

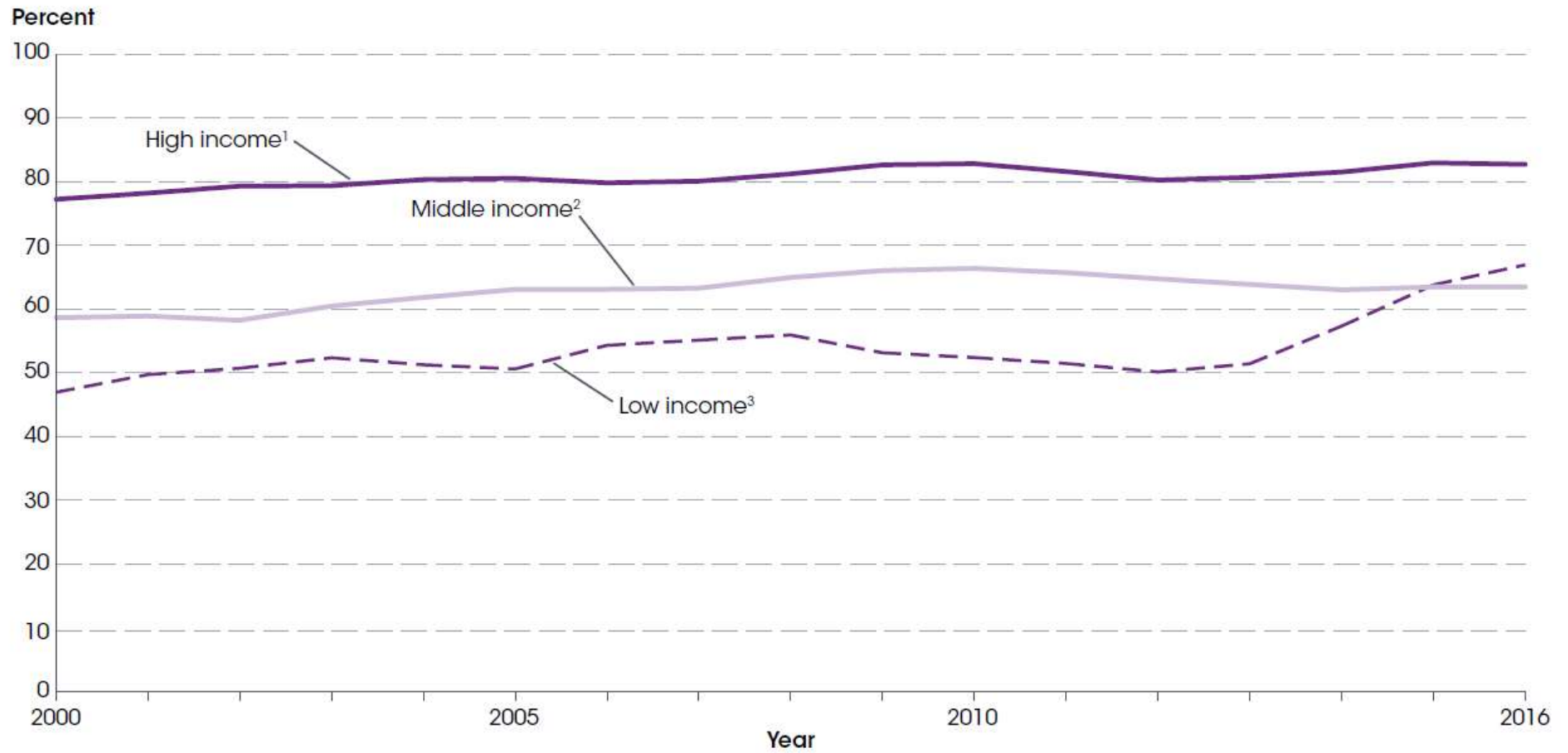
Take Two! SAT Retaking and College Enrollment Gaps

Joshua Goodman – Harvard University
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NCME, April 2019

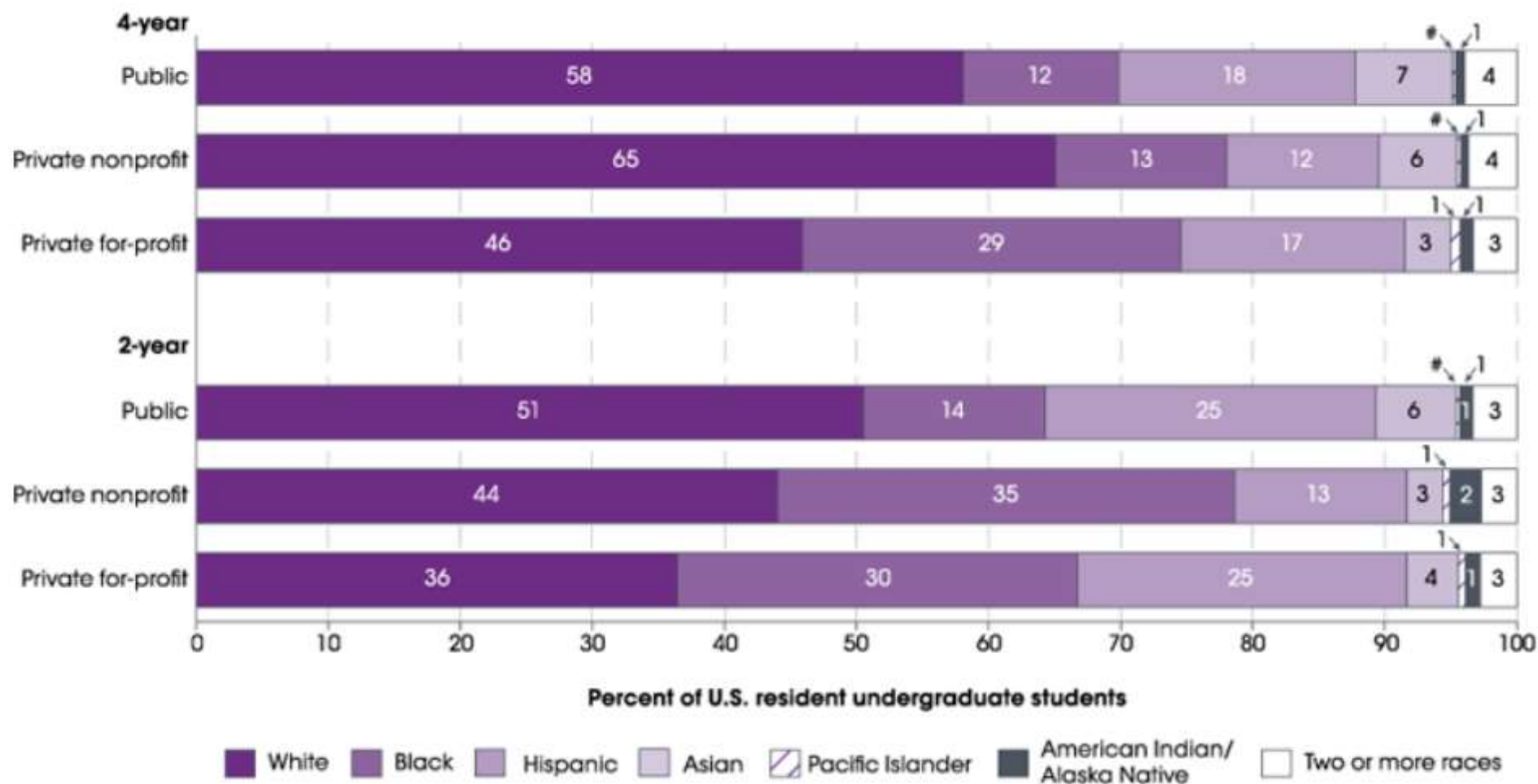
*The views do not reflect those of the College Board.

Figure 3. Percentage of high school completers who were enrolled in 2- or 4-year colleges by the October immediately following high school completion, by family income: 2000 through 2016



Source: NCES – The Condition of Education 2018

Figure 3. Percentage distribution of U.S. resident undergraduate enrollment in degree-granting postsecondary institutions, by institutional level and control and student race/ethnicity: Fall 2016



Source: NCES – The Condition of Education 2018

Why the Disparities?

- Getting to college is tricky
 - Information and procedural barriers
 - Disproportionately impact disadvantaged
- College entrance exams are one such barrier
 - Financial, time, and psychological costs
 - Mistaken beliefs on importance or own ability
- Taking ACT/SAT induces students to enroll in college
 - E.g., state mandates; opening of test centers (Bulman, 2015)

How about exam retaking?

- Retaking can increase exam familiarity & scores (Vigdor and Clotfelter, 2003; Frisancho et al., 2016)
- ~80% of colleges that use SAT, use “superscore”

Freshman (including homeschool) applicants are required to submit an ACT/SAT score. Transfer applicants with fewer than 24 university credit hours will also be required to submit an ACT or SAT test score. BYU only considers the highest overall composite score it receives in its evaluation. ACT/SAT scores can be sent from the following sources:

Does Retaking Impact Outcomes?

- Basic regression we want to run:

$$y_i = \alpha_0 + \alpha_1 \text{Retook}_i + \mathbf{X}_i + \varepsilon_i$$

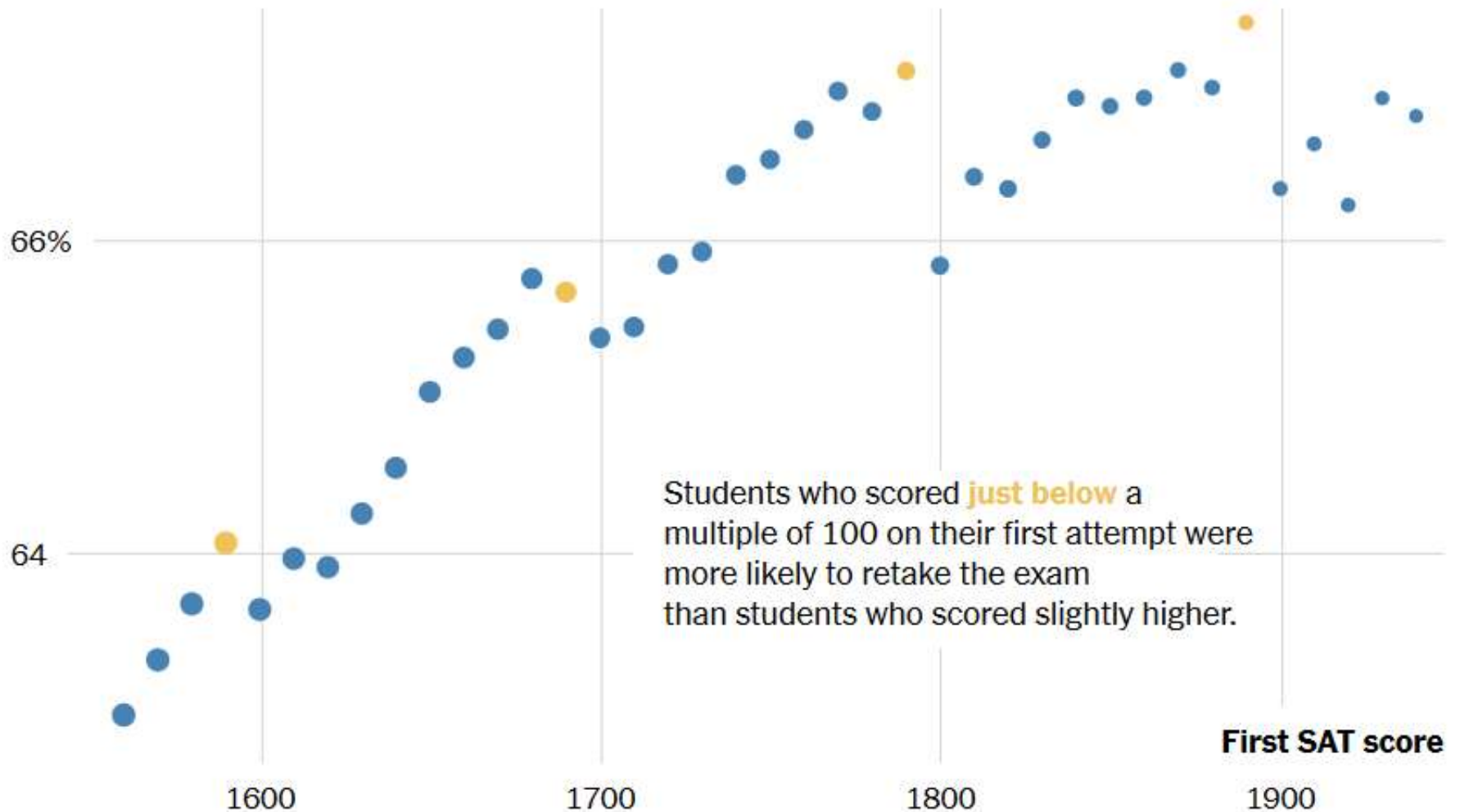
- Potential unobservable reasons for retake:
 - Performed poorly relative to true ability
 - Highly motivated and outcome oriented
 - Knowledge of admission process
- Need an instrument...round numbers

Round Numbers Induce Retake

- Students retake if they fall just short of 100 point increments
- “Left digit” bias shown in several contexts
 - SAT scores (Pope and Simonsohn, 2011)
 - Car and housing sales (Busse et al., 2013; Lacetera et al., 2013)
 - Athletic performance (Allen et al., 2017; Foellmi et al., 2016)
- Google, “Should I retake SAT?” A: “You should have a target score in mind.”
 - Reference dependent preferences (Koszegi and Rabin, 2006)
- Admissions and financial aid may exhibit “left-digit” bias
 - Bowman and Bastedo (2017) show behavioral biases of application readers

Left-Digit Bias in SAT Retaking

Percent who retook the SAT



Note: Larger circles indicate more test-takers. Source: Joshua Goodman, Oded Gurantz and Jonathan Smith, "Take Two! SAT Retaking and College Enrollment Gaps."

• By The New York Times

SAT Background

- 2006-2014 high school cohorts
- Math, reading, writing scored 200-800
- Cost ~\$40-\$60 over sample
 - Low-income students eligible for fee waiver
- Can send SAT scores directly to colleges
 - Four free at time of registration

Data

- 14 million SAT takers
 - Scores and dates of each attempt
 - College score sends
 - Basic demographics
- Matched to National Student Clearinghouse (NSC)

(A) Demographics

Female	0.53
White	0.56
URM	0.27
Asian	0.11
Low income	0.21
Fee waiver	0.20

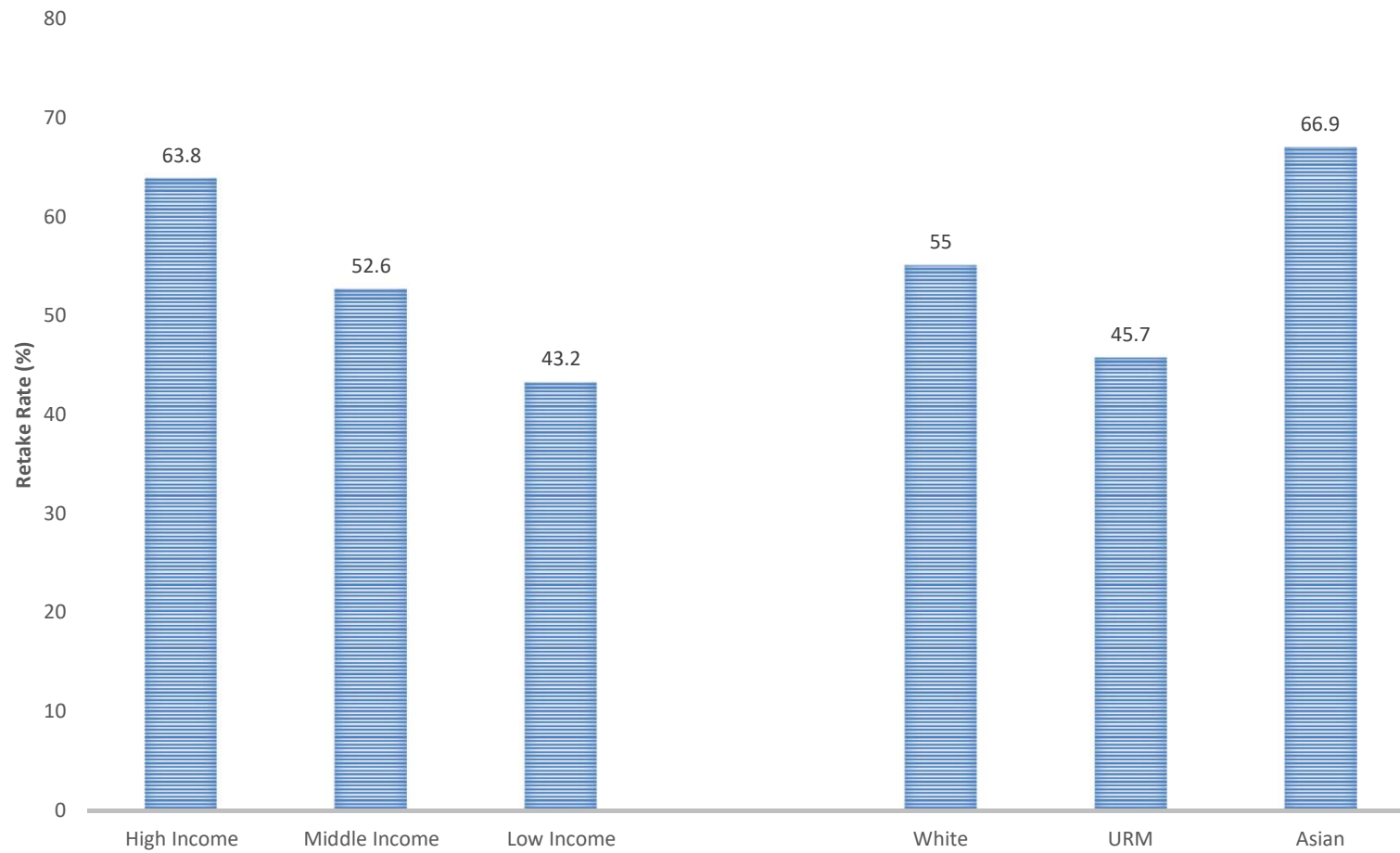
(B) SAT-taking

First SAT score	1475
SAT superscore	1531
Retook SAT	0.54
SAT takes	1.74
Months available to retake	12.4

(C) College enrollment

Four year college	0.57
Two year college	0.18
College's graduation rate	0.45
College's mean income (000s)	47.0

Who Retakes?



Who Retakes?

- More likely to retake if:
 - High scorers
 - Female
 - White (unconditionally) and Asian
 - Higher parental income
 - Used fee waiver (free retake)
 - Took initial SAT early (e.g., junior year)
- Round numbers may also induce retake

Methodology

- Regression discontinuity design (fuzzy)
 - Forcing variable is initial SAT score
 - Discontinuities at each 100 point increment
- **Intuition** – students just below 100 point increments are, on average, identical to those just above
 - Only difference is those below retake
 - Compare outcomes (e.g., college enrollment)

Methodology

- First stage regression:

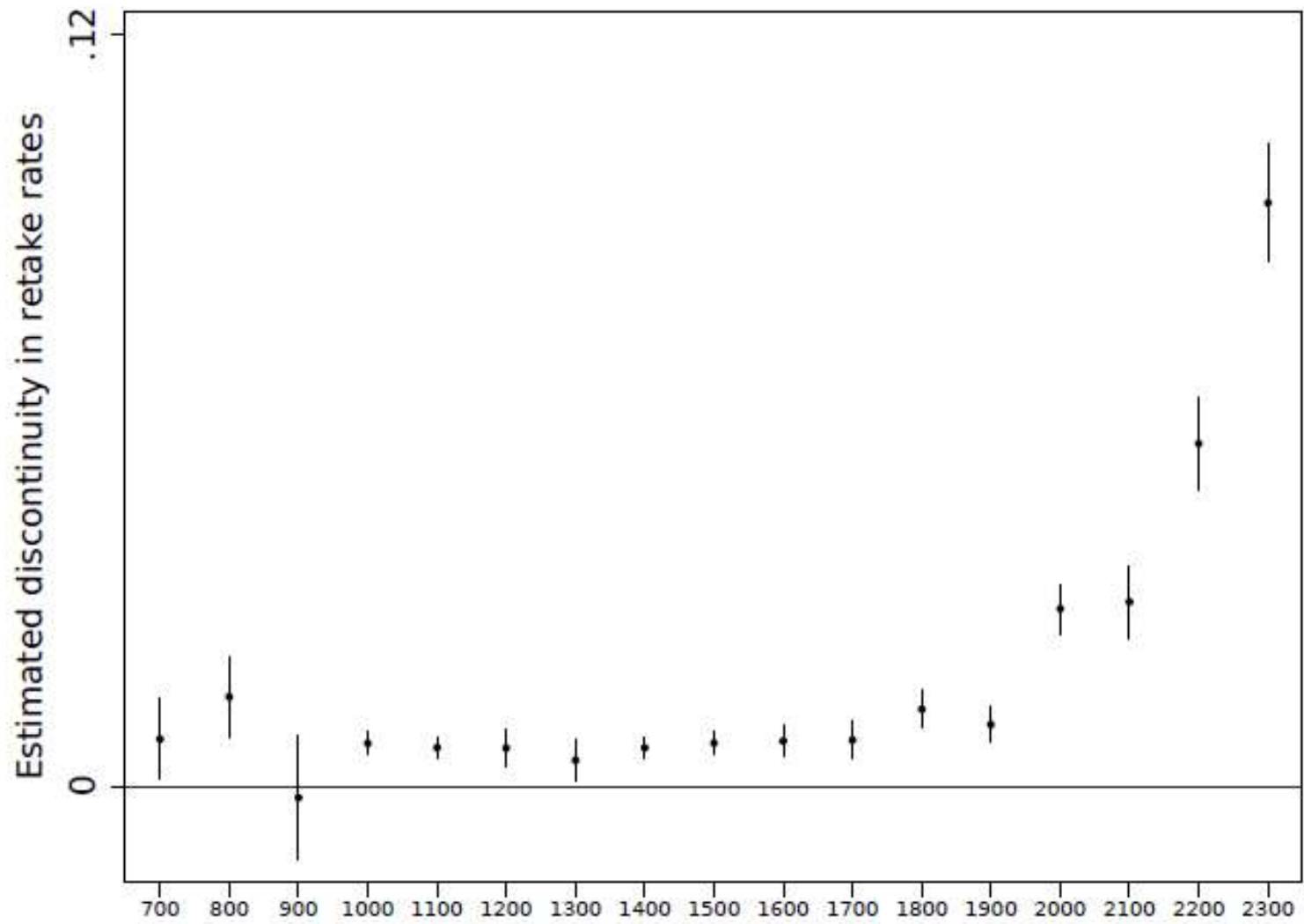
$$Retook_{ir} = \beta_{FS} Below_{ir} + \sum_{n=7}^{23} [R_{n00} * (\alpha_{n00} + \gamma_{n00} D_{ir} + \delta_{n00} Below_{ir} * D_{ir})] + \mu_{cd} + \epsilon_{ir}$$

- Second stage regression:

$$Y_{ir} = \beta_{IV} Retook_{ir} + \sum_{n=7}^{23} [R_{n00} * (\zeta_{n00} + \eta_{n00} D_{ir} + \theta_{n00} Below_{ir} * D_{ir})] + \nu_{cd} + \xi_{ir}$$

– β_{IV} is the causal impact of retaking

Figure 3: Retaking Effects at Each Threshold



SAT Scores, IV estimates

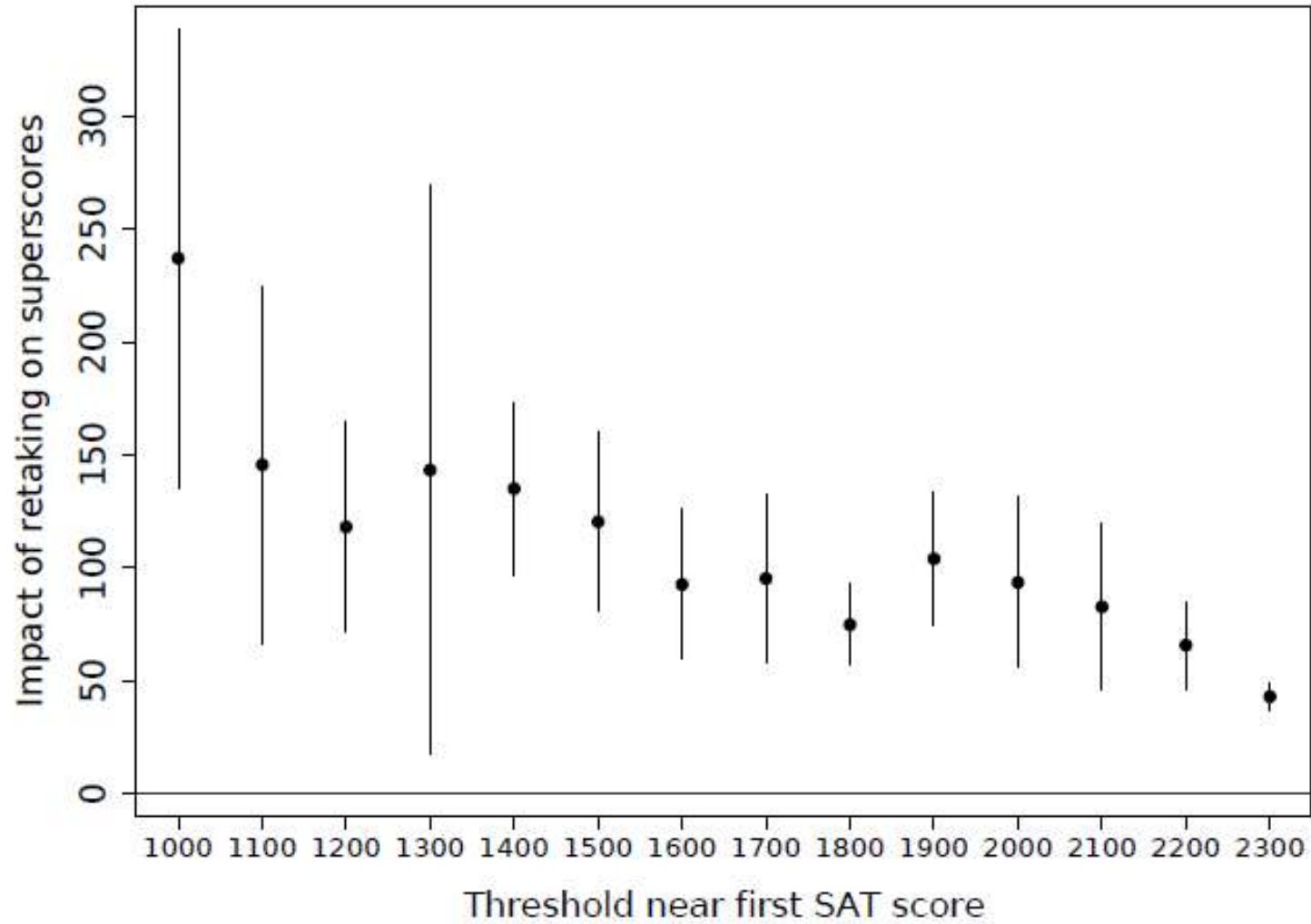
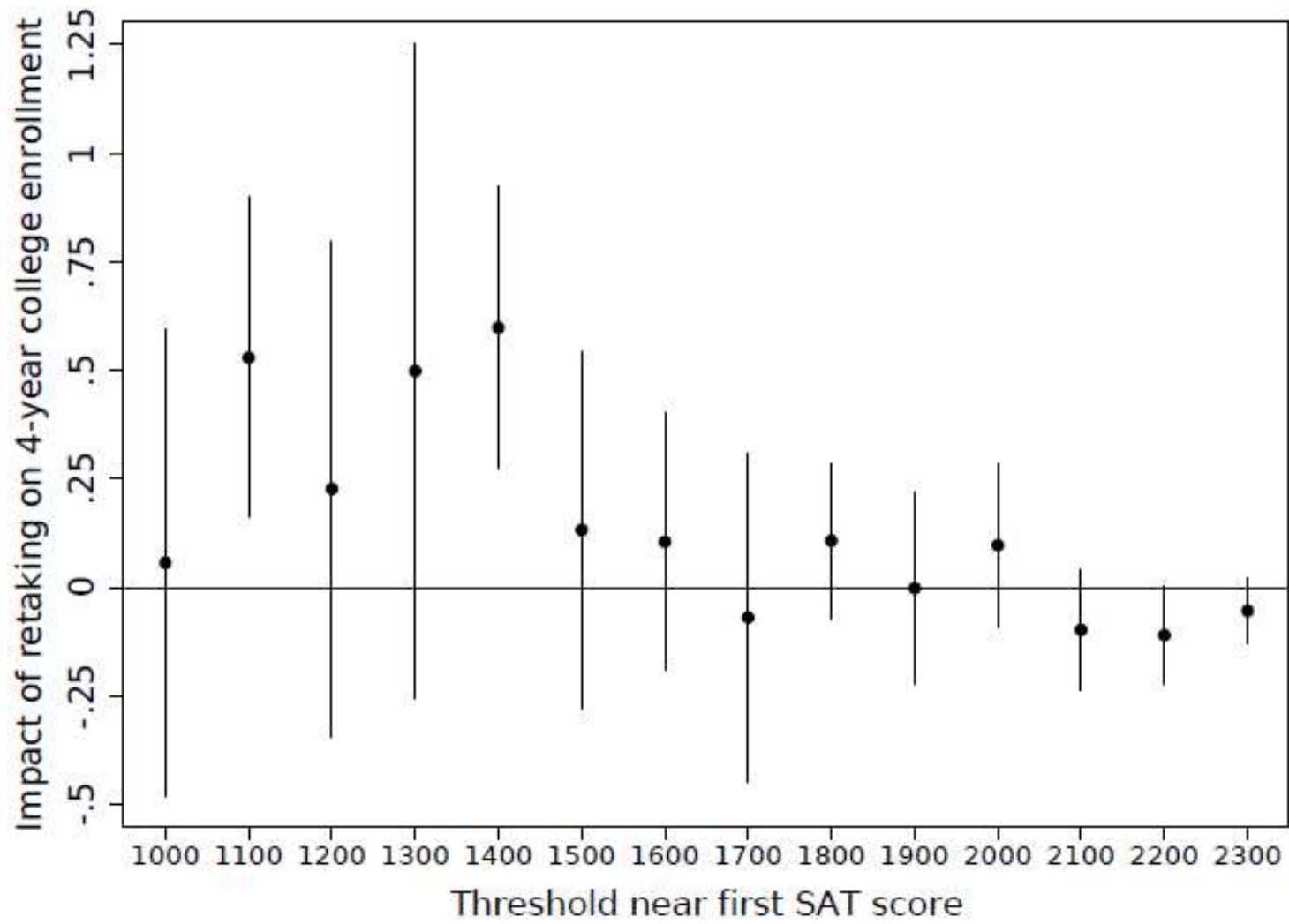


Table 4: Retaking and SAT Scores

	After two potential takes		After all takes	
	Most recent total score (1)	Superscore (2)	Superscore (3)	Superscore increase of 150+ points (4)
<u>(A) All students</u>				
All	46.4*** (7.9)	87.7*** (5.0)	101.9*** (5.9)	0.237*** (0.035)
<u>(B) By initial score</u>				
Lower scoring	90.7*** (13.3)	114.1*** (9.3)	136.1*** (11.8)	0.438*** (0.068)
Higher scoring	22.4** (9.0)	73.3*** (5.3)	83.6*** (5.4)	0.128*** (0.035)
<u>(C) By income</u>				
Low income	72.1*** (16.3)	108.9*** (12.2)	118.9*** (15.5)	0.397*** (0.088)
High income	39.4** (16.2)	81.4*** (12.3)	99.5*** (14.1)	0.168** (0.081)
<u>(D) By race/ethnicity</u>				
URM	59.5*** (15.5)	93.8*** (11.6)	106.1*** (13.0)	0.296*** (0.072)
Non-URM	37.5*** (9.2)	83.8*** (6.1)	97.5*** (6.8)	0.213*** (0.042)

Enrollment , IV estimates



Results – College Enrollment

	College type	
	Four-year (1)	Two-year (2)
<hr/>		
(A) All students		
All	0.125*** (0.042)	-0.060 (0.037)
Control complier mean	0.67	0.15
<hr/>		
(B) By initial score		
Lower scoring	0.329*** (0.088)	-0.209** (0.081)
Control complier mean	0.39	0.33
Higher scoring	0.014 (0.040)	0.020 (0.029)
Control complier mean	0.82	0.04

Results – College Enrollment

	College type	
	Four-year (1)	Two-year (2)
<u>(C) By income</u>		
Low income	0.299*** (0.109)	-0.238** (0.088)
Control complier mean	0.51	0.25
High income	0.025 (0.084)	-0.093 (0.071)
Control complier mean	0.76	0.13
<u>(D) By race/ethnicity</u>		
URM	0.204** (0.089)	-0.192* (0.077)
Control complier mean	0.55	0.29
Non-URM	0.084* (0.046)	-0.032 (0.035)
Control complier mean	0.71	0.11

Results – College Enrollment

- Going to higher quality colleges
 - Better graduation rate
 - Higher mean incomes
 - But not going to the best colleges
- Not changing SAT score sends
 - Better odds of admission or matriculation

Summary of Main Results

- Being below 100 point threshold induces 1.3 retakes
- Retaking increases SAT “admission relevant” superscores by 0.3 s.d. (90 points).
 - Larger gains for low scorers, low-income, URM
- Retaking changes lower scores’ initial colleges
 - 13 p.p. more likely to enroll in 4-yr over 2-yr
 - 20-30 p.p. for URM and low-income, respectively
 - No change in score sending → changing admission probability (or yield)

Potential Issues and Validity Checks

- Instrument validity - exclusion restriction
 - No problems when outcome related to scores
 - Two other potential channels when outcomes is college enrollment
 1. Admissions and financial aid may use round numbers
 2. Students believe used in admissions, even if not
- Precise control of initial SAT score around threshold not feasible

SAT Score Gaps

- Is a policy to close retaking gaps worth while?
 - Assume same effects on marginal retaker as compliers
 - No general equilibrium effects in college admission
 - Linear effect of retakes on enrollment
- Income: closes up to 18-25% of 25pp enrollment gap for SAT-takers
 - Closer to 10% among high school graduates
- Ethnicity: closes up to 10-14% of 18pp enrollment gap for SAT-takers
 - Closer to 7% among high school graduates

Policies to Close Gaps

- Informational interventions
 - CB intervention on Facebook didn't work (Avery et al., 2018)
 - Information tends to be consumed by advantaged groups (Hurwitz and Smith, 2018)
- Change college admission policies away from retaking
 - “the costliest, least accurate, and most biased” Vigdor and Clotfelter (2003)
- Improve fee waiver process
 - 43% of students with self-reported family income under \$30k do not use fee waiver
- Encourage early taking
 - State and local mandates (school day)
 - Pricing or subsidies (decreasing function of attempt), transportation

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NCME, April 2019

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Bonus Slides!

Findings - Retaking Determinants

- Nearly half of students retake, but gaps
 - URM students, 9 p.p. behind
 - Low-income students, 21 p.p. behind
- Retake increases with early initial exam dates, low-income fee waivers
- Retaking if just miss 100 point increments
 - Pope and Simonsohn (2011) show it with SAT

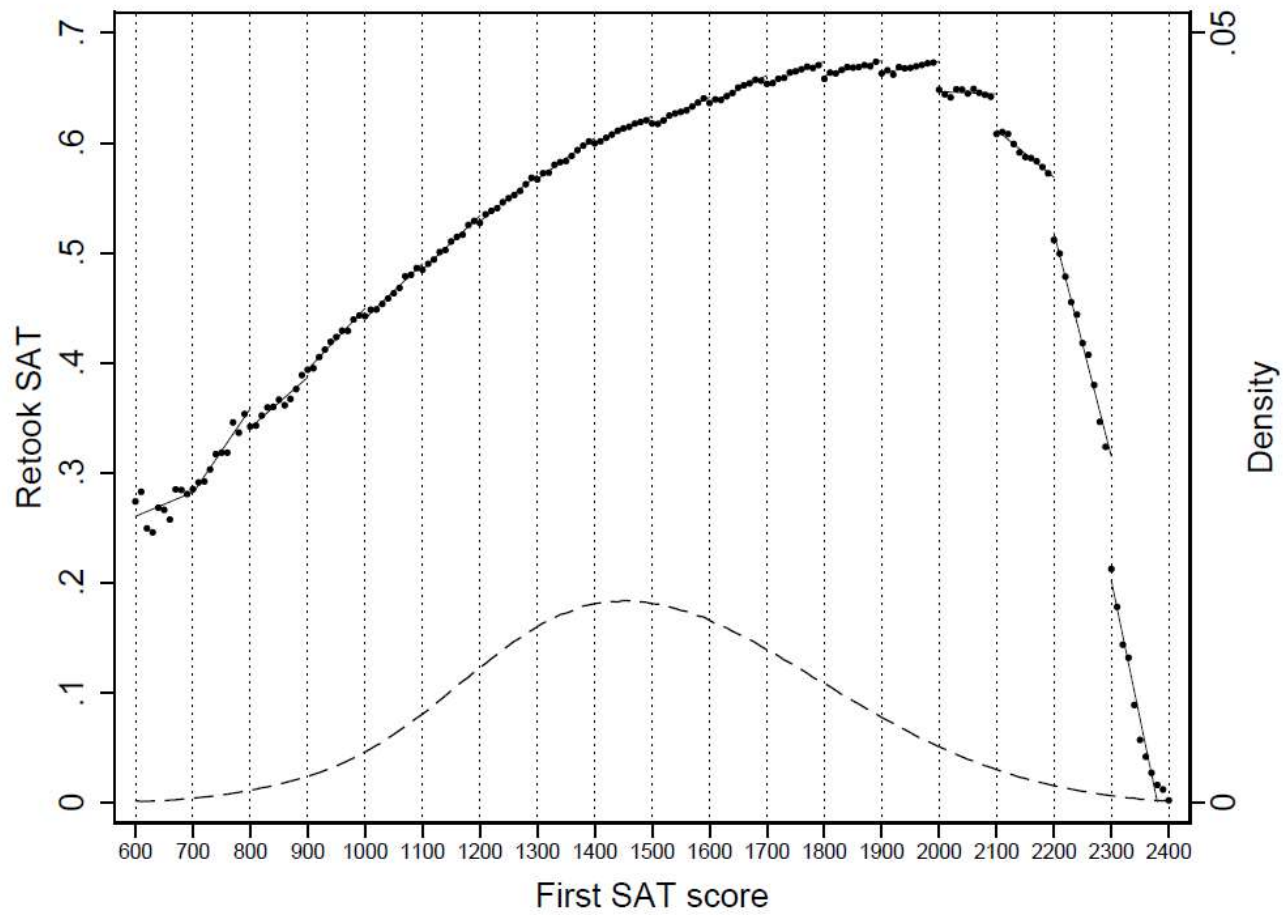


Figure A.1: Density of First SAT Scores

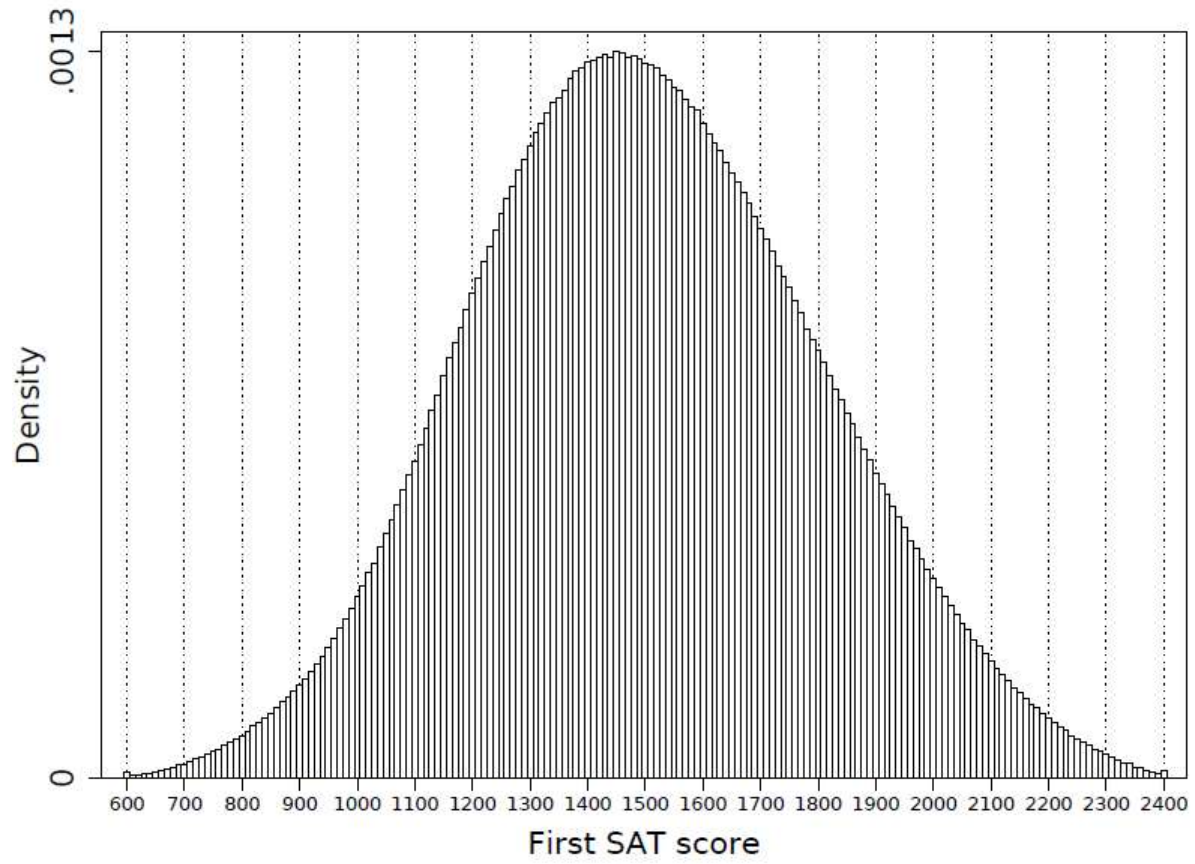


Figure A.2: Covariate Balance

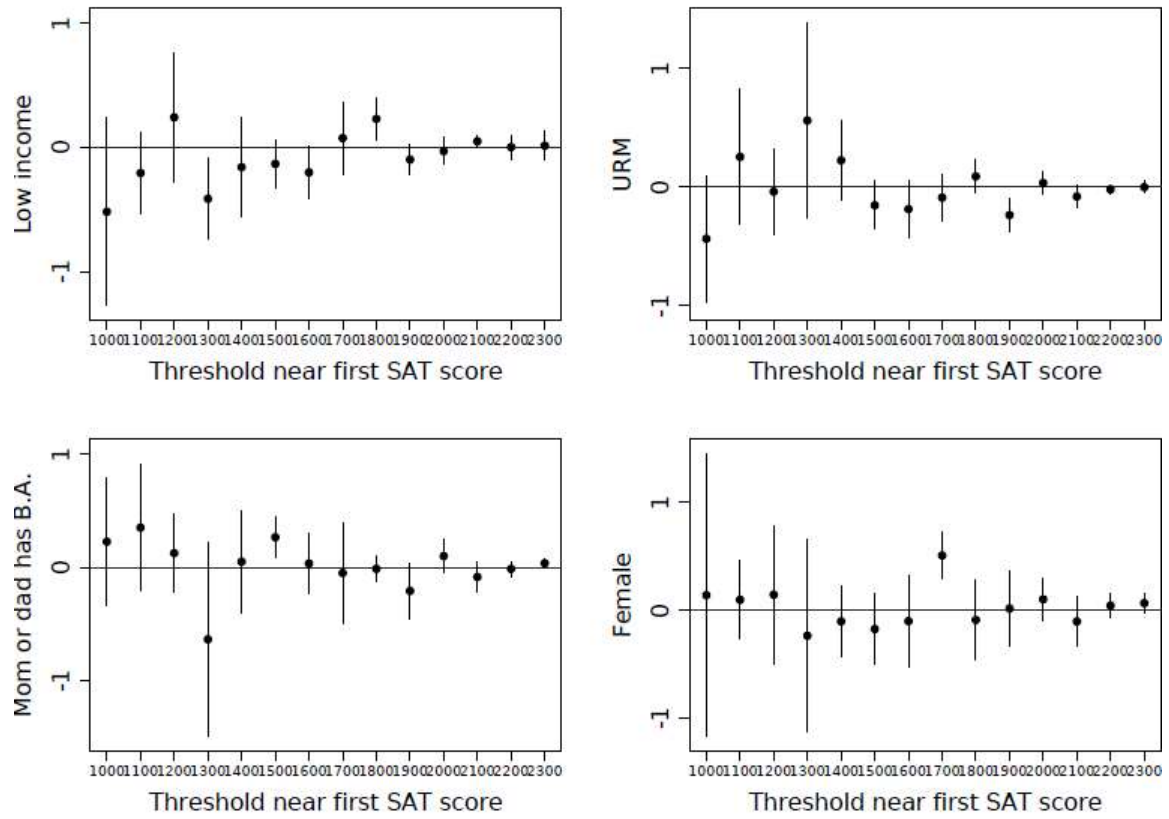


Table 3: Round-Number Thresholds and SAT Retaking

	All students (1)	Lower scoring (2)	Higher scoring (3)	Low income (4)	High income (5)	URM (6)	Non-URM (7)
Retook (FS)	0.009*** (0.001)	0.006*** (0.000)	0.014*** (0.002)	0.008*** (0.001)	0.010*** (0.001)	0.008*** (0.001)	0.010*** (0.001)
Takes (RF)	0.012*** (0.001)	0.008*** (0.001)	0.017*** (0.002)	0.012*** (0.001)	0.014*** (0.002)	0.011*** (0.001)	0.013*** (0.001)
Takes (IV)	1.331*** (0.053)	1.438*** (0.131)	1.275*** (0.040)	1.436*** (0.139)	1.383*** (0.107)	1.394*** (0.079)	1.284*** (0.047)
First stage F-statistic	180.6	144.1	82.9	71.3	83.4	89.6	149.8
<hr/> Complier characteristics <hr/>							
First SAT score	1682	1265	1912	1520	1817	1440	1757
Low income	0.19	0.33	0.12			0.42	0.13
URM	0.22	0.35	0.14	0.44	0.17		
<hr/> Mean characteristics <hr/>							
First SAT score	1499	1292	1774	1391	1599	1328	1569
Low income	0.19	0.24	0.12			0.33	0.14
URM	0.26	0.36	0.12	0.45	0.12		
N	14,368,305	8,201,406	6,166,899	2,677,386	2,661,691	3,677,470	9,810,789

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	After two potential takes		After all takes	
	Most recent total score (1)	Superscore (2)	Superscore (3)	Superscore increase of 150+ points (4)
<u>(A) All students</u>				
All	46.4*** (7.9)	87.7*** (5.0)	101.9*** (5.9)	0.237*** (0.035)
<u>(B) By initial score</u>				
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<u>(D) By race/ethnicity</u>				
URM	59.5*** (15.5)	93.8*** (11.6)	106.1*** (13.0)	0.296*** (0.072)
Non-URM	37.5*** (9.2)	83.8*** (6.1)	97.5*** (6.8)	0.213*** (0.042)

Table 5: Retaking and College Enrollment

	College type		College's graduation rate			College's mean income		
	Four-year (1)	Two-year (2)	Overall (3)	>50% (4)	>80% (5)	Overall (6)	> \$50,000 (7)	> \$65,000 (8)
(A) All students								
All	0.125*** (0.042)	-0.060 (0.037)	0.062** (0.024)	0.088** (0.038)	0.001 (0.030)	0.724 (2.104)	0.081* (0.044)	-0.036 (0.035)
Control complier mean	0.67	0.15	0.53	0.61	0.27	55.11	0.51	0.29
(B) By initial score								
Lower scoring	0.329*** (0.088)	-0.209** (0.081)	0.138*** (0.042)	0.182** (0.070)	0.003 (0.050)	6.877*** (2.561)	0.150* (0.077)	0.053 (0.051)
Control complier mean	0.39	0.33	0.32	0.34	0.04	37.25	0.21	0.04
Higher scoring	0.014 (0.040)	0.020 (0.029)	0.021 (0.029)	0.038 (0.043)	0.001 (0.038)	-2.509 (2.941)	0.045 (0.053)	-0.083* (0.047)
Control complier mean	0.82	0.04	0.65	0.76	0.40	64.89	0.68	0.42
(C) By income								
Low income	0.299*** (0.109)	-0.238*** (0.088)	0.155*** (0.058)	0.308*** (0.091)	0.076 (0.073)	3.242 (4.243)	0.275*** (0.102)	0.027 (0.078)
Control complier mean	0.51	0.25	0.40	0.43	0.15	47.66	0.36	0.21
High income	0.025 (0.084)	-0.093 (0.071)	0.004 (0.050)	0.044 (0.078)	0.015 (0.079)	-1.821 (4.311)	0.131 (0.083)	-0.066 (0.083)
Control complier mean	0.76	0.13	0.62	0.72	0.38	61.02	0.59	0.35
(D) By race/ethnicity								
URM	0.204** (0.089)	-0.192** (0.077)	0.074* (0.044)	0.097 (0.069)	0.019 (0.050)	-0.456 (3.186)	0.038 (0.072)	-0.037 (0.050)
Control complier mean	0.55	0.29	0.43	0.47	0.15	48.71	0.42	0.16
Non-URM	0.084* (0.046)	-0.032 (0.035)	0.046 (0.030)	0.066 (0.045)	-0.014 (0.037)	0.543 (2.369)	0.083 (0.053)	-0.028 (0.041)
Control complier mean	0.71	0.11	0.57	0.66	0.31	57.20	0.55	0.33

Table 6: Retaking and College Enrollment among Lower Scoring Students

	College type		College's graduation rate			College's mean earnings		
	Four-year (1)	Two-year (2)	Overall (3)	>50% (4)	>80% (5)	Overall (6)	> \$50,000 (7)	> \$65,000 (8)
<u>(A) By income</u>								
Low income	0.407** (0.169)	-0.396*** (0.130)	0.171** (0.081)	0.418*** (0.114)	0.009 (0.110)	7.292 (4.994)	0.302** (0.145)	0.054 (0.095)
Control complier mean	0.27	0.43	0.26	0.20	0.03	35.97	0.17	0.04
High income	0.023 (0.355)	-0.319 (0.321)	-0.079 (0.171)	-0.001 (0.325)	-0.019 (0.151)	5.968 (9.187)	0.217 (0.273)	0.278** (0.138)
Control complier mean	0.50	0.49	0.44	0.45	0.05	40.64	0.36	0.02
<u>(B) By race/ethnicity</u>								
URM	0.320** (0.137)	-0.287** (0.113)	0.094 (0.066)	0.116 (0.099)	0.001 (0.056)	3.410 (3.885)	0.050 (0.103)	-0.020 (0.051)
Control complier mean	0.34	0.40	0.28	0.28	0.02	35.75	0.21	0.03
Non-URM	0.296*** (0.110)	-0.202** (0.099)	0.150** (0.067)	0.200* (0.103)	0.016 (0.085)	9.228** (4.434)	0.204 (0.126)	0.124 (0.084)
Control complier mean	0.44	0.32	0.36	0.39	0.06	38.83	0.23	0.05

Table 7: Retaking and College Applications

	Score sends, by college graduation rate		
	0-50% (1)	50-80% (2)	80-100% (3)
<u>(A) All students</u>			
All	-0.161* (0.094)	-0.213 (0.183)	-1.654*** (0.263)
Control complier mean	0.67	2.03	3.15
<u>(B) By initial score</u>			
Low scoring	-0.093 (0.222)	-0.059 (0.366)	-0.566 (0.375)
Control complier mean	0.76	2.03	0.76
High scoring	-0.198*** (0.075)	-0.296 (0.198)	-2.241*** (0.310)
Control complier mean	0.63	2.02	4.47
<u>(C) By income</u>			
Low income	-0.077 (0.325)	-0.242 (0.397)	-1.193** (0.578)
Control complier mean	0.90	2.13	1.94
High income	-0.242 (0.199)	-0.289 (0.345)	-1.777*** (0.664)
Control complier mean	0.58	2.26	4.15
<u>(D) By race/ethnicity</u>			
URM	-0.099 (0.263)	0.144 (0.384)	-1.237** (0.521)
Control complier mean	0.86	2.11	2.01
Non-URM	-0.183* (0.094)	-0.387* (0.201)	-1.916*** (0.293)
Control complier mean	0.60	2.05	3.48