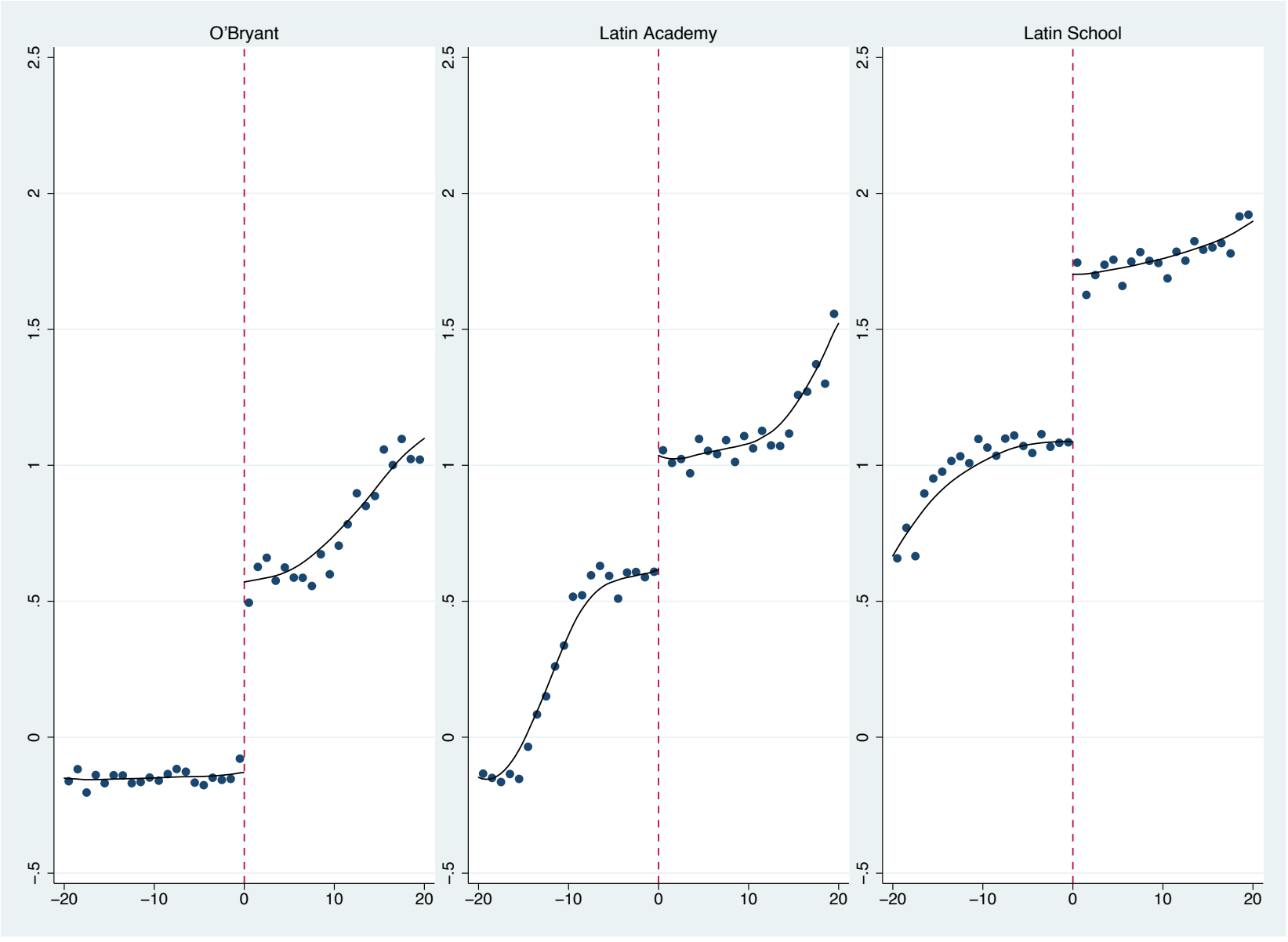

Figure 5. Average Baseline Math Scores of Peers for 7th Grade Applicants (1997-2008) in Boston

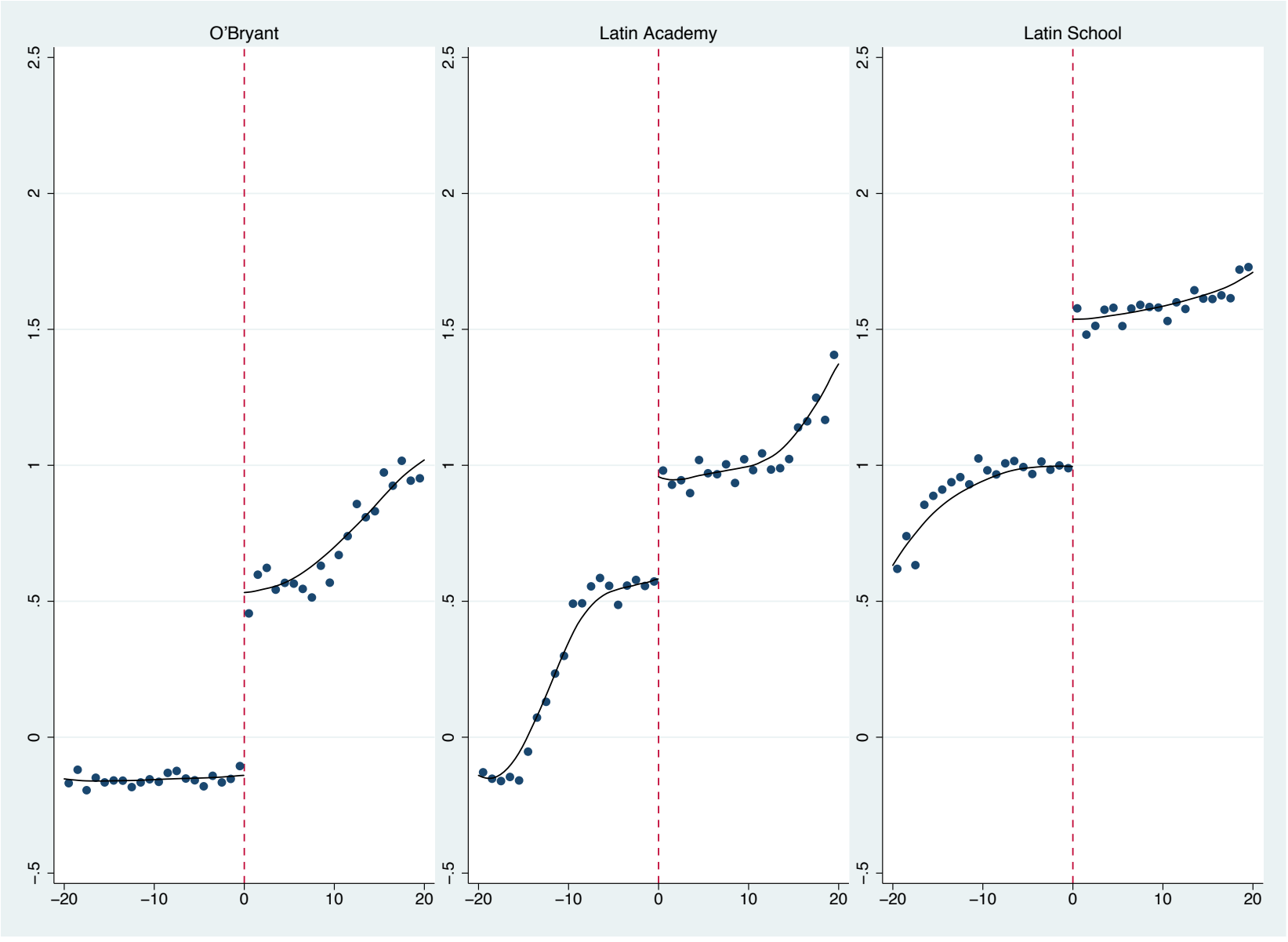

Figure 6. Average Baseline English Scores of Peers for 7th Grade Applicants (1997-2008) in Boston

Boston Reduced Form Plots

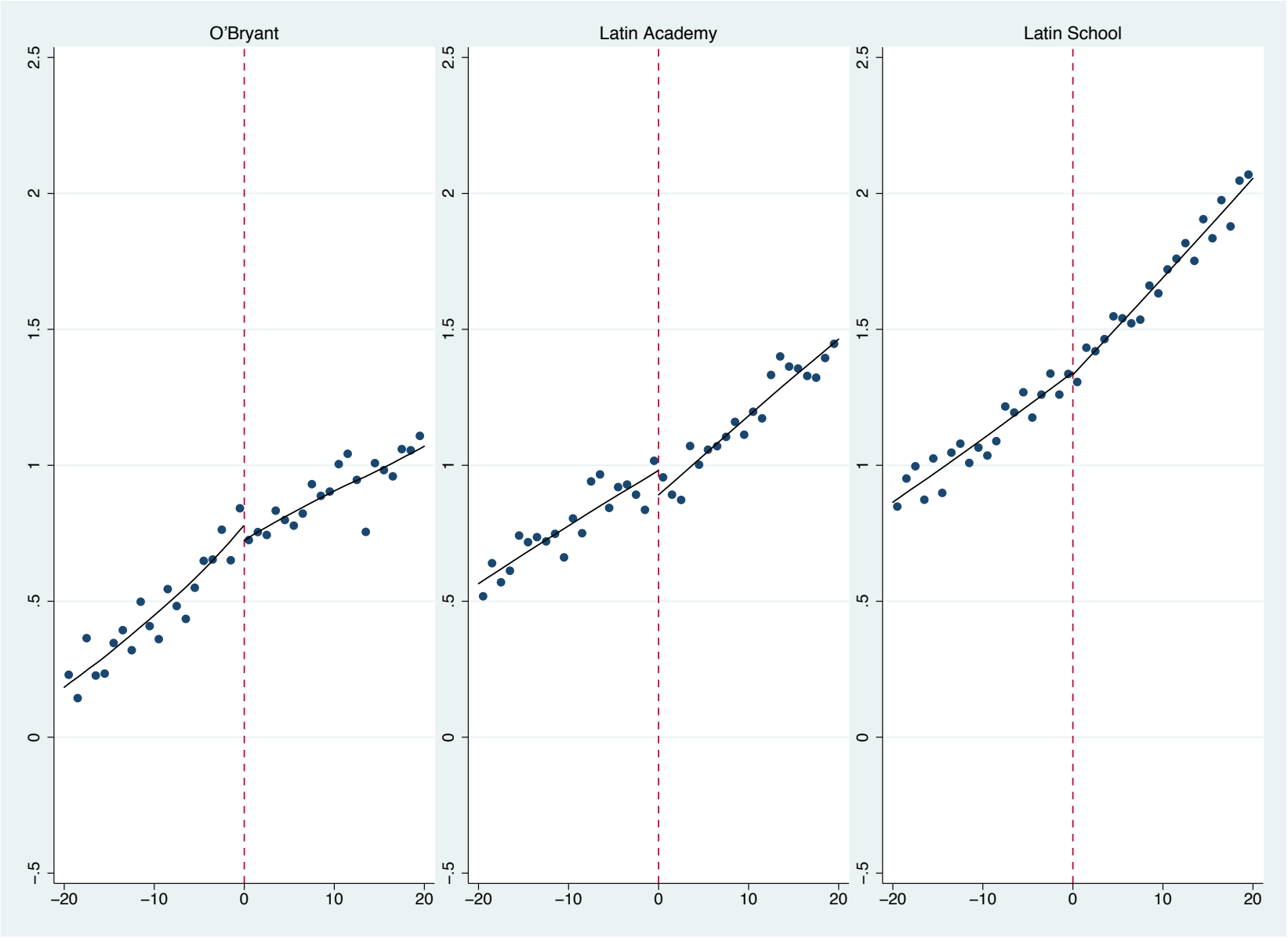

Figure 8. 7th (2006-2009) and 8th (1999-2009) Grade Math Scores for 7th Grade Applicants (1997-2007 / 2005-2008) in Boston

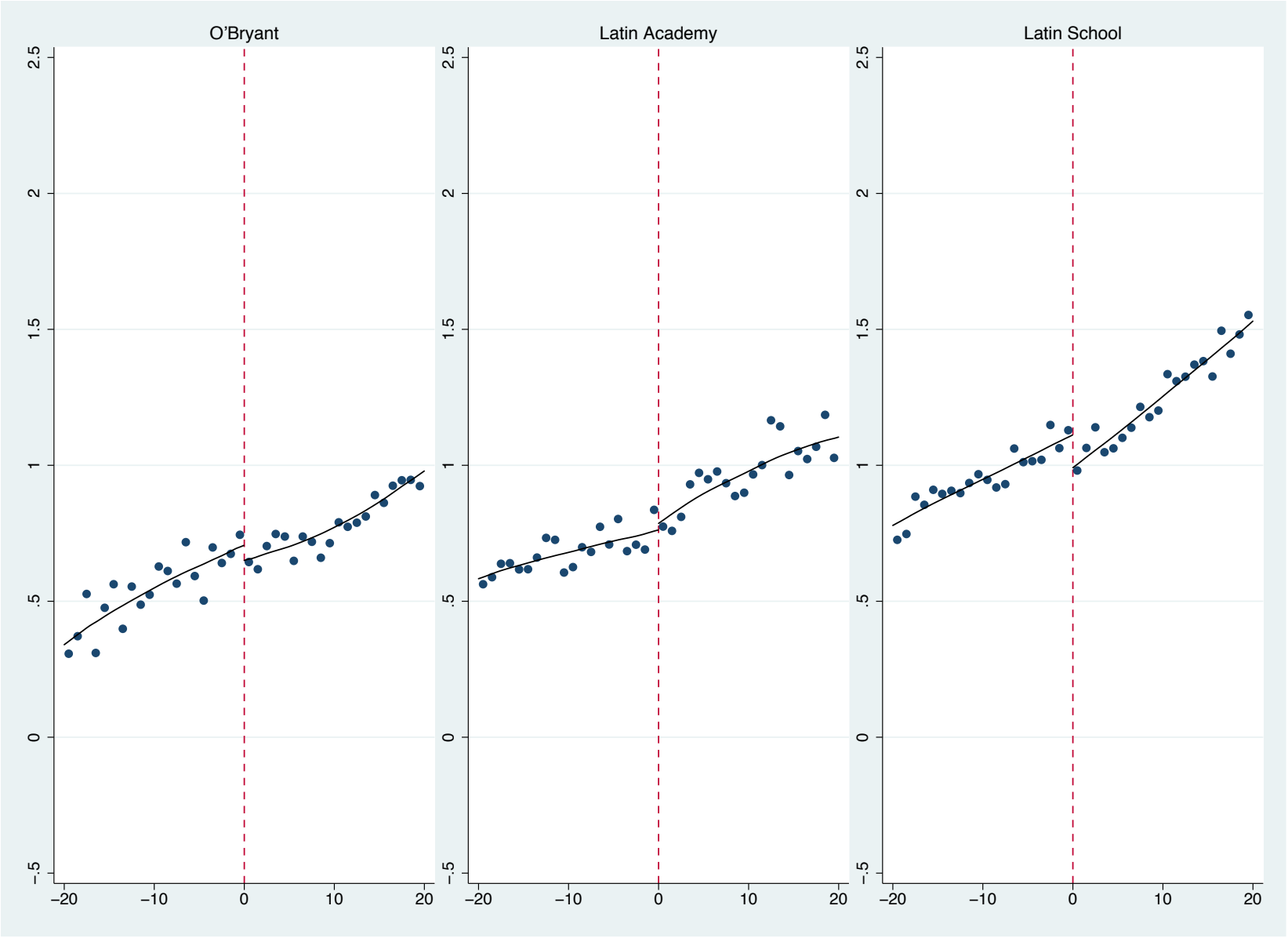

Figure 9. 7th (2001-2009) and 8th (2006-2009) Grade English Scores for 7th Grade Applicants (2000-2008 / 2004-2007) in Boston

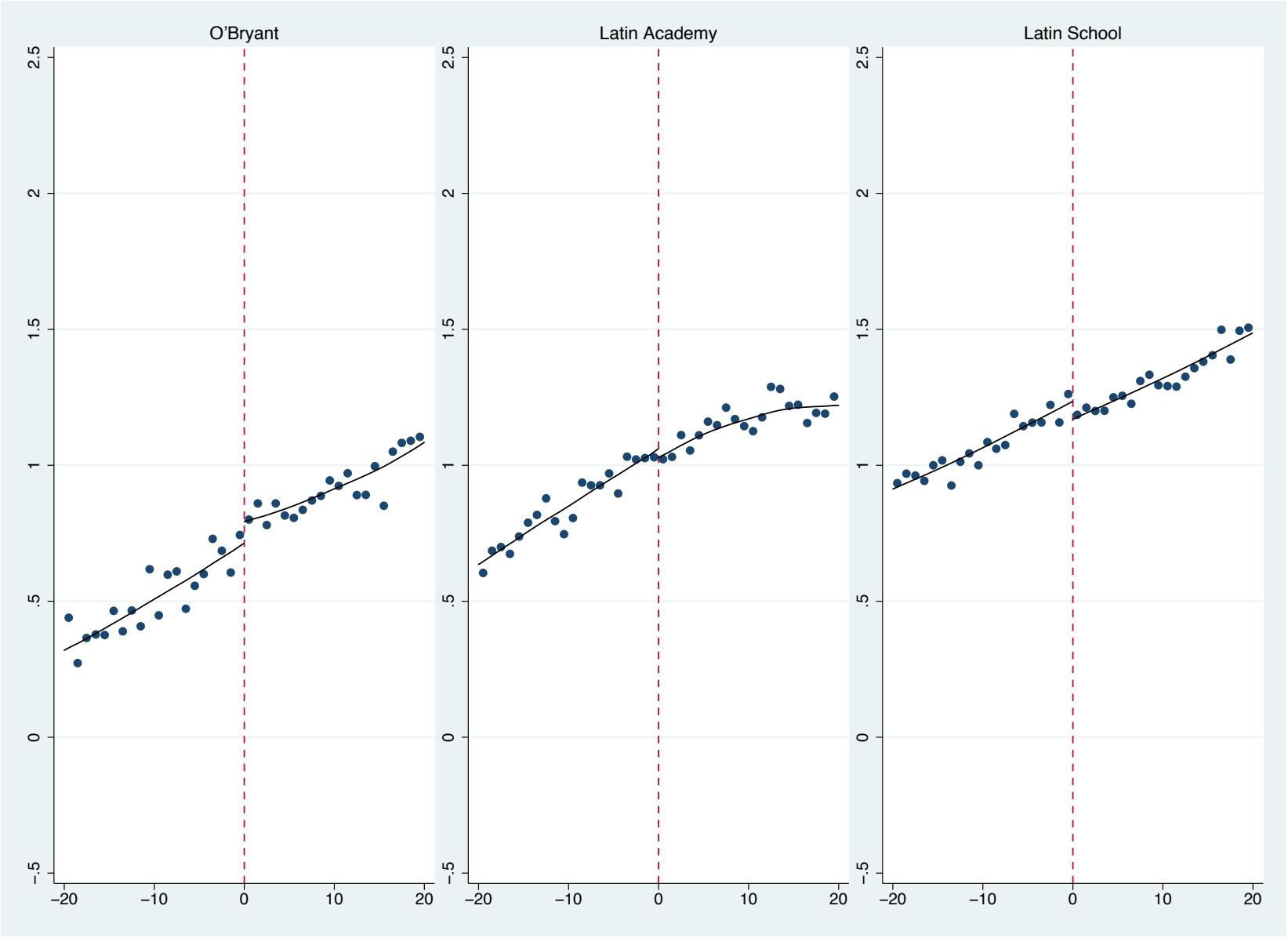

Figure 10. 10th Grade Math (2003-2009) Scores for 7th (1999-2005) and 9th (2001-2007) Grade Applicants in Boston

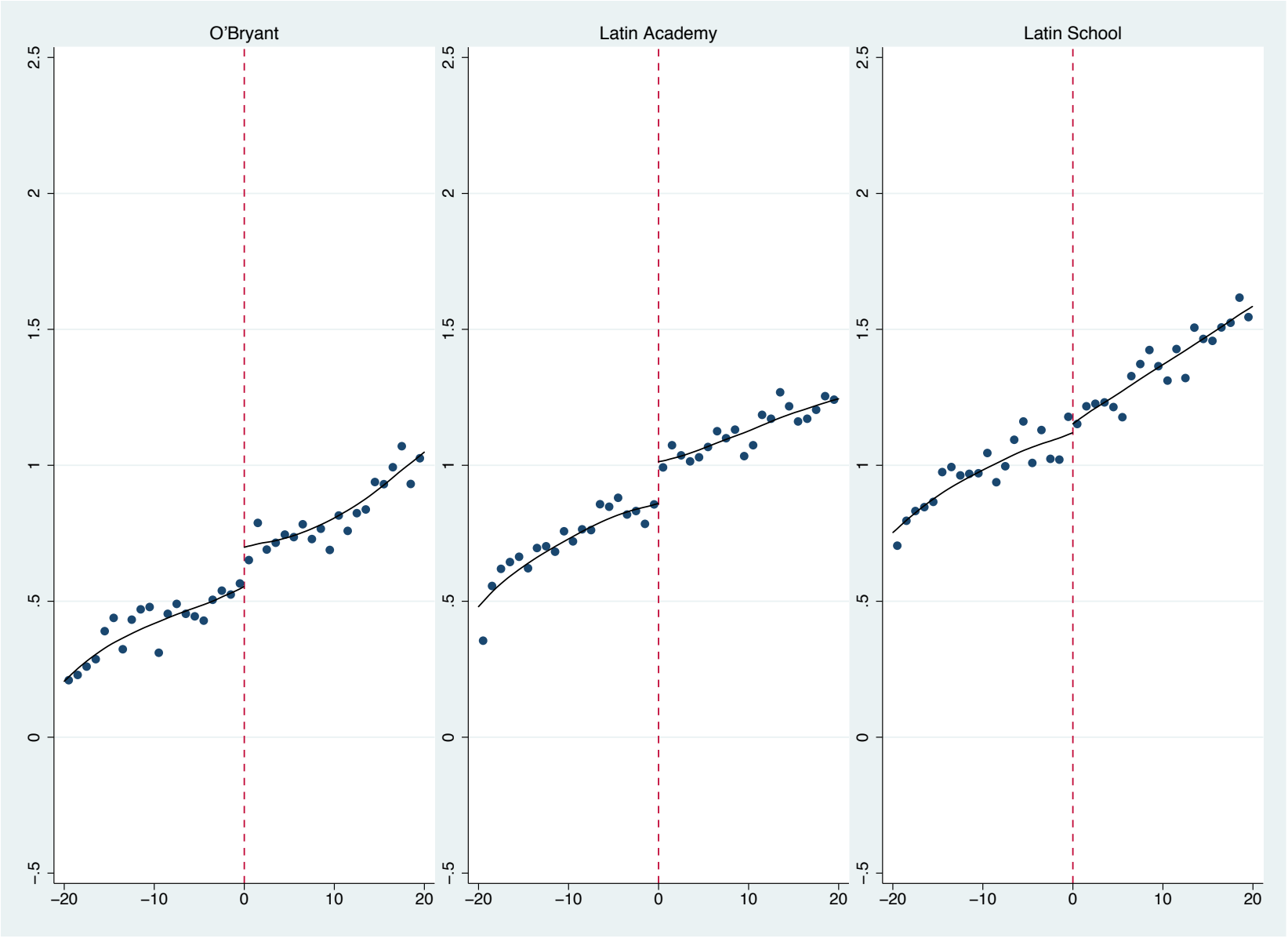

Figure 11. 10th Grade English (2003-2009) Scores for 7th (1999-2005) and 9th (2001-2007) Grade Applicants in Boston

Every Picture Tells a Story

- First Stage Effects
  - ✓ In the sample of applicants to school k, offers and enrollment at that school jump at C_k
  - ✓ At the O'Bryant and Latin Academy cutoffs, enrollment and years at *any* exam school also jump
  - ✓ We also see an approximate 0.5σ jump in baseline peer mean Math and English at the cutoff for each school
- Reduced Form Effects
  - ✓ No corresponding jumps in outcome CEFs, except perhaps for 10th grade ELA
  - ✓ The next task is to estimate jump sizes, and to put standard errors on these estimates

Reduced Form Estimation: Parametric

- School-specific parametric model

$$y_{itk} = \alpha_{tk} + \sum_j \delta_{jk} d_{ij} + (1 - D_{ik}) f_{0k}(r_{ik}) + D_{ik} f_{1k}(r_{ik}) + \rho_k D_{ik} + \eta_{itk}$$

  r_{ik}: standardized running variable for school k
  $D_{ik} = 1\{r_{ik} \geq 0\}$ (offer at school k); coefficient ρ_k
- Test year effects α_{tk} and dummies d_{ij} for application year and grade
- Third-order polynomial in standardized running variable (coefficients differ across cutoff):

$$f_{jk}(r_{ik}) = \pi_{jk} r_{ik} + \xi_{jk} r_{ik}^2 + \psi_{jk} r_{ik}^3; \quad j = 0, 1.$$

- These estimates reflect the fact that applicants to school k typically apply to more than one school and are likely to have (or lose) other options as distance from a given cutoff grows (Fig. 7)

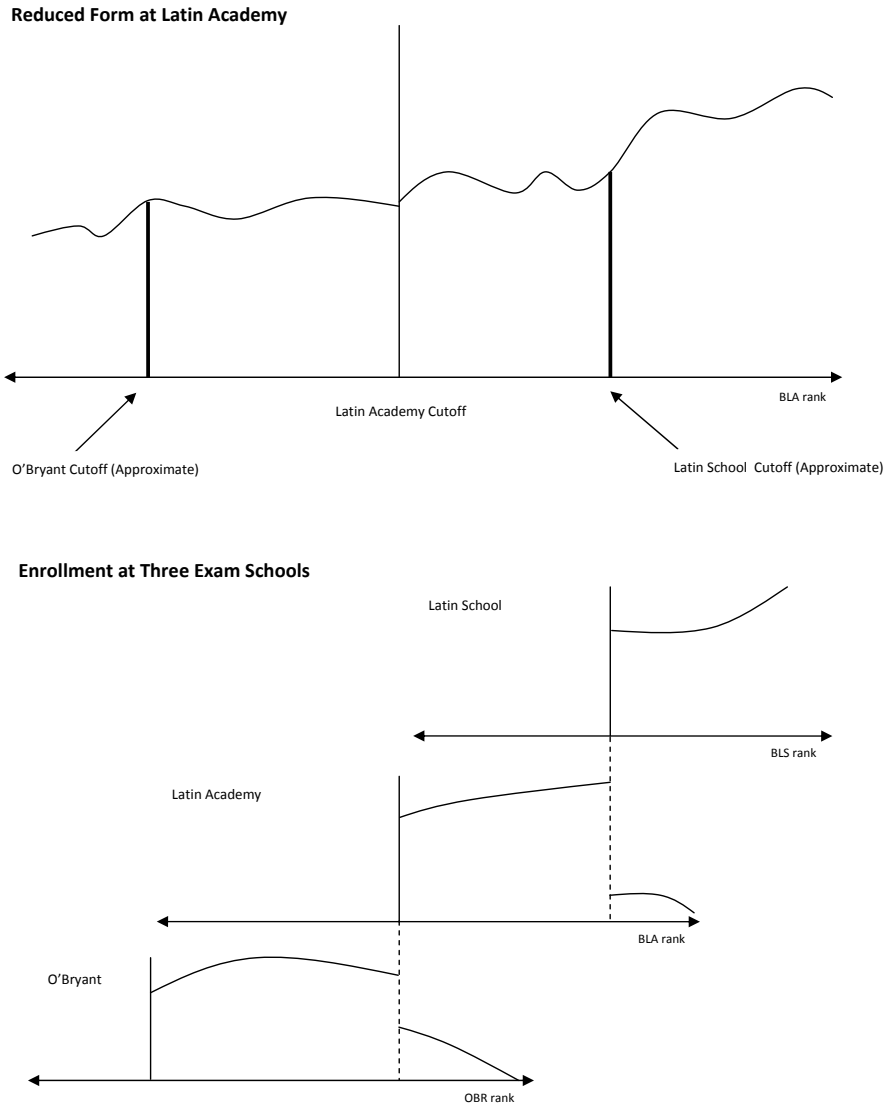

Figure 7. Reduced Form at Boston Latin Academy and Enrollment with Three Running Variables

Reduced Form Estimation: Non-parametric

- Non-parametric estimates use local linear regression with edge kernel and IK bandwidth (as in plots)
- Our non-parametric RD (IK) estimate is the estimate of ρ_k generated from a weighted least squares fit of:

$$\begin{aligned} y_{itk} = & \quad \alpha_{tk} + \sum_j \delta_{jk} d_{ij} + \gamma_{0k}(1 - D_{ik}) r_{ik} + \gamma_{1k} D_{ik} r_{ik} + \rho_k D_{ik} + \eta_{itk} \\ = & \quad \alpha_{tk} + \sum_j \delta_{jk} d_{ij} + \gamma_{0k} r_{ik} + \gamma_k^* D_{ik} r_{ik} + \rho_k D_{ik} + \eta_{itk} \end{aligned} \tag{1}$$

- How does this differ from parametric?
  - ✓ Weighted least squares instead of OLS
  - ✓ Sample may be smaller (though not necessarily)
  - ✓ Linear running variable controls
- Bandwidths can exceed window width: this means we use all the data in the window, but weights are still non-uniform

Stacking Schools

- To increase precision, we stack applicants to all three schools, interacting controls with application school dummies, imposing a single offer effect, ρ
- The stacked OLS ρ is a variance-of-treatment-weighted average of school-specific estimates (Angrist, 1998; these weights are efficient under constant effects)
- Some students apply to more than one school, so a student may contribute up to three observations, even for a single outcome; hence, we cluster on student ID in the stack
- All standard errors are clustered on year and school tested
- When schools are stacked or outcomes pooled, we apply school- and outcome-specific IK bandwidths
- Reduced form estimates appear in **Table 4**

Table 4. Boston Reduced Form Estimates - MCAS Math and English

		Parametric Estimates				Non-parametric (IK) Estimates			
Application Grade	Test Grade	O'Bryant (1)	Latin Academy (2)	Latin School (3)	All Schools (4)	O'Bryant (5)	Latin Academy (6)	Latin School (7)	All Schools (8)
					A. Math				
7th	7th and 8th	-0.121	-0.029	-0.038	-0.062	-0.091	-0.037	-0.026	-0.049
		(0.115)	(0.114)	(0.112)	(0.061)	(0.069)	(0.065)	(0.072)	(0.036)
		2779	2856	2610	8245	2590	2856	2537	7983
7th and 9th	10th	0.015	-0.031	-0.059	-0.024	0.051	-0.035	-0.063*	-0.011
		(0.099)	(0.078)	(0.065)	(0.043)	(0.055)	(0.044)	(0.035)	(0.027)
		1876	1822	1606	5304	1876	1803	1474	5153
7th and 9th	7th, 8th, and 10th	-0.065	-0.030	-0.046	-0.047	-0.030	-0.036	-0.038	-0.035
		(0.086)	(0.085)	(0.076)	(0.046)	(0.051)	(0.045)	(0.052)	(0.027)
		4655	4678	4216	13549	4466	4659	4011	13136
					B. English				
7th	7th and 8th	-0.186*	-0.079	-0.125	-0.129***	-0.091	-0.023	-0.115**	-0.079**
		(0.107)	(0.079)	(0.085)	(0.050)	(0.061)	(0.052)	(0.046)	(0.031)
		2505	2549	2257	7311	2087	1992	2173	6252
7th and 9th	10th	0.037	0.216*	0.058	0.103*	0.133**	0.206***	0.045	0.130***
		(0.104)	(0.121)	(0.086)	(0.061)	(0.060)	(0.058)	(0.064)	(0.036)
		1879	1825	1609	5313	1879	1633	1543	5055
7th and 9th	7th, 8th, and 10th	-0.088	0.046	-0.049	-0.030	0.025	0.091*	-0.045	0.022
		(0.074)	(0.079)	(0.072)	(0.044)	(0.043)	(0.047)	(0.046)	(0.028)
		4384	4374	3866	12624	3966	3625	3716	11307

Notes: This table reports estimates of the effects of exam school offers on MCAS scores. The discontinuity sample covers students within 10 standardized units of offer cutoffs. Parametric models include a cubic function of the running variable, allowed to differ on either side of offer cutoffs. IK estimates use the edge kernel, with bandwidth computed following Imbens and Kalyanaraman (2010). Optimal bandwidths were computed separately for each school. Robust standard errors, clustered on year and school are shown in parentheses. Standard errors for all schools estimates and for those pooling outcomes also cluster on student. The number of observations is reported below standard errors.

More Boston Reduced Forms

Threats to Validity:

- **Differential attrition**: are we equally likely to find winners' and losers' MCAS scores?
- **Covariate balance**

Minorities and Women:

- Why look at minorities?
- Historical and ongoing controversies surrounding minority representation at exam schools
- **Table 5**
  - Clearest evidence of gains come from minority ELA
  - Separate estimates for men and women show similar effects

Table 5. Boston Reduced Form Estimates for Subgroups

		By Race				By Sex	
Application Grade	Test Grade	Black (1)	Hispanic (2)	Black or Hispanic (3)	Not Black or Hispanic (4)	Men (5)	Women (6)
				A. Math			
7th	7th and 8th	-0.014	-0.137*	-0.078	-0.032	-0.016	-0.060
		(0.065)	(0.077)	(0.052)	(0.047)	(0.059)	(0.049)
		2363	1569	3759	3410	3386	4547
7th and 9th	10th	-0.031	-0.040	-0.031	-0.018	0.052	-0.051
		(0.051)	(0.070)	(0.049)	(0.034)	(0.035)	(0.036)
		1588	1001	2495	2281	2165	2990
7th and 9th	7th, 8th, and 10th	-0.021	-0.098*	-0.059	-0.026	0.014	-0.057
		(0.047)	(0.057)	(0.039)	(0.033)	(0.042)	(0.036)
		3951	2570	6254	5691	5551	7537
				B. English			
7th	7th and 8th	-0.026	-0.143**	-0.059	-0.083**	-0.058	-0.079*
		(0.047)	(0.070)	(0.043)	(0.042)	(0.052)	(0.041)
		2187	1431	3548	3144	2780	3829
7th and 9th	10th	0.192***	0.117	0.173***	0.070*	0.144***	0.109***
		(0.053)	(0.080)	(0.046)	(0.042)	(0.051)	(0.042)
		1560	962	2673	2355	2027	3028
7th and 9th	7th, 8th, and 10th	0.065	-0.048	0.045	-0.017	0.028	0.005
		(0.042)	(0.062)	(0.038)	(0.036)	(0.042)	(0.037)
		3747	2393	6221	5499	4807	6857

Notes: This table reports reduced form estimates for minorities and by sex. The table shows IK estimates with bandwidth computed as in the all schools model in Table 4.

* significant at 10%; ** significant at 5%; *** significant at 1%

Interpreting Boston RD

2SLS Estimates of Mediating Effects

- The second stage model for school k is:

$$y_{itk} = \Gamma_k' X_{itk} + \theta M_{it} + \epsilon_{itk}$$

  - ✓ X_{itk}: all controls (year of test, grade, application cohort, own- and other-school running variables)
  - ✓ M_{it}: exam school enrollment, years, or peer mean (to be instrumented), θ is the causal effect of interest
  - ✓ We can't say that any single M_{it} satisfies IV exclusion restrictions, but biases are likely positive, so 2SLS can be thought of as an upper bound on one-at-a-time casual effects

- The corresponding first stage includes the same controls as the second, plus three own-school offer dummies as instruments in the 3-school stack
- To boost precision, we add interactions between offer dummies and application cohort to the instrument list

2SLS Results

Table 6 reports first stage and 2SLS estimates.

- Enrollment and years first stages are greatest at O'Bryant; the peer mean first stage is large at BLS
- 2SLS estimates of enrollment and years effects are negative or small; the corresponding OLS estimates (with and without ISEE controls) are mostly outside these confidence intervals
- Although we see strong peer first stages of roughly 0.4-0.8σ at each school, there is no evidence of peer effects on scores
- The most precisely estimated peer effects come with standard errors approaching 0.04σ; significantly different from large positive OLS estimates in Table 3

Table 6. Boston 2SLS Estimates for Enrollment, Years in Exam School, and Peer Means

	Instrument: Offer Indicators						Instrument: Offer Indicators x Application Cohort					
	Math			English			Math			English		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	2SLS Estimates						*2SLS Estimates*					
Enrollment	-0.050			0.053			-0.010			0.032		
	(0.069)			(0.058)			(0.066)			(0.057)		
Exam Years		-0.024			0.026			0.003			0.018	
		(0.033)			(0.031)			(0.032)			(0.030)	
Peer Mean			-0.089*			-0.001			-0.040			0.001
			(0.049)			(0.052)			(0.043)			(0.046)
	First Stage Estimates											
O'Bryant	0.730***	1.530***	0.753***	0.737***	1.403***	0.687***						
	(0.064)	(0.125)	(0.073)	(0.068)	(0.127)	(0.070)						
Latin Academy	0.118**	0.219*	0.388***	0.142**	0.227	0.378***						
	(0.057)	(0.128)	(0.085)	(0.062)	(0.143)	(0.079)						
Latin School	0.032	0.072	0.628***	0.022	0.045	0.534***						
	(0.022)	(0.053)	(0.093)	(0.022)	(0.058)	(0.080)						
N	13130	13136	11116	11305	11307	10604	13130	13136	11116	11305	11307	10604

Notes: This table reports two-stage least squares (2SLS) estimates of the effects of exam school enrollment, years spent in exam school, and mean baseline peer achievement on MCAS scores. The table shows IK estimates using the reduced form bandwidths computed for Table 4. Excluded instruments for columns 1-6 are three offer dummies. Columns 7-12 show the results of adding cohort interactions to the instrument list.

* significant at 10%; ** significant at 5%; *** significant at 1%

The Wrong Pond?

- An alternative view of peer effects is that achievement and other outcomes are affected by students' *relative position* in the peer ability distribution
- Marsh, et al. (1995) and others call this sort of peer effect the "Big Fish Little Pond Effect"
- Bui, Craig, and Imberman, et al. (2011) argue that BFLPE can explain the failure to find benefits from a gifted and talented program
- Exam school admission is indeed associate with a decline in applicants' rank in the baseline score distribution among peers
- This is documented in **Figures 13-14**, though note that as far as *baseline* scores go, marginal admits don't fall to the bottom or even much below about 0.4

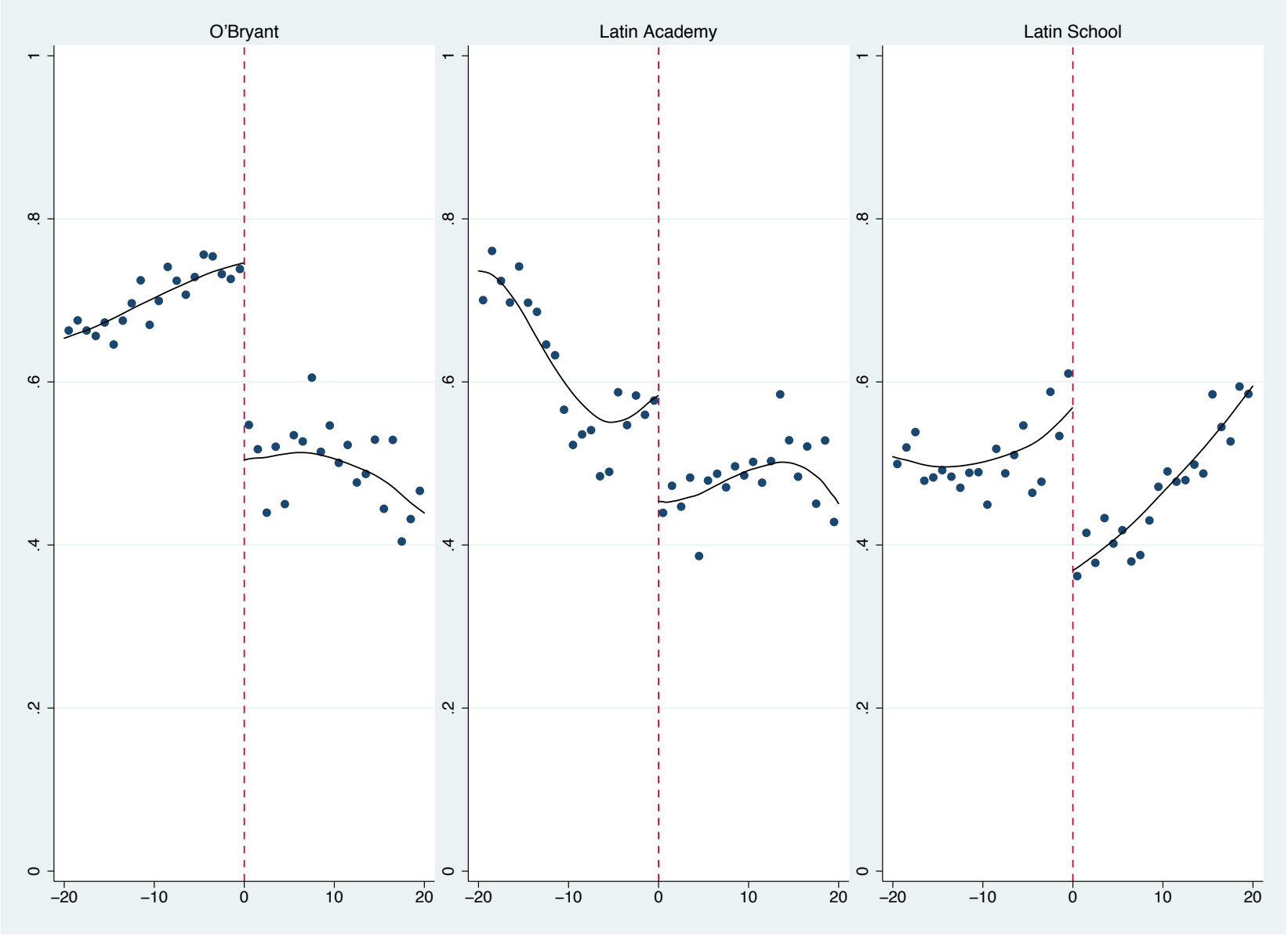

Figure 13. Rank in Baseline Math for 7th Grade Applicants (1997-2008) in Boston

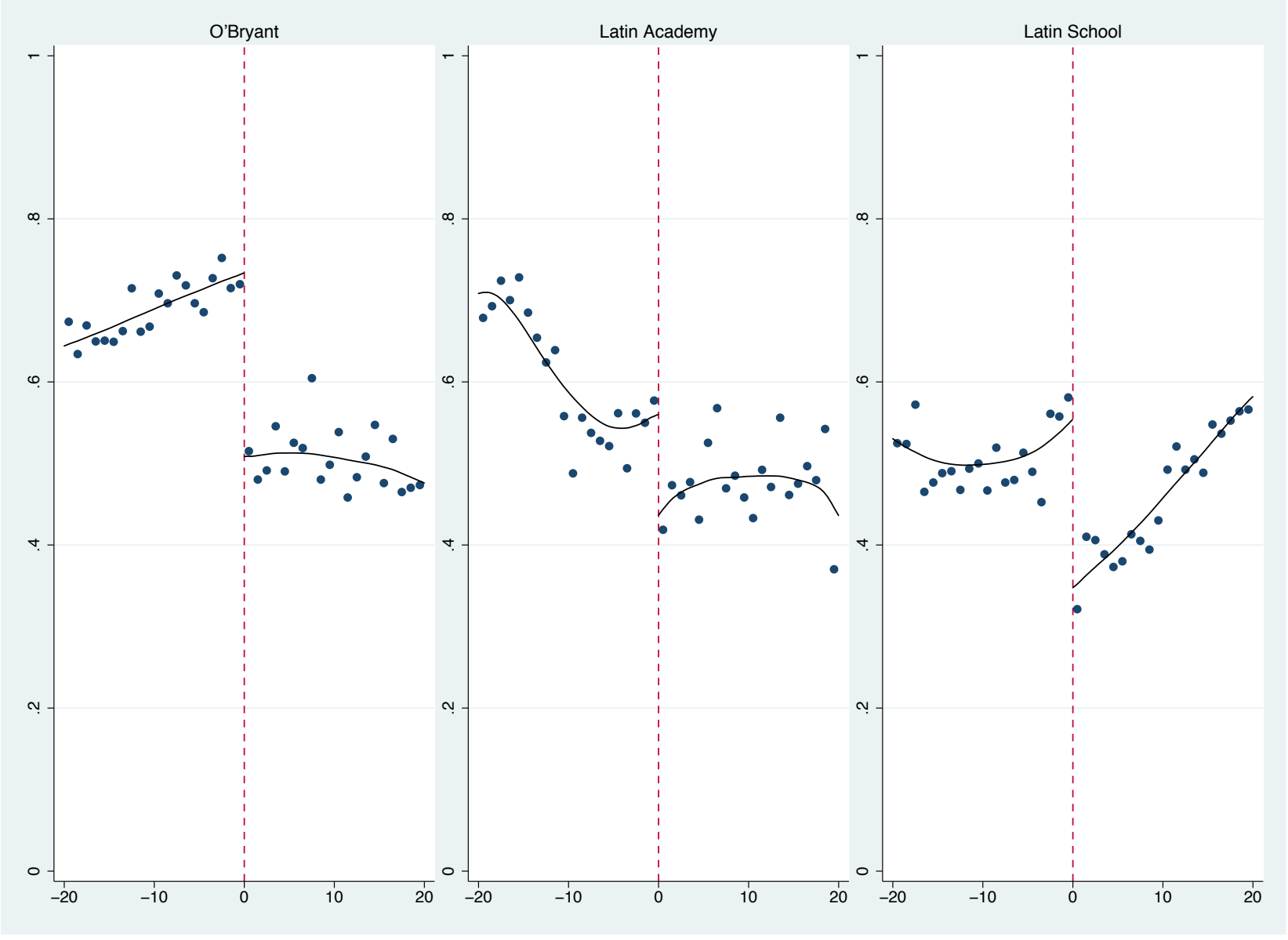

Figure 14. Rank in Baseline English for 7th Grade Applicants (1997-2008) in Boston

BFLPE Parameterization

- We capture BFLPE through baseline score gap interactions

  b_i: student i's baseline score
  $\bar{b}_{(i)k}$: student i's baseline peer mean at targeted exam school k
  $g_{ik} \equiv (b_i - \bar{b}_{(i)k})$ is student i's *potential peer gap*

- How do exam school effects change as a function of the potential peer gap?
- 2SLS model with peer gap interactions

$$y_{itk} = \Gamma_k' X_{itk} + \theta_0 E_{it} + \theta_1 E_{it} g_{ik} + \epsilon_{itk},$$

  with endogenous variables E_{it} (exam school enrollment) and $E_{it}g_{ik}$ (exam school enrollment interacted with potential peer gap)

- The instruments in this case are offer cutoff indicators, D_{ik}, and the cutoff indicator times the potential peer gap, $D_{ik}g_{ik}$
- IK estimates of θ_1: -0.08 for Math, -0.12 for ELA in pooled stack, not sig. and negative (inconsistent with BFLPE; para. ests. sig. neg.)

External Validity

X-Validity Part 1: High Baseline Scorers

- Why look at applicants with high baseline scorers?
- RD estimates need not be informative for students at the upper end of the *admissions* score distribution
  - ✓ Any single test is a noisy measure of ability, so we can look at students in the upper tail of the *baseline* score distribution
  - ✓ Some high-baseline students are ultra high achievers who earned marginal ISEE scores by chance
  - ✓ Average baseline score for upper half students is $1.2 - 1.4\sigma$ in Math and English
  - ✓ MCAS scores are still informative for these high achievers (Many score below MCAS Advanced)
- **High Baseline results**

Table 7. Boston Estimates for High Achievers and Away from Admission Cutoffs

		Conditional on Baseline				Extrapolation			
		Baseline in Upper Half		Baseline in Upper Quartile		Parametric		Non-parametric (IK)	
Application Grade	Test Grade	Baseline Mean (1)	Estimates (2)	Baseline Mean (3)	Estimates (4)	1 unit away from cutoff (5)	5 units away from cutoff (6)	1 unit away from cutoff (7)	Derivative (8)
						A. Math			
7th	7th and 8th	1.445	-0.104**	2.045	-0.040	-0.143	-0.740	-0.047	0.001
			(0.050)		(0.087)	(0.107)	(0.646)	(0.039)	(0.007)
		3768	3831	1723	1742	8245	8245	7983	7983
7th and 9th	10th	1.334	-0.007	1.779	-0.020	-0.058	-0.352	-0.015	-0.006
			(0.028)		(0.031)	(0.072)	(0.430)	(0.028)	(0.006)
		3469	3163	1935	1948	5304	5304	5153	5153
7th and 9th	7th, 8th, and 10th	1.392	-0.060*	1.904	-0.029	-0.109	-0.586	-0.035	-0.001
			(0.032)		(0.047)	(0.079)	(0.465)	(0.029)	(0.006)
		7237	6994	3658	3690	13549	13549	13136	13136
						B. Englis			
7th	7th and 8th	1.336	-0.095***	1.758	-0.114**	-0.166**	-0.677	-0.075**	0.004
			(0.036)		(0.058)	(0.081)	(0.487)	(0.033)	(0.007)
		4159	3767	1922	1752	7311	7311	6252	6252
7th and 9th	10th	1.200	0.074*	1.501	0.087**	0.023	-0.619	0.130***	0.000
			(0.039)		(0.043)	(0.089)	(0.475)	(0.038)	(0.005)
		3206	3065	1770	1568	5313	5313	5055	5055
7th and 9th	7th, 8th, and 10th	1.277	-0.013	1.635	-0.022	-0.085	-0.657*	0.023	0.001
			(0.033)		(0.046)	(0.068)	(0.380)	(0.030)	(0.004)
		7365	6832	3692	3320	12624	12624	11307	11307

Notes: This table reports reduced form estimates for students with high baseline scores and for applicants away from admission cutoffs. Baseline means and the proportion of applicants at an advanced level are computed for those who belong to at least one discontinuity sample. Conditional on baseline are IK estimates with bandwidth computed as in the all schools model in Table 4. Parametric extrapolation estimates use the parametric model to form counterfactuals 1 and 5 units from the cutoff. Non-parametric estimates are based on Taylor-type approximations of the derivative of the treatment effect at the cutoff.

* significant at 10%; ** significant at 5%; *** significant at 1%

Extrapolating Away from the Cutoff

- Modeling potential-outcome CEFs with polynomials, we have

$$\begin{aligned} E[\mathrm{Y}_{0i}|r_i] &= \alpha + \beta_{01} r_i + \beta_{02} r_i^2 + ... + \beta_{0p} r_i^p \\ E[\mathrm{Y}_{1i}|r_i] &= \alpha + \rho + \beta_{11} r_i + \beta_{12} r_i^2 + ... + \beta_{1p} r_i^p, \end{aligned}$$

- Substituting in $E[\mathrm{Y}_i|r_i] = E[\mathrm{Y}_{0i}|r_i] + E[\mathrm{Y}_{1i} - \mathrm{Y}_{0i}|r_i]D_i$ we have

$$\begin{aligned} \mathrm{Y}_i &= \alpha + \beta_{01} r_i + \beta_{02} r_i^2 + ... + \beta_{0p} r_i^p \\ &\quad + \rho \mathrm{D}_i + \beta_1^* \mathrm{D}_i r_i + \beta_2^* \mathrm{D}_i {r_i}^2 + ... + \beta_p^* \mathrm{D}_i {r_i}^p + \eta_i, \end{aligned}$$

- The treatment effect at $r_i = cs$ is (see **figure**)

$$\tau(c) \equiv E[\mathrm{Y}_{1i} - \mathrm{Y}_{0i}|r_i = c] = \rho + \beta_1^* c + \beta_2^* c^2 + ... + \beta_p^* c^p$$

- Alternately, Dong and Lewbel (2011) propose local extrapolation:

$$\tau(c) \approx \tau(0) + \tau'(c) \cdot c.$$

- $\tau'(c)$ is estimated by the IK interaction term, γ_k^* in (**??**)

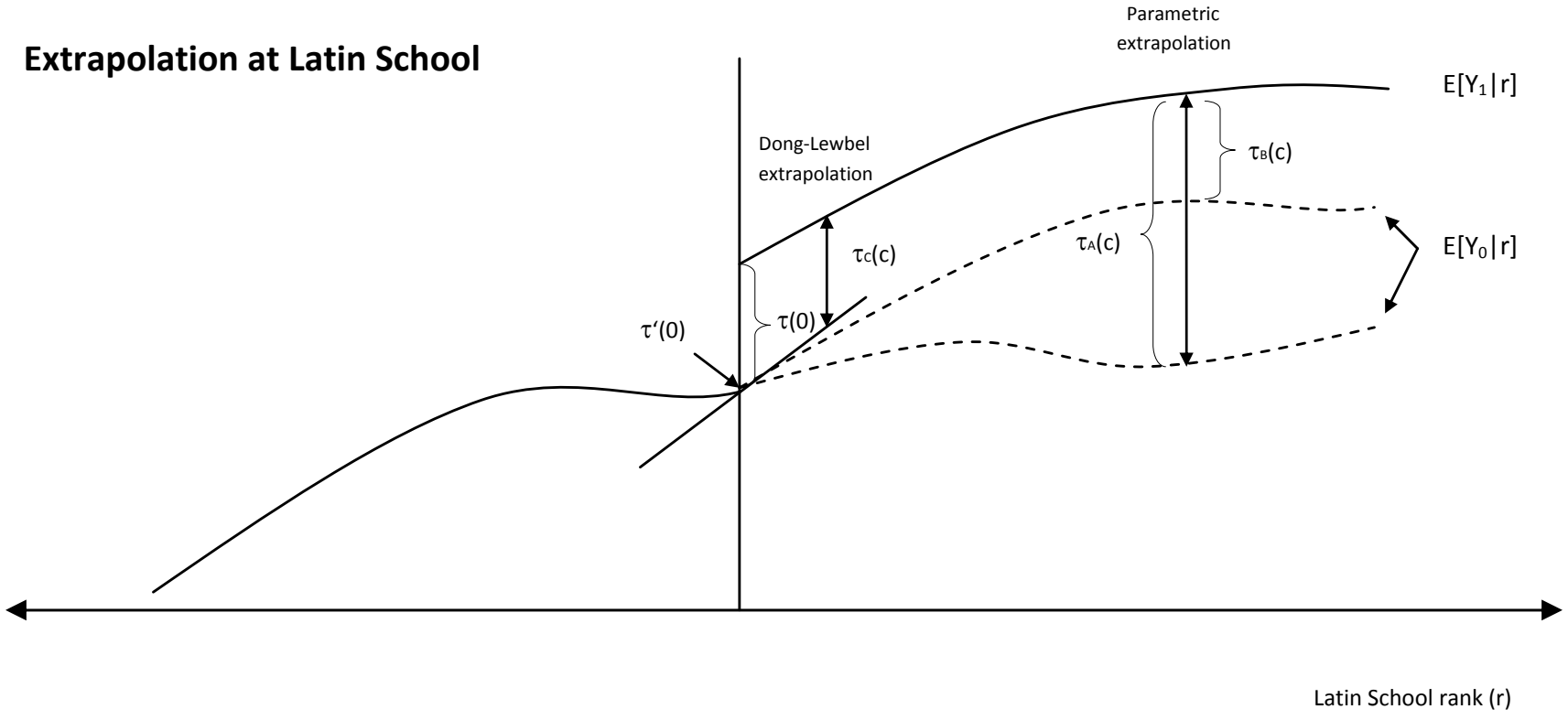

Figure 14. Parametric and non-parametric extrapolation above the cutoff.

Table 7. Boston Estimates for High Achievers and Away from Admission Cutoffs

		Conditional on Baseline				Extrapolation			
		Baseline in Upper Half		Baseline in Upper Quartile		Parametric		Non-parametric (IK)	
Application Grade	Test Grade	Baseline Mean (1)	Estimates (2)	Baseline Mean (3)	Estimates (4)	1 unit away from cutoff (5)	5 units away from cutoff (6)	1 unit away from cutoff (7)	Derivative (8)
						A. Math			
7th	7th and 8th	1.445	-0.104**	2.045	-0.040	-0.143	-0.740	-0.047	0.001
			(0.050)		(0.087)	(0.107)	(0.646)	(0.039)	(0.007)
		3768	3831	1723	1742	8245	8245	7983	7983
7th and 9th	10th	1.334	-0.007	1.779	-0.020	-0.058	-0.352	-0.015	-0.006
			(0.028)		(0.031)	(0.072)	(0.430)	(0.028)	(0.006)
		3469	3163	1935	1948	5304	5304	5153	5153
7th and 9th	7th, 8th, and 10th	1.392	-0.060*	1.904	-0.029	-0.109	-0.586	-0.035	-0.001
			(0.032)		(0.047)	(0.079)	(0.465)	(0.029)	(0.006)
		7237	6994	3658	3690	13549	13549	13136	13136
						B. English			
7th	7th and 8th	1.336	-0.095***	1.758	-0.114*	-0.166**	-0.677	-0.075**	0.004
			(0.036)		(0.058)	(0.081)	(0.487)	(0.033)	(0.007)
		4159	3767	1922	1752	7311	7311	6252	6252
7th and 9th	10th	1.200	0.074*	1.501	0.087**	0.023	-0.619	0.130***	0.000
			(0.039)		(0.043)	(0.089)	(0.475)	(0.038)	(0.005)
		3206	3065	1770	1568	5313	5313	5055	5055
7th and 9th	7th, 8th, and 10th	1.277	-0.013	1.635	-0.022	-0.085	-0.657*	0.023	0.001
			(0.033)		(0.046)	(0.068)	(0.380)	(0.030)	(0.004)
		7365	6832	3692	3320	12624	12624	11307	11307

Notes: This table reports reduced form estimates for students with high baseline scores and for applicants away from admission cutoffs. Baseline means and the proportion of applicants at an advanced level are computed for those who belong to at least one discontinuity sample. Conditional on baseline are IK estimates with bandwidth computed as in the all schools model in Table 4. Parametric extrapolation estimates use the parametric model to form counterfactuals 1 and 5 units from the cutoff. Non-parametric estimates are based on Taylor-type approximations of the derivative of the treatment effect at the cutoff.

* significant at 10%; ** significant at 5%; *** significant at 1%

More from Boston

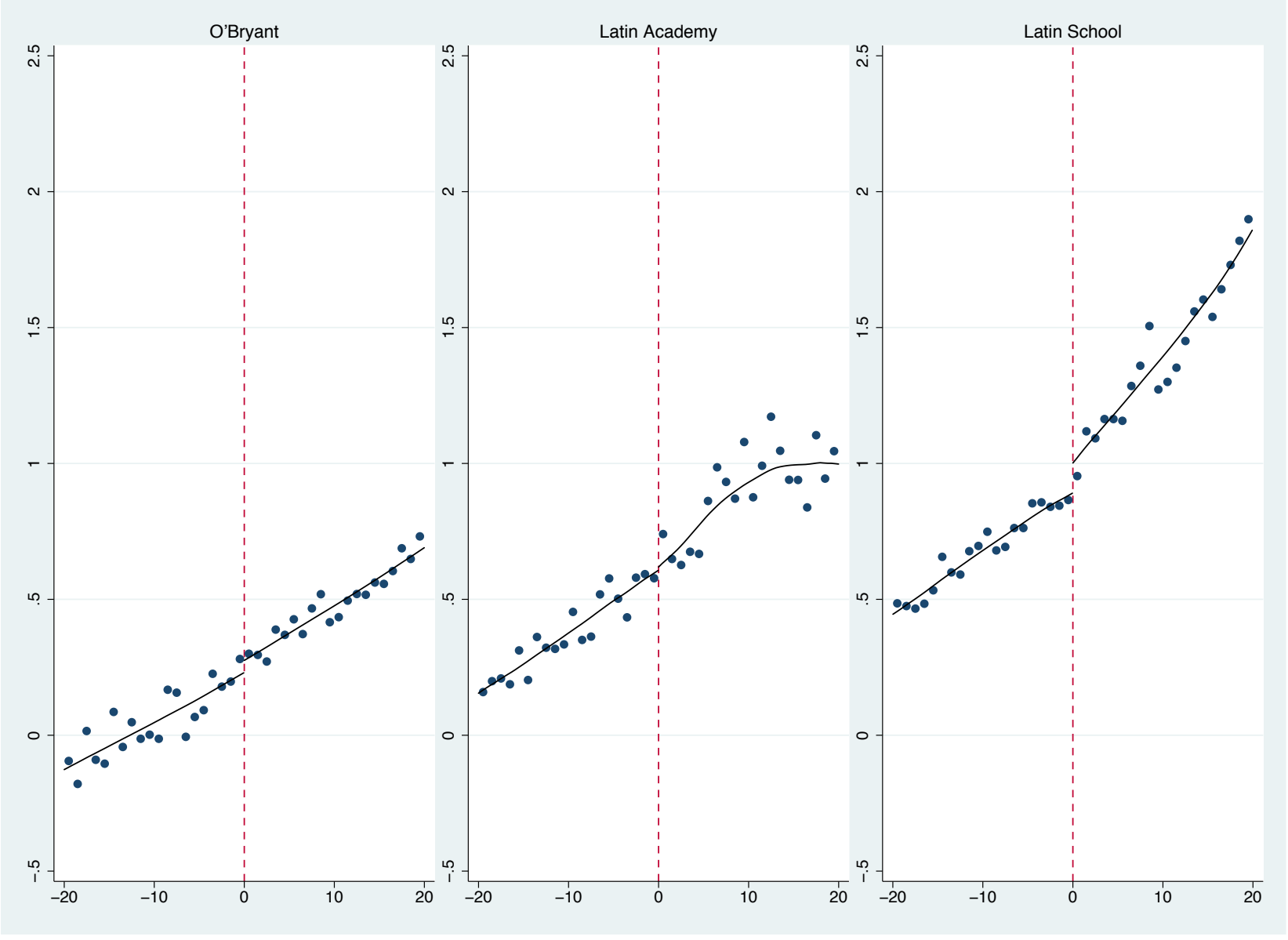

Figure 15. PSAT Scores for 7th (2000-2005) and 9th (2002-2007) Grade Applicants in Boston

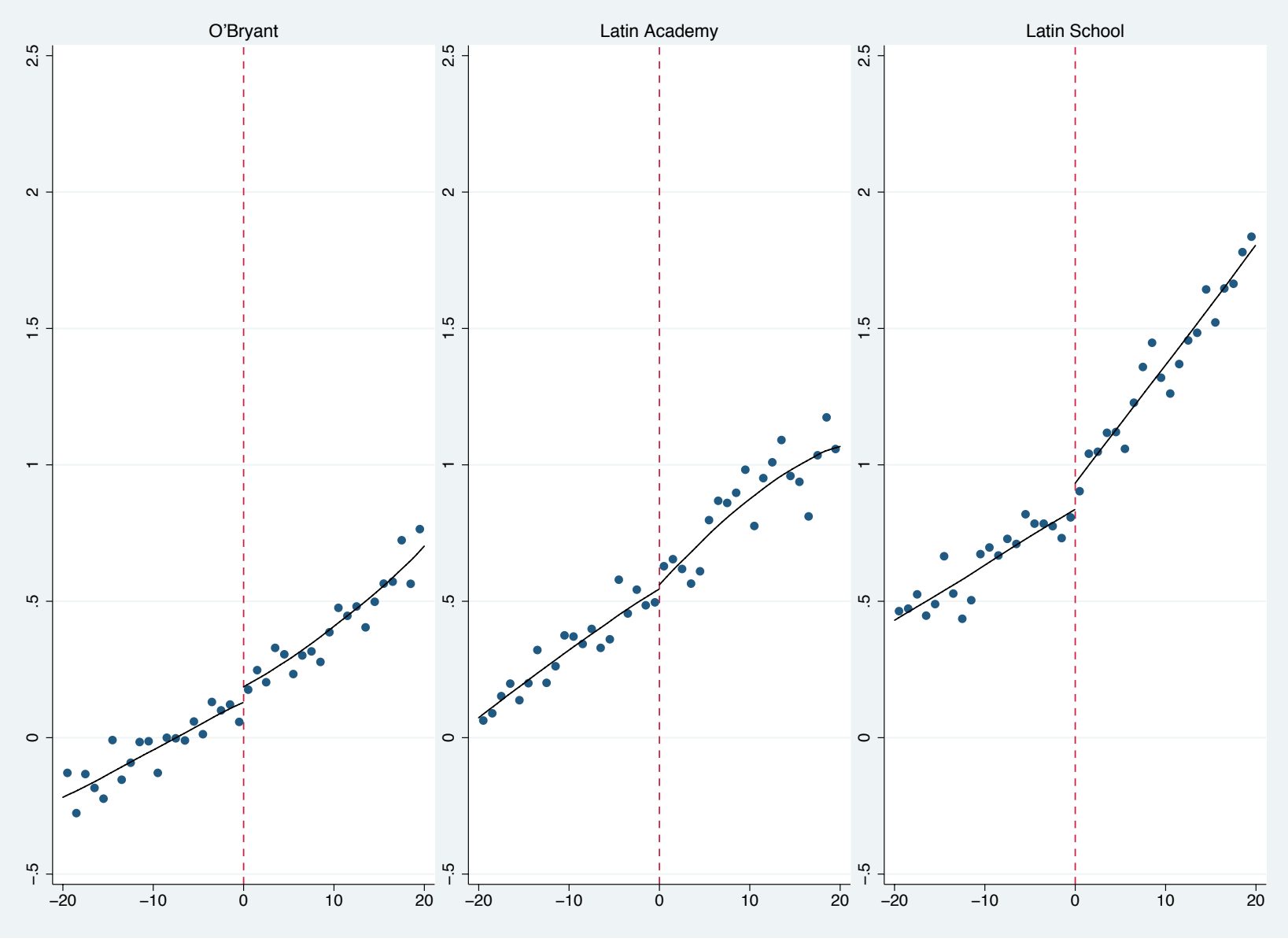

Figure 16. SAT Scores for 7th (2000-2005) and 9th (2001-2006) Grade Applicants in Boston

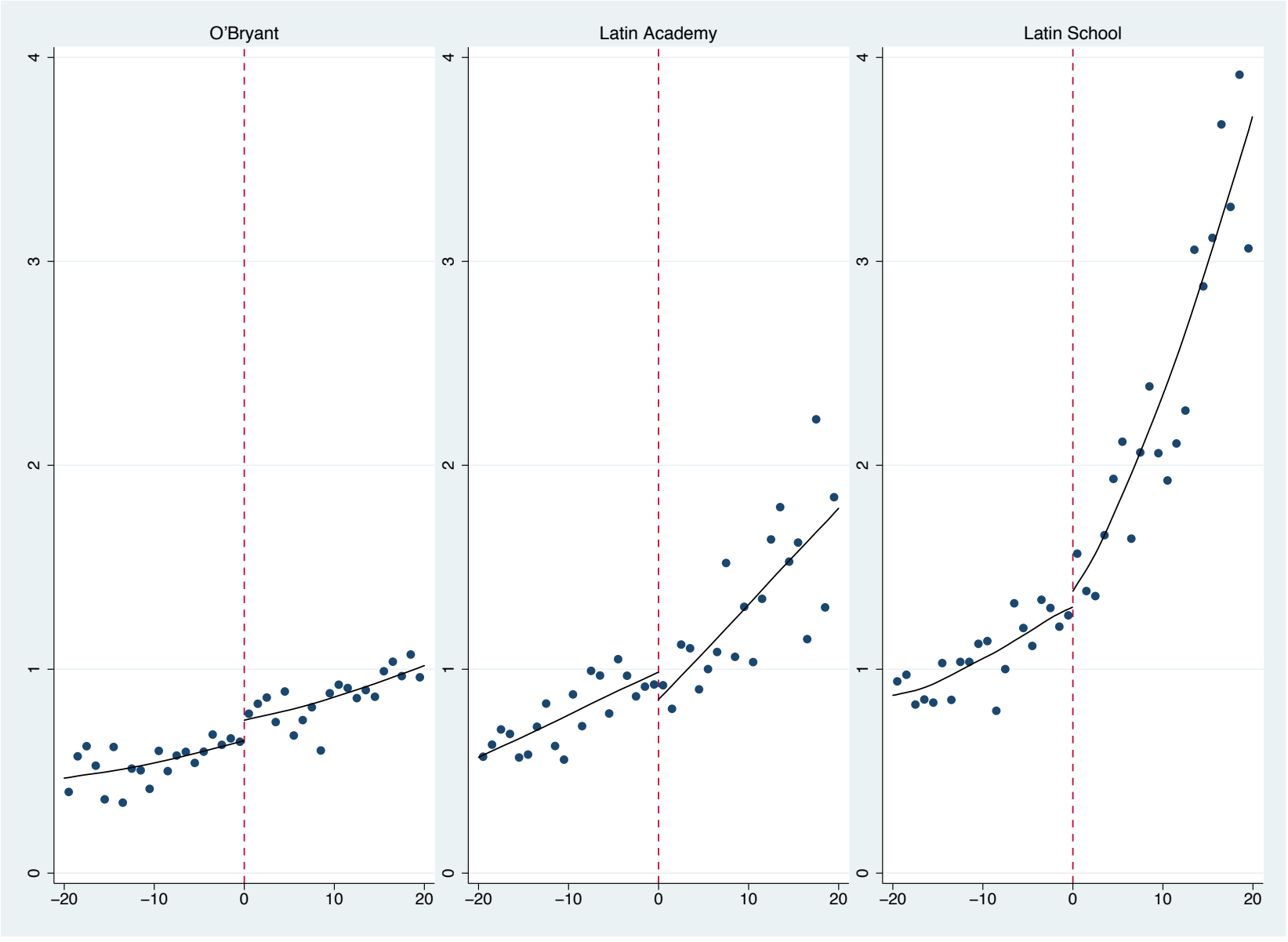

Figure 17. Number of AP Classes for 7th (1999-2004) and 9th (2001-2006) Grade Applicants in Boston

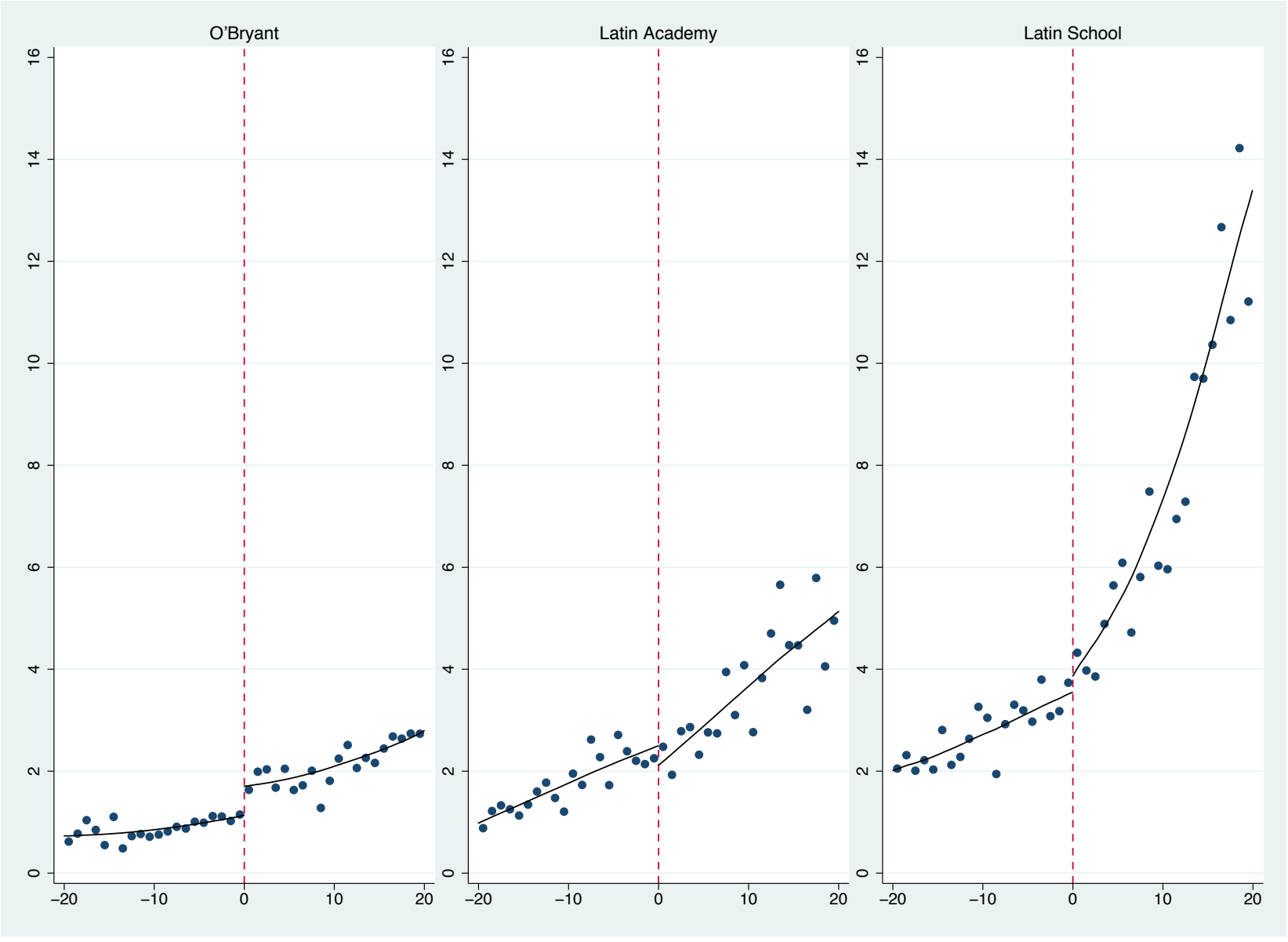

Figure 18. Sum of AP Scores for 7th (1999-2004) and 9th (2001-2006) Grade Applicants in Boston

Table 8. Boston Reduced Form Estimates - PSAT and SAT Scores

	Probability Tested				Test Score for Takers			
Application Grade	O'Bryant (1)	Latin Academy (2)	Latin School (3)	All Schools (4)	O'Bryant (5)	Latin Academy (6)	Latin School (7)	All Schools (8)
				A. PSAT				
7th	0.101**	0.103**	-0.072	0.050*	0.048	-0.075	0.021	0.001
	(0.051)	(0.048)	(0.049)	(0.030)	(0.074)	(0.060)	(0.067)	(0.036)
	1366	1348	1164	3878	917	965	890	2772
9th	0.116**	-0.008	0.113	0.073**	-0.100	0.205***	0.036	0.036
	(0.056)	(0.053)	(0.071)	(0.034)	(0.104)	(0.068)	(0.120)	(0.055)
	889	701	442	2032	478	376	328	1182
7th and 9th	0.107***	0.069*	-0.034	0.058**	0.004	0.007	0.025	0.011
	(0.038)	(0.037)	(0.041)	(0.023)	(0.059)	(0.050)	(0.063)	(0.032)
	2255	2049	1606	5910	1395	1341	1218	3954
				B. SAT				
7th	0.060	0.111**	0.026	0.067**	0.091	-0.107*	0.111	0.020
	(0.054)	(0.052)	(0.052)	(0.031)	(0.085)	(0.057)	(0.083)	(0.042)
	1349	1354	1207	3910	623	855	860	2338
9th	0.040	-0.065	0.019	0.003	0.017	0.360***	0.189**	0.139**
	(0.064)	(0.069)	(0.078)	(0.039)	(0.083)	(0.111)	(0.081)	(0.056)
	859	716	533	2108	550	318	299	1167
7th and 9th	0.052	0.057	0.024	0.046*	0.052	0.001	0.129*	0.059*
	(0.041)	(0.042)	(0.043)	(0.025)	(0.063)	(0.043)	(0.069)	(0.035)
	2208	2070	1740	6018	1173	1173	1159	3505

Notes: This table reports estimates of the effects of exam school offers on PSAT and SAT test taking and scores. Outcome-specific IK estimates, bandwidths, and standard errors were computed as for Table 4.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 9. Boston Reduced Form Estimates - AP Exams

	Number of Exams				Sum of Scores			
Application Grade	O'Bryant (1)	Latin Academy (2)	Latin School (3)	All Schools (4)	O'Bryant (5)	Latin Academy (6)	Latin School (7)	All Schools (8)
				A. All Exams				
7th	0.180	-0.099	0.205	0.110	1.049***	-0.205	0.573	0.562**
	(0.149)	(0.233)	(0.176)	(0.091)	(0.359)	(0.671)	(0.491)	(0.266)
	864	787	898	2549	864	724	868	2456
9th	-0.127	0.100	-0.103	-0.057	-0.004	0.849	-0.181	0.188
	(0.262)	(0.318)	(0.367)	(0.142)	(0.605)	(1.086)	(1.232)	(0.392)
	626	391	370	1387	509	342	342	1193
7th and 9th	0.065	-0.033	0.120	0.055	0.710*	0.126	0.378	0.450**
	(0.162)	(0.207)	(0.178)	(0.084)	(0.365)	(0.560)	(0.487)	(0.227)
	1490	1178	1268	3936	1373	1066	1210	3649
				B. Exams with 500+ Takers				
7th	0.108	-0.105	0.020	0.022	0.690**	-0.458	0.073	0.209
	(0.131)	(0.212)	(0.157)	(0.074)	(0.287)	(0.585)	(0.452)	(0.196)
	864	699	867	2430	864	652	859	2375
9th	-0.285	0.141	-0.353	-0.171	-0.435	0.901	-0.602	-0.105
	(0.248)	(0.288)	(0.320)	(0.138)	(0.518)	(1.009)	(0.961)	(0.363)
	580	444	401	1425	482	363	402	1247
7th and 9th	-0.035	-0.009	-0.093	-0.046	0.351	0.026	-0.134	0.110
	(0.146)	(0.183)	(0.161)	(0.076)	(0.291)	(0.527)	(0.434)	(0.176)
	1444	1143	1268	3855	1346	1015	1261	3622

Notes: This table reports estimates of effects of exam school offers on AP test taking and scores. Tests with 500+ or more takers are Calculus AB/BC, Statistics, Biology, Chemistry, Physics B/C, English Language and Composition, English Literature and Composition, European History, US Government and Politics, US History, Microeconomics, and Macroeconomics. Outcome-specific IK estimates, bandwidths, and standard errors were computed as for Table 4.

* significant at 10%; ** significant at 5%; *** significant at 1%

New York RD

New York Data and Samples

- We start with exam school applicants from 2003/4-2006/7; limited to NYC public school 8th graders applying for 9th grade seats
- Data on these applicants, including their SHSAT scores, were matched to registration and enrollment files for NYC public school students

Outcomes

- New York State Regents scores; standardized by test and year
- Regents scores are not an ideal outcome
  - ✓ Locally graded, ongoing concerns about "scrubbing"
  - ✓ Although a minimal subset is required for a local diploma, students can choose when to be tested and in what
- We focus on 4 required subjects for local diploma (Math, Global History, US History, ELA), plus Living Environment and Advanced Math, which fulfill req.s for Advanced Regents
- For multiple takers, we look at the first scores we see recorded

Table 10. Descriptive Statistics for NYC Exam School Applicants

		Any Exam			Enrolled in		
	All NYC	Exam Applicants	Offered Students	Enrolled Students	Brooklyn Tech	Bronx Science	Stuyvesant
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				A. Demographics			
Female	0.487	0.503	0.456	0.426	0.415	0.443	0.429
Black	0.336	0.299	0.078	0.076	0.133	0.040	0.019
Hispanic	0.377	0.248	0.073	0.067	0.089	0.070	0.030
Free Lunch#	0.667	0.685	0.671	0.681	0.664	0.682	0.706
LEP	0.125	0.039	0.004	0.005	0.007	0.003	0.003
SPED	0.089	0.006	0.000	0.000	0.000	0.000	0.000
N	453233	84539	11914	9364	4255	2405	2704
				B. Baseline Scores			
Math	-0.004	0.779	1.780	1.802	1.619	1.771	2.119
English	-0.005	0.709	1.714	1.667	1.426	1.666	2.047
N	349817	82527	11841	9312	4231	2397	2684

Notes: This table reports sample means for 2004-2007. The All NYC sample includes 8th graders in NYC public schools. Exam applicants are students who applied to Brooklyn Tech, Bronx Science, or Stuyvesant. Offered students are applicants offered a seat at any of these schools. Enrolled students are applicants who register at one of these schools in the year following application. Baseline scores are from 8th grade NYSED Math and Reading.

For applicants in 2004 and 2005, free lunch status is from school year 2004-2005 (after assignment), while for applicants in 2006 and 2007, free lunch status is from school year 2004-2005 and 2005-2006 (before assignment).

NYC Exam School Assignment

- Applicants rank the exam schools to which they'd like to apply
- Applicants to each school are ordered by score on the Specialized High School Admissions Test (SHSAT)
- NY exam schools select down their ranked applicant list by *serial dictatorship*
  - ✓ Unlike Boston, NY exams uses a common running variable
  - ✓ We define cutoff C_k to be the lowest rank offered a seat at school k
- C_k is used to construct school-specific standardized running variables for student i at school k:

$$r_{ik} = 100 \times \frac{R_i - C_k}{\max_{j \in \mathcal{I}_k}\{R_j\} - \min_{j \in \mathcal{I}_k}\{R_j\}},$$

  where $\mathcal{I}_k$ is the set of students who ranked school k
- As in Boston, this facilitates plots and school stacking

NYC Window and Results

- The New York estimation window is [+/-5] reflecting the larger New York sample (we plot NY in a window of 10)
  - ✓ Trimming at five mitigates the problem of reduced form confounding from nearby admissions cutoffs (as described in Figure 7)
  - ✓ NY cutoffs are separated by about 6 standardized units - with clearer separation than for Boston due to single NY running variable

- **Figures 19-25 and Tables 11-12**:
  - ✓ Offer, enrollment, and years-in-school CEFs look similar to those in Boston; 0.3σ-0.5σ jump in peer baseline Math and English
  - ✓ No corresponding jump in outcome scores
  - ✓ Parametric and IK estimates are broadly similar
  - ✓ Reduced-form SEs as low as 0.02 in stacked RFs
  - ✓ 2SLS estimates are again inconsistent with large positive peer effects; the most precise peer estimates have SEs on the order of $0.05 - 0.06\sigma$

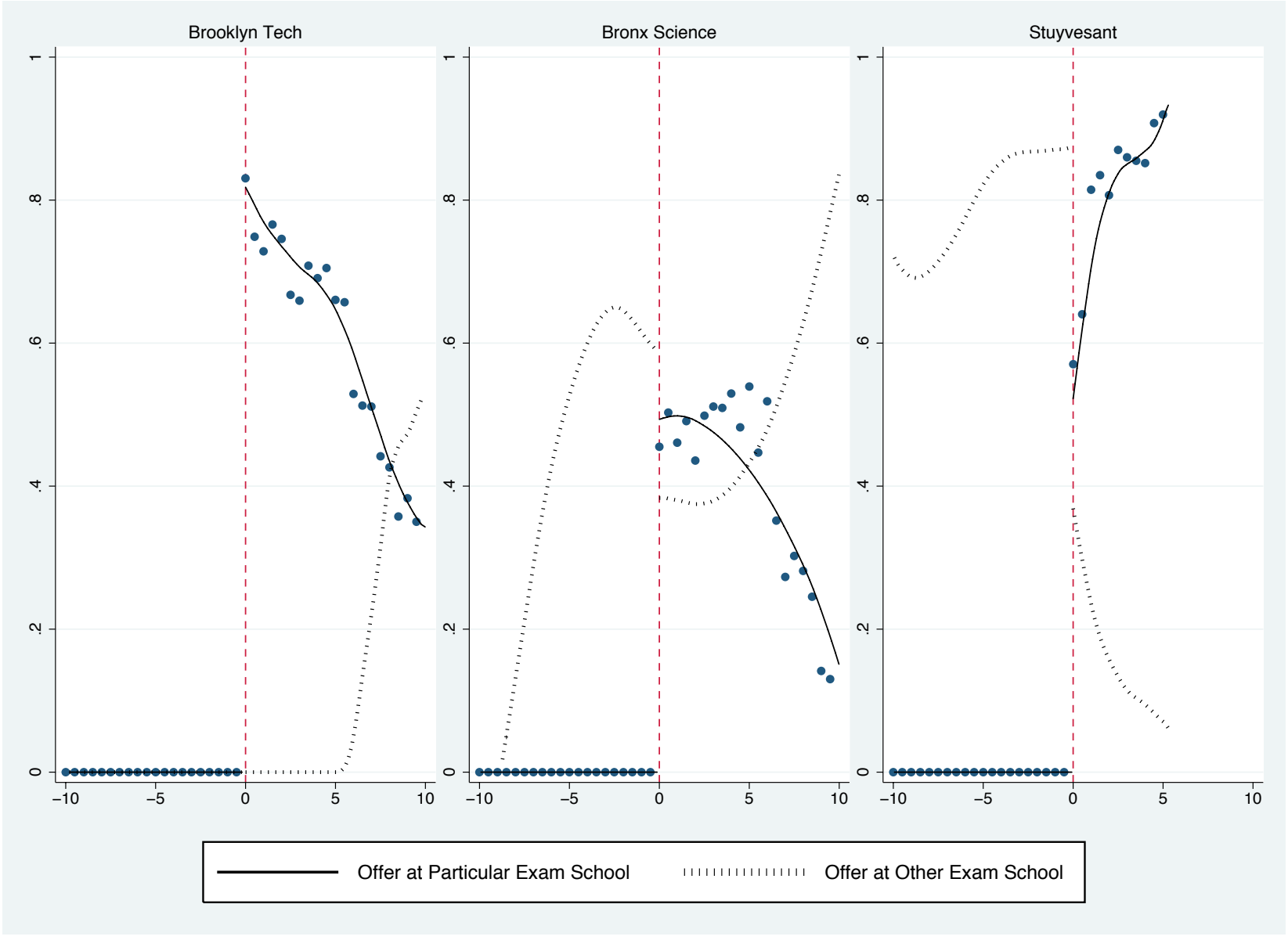

Figure 19. Offers at Each NYC Exam School for 9th Grade Applicants (2004-2007)

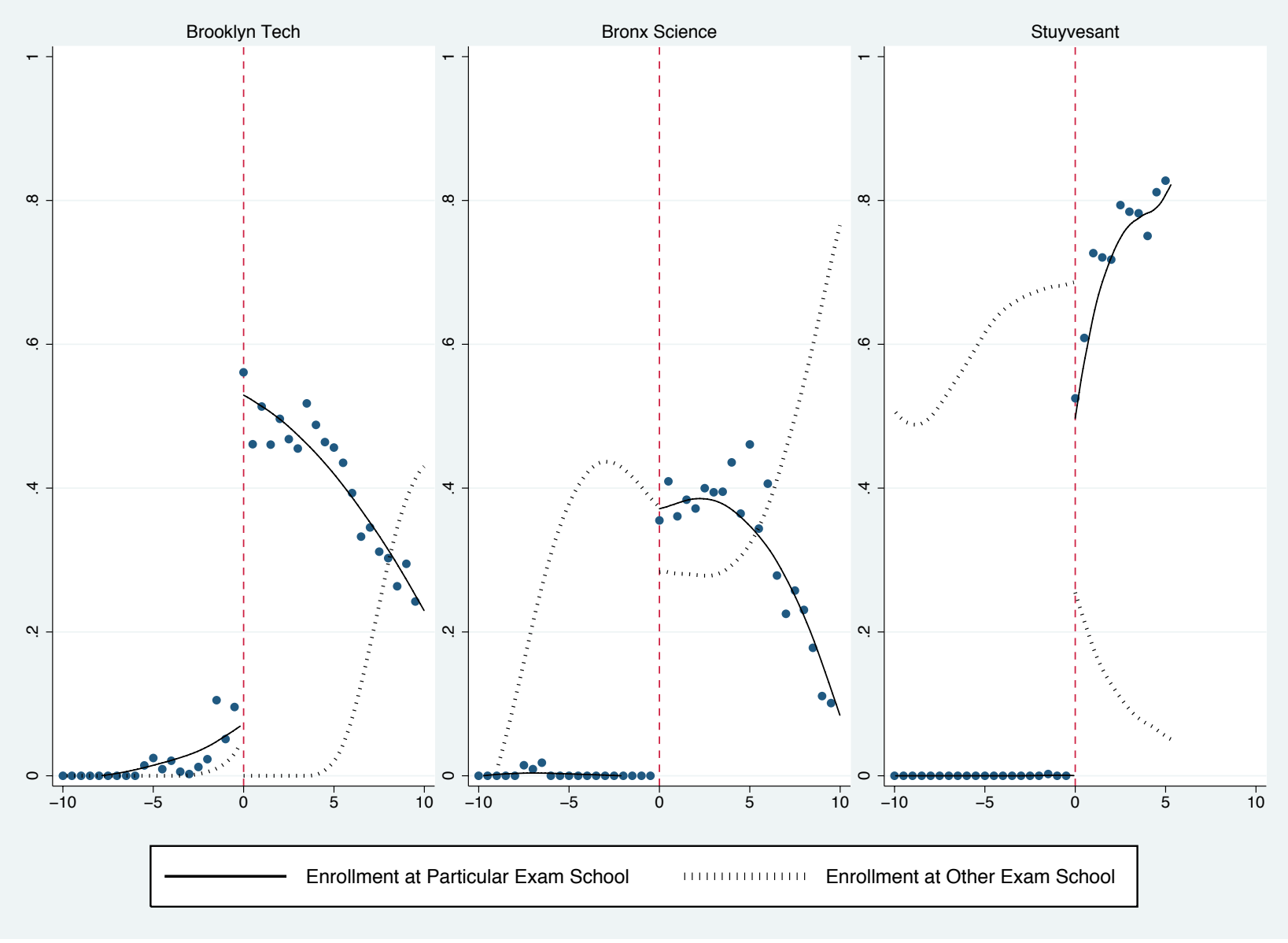

Figure 20. Enrollment at Each NYC Exam School for 9th Grade Applicants (2004-2007)

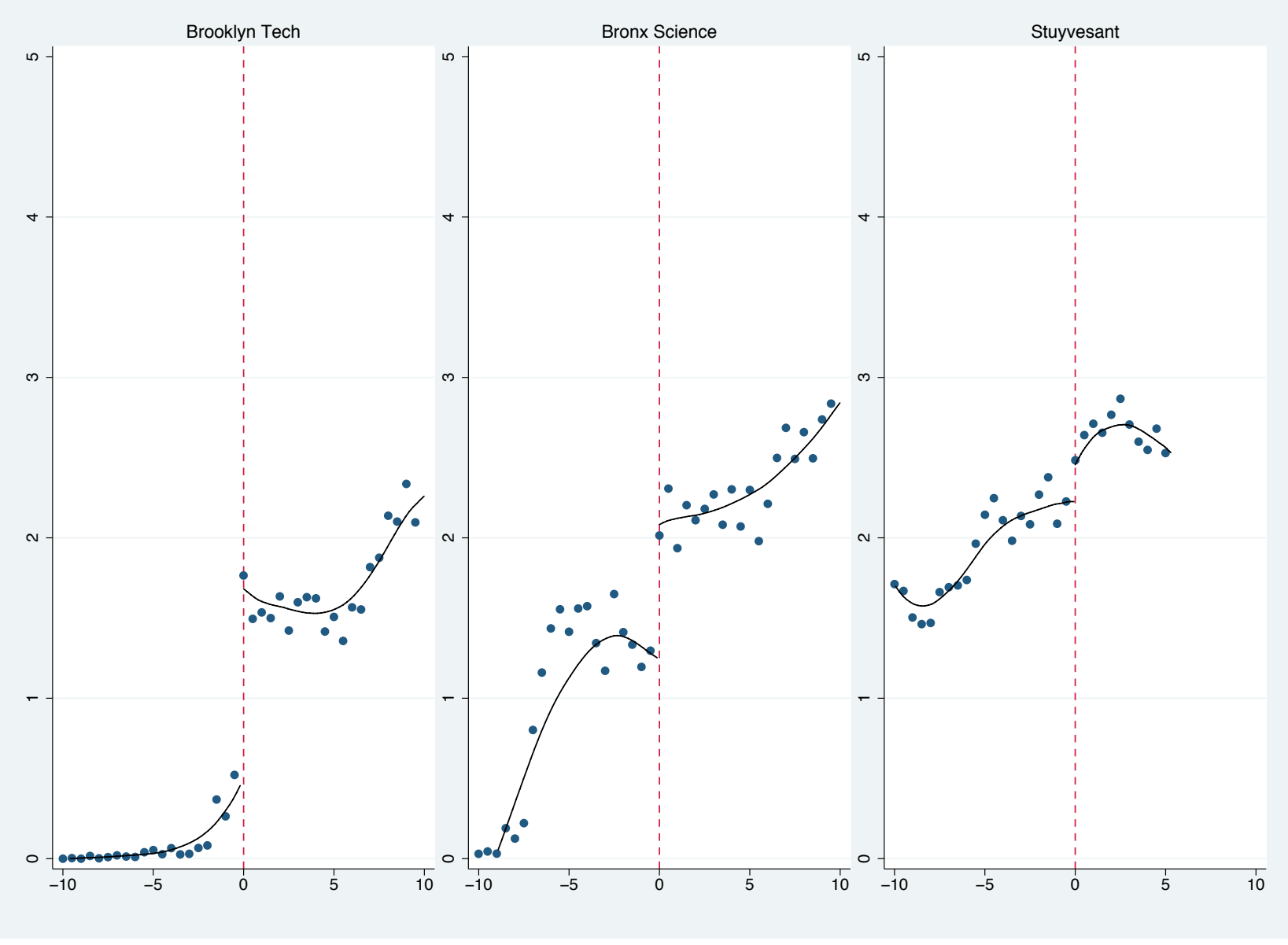

Figure 21. Years at Any NYC Exam School for 9th Grade Applicants (2004-2007)

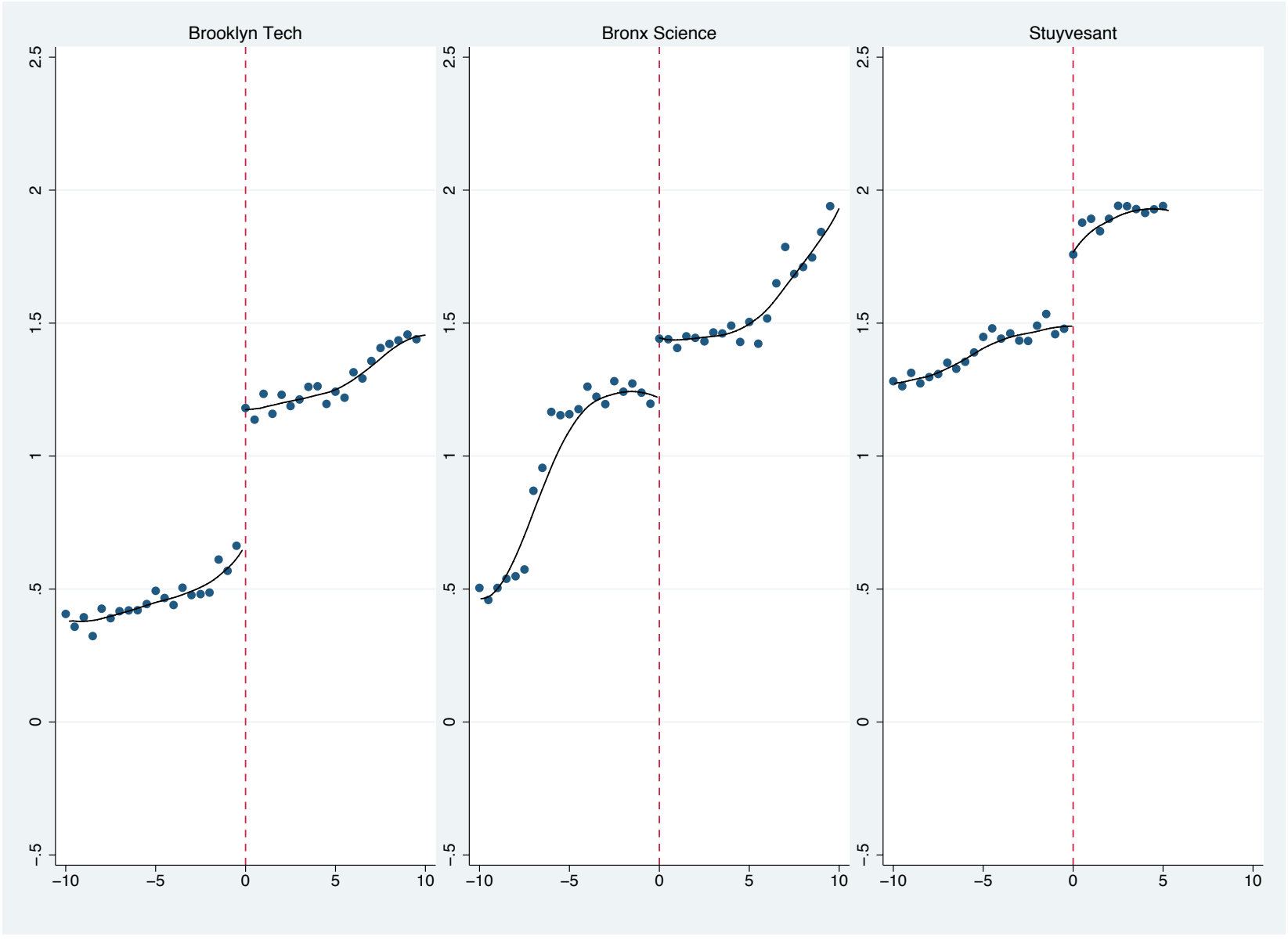

Figure 22. Average Baseline Math Score of Peers for 9th Grade Applicants (2004-2007) in NYC

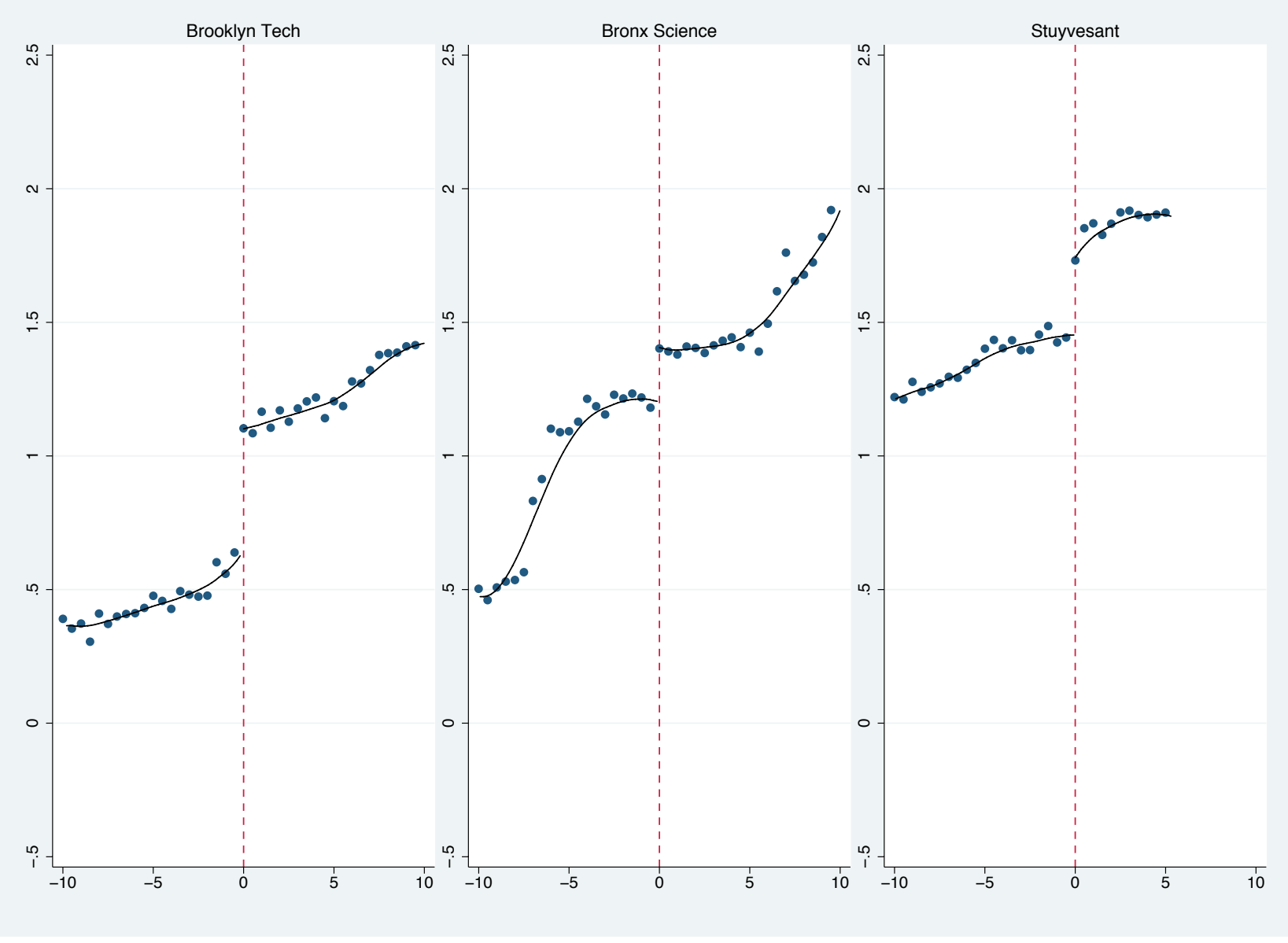

Figure 23. Average Baseline English Score of Peers for 9th Grade Applicants (2004-2007) in NYC

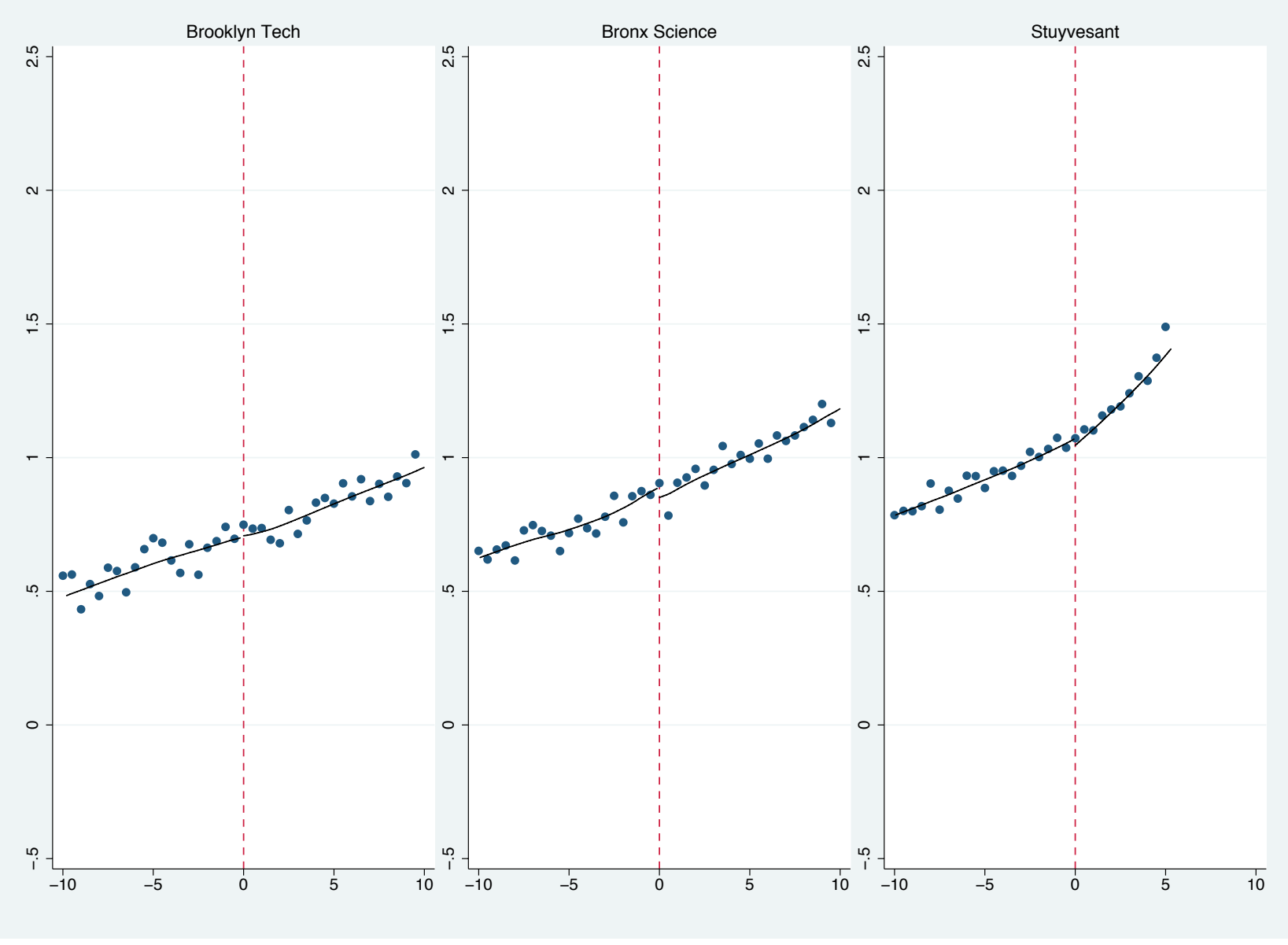

Figure 24. Advanced Math Regents Scores for 9th Grade Applicants (2004-2007) in NYC

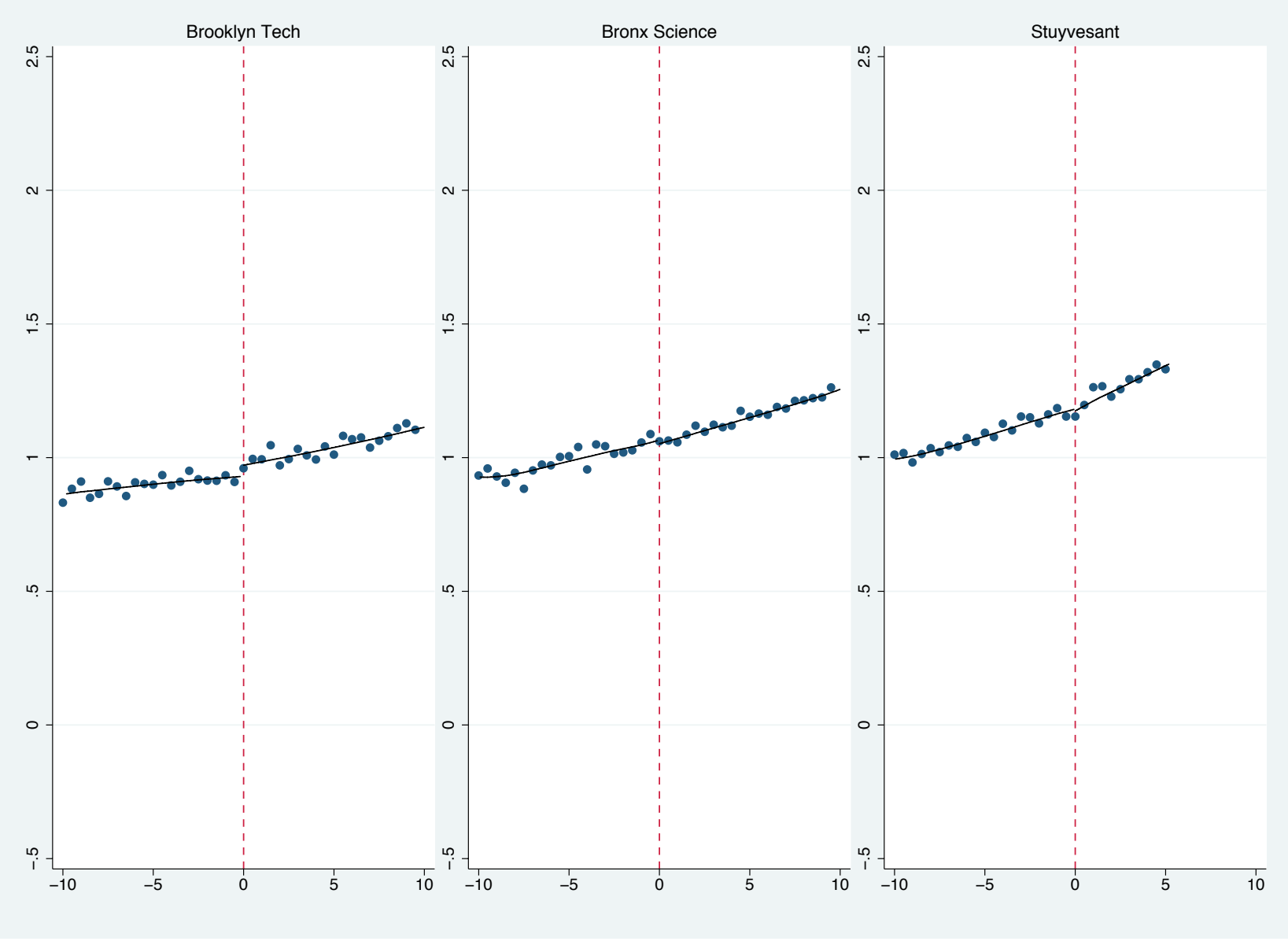

Figure 25. English Regents Scores for 9th Grade Applicants (2004-2007) in NYC

Table 11. NYC Reduced Form Estimates - Regents Exams

	Parametric Estimates				Non-parametric (IK) Estimates			
	Brooklyn Tech	Bronx Science	Stuyvesant	All Schools	Brooklyn Tech	Bronx Science	Stuyvesant	All Schools
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Math	0.083	-0.096*	-0.056	-0.021	0.012	-0.129***	-0.037	-0.056***
	(0.064)	(0.056)	(0.039)	(0.029)	(0.040)	(0.033)	(0.038)	(0.018)
	4264	3746	3800	11810	3743	3746	3417	10906
Advanced Math	-0.029	-0.024	-0.030	-0.028	0.000	-0.059	-0.022	-0.025
	(0.080)	(0.072)	(0.050)	(0.044)	(0.044)	(0.040)	(0.027)	(0.021)
	5619	5524	6584	17727	5619	5524	6584	17727
English	0.028	-0.035	-0.028	-0.013	0.051	-0.018	-0.005	0.013
	(0.057)	(0.043)	(0.030)	(0.025)	(0.039)	(0.023)	(0.022)	(0.014)
	4950	4581	5150	14681	4950	4217	5150	14317
Global History	-0.085	-0.025	-0.008	-0.036	-0.072**	-0.017	0.009	-0.025
	(0.053)	(0.042)	(0.038)	(0.025)	(0.035)	(0.028)	(0.025)	(0.015)
	6277	5925	6863	19065	4757	4699	5222	14678
US History	-0.070*	-0.012	0.038	-0.011	-0.053**	-0.017	0.038	-0.007
	(0.038)	(0.032)	(0.036)	(0.023)	(0.024)	(0.026)	(0.023)	(0.016)
	4440	4281	4987	13708	2808	4148	3797	10753
Living Environment	-0.060	0.092**	-0.072**	-0.015	-0.080***	0.057**	-0.031	-0.025**
	(0.041)	(0.039)	(0.033)	(0.021)	(0.022)	(0.024)	(0.020)	(0.012)
	5801	5508	6276	17585	5801	5508	6276	17585

Notes: This table reports estimates of the effect of exam school offers on New York Regents scores. The discontinuity sample includes applicants 5 standardized units from the cutoff. Model parameterizations and estimation procedures are the same as for Boston. Math scores are from Regents Math A (Elementary Algebra and Planar Geometry) or Integrated Algebra I. Advanced Math scores are from Regents Math B (Intermediate Algebra and Trigonometry) or Geometry. The table reports robust standard errors, clustered on year and school of test, in parentheses. Standard errors are also clustered on student when schools are stacked. Sample sizes for each outcome are reported below the standard errors.

*significant at 10%; **significant at 5%; ***significant at 1%.

Table 12. New York 2SLS Estimates for Enrollment, Years in Exam School, and Peer Means

	Advanced Math			English		
	(1)	(2)	(3)	(4)	(5)	(6)
			2SLS			
Enrollment	-0.073			0.071		
	(0.082)			(0.070)		
Exam Years		-0.027			0.028	
		(0.038)			(0.029)	
Peer Mean			-0.038			0.066
			(0.061)			(0.052)
			First Stage			
Brooklyn Tech	0.401***	0.967***	0.559***	0.406***	0.901***	0.523***
	(0.075)	(0.156)	(0.064)	(0.090)	(0.221)	(0.057)
Bronx Science	0.325***	0.629***	0.177***	0.304***	0.785***	0.155**
	(0.114)	(0.217)	(0.068)	(0.114)	(0.296)	(0.073)
Stuyvesant	0.087	0.104	0.272***	0.067	0.118	0.258***
	(0.074)	(0.131)	(0.076)	(0.081)	(0.197)	(0.095)
N		17727			14317	

Notes: This table reports 2SLS estimates of the effect of exam school enrollment, years in exam school, and peer achievement on Regents scores. Advanced Math scores are from Regents Math B (Intermediate Algebra and Trigonometry) or Geometry. Peer means are from 8th grade NYSED tests. The table shows IK estimates using the same bandwidths as for the reduced form estimates in Table 10. Robust standard errors clustered by year and school of test, and by student, are shown in parenthesis.

* significant at 10%; ** significant at 5%; *** significant at 1%

More from New York

- Threats to Validity
  - ✓ **Attrition**
  - ✓ **Covariate balance**
- No gains for NYC subgroups
  - ✓ **High achievers**
  - ✓ **Blacks and Hispanics**
- Stacking Boston and New York makes 2SLS estimates of peer effects more precise . . . and still zero (**Table 13**)

Table 13. Boston and New York: 2SLS Estimates for Enrollment, Years in Exam School, and Peer Means

	Instrument: Offer Indicators						Instrument: Offer Indicators x Application Cohort Indicators					
	Math			English			Math			English		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						2SLS Estimates						
Enrollment	-0.059			0.059			-0.022			0.038		
	(0.053)			(0.044)			(0.051)			(0.042)		
Exam Years		-0.025			0.027			-0.008			0.016	
		(0.025)			(0.021)			(0.025)			(0.021)	
Peer Mean			-0.070*			0.025			-0.030			0.027
			(0.038)			(0.037)			(0.036)			(0.034)
						First Stage Estimates						
O'Bryant	0.730***	1.530***	0.753***	0.737***	1.403***	0.687***						
	(0.064)	(0.125)	(0.073)	(0.068)	(0.127)	(0.070)						
Latin Academy	0.118**	0.219*	0.388***	0.142**	0.227	0.378***						
	(0.057)	(0.128)	(0.085)	(0.062)	(0.143)	(0.079)						
Latin School	0.032	0.072	0.628***	0.022	0.045	0.534***						
	(0.022)	(0.053)	(0.093)	(0.022)	(0.058)	(0.080)						
Brooklyn Tech	0.401***	0.967***	0.559***	0.406***	0.901***	0.523***						
	(0.075)	(0.156)	(0.064)	(0.090)	(0.221)	(0.057)						
Bronx Science	0.325***	0.629***	0.177***	0.304***	0.785***	0.155**						
	(0.114)	(0.217)	(0.068)	(0.114)	(0.296)	(0.073)						
Stuyvesant	0.087	0.104	0.272***	0.067	0.118	0.258***						
	(0.074)	(0.131)	(0.076)	(0.081)	(0.197)	(0.095)						
N	30857	30863	28843	25622	25624	24921	30857	30863	28843	25622	25624	24921

Notes: This table reports two-stage least squares (2SLS) estimates of the effects of exam school enrollment, years spent in exam school, and mean baseline peer achievement on MCAS scores in a sample combining Boston and New York. Boston scores are from MCAS Math and English tests for all grades tested; NYC scores are Advanced Math (Regents Math B or Geometry) and Regents English. The table shows IK estimates using bandwidths computed one city at a time. Excluded instruments for columns 1-6 are three offer dummies. Columns 7-12 show the results of adding cohort interactions to the instrument list.

* significant at 10%; ** significant at 5%; *** significant at 1%

Summary and Conclusions

- Exam school students do well, but this is not a causal effect . . . Anxious parents relax!
- X-validity: high baseline samples and extrapolation away from the cutoff generate similar findings
- Evidence of a boost in high school English, driven by minorities
- Little effect on PSAT or AP scores; a subset of Boston applicants (9th graders) see modest gains on the SAT
- Implications
  - ✓ Not much in the way of peer effects; BFLPE goes the wrong way
  - ✓ Results here contrast with big gains at Boston & NYC *No Excuses* charter schools; these schools serve *low* achievers
  - ✓ This calls into question the view that "... returns to adolescent education for the most disadvantaged and less able are lower than the returns for the more advantaged" (Cunha and Heckman, 2007)
  - ✓ Exam schools are heavily oversubscribed without adding value; demand-side pressure need not improve education production

Additional Material

Table A1. Boston Attrition Differentials

Application Grade	Test Grade	Fraction with Follow Up	Parametric Estimates: O'Bryant (1)	Parametric Estimates: Latin Academy (2)	Parametric Estimates: Latin School (3)	Parametric Estimates: All Schools (4)	Non-parametric (IK) Estimates: O'Bryant (5)	Non-parametric (IK) Estimates: Latin Academy (6)	Non-parametric (IK) Estimates: Latin School (7)	Non-parametric (IK) Estimates: All Schools (8)
						A. Math				
7th	7th and 8th	0.879	0.066	0.035	-0.033	0.024	0.042	0.044*	0.003	0.030*
			(0.054)	(0.044)	(0.043)	(0.032)	(0.029)	(0.023)	(0.024)	(0.016)
		7576	3284	3229	2899	9412	3079	3229	2819	9127
7th and 9th	10th	0.765	0.027	0.085	0.028	0.046	0.049	0.024	0.025	0.034
			(0.070)	(0.069)	(0.064)	(0.040)	(0.037)	(0.036)	(0.037)	(0.022)
		5592	2592	2381	1993	6966	2592	2356	1821	6769
7th and 9th	7th, 8th, and 10th	0.830	0.048	0.057	-0.008	0.034	0.045*	0.036*	0.011	0.032**
			(0.044)	(0.039)	(0.037)	(0.029)	(0.023)	(0.020)	(0.020)	(0.015)
		13168	5876	5610	4892	16378	5671	5585	4640	15896
						B. English				
7th	7th and 8th	0.895	0.062	0.049	0.009	0.040	0.038	0.054**	-0.007	0.026
			(0.057)	(0.045)	(0.043)	(0.035)	(0.033)	(0.026)	(0.024)	(0.020)
		6671	2905	2829	2474	8208	2421	2207	2376	7004
7th and 9th	10th	0.766	0.034	0.059	0.051	0.047	0.052	0.016	0.033	0.035
			(0.070)	(0.069)	(0.063)	(0.039)	(0.036)	(0.037)	(0.036)	(0.022)
		5592	2592	2381	1993	6966	2592	2144	1913	6649
7th and 9th	7th, 8th, and 10th	0.836	0.048	0.054	0.028	0.044	0.046*	0.033	0.011	0.031*
			(0.045)	(0.040)	(0.037)	(0.030)	(0.025)	(0.024)	(0.021)	(0.017)
		12263	5497	5210	4467	15174	5013	4351	4289	13653

Notes: This table reports estimates of the effects of exam school offers on an indicator for non-missing outcome scores. The specification and estimation procedures are the same as used to construct the estimates in Table 4. The fraction with follow-up is the follow-up rate for appliants who appear in any school-speciifc discontinuity sample.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A2. Boston Covariate Discontinuities

		Parametric Estimates				Non-parametric (IK) Estimates			
		O'Bryant	Latin Academy	Latin School	All Schools	O'Bryant	Latin Academy	Latin School	All Schools
Covariate	Mean	(1)	(2)	(3)	(5)	(5)	(6)	(7)	(8)
					A. 7th Grade Applicants				
Female	0.565	0.074	-0.069	0.053	0.020	-0.012	-0.017	0.039	0.005
		(0.077)	(0.079)	(0.082)	(0.046)	(0.042)	(0.051)	(0.044)	(0.026)
	6049	2616	2592	2338	7546	2589	1765	2338	6692
Black	0.327	0.048	0.034	0.098	0.059	0.040	-0.009	0.039	0.023
		(0.074)	(0.075)	(0.069)	(0.042)	(0.043)	(0.039)	(0.035)	(0.022)
	6043	2615	2591	2333	7539	2333	2591	2333	7257
Hispanic	0.195	-0.070	-0.073	-0.062	-0.068*	-0.059	-0.028	-0.053	-0.046**
		(0.063)	(0.063)	(0.066)	(0.037)	(0.037)	(0.036)	(0.042)	(0.022)
	6043	2615	2591	2333	7539	2316	2414	1767	6497
Free Lunch	0.707	0.084	-0.149**	-0.133*	-0.062	0.018	-0.119***	-0.061	-0.051**
		(0.060)	(0.064)	(0.071)	(0.038)	(0.036)	(0.039)	(0.041)	(0.022)
	6049	2616	2592	2338	7546	2343	2098	2212	6653
LEP‡	0.125	0.009	-0.053	-0.018	-0.020	-0.013	-0.015	-0.070**	-0.026
		(0.056)	(0.053)	(0.047)	(0.031)	(0.028)	(0.028)	(0.031)	(0.017)
	5608	2404	2389	2134	6927	2404	2389	1558	6351
SPED¥	0.014	-0.046	0.004	0.008	-0.012	-0.016	0.003	0.002	-0.005
		(0.043)	(0.021)	(0.023)	(0.018)	(0.019)	(0.013)	(0.014)	(0.010)
	3621	1543	1544	1388	4475	1543	1269	1297	4109
Joint p-value		0.465	0.191	0.313	0.336	0.602	0.104	0.087	0.099
					B. 9th Grade Applicants				
Female	0.607	-0.024	-0.032	-0.070	-0.038	-0.010	-0.031	-0.048	-0.025
		(0.116)	(0.134)	(0.158)	(0.077)	(0.060)	(0.071)	(0.083)	(0.038)
	1885	1022	809	612	2443	1022	809	612	2443
Black	0.386	-0.016	0.064	-0.230*	-0.042	0.035	-0.022	-0.092	-0.018
		(0.115)	(0.126)	(0.121)	(0.071)	(0.069)	(0.068)	(0.070)	(0.039)
	1883	1022	807	612	2441	893	807	612	2312
Hispanic	0.230	-0.151	0.025	0.052	-0.046	-0.095	0.049	0.047	0.003
		(0.096)	(0.116)	(0.127)	(0.064)	(0.065)	(0.056)	(0.069)	(0.035)
	1883	1022	807	612	2441	720	807	612	2139
Free Lunch	0.784	-0.084	-0.091	-0.225*	-0.120**	-0.024	-0.024	0.016	-0.013
		(0.091)	(0.101)	(0.126)	(0.060)	(0.051)	(0.069)	(0.070)	(0.035)
	1885	1022	809	612	2443	1022	518	612	2152
LEP‡	0.120	0.060	-0.079	0.032	0.009	0.030	-0.025	0.025	0.008
		(0.076)	(0.111)	(0.089)	(0.053)	(0.046)	(0.050)	(0.049)	(0.027)
	1885	1022	809	612	2443	969	809	612	2390
SPED¥	0.023	0.059	0.000	-0.028	0.019	0.022	-0.009	-0.034	-0.003
		(0.053)	(0.027)	(0.026)	(0.025)	(0.031)	(0.009)	(0.027)	(0.016)
	1040	545	464	374	1383	474	320	361	1155
Joint p-value		0.506	0.947	0.209	0.441	0.737	0.863	0.619	0.991

Notes: This table reports estimated discontinuities in covariates using models like those used to construct the reduced form estimates in Table 4. The joint p-value is from a F-test looking at all covariate discontinuities at once.

‡ LEP only available beginning in year 1998.

¥ SPED only available for years 1998-2004.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table B1. New York Attrition Differentials

	Fraction with Follow Up	Parametric Estimates				Non-parametric (IK) Estimates			
		Brooklyn Tech	Bronx Science	Stuyvesant	All Schools	Brooklyn Tech	Bronx Science	Stuyvesant	All Schools
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Math	0.535	-0.087*	0.059	0.059	0.012	0.010	0.017	0.050*	0.026*
		(0.049)	(0.049)	(0.046)	(0.028)	(0.026)	(0.025)	(0.026)	(0.015)
	17713	7622	6829	7553	22004	6707	6829	6786	20322
Advanced Math	0.804	0.126***	0.041	-0.010	0.050**	0.070***	0.032	0.025	0.043***
		(0.043)	(0.039)	(0.033)	(0.022)	(0.021)	(0.021)	(0.016)	(0.011)
	17713	7622	6829	7553	22004	7622	6829	7553	22004
English	0.874	0.017	0.032	0.028	0.026	0.034*	0.032	0.025	0.030***
		(0.038)	(0.036)	(0.031)	(0.020)	(0.019)	(0.021)	(0.016)	(0.011)
	13147	5867	5268	5695	16830	5867	4834	5695	16396
Global History	0.866	0.082**	0.035	0.035	0.050***	0.062***	0.036*	0.020	0.039***
		(0.038)	(0.033)	(0.028)	(0.019)	(0.022)	(0.020)	(0.017)	(0.011)
	17713	7622	6829	7553	22004	5782	5396	5739	16917
US History	0.814	0.035	0.032	0.008	0.024	0.041	0.039	0.009	0.030**
		(0.046)	(0.044)	(0.035)	(0.024)	(0.030)	(0.024)	(0.022)	(0.014)
	13147	5867	5268	5695	16830	3706	5086	4342	13134
Living Environment	0.797	0.015	0.040	0.024	0.026	0.033*	0.012	0.003	0.017
		(0.041)	(0.038)	(0.035)	(0.022)	(0.020)	(0.021)	(0.017)	(0.011)
	17713	7622	6829	7553	22004	7622	6829	7553	22004

Notes: This table reports estimates of the effect of exam school offers on indicators for non-missing outcome scores. Models and estimation procedures are the same as for Table 11. The fraction with follow-up is the follow-up rate for appliants who appear in any school-specific discontinuity sample.

*significant at 10%; **significant at 5%; ***significant at 1%.

Table B2. New York Covariate Discontinuities

		Parametric Estimates				Non-parametric (IK) Estimates			
	Mean of Variable	Brooklyn Tech (1)	Bronx Science (2)	Stuyvesant (3)	All Schools (4)	Brooklyn Tech (5)	Bronx Science (6)	Stuyvesant (7)	All Schools (8)
Female	0.468	-0.038	-0.017	-0.004	-0.019	0.001	-0.012	-0.018	-0.009
		(0.049)	(0.049)	(0.046)	(0.028)	(0.025)	(0.029)	(0.025)	(0.015)
	17713	7622	6829	7553	22004	7622	5848	7469	20939
Black	0.106	-0.056	-0.002	0.033	-0.006	-0.033*	-0.002	0.015	-0.005
		(0.037)	(0.031)	(0.022)	(0.017)	(0.018)	(0.015)	(0.011)	(0.009)
	17713	7622	6829	7553	22004	7622	6829	7553	22004
Hispanic	0.104	0.011	-0.010	0.048**	0.018	0.032*	-0.015	0.025*	0.013
		(0.035)	(0.030)	(0.021)	(0.017)	(0.017)	(0.015)	(0.015)	(0.010)
	17713	7622	6829	7553	22004	7622	6829	4626	19077
Free Lunch[#]	0.668	-0.064	0.062	-0.080*	-0.03	-0.007	0.040*	-0.042*	0.000
		(0.046)	(0.046)	(0.043)	(0.026)	(0.024)	(0.023)	(0.024)	(0.014)
	17713	7622	6829	7553	22004	7339	6829	6972	21140
LEP	0.005	0.009	-0.002	0.002	0.003	0.004	-0.003	-0.002	-0.001
		(0.006)	(0.004)	(0.006)	(0.003)	(0.004)	(0.003)	(0.003)	(0.002)
	17713	7622	6829	7553	22004	5330	6829	7553	19712
Joint test: p-value		0.234	0.780	0.056	0.581	0.207	0.397	0.136	0.775

Notes: This table reports estimated discontinuities in covariates using models like those used to construct the reduced form estimates in Table 11. The joint p-value is from an F-test looking at all covariate discontinuities at once.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table B3. New York Reduced Form Estimates for Subgroups

	High Baseline Scores						Black and Hispanic		
	Upper Half			Upper Quartile					
	Baseline Mean	Proportion above 85 on Regents	Non-parametric (IK) Estimates	Baseline Mean	Proportion above 85 on Regents	Non-parametric (IK) Estimates	Baseline Mean	Proportion above 85 on Regents	Non-parametric (IK) Estimates
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Math	1.425	0.872	-0.054***	1.495	0.927	-0.037*	1.253	0.723	0.024
			(0.018)			(0.021)			(0.047)
	9049		10471	6744		7570	2006		2381
Advanced Math	0.937	0.571	-0.020	1.027	0.637	-0.007	0.600	0.346	0.002
			(0.021)			(0.019)			(0.051)
	13854		17261	10990		13446	2596		3126
English	1.097	0.816	0.013	1.161	0.869	0.008	0.975	0.716	0.021
			(0.014)			(0.018)			(0.044)
	10772		12624	7703		9018	2298		2947
Global History	1.236	0.841	-0.026	1.284	0.879	-0.025	1.085	0.723	-0.063
			(0.016)			(0.015)			(0.043)
	14251		12296	10365		10858	2994		3060
US History	1.151	0.937	0.003	1.186	0.955	-0.003	1.037	0.871	-0.013
			(0.015)			(0.015)			(0.034)
	10034		10096	7216		8114	2092		2522
Living Environment	1.335	0.711	-0.020	1.380	0.754	-0.019	1.178	0.563	-0.075**
			(0.012)			(0.015)			(0.036)
	13610		16975	10585		13242	2612		3092

Notes: This table reports reduced form estimates for students with high baseline scores and for minorities. Baseline means and the proportion of applicants above 85 are computed for those who belong to at least one discontinuity sample. Math scores are from either Regents Math A (Elementary Algebra and Planar Geometry) or Integrated Algebra I. Advanced Math scores are from either Regents Math B (Intermediate Algebra and Trigonometry) or Geometry. The Table reports IK estimates using bandwidths computed as for the all schools model in Table 11.

* significant at 10%; ** significant at 5%; *** significant at 1%