Strategic Disclosure of Test Scores: Evidence from US College Admissions*

Brian McManus
University of North Carolina – Chapel Hill

Jessica Howell
College Board

Michael Hurwitz
College Board

February 2024

Abstract: We analyze individual applicants' standardized test scores and disclosure behavior to 50 selective US colleges for entry in fall 2021, when Covid-19 prompted widespread adoption of test-optional admissions policies. Applicants withheld low scores and disclosed high scores, including seeking admissions advantages by conditioning their disclosure choices on their other academic characteristics, colleges' selectivity and testing policy statements, and the Covid-related test access challenges of the applicants' local peers. We find only modest differences in test disclosure strategies by applicants' race and socioeconomic characteristics. After enrolling, individuals who withheld scores received lower first-year college grades and completed fewer credit hours.

JEL Codes: D82, I23

* We thank Parker Goyer, Sam Imlay, Meagan Madden, and Katie Widdoss for assistance in data collection and preparation. We received helpful feedback from Gary Biglaiser, Daniel Chaves, Fei Li, Peter Norman, Collin Raymond, Mike Waldman, Paige Weber, Jon Williams, and members of the Admissions Research Consortium's Research Advisory Committee. Corresponding author: Brian McManus (mcmanusb@unc.edu), Department of Economics, University of North Carolina, Chapel Hill NC 27599. Jessica Howell (jhowell@collegeboard.org) and Michael Hurwitz (mhurwitz@collegeboard.org): College Board, 1919 M St NW #300, Washington DC 20036.

1. Introduction

US colleges and universities are considering significant changes to the role of standardized tests in their admissions policies and practices. Prior to the 2020-21 academic year, most selective postsecondary institutions required standardized tests for applicants, but reduced testing opportunities due to Covid-19 prompted widespread adoption of test-optional policies, with many institutions continuing these policies after pandemic-related testing barriers receded. Test-optional admissions policies, which invite applicants to submit scores if they desire and suggest no penalty for absent scores, are an active area of investigation in education policy and among postsecondary institutions considering retaining these policies permanently.[1] The policies' impacts on competitive admissions and higher education access will depend on how applicants and institutions regard these policies as strategic opportunities. Several aspects of the college admissions setting raise novel questions about score disclosure behavior and its consequences: Do college applicants, who are generally minors and one-time participants in this disclosure setting, act strategically in their choices of whether to disclose test scores? Do applicants believe that colleges can commit to policies in which the institutions do not make negative inferences about applicants who do not submit scores? Do test-optional policies have significant impacts on information available to institutions?

We answer these questions with novel evidence on college applicants' actions and outcomes. We analyze the test score disclosure choices of individuals who applied to enter US colleges and universities in fall 2021. These applicants, who were completing their applications during the 2020-2021 school year, encountered test-optional policies that were generally not present for earlier cohorts. Our data come from College Board, which administers the SAT (the leading standardized test for US college admissions), and 50 selective US colleges and universities which received over a million applications in fall 2020. The data link individuals' SAT scores to their application records at the sample institutions. In addition to information on an individual's high school performance, demographics, and admissions outcomes, we

[1] While many selective colleges are still in the experimental phase of this admissions policy, some have decided to reinstate testing requirements, while others, at least in the near term, have halted the consideration of test scores (Jaschik, 2021; Wren, 2022). Some state governments (e.g., Colorado) have passed legislation making admissions test-optional in their public universities.

observe the applicant's SAT score even if it was not disclosed on the application for consideration in admissions. We observe that applicants with low scores are less likely to disclose than those with high scores. This selective disclosure behavior is rationalized by institutions' admissions decisions, which tended to reward high-scoring applicants who disclosed scores and low-scoring applicants who withheld. We find these patterns in disclosure activity across a variety of applicant racial, ethnic, and socioeconomic backgrounds. This is notable because differences in cultural capital around disclosure strategies, if such differences exist, could exacerbate challenges in college access for applicants from historically disadvantaged subgroups, who have lower test scores, on average, and therefore may benefit from opportunities to withhold their scores.

Applicants' behaviors go beyond simply disclosing high scores and withholding low scores, relative to the overall distribution of SAT scores in the US. Applicants are more likely to disclose scores that are high conditional on the applicants' other academic and personal characteristics, e.g., an applicant with poor high school grades is more likely to disclose a middling SAT score than an applicant with excellent grades and the same SAT score. This suggests that applicants consider how institutions combine information from test scores and other factors to make inferences about applicants' academic preparation. In addition, we take advantage of opportunities to observe applicants who applied to multiple institutions to investigate within-applicant variation in disclosure choices. This serves two purposes in our analysis. First, it provides evidence that a given student will deliberately vary their disclosure choice, and the patterns above are not simply due to correlation in test scores and disclosure tendencies that are unresponsive to applicants' circumstances. Second, it provides insight on another dimension where applicants may strategically shade their disclosure choices. We find that an applicant with a given nominal score, which may be relatively low for one institution and high for another, is significantly more likely to withhold the score when it is relatively low.

We also provide evidence on how applicants anticipated institutions' responses to test scores and disclosure choices. The institutions' test-optional policies generally stated that the absence of scores would not hurt an applicant, but some applicants may have suspected that institutions would be unable to resist making negative inferences when scores were absent. This is the central intuition of the unravelling equilibrium in classic disclosure models, in which virtually all individuals voluntarily reveal information, even if it is fairly negative, because agents who have requested the information take all opportunities to make inferences from what is and is not revealed (Milgrom, 1981; Grossman, 1981).[2] By contrast, if institutions were able to convince applicants that they would constrain themselves to follow-through on their policies, then applicants would be more likely to trust the policies and selectively disclose high SAT scores. Our evidence on these issues is mixed. In addition to the general pattern of selective disclosure of high scores, we find that differences in how institutions described their test-optional policies are associated with significantly different score disclosure choices by applicants, suggesting that many applicants took institutions' policies at face value. However, we also show that applicants were less likely to disclose their low scores if they lived in localities with greater Covid-related reductions in testing opportunities. This is consistent with intuition from disclosure games in which testing barriers moderate the forces which compel disclosure of low scores, as individuals with low scores can pool with individuals who lack test scores (Jovanovic, 1982; Shin, 1994).

We conclude our analysis by analyzing the impact of information loss on institutions from test-optional policies. First, we show that test-optional policies led to a significant share of enrolled students who did not report test scores. Following from individuals' disclosure patterns during the admissions stage, the enrolled students who withheld scores had significantly lower scores than those who disclosed. In addition to the implications for competitive admissions, this means that institutions were less informed about their students who were in greater need of academic support to be successful in college. We demonstrate this in a second set of results, which present the relationship between score disclosure and academic achievement during enrolled students' first year in college. Students who disclosed SAT scores received higher college grades and completed more college credit hours than those who withheld scores. We show that differences in college performance are primarily explained by the students' scores themselves

[2] See Milgrom (2008) and Dranove and Jin (2010) for surveys of disclosure and quality certification.

rather than their discrete disclosure actions, implying that observing the disclosure choice does not fully remedy information loss from the application stage.

There is a substantial literature on students' responses to incentives within their college application behavior, including how these choices have important effects on their longer-run outcomes. Students' responses to incentives include submitting fewer applications to institutions with greater monetary or time costs of applying (Liu et al., 2007; Smith et al., 2015; Hurwitz et al., 2016). While this literature on incentive effects shows that students respond to the prices and costs they face directly, our paper documents more sophisticated behavior which involves anticipating the responses of other agents, i.e., the colleges.

Students' choices during the application stage have effects that carry-over to college enrollment and completion (Hoxby and Avery, 2012; Hoxby and Turner, 2013; Smith, 2014), as well as the matches made between students and colleges (Smith et al., 2013; Howell and Pender, 2016). Highly selective colleges, like many institutions we study in this paper, are the subject of much attention and analysis because of the opportunities and earnings they may facilitate for their graduates. Chetty et al. (2020) and Chetty et al. (2023) study differences in access to these institutions across households of different socioeconomic circumstances.

Previous studies of pre-pandemic test-optional admissions policies have generally focused on whether institutions' applicant pools grow or change when a college switches from test-required to test-optional. These studies' results suggest that submission of college entrance exams was perceived as a barrier by some applicants (Bennett, 2022; Belasco et al., 2015; Saboe and Terrizzi, 2019). Like us, Conlin et al. (2013) and Conlin and Dickert-Conlin (2017) study empirically the strategic considerations of applicants and institutions under test-optional policies, but their evidence comes from a more limited set of colleges (2) and applicants (about 10,000) relative to our data. Recent empirical research documents that pandemic-related increases in test-optional policies led to students increasing their number of college applications

(Kim et al., 2022; Howell et al., 2022).[3] In addition, in studies using different data than ours, Rodriguez (2023) and Cruce and Sanchez (2023) document that pandemic-related test-optional policies are associated with applicants opting to disclose only relatively high test scores.[4] To explore institutions' incentives to adopt test-optional policies, Dessein et al. (2023) offer a theoretical model in which institutions and society disagree about admissions priorities, and test-optional policies allow the two sides to reduce their conflict because the information transmitted in applications is less contentious.

In addition to the education literature, our results contribute to the empirical literature on voluntary disclosure. In the core examples of disclosure literature, sellers with information on product quality or value choose whether to share this information with potential buyers. Evidence from the laboratory (Jin et al., 2021) and field (Brown et al., 2012; Bederson et al., 2018) generally documents that individuals are more likely to share good news than bad news. In these settings, partial disclosure can be rationalized because information receivers may be naïve or inattentive, and therefore they do not infer that missing signals are likely negative (e.g., Fishman and Hagerty, 2003). In many empirical contexts, this follows from signal-senders being firms that behave more strategically than their potential customers. Our setting offers several novel opportunities for empirical analysis. First, the sophistication and experience of the two sides is reversed, with teenage college applicants choosing whether to send scores to higher education institutions.[5] Second, the institutions announced policies against negative inferences that agents in standard disclosure games would not want to obey, which raises questions about whether the policies are credible. Third, to our

[3] The increase was especially sharp at selective colleges. This may be due, in part, to applicants with low test scores sending applications to institutions which may have seemed out of reach under test-mandatory policies.

[4] Rodriguez (2023) employs data from a single public four-year institution. Cruce and Sanchez (2023) examine data on ACT score-sending (a proxy for college application) by students attending high schools in states where all students have an opportunity to take the ACT for free during the school day, but the authors do not have applications or admissions data.

[5] In this regard, our findings on less experienced players in information games are relevant to the growing literature on how consumers handle their personal data when interacting with firms who attempt to extract demand information (e.g., Ali, Lewis, and Vasserman, 2023).

knowledge we are the first to study field data that include variation in pooling opportunities in disclosure games.[6]

2. Institutions and setting

Prior to 2020, when the Covid-19 pandemic upended college admissions, most US colleges and universities required applicants to submit standardized test scores. The test score contributes to the applicant's overall admissions profile, which also includes high school curriculum and grades, activities in and out of school, essays, and confidential letters of recommendation. Arguments for the use of standardized tests include the tests' value in improving college access for students in high schools with limited academic offerings and extracurricular activities, as well as the tests predicting students' success in college-level coursework, retention, and degree completion.[7] Advocates for test-optional policies argue that these policies enhance diversity on college campuses, but evidence is mixed on their causal impact on student diversity (Belasco et al., 2015; Bennett, 2022).

There are two main standardized tests for US college admissions: the SAT and the ACT. Virtually all institutions accept both SAT and ACT scores, and institutions utilize a published method for "concording" SAT and ACT scores onto a common scale.[8] Each test is administered several times a year in thousands of locations. Students taking a test on a weekend pay a fee to register with their preferred date and location. In addition, most students now also have an annual opportunity to take the SAT or ACT for free during the school day in their own school.[9] Prior to Covid-19, about 60% of high school graduates took the SAT and 50% took the ACT, with an unknown share taking both (National Center for Education

[6] King and Walling (1991) and Dickhaut et al. (2003) provide laboratory evidence on cases in which a fraction of sellers (asset owners) may not have information to share with counterparties.

[7] Westrick et al. (2019); Westrick et al. (2022); Wren (2022).

[8] Official concordance tables are constructed together by College Board and ACT, and explained in a jointly published guide at https://satsuite.collegeboard.org/media/pdf/guide-2018-act-sat-concordance.pdf.

[9] 49% of students in the high school graduating class of 2020 took the SAT in their home high school during the school day. This figure rose to 62% for the class of 2021 and 63% for the class of 2022 (College Board, 2022b).

Statistics, 2021a and 2022). Applicants may take one or both standardized tests multiple times, reporting their best score on their applications.[10] Applicants often take standardized tests between the start of 11th grade and the first half of 12th grade, when they are completing their college applications. Before Covid-19, about 39% of traditional four-year degree-granting institutions, accounting for 26% of enrolled students, had test-optional admissions policies, where scores were neither required nor recommended.[11] Despite these colleges' test-optional policies, almost 50% of their applicants submitted the SAT plus 33% of applicants submitted the ACT in the last year prior to widespread test-optional admissions (National Center for Education Statistics, 2019).[12]

Covid-19 had a substantial impact on the application and admissions process for individuals who submitted applications in 2020-2021 to start college in fall of 2021. Many high schools shifted to virtual learning and adopted more lenient grading practices, extracurricular activities were curtailed, and standardized test opportunities were cancelled or reduced. Each factor affected applicants' opportunities to distinguish themselves from their peers on college applications. In response to reduced testing opportunities, US colleges and universities largely shifted to test-optional admissions policies. Institutions began announcing these policy changes in summer 2020, after some individuals from the high school graduating class of 2021 had taken the SAT and before they made final decisions about where to apply. The test-optional policy applied to all applicants; institutions did not require proof that the applicant lacked a test score or experienced substantial reductions in testing opportunities due to Covid-19. The new testing policies typically emphasized that applicants without test scores would not be penalized in admissions

[10] There is geographic variation in whether the SAT or ACT is the more common test taken by US college applicants. The SAT is more popular in most coastal states, while the ACT is generally more popular in the Midwest, plains states, and south. Applicants in our data who disclosed ACT scores are similar to SAT disclosers in their prior academic achievements and standardized test scores.

[11] Prior to Covid-19, more selective institutions in the US, like the colleges in oursample, were relatively likely to require standardized tests. See the National Center for Education Statistics (2019) for data on pre-Covid test-optional policies.

[12] Industry experts suggest that the high share of submitted scores at test-optional institutions could be due to applicants almost always having a test score because they also plan to apply to other school which require scores, and the low stakes or low salience attached to the test disclosure choice at test-optional colleges prior to Covid-19.

decisions. Institutions did not specify what this would mean in practice, however, and institutions made no explicit commitments to eschew revisions of how they interpreted test scores. Institutions described their test-optional policies using language that varied across institutions; we return to this below.

In many cases, applicants who took a standardized test faced higher costs due to cancellations or postponements of individual testing sessions, increased travel to a testing site with capacity, or more difficult testing circumstances due to masking or social distancing. Despite these challenges, most applicants in the 2021 cohort had at least one test score to consider disclosing. College Board reports that the total number of SAT takers declined from 2.2 million in the 2020 high school graduation cohort to 1.5 million in the 2021 cohort (College Board, 2022b). Similarly, the number of ACT takers in the 2021 cohort fell by 22% relative to ACT takers in the previous cohort (ACT, 2021).

As in pre-pandemic application cycles, applicants in the 2021 cohort had a variety of resources to help them compare their scores to relevant benchmarks. Applicants may have obtained score data for enrolled students from public-facing resources like colleges' own descriptions of their study bodies, *US News and World Report*'s "Best Colleges" issue, the Common Data Set (CDS), and the US Department of Education's Integrated Postsecondary Education Data System (IPEDS), which powers the College Scorecard and College Navigator websites. Colleges' application materials might also guide student decision-making on whether to disclose test scores. These resources, as well as information from knowledgeable adults like school counselors, were likely to have influenced choices about score disclosure.

3. Data and preliminary analysis

3.1 Sources and summary statistics

Our data come from the Admissions Research Consortium (ARC) formed between College Board (CB) and more than 50 US colleges and universities. The consortium conducts research on trends in college applications, admissions, enrollment, and college student performance. Institutions participating in the consortium provide data on individual applicants' high school grades, standardized test scores and disclosure choices, socioeconomic backgrounds, and admissions outcomes. The resulting sample of applicants and applications are linked across College Board data and all ARC applications. The data sources and connections provide several useful opportunities for analysis. It is possible to observe some applicants who take the SAT and apply to consortium institutions yet provide no test score to colleges, as well as applicants who apply to multiple institutions and vary their SAT disclosure decisions. The ARC institutions are dispersed throughout the US, range in size from small liberal arts colleges to state flagship universities, and most have competitive admissions processes, with an average admissions rate of 43%. We provide more information on these institutions below.

We observe over 685,000 unique individual applicants from the high school graduating class of 2021 in the ARC data. 85% are US residents, which implies that we observe about 16% of the 3.66 million US high school graduates in 2021 (National Center for Educational Statistics, 2021b). We include only US resident applicants in our analysis. 20.6% of ARC applicants report an ACT score (and may have an SAT score), and 34% have no SAT score and report no score to an ARC institution.[13] We exclude both applicant groups from our analysis, which means we focus on US applicants who had an SAT score, and this was the score disclosed if any test result was shared with an ARC institution. In addition to the sample restrictions described above, which together reduce the ARC applicant sample by about 60%, we drop observations from the small share of applicants who reported inconsistent data on race, test score, high school, or their home address across their ARC institution applications. After applying all the sample restrictions described above, we have data on 275,920 individual applicants. We refer to these applicants and their applications as “sample 1.” These applicants submitted 503,247 total applications to the ARC institutions, implying that each applicant appears, on average, 1.82 times. 115,620 applicants in sample 1 submitted multiple applications, with half submitting two, a quarter submitting three, and a quarter submitting four or more. From within this population with multiple applications, our 99,900 “sample 2” contains applicants who varied their disclosure choices across ARC institutions. Approximately a quarter of individuals in sample

[13] The applicants with no SAT and no disclosed ACT score include: individuals with an ACT score who did not disclose, individuals who wanted to test but did not due to pandemic-related increases in testing costs, and individuals without significant testing costs who chose to forego testing in light of the new admissions policies.

1 with multiple applications varied their disclosure decisions. See Table A1 in the Online Appendix for additional information on how the test scores, high school performance, and demographic characteristics of samples 1 and 2 compare to the full population of SAT takers for the fall 2021 first-year college class and the ARC dataset.

In Table 1 we describe the US-resident applicants of sample 1. Applicants who identify as white account for 48.9% of applicants, 17.2% of applicants are Hispanic, 11.5% are Black, and 14.9% are Asian. SAT takers are asked about their parents' education and 97% provided responses, with 72% of all applicants reporting that one or more parents earned a bachelor's degree and 25% are from a "first-generation" family where no parent earned a bachelor's degree. SAT takers also self-report their high-school grade average (HSGPA) as A+, A, A-, and B+, and so on. We convert these to GPAs on a 4.0 scale (with A+ = 4.33) and report the average grades overall and by applicant race, ethnicity, or parents' education. Most applicants (71.8%) have grades in the A+ to A- range.[14] There is a strong positive correlation between applicants' high school grades and their SAT scores. We capture applicants' strength of high school curriculum through the number of Advanced Placement (AP) exams taken by the end of 12th grade. About one quarter of applicants are in each of four bins counting AP exams: 0, 1-2, 3-5, and 6+. Like grades, this measure of curricular strength is positively correlated with SAT scores. The socioeconomic circumstances of the applicant's community are in College Board's "neighborhood challenge" variable, which takes values from 1 to 100 and is constructed to represent the educational and societal challenges in the applicant's census tract.[15] On average, applicants in sample 1 have a neighborhood challenge of 28.5. Applicants in sample 1 have an average SAT score of 1200, which exceeds the 2022 national average score of 1050 (College Board, 2022a), indicating that the ARC institutions attract relatively high-achieving individuals. The score differences by

[14] Self-reported high school GPA data is collected from students on a single, letter grade scale, while official transcript high school GPA data come in many different scales that are more challenging to standardized across schools. Research shows the correlation between self-reported high school GPA and official high school GPA from transcript data is 0.74 (Marini et al., 2021) and that this relationship has been stable for decades (Shaw and Mattern, 2009), so we utilize self-reported high school GPA in our analyses.

[15] More information about the construction of the neighborhood challenge variable is available at https://secure-media.collegeboard.org/landscape/comprehensive-data-methodology-overview.pdf.

demographic characteristics and socioeconomic circumstances mirror the patterns in the population of all SAT takers. The applicants in the ARC data and samples 1 and 2 are drawn from areas with slightly greater Covid-related reductions in activity (as measured by foot traffic changes in high school buildings), relative to the full SAT-taking population. In Online Appendix Table A1 we report that foot traffic fell by 54%, on average, in the counties of sample 1 applicants' high schools between October 2019 and October 2020. This decline in foot traffic was accompanied by a 31% reduction in county-level SAT testing volume.

In Table 2 we describe some application-level statistics. In sample 1, 44% of applications contained a disclosed SAT score. Across applicants of different race/ethnicities, raw disclosure rates ranged from 25.1% for applications submitted by Black applicants to 56.5% for those submitted by Asian applicants. One-third of applications submitted by first-generation applicants included an SAT score, and the rate was 48% for non-first-generation applicants.[16] Applicants with higher high school grades and more AP exams were more likely to disclose SAT scores. In the analysis below, we disentangle whether relationships between SAT scores and grades or AP exams are due to general differences in disclosure propensity or a consequence of strategic behavior across different circumstances.

The SAT scores in sample 2 are considerably higher than those in sample 1, likely reflecting correlation between an applicant's score and the number of selective institutions she applies to. Applications in sample 2 contain smaller differences across demographic and family background measures. Disclosure rates among Black and Hispanic applicants are 47%, compared to approximately 60% disclosure by Asian applicants. The disclosure rate gap between first-generation and non-first-generation applicants in sample 1 falls by about half in sample 2, from 16 percentage points to 8. Finally, the Table also includes average scores and disclosure rates from applications to in-state colleges (public and private), public institutions, and between "feeder" high schools and the corresponding colleges that receive a high number of applications, as well as data by HSGPA and AP scores.[17] Disclosure rates in sample 1 are markedly higher

[16] Freeman et al. (2021) find similar differences by race/ethnicity and socioeconomic status in raw score disclosure rates among college applications submitted via the Common Application.

[17] Feeder high schools sent 30 or more applications to an institution during the 2018-2020 application cycles.

for students with higher HSGPAs as well as for students who took more AP exams in high school. These gradients are smaller in sample 2.

We summarize the characteristics of ARC institutions in Table 3. The institutions are relatively selective, as reflected by rates of admission, high school grades, and standardized test scores of the applicants. 32 colleges are private non-profit and 18 are public. We define half of the institutions in each group as “very selective” and the others as “selective” based on admission rates above/below 25% for private institutions and 60% for public institutions.[18] SAT scores and high school grades are both higher among applicants to very selective colleges than among applicants to selective colleges. SAT disclosure rates are lower at private colleges than public colleges. Applicant characteristics in most categories are similar, except for very selective private schools, which have applicant pools with more Asian applicants and fewer white applicants.

Our information on institutions includes the statements they provided online about how they intended to use standardized test scores during the fall 2021 admissions cycle. While all 50 institutions had test-optional policies, some reinforced the value of test scores in admissions decisions in their policy language, while others employed language that emphasized a reduced value or use of test scores. We scraped archived versions of the institutions’ webpages to collect these statements, and we placed them into three ranked categories based on how accommodating their language was about the absence of test scores. See the Online Appendix for additional detail on the language-scoring method and some examples of policy language. To summarize the policy language, we assign integer values 1 through 3 to the three ranked categories, with greater values for policies that are more favorable to standardized tests. In Table 3 we provide the average policy language score for the four institution types we observe. Public institutions tended to have more pro-test language in their policies. More selective public institutions were more encouraging of test disclosure than less selective public institutions, and the same pattern applies by

[18] We use the selectivity categories only in describing the data, so differences in public versus private selectivity designations do not carry-over to our empirical analysis.

selectivity within private universities. However, selective private institutions, which had the most flexible stance on score disclosure (average policy score 1.41 and admissions probability 0.451), admitted a smaller share of applicants than very selective public institutions (average policy score 2.35 and admissions probability 0.547.) 49 of the 50 ARC institutions retained test-optional policies for the fall 2022 admissions cycle.

3.2 The impact of test scores and disclosure choices

Applicants benefit from thinking strategically about score disclosure if their standardized test scores matter to admissions decisions. We provide two types of evidence that test scores and disclosure choices have real stakes for applicants. First, using pre-pandemic ARC admissions data for the entering classes of fall 2019 and fall 2020, we regress admissions probabilities on applicants' disclosed SAT scores and their other observable characteristics. We find that, on average historically, if an applicant's score is 1 percentage point greater within the distribution of enrollees' scores, her admission probability is 0.45 percentage points greater. While this relationship is not causal, it confirms conventional wisdom that a greater test score is beneficial to an applicant's admissions likelihood.[19]

Second, we use data on disclosure choices and admissions probabilities for the entering class of fall 2021. We document below that applicants with higher scores disclose these scores more often, but there is heterogeneity in students' disclosure choices throughout the score distribution. We use this variation to provide descriptive analysis of how admissions probabilities vary with applicants' disclosure choices. Separately for each quartile q of institution c's applicant scores, we compute the admissions probability a_{cq}^{d} for applicants who have made disclosure choice d, where d = 1 for disclosing a test score and d = 0 for withholding. The value a_{cq}^{d} is calculated as a simple empirical frequency; we do not control for any other aspects of an applicant's academic profile. We compute the difference $(a_{cq}^{1} - a_{cq}^{0})$ for each quartile at each

[19] A student's test score could be correlated with characteristics that are observed by admissions officers but are not in the data shared by ARC institutions. We do not have the opportunity to evaluate the impact of an exogenous shift in test score on admissions probability.

institution, and in Table 4 we report the share of 50 ARC colleges where admissions probabilities were similar ($|a_{cq}^1 - a_{cq}^0| < 0.03$), provided an advantage to disclosers ($a_{cq}^1 - a_{cq}^0 \geq 0.03$), and provided an advantage to withholders ($a_{cq}^0 - a_{cq}^1 \geq 0.03$). For applicants in the lowest quartile of an institution's applicant pool, most institutions (56%) had admissions probabilities at least 3 percentage points greater for withholders than disclosers. 32% of these institutions had small differences in admissions probabilities in this quartile, and only 14% had a_{cq}^1 significantly above a_{cq}^0. For applicants in the top score quartile, the opposite pattern holds. For 58% of institutions, high-scoring applicants who disclosed scores had a greater admission frequency than those who withheld scores. High-scoring applicants who withheld scores had greater admissions probabilities at only 18% of ARC institutions. Differences in admissions probabilities in the middle two quartiles follow a similar pattern. In summary, we view these differences in admissions probabilities as establishing the stakes of an applicant's choice whether to disclose a standardized test score. The choice made a meaningful difference in admissions at most ARC colleges, especially for applicants at the top and bottom of the score distribution. Moreover, the outcomes suggest that the institutions were, in general, able to commit to their stated policies to not punish applicants who withheld scores.

4. Empirical model of disclosure choice

4.1 The applicant's disclosure decision

We study an applicant's decision to disclose an SAT score to a college or university, given that the applicant has a score to send and has decided to apply to the institution.[20] Let applicant i have test score t_i. She applies to institution (college) c. In addition to the applicant's test score, she has additional characteristics in the vector x_{ic}, which includes personal characteristics (e.g., grades, curriculum) independent of c plus other details that may depend on her relationship to c (e.g., in-state status at a public institution). Relative to c's enrolled students during 2018-20, applicant i's test score is at the t_{ic} percentile. We treat the value t_{ic} as i's

[20] Applicants' choices about whether to take any standardized test and which universities to apply to, while important, are beyond the scope of this paper. We do not account for individuals' selection into application and how this depends on their preferred disclosure action.

relevant test score for institution c.[21] The applicant's choice to disclose a test score to institution c is d_{ic}, with $d_{ic} = 0$ for withholding a score and $d_{ic} = 1$ for disclosure. We assume that, after taking the SAT, there is no cost for i to send c her score.[22] Due to Covid-related reductions in testing opportunities, some applicants may have been prevented from re-taking the SAT in attempts to increase their scores. While this can create a divergence between an applicant's best realized score and what she thought she would receive with enough tries, at the time of the application she must take t_{ic} as given and base her decision on it alone. As we describe below, we find no difference between the disclosure choices of applicants who took the SAT multiple times (40% of ARC sample 1) versus the full applicant population.

The applicant has beliefs about whether institution c will admit her, given t_{ic} and x_{ic}, her disclosure choice, the institution's admission policy, and the characteristics and choices of other applicants. We write the applicant's belief about admission to c conditional on d_{ic} as $P_d(t_{ic}, x_{ic}, c)$; when $d_{ic} = 0$, we write the admission probability more compactly as $P_0(x_{ic}, c)$, without t_{ic}. We suppress other factors that can affect the applicant i's admission beliefs; these may include other applicants' scores and disclosure actions, as well as institutions' policies, commitment power, and methods for making inferences about i.

The applicant's utility value from being accepted by c is u_{ic}^{ACC}, and the utility of being rejected is u_{ic}^{REJ}. Applicants prefer acceptance to rejection, of course, but the difference between these values may vary with choices outside our model, such as preferences across institutions and the portfolio of institutions i applies to. The applicant's expected utility from test disclosure choice d is:

$$u_{ic}(d) = P_d(t_{ic}, x_{ic}, c)u_{ic}^{ACC} + [1 - P_d(t_{ic}, x_{ic}, c)]u_{ic}^{REJ} + \varepsilon_{icd},$$

where ε_{icd} is an idiosyncratic taste shock from disclosure choice d by i for institution c. We observe an applicant's binary disclosure choice, which we assume is determined by the latent utility difference $u_{ic}^{*} =$

[21] Working with percentile scores rather than nominal scores has no impact on the decision framework or estimation, but the percentile approach facilitates our discussion of results that aggregate across institutions.

[22] It is now common practice for colleges to allow applicants to provide unofficial scores on their applications, and then provide colleges with official scores after making their matriculation decisions. The colleges anticipate little fraud in self-reported scores on applications (Wren, 2022).

$u_{ic}(1) - u_{ic}(0)$, with the applicant choosing disclosure (d_{ic} = 1) when $u_{ic}^* > 0$ and withholding the score otherwise. In terms of the utility terms and outcome probabilities above, the utility difference is:

$$u_{ic}^* = [P_1(t_{ic}, x_{ic}, c) - P_0(x_{ic}, c)]\left(u_{ic}^{ACC} - u_{ic}^{REJ}\right) + \varepsilon_{ic}^*, \tag{1}$$

with $\varepsilon_{ic}^* = \varepsilon_{ic1} - \varepsilon_{ic0}$.

The applicant's beliefs about the disclosure game are embedded in the probability difference $P_1 - P_0$, which nests several potential hypotheses about applicant and institution behavior. If the typical applicant is not strategic or does not care about her disclosure choice, then we expect her to act as if $P_1 \approx P_0$, and disclosure choices would be independent of test scores. On the other hand, if the applicant is strategic about test score disclosure, we expect her to consider how her own score and the institution's inferences about her influence the difference $P_1 - P_0$. One straightforward way to describe a strategic applicant's approach to $P_1 - P_0$ is to write $P_0 = P_1(\tilde{t}_{ic}, x_{ic}, c)$, where $\tilde{t}_{ic}$ is applicant *i*'s belief about what score institution *c* would infer for her, given x_{ic} and the absence of a score in *i*'s application. The strategic applicant then chooses:

$$d_{ic} = \begin{cases} 1 & \text{if } t_{ic} > \tilde{t}, \text{ and} \\ 0 & \text{otherwise,} \end{cases} \tag{2}$$

with the responsiveness of this choice to differences across institutions' policies and applicants' circumstances shedding light on applicants' beliefs about their strategic situations. If applicants believe that institutions, in general, can commit to avoiding negative inferences about absent scores, then applicants may interpret $\tilde{t} = E(t_{ic}|x_{ic})$, i.e., as the expected test score conditional on a student's observable characteristics (x_{ic}) for the full distribution of (x, t) among applicants to *c*, regardless of selective disclosure choices. In addition, if applicants view institutions' statements as credible commitments, then differences in institutions' policy statements may affect applicants' disclosure behavior. By contrast, for applicants who doubt the institution's ability to avoid negative inferences, then unravelling logic suggests $\tilde{t}$ would be very low, and applicants would disclose scores that are low conditional on x_{ic}. In this case, withholding scores is more beneficial when institutions have less opportunity to make negative inferences about absent scores, so we would expect applicants' disclosure choices to vary with pooling opportunities.

4.2 Econometric models

In our empirical analysis, we estimate models derived from equations (1) and (2), with each equation presenting a few challenges. In equation (1), we have a latent utility expression which is the product of two unobserved objects: the utility difference $\left(u_{ic}^{ACC} - u_{ic}^{REJ}\right)$ and the applicant's belief about $(P_1 - P_0)$. In our analysis, we effectively normalize the utility difference to one and focus on the admissions probability difference, which we write as $\Delta = P_1 - P_0$. We estimate two different models that capture the latent benefit from disclosure, $u_{ic}^{*} = \Delta(t_{ic}, x_{ic}, c) + \varepsilon_{ic}^{*}$.[23] The first type of model uses the full within- and across-applicant variation of sample 1 to estimate a flexible version of Δ:

$$u_{ic}^{*} = \alpha \mathbf{t}_{ic} x_{ic} + \beta \mathbf{t}_{ic} \mu_c + \varepsilon_{ic}^{*}, \tag{3}$$

where $\mathbf{t}_{ic}$ is the vector $[1, t_{ic}, t_{ic}^2, t_{ic}^3]$, x_{ic} is a rich set of observed applicant characteristics, and μ_c is a fixed effect for college *c*. The interaction $\mathbf{t}_{ic} x_{ic}$ allows applicants with different observable characteristics to respond differently (in flexible functional form) to their test scores. The variables we include in x_{ic} are: dummies for the race/ethnicity categories in Table 1, dummies for information on parents' education, dummies for high school GPA values, dummies for the applicant's number of AP exams, dummies for whether the institution is in-state for applicant *i* and an interaction of in-state with an indicator for whether *c* is public, and a dummy for whether *i* is from a "feeder" high school that averages more than 10 applications per year to *c*. In estimating the parameters in equation (3), we assume that x_{ic} contains all the characteristics relevant to *i*'s decision whether to disclose t_{ic}. The interaction $\mathbf{t}_{ic} \mu_c$ allows applicants to each college *c* to respond flexibly to relative test score values. The constant term in $\mathbf{t}_{ic}$ creates a conventional fixed effect for each ARC college *c*, and the remaining terms in $\mathbf{t}_{ic}$ allow applicants to perceive

[23] In principle, it is possible to use restrictions on the size of $|P_1 - P_0|$ to bound ε_{ic}^{*}'s variance or the utility difference $\left(u_{ic}^{ACC} - u_{ic}^{REJ}\right)$, but we defer these issues to future research.

flexible college-specific differences in the return from score disclosure as t_{ic} increases. Other variation in disclosure choices is attributed to the error term ε^*_{ic}. We assume that ε^*_{ic} is Type-1 extreme value, which implies logit probabilities for test score disclosure.

Our second estimation approach to equation (1) exploits within-applicant variation in disclosure choices. While this reduces the sample size, the approach allows us to control for all individual-level differences in the benefit from disclosure. Of the factors discussed above, this can account for differences in the utility of acceptance versus rejection $\left(u^{ACC}_{ic} - u^{REJ}_{ic}\right)$ that are constant across colleges, differences in applicants' intrinsic value from disclosing scores, and differences in applicant characteristics (e.g., extracurricular activities, college advice resources at home or in school) that are unobserved in the ARC data and may change disclosure's perceived benefit.[24] We implement this analysis with a linear probability model:

$$d_{ic} = \gamma_0 t_{ic} + \gamma_1 t_{ic} x_{ic} + \delta_i + \mu_c + \epsilon_{ic}. \tag{4}$$

In this model, the dependent variable d_{ic} is a binary indicator for whether applicant *i* disclosed a score to institution *c*. The approach's central feature is that an individual applicant's best SAT score will have different positions in the score distributions of different institutions, and therefore a single nominal score t_i provides within-applicant variation in t_{ic}. To include an applicant's disclosure choices in estimating this model, the applicant must have variation in their disclosure choices across *c*. Intuitively, the parameter γ_0 captures the relative frequency that a disclosed score is greater than a withheld score, and how this frequency varies with differences in t_{ic}. The term $\gamma_1 t_{ic} x_{ic}$ captures how applicants of different observable characteristics vary in their disclosure choices. Applicant *i*'s characteristics are captured by the student fixed effect δ_i, institution-level differences in disclosure are captured by the college fixed effect μ_c, and other variation in disclosure choices is due to the error term ϵ_{ic}.

[24] For example, applicants with high test scores may also be likely to have leadership positions in extracurricular activities, and these leadership positions may reduce the value or role of test performance in a college's evaluation of the applicant.

For our empirical approach to equation (2), which presents a more focused perspective on how disclosure choices are related to expected test scores, we implement a two-step procedure. In the first step, we estimate a simple model of expected test scores conditional on applicant characteristics (x_{ic}) and institution identities (c).[25] In particular, we assume that the relevant expected score is unconditional on disclosure, as when the applicant believes that institution will not penalize her for an absent score; our results below show that this perspective is consistent with most applicants' behavior. We use the applications in sample 1 in a linear regression of t_{ic} values on institution fixed effects, all entries of x_{ic}, and interactions between each race/ethnicity indicator and the applicant's GPA and number of AP exams. For each applicant in sample 1, we use the estimated model to calculate a predicted test score, $\hat{t}_{ic}$. In the second step, we estimate a model of binary disclosure choice as a function of an applicant's characteristics and $(t_{ic} - \hat{t}_{ic})$, the difference between her actual and predicted scores. The underlying latent benefit from disclosure is:

$$d_{ic}^{*} = \theta_0 + \theta_1(t_{ic} - \hat{t}_{ic}) +_1 + \theta_2 x_{ic}(t_{ic} - \hat{t}_{ic}) + \theta_3 x_{ic} + e_{ic}, \tag{5}$$

and the applicant discloses if $d_{ic}^{*} > 0$ and withholds otherwise. The parameter θ_1 provides the baseline effect of the difference between realized and expected scores, $(t_{ic} - \hat{t}_{ic})$, on disclosure choices. The parameter vector θ_2 accounts for differences in selective disclosure across applicant characteristics, which we capture through the interaction term $x_{ic}(t_{ic} - \hat{t}_{ic})$. Finally, we include x_{ic} alone to account for differences in overall disclosure frequencies. We assume e_{ic} is distributed Type-I extreme value, and therefore we estimate the logit probability of disclosure. To account for estimation error in $\hat{t}_{ic}$, we compute bootstrapped standard errors for θ.

[25] The expected score is a proxy for the student's belief about what score she might be expected to receive, given her other academic background, personal characteristics, and publicly available information about the overall and institution-specific distribution of test scores.

5. Applicants' selective disclosure of test scores

In this section, we document that applicants systematically disclosed high test scores and withheld low ones. We do this in three steps. We begin by using sample 1 to establish overall patterns in selective disclosure and study differences across applicant demographic characteristics. Next, we use sample 1 to show that applicants' behaviors are consistent with applicants forming beliefs about what institutions might infer about their scores based other aspects of their applications, and then shading their disclosure choices strategically. Finally, we use sample 2 to reinforce our results on selective disclosure by examining individual applicants who vary their disclosure choices across institutions.

5.1. Disclosure choices by score and applicant characteristics

We estimate equation (3) using sample 1, which contains within- and across-applicant variation in disclosure choices. To present the results, we use the estimated α and β to compute predicted disclosure frequencies using the flexible function $\Delta = \alpha\mathbf{t}_{ic}x_{ic} + \beta\mathbf{t}_{ic}\mu_c$. We then graph the predicted disclosure frequencies, first in Figure 1 with the frequencies for all applications in sample 1. The horizontal axis tracks values of t_{ic}, the applicant's percentile-normalized test score at college *c*. Other than t_{ic}, we set all other variables equal to their sample 1 means. The curve in Figure 1 includes 95% confidence intervals, which are very close to the predicted disclosure frequencies.

Figure 1's predicted disclosure probability curve suggests that applicants believed colleges' test-optional policy language was credible, and they responded strategically to it. The applicants with the lowest scores, relative to college c's enrolled students, reveal their scores to colleges on less than half of all applications. By contrast, students with scores at the 80$^{\text{th}}$ percentile or above have a disclosure frequency around 90%. This is rational behavior in anticipation of college policies which provide benefits from withholding scores by low-scoring applicants and benefits from disclosing by high-scoring applicants. Applications are more likely than not to include an SAT score if $t_{ic} > 0.25$, which could come from a rule of thumb to disclose scores that are in or above the widely publicized interquartile ranges of enrolled students' scores. In Online Appendix Figure A1, we show that applicants who took the SAT multiple times have virtually identical disclosure probabilities at all percentiles to the full ARC sample 1 population.

If applicants did not pay attention to disclosure incentives or anticipated full unravelling among applicants with scores, the disclosure probability curve would have a different shape. If inattentive behavior was dominant, the estimated disclosure frequencies would be roughly flat in t_{ic} at a level around 50%. If applicants largely anticipated full unravelling, the estimated frequencies would be constant in t_{ic} around 100% for all scores.

Given the advantages of strategic score disclosure in college admissions, it is valuable to investigate the disclosure choices of students from groups that historically have had difficulty accessing higher education. If there are significant differences in applicants' willingness to withhold low scores and disclose high ones, then they may fail to receive the admission advantages institutions provide to strategic applicants, described in Section 3.2. We repeat the predicted disclosure probability calculations described above but conditioned on a student's race or ethnicity. We display these results in Figure 2. To generate the curves in Figure 2, we use the same parameter estimates as in Figure 1, but we separate the sample by applicant race or ethnicity along with the corresponding elements of α.[26] All displayed student groups show an increasing probability of disclosure as t_{ic} increases. At the tails of the score distribution (near 0 and 100 on the horizontal axis), all groups' disclosure probabilities are very similar. In the middle of the distribution, however, Asian applicants are significantly less likely to disclose scores. For example, Asian applicants with scores at the 50th percentile have a 65% predicted disclosure probability, and white applicants with similar relative SAT scores disclose them on over 80% of applications. Disclosure probabilities for Hispanic applicants follow closely those of white applicants. Black and white applicants have very similar disclosure probabilities for scores below the median, but Black applicants with relatively high scores are less likely to

[26] In the underlying model, each disclosure pattern by race or ethnicity is estimated freely through interactions of $\mathbf{t}_{ic}$ and the appropriate entries of x_{ic}. Other than the race/ethnicity categories treated separately in Figure 2, we set all other x values equal to their sample means. In all similar figures below, we take the same approach to the highlighted categories and other variables in x.

disclose than white applicants with similarly strong scores. In general, differences across racial and ethnic groups may be due to differences in applicants' perceptions of universities' admission policies for applicants of different races. In addition, different programs (e.g., engineering) within an institution may have different admissions standards, but we do not see these within-institution differences or their correlation with applicant demographic characteristics. Without observing these policies, we cannot make statements about whether any applicant group, on average, responds more sharply to the strategic incentives for score disclosure.

In Figure 3 we perform a similar analysis, focusing on differences in the educational attainment of an applicant's parents. We find that first-generation and non-first-generation students are equally responsive to their relative SAT score percentiles when determining whether to disclose scores. The relationship between disclosure and the college-specific SAT percentile is steepest in the middle of the score distribution and flattest at the tails. Finally, in Figure 4 we present disclosure probability curves separately for different values of College Board's neighborhood challenge variable, which is negatively correlated with the level of resources for local high schools, the educational attainment of the area's adults, and local income and wealth.[27] Again, we find qualitatively similar patterns in disclosure probabilities for applicants from different socioeconomic backgrounds. The disclosure probabilities are most different for scores below the mean, where applicants from greater-challenge areas (i.e. higher values of the challenge variable) are more likely to disclose scores than applicants from low-challenge areas. As in the case of applicant race and ethnicity, we are unable to distinguish whether disclosure differences by neighborhood challenge are due to differences in strategic sophistication or how the applicants perceive admissions policies for individuals of different backgrounds. For scores above the median, individuals with different neighborhood challenge values behave very similarly. In total, the results on Figures 3 and 4 suggest there is little significant

[27] The underlying econometric model includes neighborhood challenge as a continuous variable between 0 and 100. We evaluate the estimated model at five distinct values of the challenge variable (10, 25, 50, 75, and 90).

difference in awareness of strategic disclosures' benefits across applicants of different socioeconomic backgrounds.

5.2. Applicants' responses to institutions' expectations

The results above demonstrate that applicants respond to general incentives to disclose when they have higher scores relative to a college's distribution, and they withhold scores that are relatively lower. We now investigate whether applicants' disclosure choices are associated with more subtle differences in the benefit from disclosing. If they are, this provides further evidence that applicants respond to test-optional policies strategically. More broadly, it provides evidence that applicants act on beliefs they have about institutions' opportunities to infer scores where they are missing. This is a necessary building block for the analysis described below regarding applicants' opportunities to pool with others who lacked tests.

When an applicant considers withholding a test score, she may consider what score a college would impute in the score's absence, and then disclose if she believes her actual score is better than the imputed value. We follow the two-step procedure described in Section 4 to estimate equation (5). In Table 5 we display the marginal effects of an increase in $(t_{ic} - \hat{t}_{ic})$ on the probability of disclosure. We provide a baseline response for a white applicant with an "A" high school grade average, zero AP exams, college-educated parents, and a high school with a low (< 50) "challenge" score for its socioeconomic characteristics. The remaining results in Table 5 are differences from this baseline effect. We find that an applicant in the baseline category is 1.41 percentage points ($p < 0.01$) more likely to disclose her score when $(t_{ic} - \hat{t}_{ic})$ increases by one percentage point. This marginal effect is calculated at the sample means, where the relationship between expected scores and disclosure is particularly steep. Non-white applicants in each race/ethnic category are slightly less responsive to differences between their own scores and their expected scores, given their demographic and other academic characteristics. Black applicants have the greatest difference from white applicants, but the difference is quantitatively small (13.5% in magnitude); Hispanic applicants are 2.8% less responsive than white applicants, on average, to deviations between their personal and expected scores. In all, this is further evidence that underrepresented minority applicants to

ARC institutions do not fail to take opportunities for selective score disclosure. Similar to the results in Figure 3, we find that first-generation applicants have quantitatively similar responses to those whose parents attended college.

In Table 5, we also show that applicants across the GPA and AP exam ranges are similar in their likelihood of disclosing a score that is high relative to the average conditional on an applicant's characteristics. Applicants with A+ high school grades are slightly less sensitive to test score deviations from expected than applicants with A grades, while applicants with lower grades are generally more sensitive. The signs of coefficients on AP exam categories are not as uniform as high school grades, but the magnitudes of differences by AP exam count are all less than 5% different than the baseline.

To supplement the results in Table 5, we analyze differences in disclosure choices by students with a given t_{ic} and varying high school grades. It is well known by applicants and colleges that high school grades and standardized test scores are positively correlated, so colleges might impute a higher score for an applicant with higher high school grades.[28] We hypothesize that this generates a negative correlation between disclosure and high school grades for a given standardized test score in a college's applicant pool. For example, suppose student A has excellent grades and would be expected to score in the 70th percentile of a college's student population, but instead her score is at the 60th percentile. Student B, on the other hand, has weaker grades and would be expected to score at the 50th percentile, but he has taken a standardized test and received the same score as student A, at the 60th percentile. In this example, student B has a greater benefit from disclosing his 60th percentile score than student A.

We explore this issue using sample 1 and the same equation (1) estimates we summarized in Figures 1-4. We now condition on an applicant's high school grades for 6 major grade categories. Our results are in Figure 5. The predicted disclosure curves, which include 95% confidence intervals, show that applicants with lower grades were relatively more likely to disclose scores throughout the percentiles of t_{ic}. An applicant with high school grades around B- or B disclosed a 25th percentile score with probability around

[28] The correlation between high school grades and SAT scores is 0.5 (Westrick et al., 2019).

0.75, while an A+ or A student with the same percentile score disclosed on about 35% of applications. While most applicants disclosed high-percentile scores (e.g., 75th and above), those with lower high school grades were significantly more likely to do so. In the Online Appendix we report similar results for applicants with different numbers of AP exams. Applicants who took more AP exams, indicating more rigorous curricula, may be expected to have greater SAT scores, all else equal. Online Appendix Figure A2 shows that applicants with fewer AP exams were more likely to disclose a given SAT score than applicants with more AP exams.

5.3. Variation within individual applicants' disclosure choices

To supplement the results above, we estimate equation (3) using sample 2, which contains within-student variation in disclosure choices. By focusing on disclosure variation within individual applicants, we eliminate concerns that disclosure differences are driven by differences in applicants across institutions or in different parts of the score distribution. In addition, we can evaluate whether applicants track how they fit within a particular institution's student body, not just whether their scores are high or low relative to the whole distribution of test-takers. We report our results in Table 6, following the structure of Table 5 including the same combination of applicant characteristics in the baseline category. We find that a white applicant with an "A" high school GPA, college-educated parents, no AP exams, and a low-challenge high school is significantly more likely to disclose scores that are greater within an institution's score distribution for enrolled students. In the typical case in sample 2, in which an applicant has applied to two institutions and has made different disclosure decisions, the estimate implies that if the greater of the two normalized scores increases by one percentile point, the greater score is 0.73 percentage points more likely to be disclosed.

In sample 2, Asian and Hispanic applicants respond to differences in t_{ic} quantitatively similarly to white applicants. Black applicants' disclosure choices are less responsive to relative test scores than white applicants' choices, although the Black applicants' responses are significantly positive. An increase in a Black applicant's score by one percentile point is associated with a 0.50 percentage point increase in disclosure probability, a response 27% smaller in magnitude than the baseline effect for white applicants. It is not clear what drives this difference between white and Black applicants; potential explanations include differences in expectations of how scores are considered in the admissions process. It is also possible that differences in the Black and white test score distributions result in the applicants facing different benefits from varying their disclosure choices, analogous to this sample's applicants coming from differently sloped portions of the curves in Figure 2. Other Table 6 results on socioeconomic characteristics indicate that applicants from first-generation households are not significantly different from applicants with college-educated parents, and applicants from high-challenge high schools are significantly less responsive to score differences, although this coefficient is not large in magnitude.

In Table 6's right columns, we display differences across measures of high school grade performance and curriculum. Differences in disclosure behavior are generally minor across these applicant characteristics. As in Table 5, we find statistically significant but small differences between the baseline category (A grades, no AP exams) and those with better grades (A+) or the greatest number of AP exams (6+). With the exception of the disclosure difference for applicants with A- grades (which also matches Table 5's corresponding result), we find no additional statistically or quantitatively significant results.

6. Applicants' interpretations of test policy statements

The results above establish that applicants were selective in disclosing high scores and withholding low ones. Further, we provide evidence in Section 5.2 that applicants respond to what institutions might infer about their scores given the applicants' other characteristics. In this section, we provide additional analysis related to the issue of how applicants view the credibility of institutions' policy statements. This is related to applicants' beliefs about institutions' ability to commit to test-optional policies that do not negatively affect applicants without scores. We first look directly at whether applicants respond to institutions' policy language, as they would if the applicants believed that the policy statements are credible. Next, we investigate whether applicants vary their actions in response to pooling opportunities, as they would if they were concerned about negative inferences about absent scores. Ultimately, we find evidence of both types of responses, suggesting heterogeneity in the applicant population about how to interpret test-optimal policies in the first year of widespread test-optional policies brought about by Covid-19.

6.1. The relationship between test-optional policy language and disclosure choices

Institutions largely allowed voluntary score disclosure for applicants to the fall 2021 entering class, but there were differences in how colleges described their test policies. Most important to applicants' disclosure choices, there was variation in how institutions described their treatment of applications with missing scores. Some institutions may have given the impression of a more skeptical stance toward applications with missing scores, while other institutions could be more reassuring that the absence of scores would not be held against the student, particularly in a year in which the pandemic disrupted standardized testing opportunities. While institutions did not waver from their test-optional policy statements once they were announced in summer 2020, applicants may have been uncertain whether evolving circumstances with test access could affect institutions' willingness to adhere to the policy statements while the applications were being evaluated.

We investigate applicants' responses to policy language by calculating predicted disclosure frequencies, conditional on an evaluation that puts each institution in one of three test policy categories: scores important, scores somewhat important, and scores unimportant.[29] This does not require changes to the model in equation (2); we retain our flexible approach to institution-specific impacts on disclosure choices through $\mathbf{t}_{ic}\mu_c$. We display predicted disclosure probabilities in Figure 6. We find that institutions in the most stringent policy category ("Scores important") have applicant disclosure rates that are substantially greater than other institutions. These institutions' applicants disclose scores on 50% of applications even around the 10th percentile of enrolled students' scores. For scores at the 40th percentile or above, disclosure is above 90% at institutions whose test policy language conveys their value and use of

[29] See Online Appendix A1 for detail on how institutions' test policy language was classified into these three categories.

test scores. There is a positive correlation between more stringent policy language and selectivity, so some of the relationship between disclosure and enrolled students' scores is because all these scores are quite high in an absolute sense. If we repeat the analysis using scores normalized against the full applicant pool, then even the "Scores important" institutions have substantial withholding of test scores throughout the score distribution; see Online Appendix Figure A3.

Institutions with less stringent policy language observed more variation in disclosure choices. As would be expected, the institutions in the middle category ("Scores somewhat important") have a disclosure pattern in t_{ic} that resembles the overall response on Figure 1. Institutions with weaker language about test scores ("Score unimportant") receive fewer scores from applicants. These institutions have disclosure rates that are around 60% for applicants above the 50$^{\text{th}}$ percentile. This is close to applicants viewing $P_1 \approx P_0$ and being indifferent about test score disclosure. This may be because applicants with relatively high scores view their other attributes as more important to this group of institutions, so the applicants see little benefit in providing a test score. For the same institutions, however, disclosure frequencies clearly rise in t_{ic} for scores below the 50$^{\text{th}}$ percentile. This suggests that even institutions which announce that tests are unimportant will have some applicants acting strategically in whether they share test scores.[30]

6.2. The relationship between pooling opportunities and disclosure

If applicants are inclined to think about unravelling outcomes, they would behave differently based on opportunities to pool with other applicants who lack tests. If some applicants with moderately low scores perceive a risk that institutions will infer even lower scores for those do not disclose, then these applicants have an incentive to disclose. This incentive is moderated when exogenous factors remove testing opportunities from many applicants who would be represented throughout the score distribution. The greater the share of applicants with exogenously missing scores, the less negative the inference about a

[30] Among applicants to "Scores unimportant" colleges, the low disclosure rates of high-scoring applicants can provide an additional incentive for low-scoring applicants to withhold scores, as the pool of non-disclosing applicants is of higher quality, as measured through test scores.

score's absence on an application. The Covid-19 pandemic provides a valuable opportunity to investigate whether applicants respond to pooling incentives. The geographic variation in pandemic shut-downs, related to public health and political considerations, provides a novel opportunity to see applicants in different locations play different versions of the same high-stakes information game.

Consider the example of two applicants, A (he) and B (she), to a given institution. Assume both applicants have the same low test score (e.g. t_{ic} = 15) within the institution's distribution of enrolled students' scores. Applicant A is from a region of the country with substantial Covid-related shutdowns, and many other applicants from this region are likely to lack test scores because of test center closures and reduced testing capacity. Applicant B is from a region that re-opened relatively quickly following Covid's onset, and there were fewer interruptions to standardized testing opportunities in this region. If applicants are sensitive to the full inferences that institutions can make in the absence of test scores, then Applicant A would be more likely to withhold his score—under the belief that institutions might assume he did not have a testing opportunity—than Applicant B to withhold hers.

In Table 7 we display results from ten separate logit models of disclosure choice, with one model for each decile of applicants' scores relative to the distribution of a college's enrolled students. In addition to the variables in the baseline specification of equation (3), we include dummy variables for the second, third, and fourth quartiles of reductions in foot traffic in the applicants' high schools' zip codes. We take this approach – with separate models by decile – to provide flexible estimates of applicants' responses to foot traffic changes across the score distribution and with the severity of the foot traffic reduction. Each model also includes the same set of applicant characteristics (i.e., x_{ic} variables) that we include in the analysis discussed above; to conserve space we do not report the associated coefficients. As in the models described above, these variables account for applicants' local socioeconomic circumstances and academic characteristics, as well as cross-institution differences captured with college-level fixed effects.

The results in Table 7 suggest that applicants' disclosure choices varied in ways that are consistent with the intuition on pooling incentives in disclosure games. At the lowest decile, there are statistically significant differences in disclosure frequency across quartiles of foot traffic decline, but the effects are relatively small. This accords with basic intuition on the incentive to disclose a very low score: when a score is already at the bottom of the distribution, differences in pooling opportunities provide little impact on the relative benefits of disclosing versus withholding. The largest effects on Table 7 are in the second through fourth deciles of test scores, where applicants who experienced the largest reductions in foot traffic are 8 to 10 percentage points less likely to disclose scores. Relative to the mean disclosure rate of students in the same score decile, this has the largest proportional effect (about 23%) in the second decile. In locations with foot traffic declines in the third quartile, test disclosure was reduced by about 7 percentage points. This significant but smaller decline in disclosure is in line with the reduced benefit from pooling when fewer applicants exogenously lack tests. In the upper deciles, the impact of foot traffic reductions is smaller than in lower deciles, and as test scores rise the disclosure reductions generally become smaller in magnitude. The reduced disclosure among applicants in the top third of test scores, which is present but quite small in magnitude, may point to spatial differences in test score salience. In localities where many applicants lack tests due to Covid shut-downs, there may have been more discussion from college counselors and peers that de-emphasized the role of standardized tests in admissions. An applicant with high test score in addition to other strong application characteristics may see little to gain from disclosing a score that is not at the very top of the distribution.

7. Strategic score disclosure's impact on information available to institutions

The evidence above shows a clear pattern of strategic disclosure of standardized test scores. Applicants with high scores were more likely to disclose than those with low scores. Whether this has had a meaningful impact on college admissions and student performance, however, is a different question. The disclosure patterns we document above have ambiguous implications for whether admitted students' test scores are meaningfully correlated with their disclosure choices. Applicants who withheld low scores may have been less likely to be admitted because of their other characteristics. In addition, the negative correlation between high school grades and disclosure, documented in Figure 5, suggests that some admitted applicants with high GPAs and withheld scores may have SAT scores just as strong as other lower-GPA admitted applicants who disclosed. We provide two additional pieces of evidence on selection and information loss due to test-optional admissions policies. First, we describe how admissions and enrollment outcomes vary by disclosure choice. Second, we analyze college academic performance outcomes.

In the first part of our discussion, we describe and highlight some aspects of selection into institutions' admitted and enrolled classes. In Table 8, we display descriptive statistics on standardized test disclosure and scores. We note that, for the SAT alone or either the SAT or ACT, the admitted students were more likely to have disclosed scores than individuals who applied. This follows, in part, from selective disclosure of higher scores, as well as the correlation between scores and applicants' other characteristics which are favored in college admissions. The positive relationship between test scores and admission is apparent in Table 8's SAT Percentile row. Admitted students, regardless of whether they disclosed scores, had higher percentile scores, on average, than the full applicant population. In addition, disclosed test scores from admitted students were greater than the scores of admitted students who withheld their test scores.

As students move from admission to enrollment, two additional selection channels are present. First, enrolled students disclosed scores relatively frequently within the admitted population. This positive selection could be due to correlation between students' interest in an institution and their choice to disclose scores, price effects where students who disclosed are more likely to be offered merit aid and therefore are more likely to attend, or other factors. Offsetting effects are present in the second channel, with the test scores of enrolled students relative to the admitted pool. This points to negative selection among students who accept offers of admission; more qualified admitted students are more likely to have alternative opportunities at even more selective colleges. While enrolled students who disclose scores have an average score equal to the institution's median among previous enrolled classes, those who withheld scores had an average performance at the 19th percentile.[31]

[31] These patterns are present across the distinct types of institutions (public/private, selective/very selective) in the ARC data; see Online Appendix Table A2 for separate statistics by institution type.

This leads to the next area in which we provide evidence: academic performance among enrolled students. For 47 of 50 ARC institutions represented in sample 1, individuals' application records are linked to data on their first-year college GPAs (FYGPA) and number of college credits completed during the first year. In Table 8, we summarize these measures of academic performance between enrolled students who withheld and disclosed their test scores in the admission process. Score disclosers earned FYGPAs 0.16 points higher and 0.4 more academic credits, on average, than score withholders. Average differences may mask relevant variation in students who are struggling academically, so in Table 8 we also report the share of first-year students with lower FYGPAs. Students who withheld scores were 35% more likely (0.278 vs. 0.206) to earn a FYGPA less than 3.0 and 38% more likely to earn less than a 2.5. Lower FYGPAs, in addition to signaling weaker academic performance, can put students at risk of losing scholarships and financial aid, increase time-to-degree completion, and reduce the probability of completing college with a cumulative GPA of 3.0 or higher (Westrick et al., 2023). Overall, the differences in average academic performance correspond to the differences in average SAT scores among disclosers and withholders. The information loss for the institution is more subtle, however, as the withheld scores have substantial variance and therefore prevent institutions from receiving this signal about which students face greater risk to their academic progress.

We use a regression framework to provide a more precise analysis of the relationship among standardized test scores, disclosure choices, and college performance. We use college performance measures (y_{ic}) described in Table 8, together with information on test scores (t_i), disclosure choices (d_{ic}) and student academic characteristics available at the time of application (a_{ic}), to estimate the following model:

$$y_{ic} = \alpha d_{ic} + \beta_1 d_{ic} t_i + \beta_2 (1 - d_{ic}) t_i + \gamma a_{ic} + \mu_c + \varepsilon_{ic}. \tag{6}$$

In equation (6), y_{ic} contains student i's FYGPA or number of credits completed. The variable t_i is applicant i's SAT score divided by 100; we use the true SAT score rather than the normalized value (t_{ic}) to facilitate comparisons between our results and others (e.g. Westrick et al., 2019; Friedman et al., 2023) which use test score data in this way. The vector a_{ic} contains the pre-college academic performance information contained in x_{ic}, specifically indicators for high school GPA and number of AP exams. The institution-level fixed effects, μ_c, control for cross-college differences in the performance measures. We include β_1 and β_2 separately to ease interpretation of how disclosed and undisclosed test scores are each correlated with academic performance; an equivalent specification would include the test score and its interaction the disclosure choice.

We estimate several versions of equation (6) and report the results in Table 9. Specifications 1-4 include first-year college GPA as the dependent variable, and specifications 5-8 analyze college credits earned during the first year. Specifications 1 and 5 are analogous to Table 8's comparison of means but with fixed effects to account for cross-college differences. Students who disclosed scores, on average, earned higher college grades and more college credits. Specifications 2 and 6 demonstrate that the strength of correlation between disclosure and college performance is moderated somewhat when we control for academic performance in high school. The results of specifications 1, 2, 5, and 6 follow from previously documented correlation between SAT scores and college performance (Sackett et al., 2012; Dahlke et al., 2019) together with the correlation between scores and disclosure we describe in Section 5. Specifications 3, 4, 7, and 8 include interactions between disclosure choice and the student's SAT score. These models are important for evaluating information loss under test-optional policies because it is possible that the student's observed discrete disclosure choice may be sufficient to identify needs for academic assistance. Our results indicate that this is not the case. Specifications 3 and 4 show that the score value (t_i) is significantly correlated with college GPA. The estimates in specification 4 indicate that a difference of 100 points in nominal SAT score is associated with FYGPA values that are 0.12 greater, regardless of whether the score was disclosed or not. Conditional on SAT score, the discrete disclosure choice is not significantly correlated with college grades. While disclosure alone could provide a coarse measure of college performance, the SAT score is a clearer signal, and this could be important if an institution does not have sufficient resources to provide academic support services to all enrolled students who withheld scores on their applications. Specifications 7 and 8 provide qualitatively similar results on college credits earned. The models which include students' high school academic performance (specifications 4 and 8) show relationships between test scores and performance that are around 25% smaller in magnitude than the models without these controls (specifications 3 and 5), but the relationships remain statistically and economically significant. In summary, test-optional admissions policies can lead to the withholding of information that is predictive of college readiness, especially among students in greatest need of academic advising or remedial instruction.

8. Conclusions

Advocates for test-optional college admission policies suggest that the policies can increase college access for applicants who do not test well or have difficulty paying for test-related expenses. The actual impact of these policies, including whether they achieve their advocates' aims, depends on how applicants and institutions behave within them. On the applicant side, it is important to know how disclosure decisions may help or hurt their admissions chances at a particular institution. For the institutions, a critical question is whether they can commit (and convince applicants they have committed) to policies which do not penalize applicants for omitting test scores from their applications. If commitment is not possible, and institutions infer poor testing aptitude when scores are not present, then the voluntary nature of test-optional policies may unravel, and all applicants will feel compelled to disclose scores. In addition to the relevance of these issues for education policy, they are central to studies of voluntary disclosure, where previous empirical work has not addressed several aspects of the choice environment we study, including score-sender sophistication, score-receiver commitments on information interpretation, and senders' sensitivity to pooling opportunities.

We study these issues using novel individual-applicant data from the first year of widespread test-optional policies initiated by the Covid-19 pandemic. Among applications to 50 US colleges and universities, we find that the applicants were significantly more likely to disclose high test scores than low scores, and this pattern appears consistently across applicants of different racial, ethnic, and socioeconomic backgrounds. In addition, applicants responded to differential disclosure incentives due to other aspects of their academic profiles, for example disclosing a score more often if it was high conditional on the applicant's grades. These patterns of selective disclosure are consistent with the applicants generally believing that institutions can follow-through on statements not to penalize applicants who submit no scores. This interpretation is supported by applicants' substantial sensitivity to institutions' policy language, which is irrelevant if the institutions cannot commit. We also provide evidence, however, that this interpretation of institutions' policy statements was not universal in the applicant population; applicants were more likely to withhold low scores in localities where they had greater opportunities to pool with applicants who exogenously lacked scores due to Covid-related testing interruptions. This suggests institutions may need to supplement test-optional policies with clear statements of how they will interpret the absence of scores on an application. With the restoration of standardized testing opportunities since our sample period, data from subsequent years will provide additional opportunities to evaluate institutions' commitment to policies which welcome applications without test scores. Colleges' incentives for making negative inferences from absent scores may be stronger when score absences cannot be attributed to pandemic-related testing barriers.

The overall impact of test-optional policies includes the effects of missing information on the academic performance of college students admitted under these policies. Students who withheld their scores during admission earn lower first-year college grades and fewer credits, on average, than their peers who disclosed scores. Colleges and universities which lack scores may be missing opportunities to provide academic support to students who would benefit from it most. More broadly, test-optional policies may make it difficult for applicants to understand whether their own scores compare favorably to the score distribution for a college's full enrolled student population, which may lead to outcomes in which even fewer applicants disclose scores over time.

References

ACT, "The ACT Profile Report – National. Graduating Class of 2021," https://www.act.org/content/dam/act/unsecured/documents/2021/2021-National-ACT-Profile-Report.pdf, 2021

Ali, S. Nageeb, Greg Lewis, and Shoshana Vasserman, "Voluntary Disclosure and Personalized Pricing," The Review of Economic Studies, 90 (2023), 538–571.

Bederson, Benjamin B., Ginger Zhe Jin, Phillip Leslie, Alexander J. Quinn, and Ben Zou, "Incomplete Disclosure: Evidence of Signaling and Countersignaling," American Economic Journal: Microeconomics, 10 (2018), 41-66.

Belasco, Andrew S., Kelly O. Rosinger, and James C. Hearn, "The Test-Optional Movement at America's Selective Liberal Arts Colleges: A Boon for Equity or Something Else?" Educational Evaluation and Policy Analysis, 37 (2015), 206–223.

Bennett, Christopher T, "Untested Admissions: Examining Changes in Application Behaviors and Student Demographics Under Test-Optional Policies," American Educational Research Journal, 59 (2022), 180-216.

Brown, Alexander L., Colin F. Camerer, and Dan Lovallo, "To Review or Not to Review? Limited Strategic Thinking at the Movie Box Office," American Economic Journal: Microeconomics, 4 (2012), 1-26.

Chetty, Raj, David J. Deming, and John N. Friedman, "Diversifying Society's Leaders? The Determinants and Causal Effects of Admission to Highly Selective Private Colleges," NBER Working Paper 31492, 2023.

Chetty, Raj, John N. Friedman, Emmanuel Saez, Nicholas Turner, and Danny Yagan, "Income Segregation and Intergenerational Mobility Across Colleges in the United States," The Quarterly Journal of Economics, 135 (2020), 1567–1633.

College Board, "SAT Suite of Assessments Annual Report," https://reports.collegeboard.org/media/pdf/2022-total-group-sat-suite-of-assessments-annual-report.pdf, 2022a.

College Board, "SAT Program Results Show Increased Participation for the Class of 2022," https://newsroom.collegeboard.org/sat-program-results-show-increased-participation-class-2022, 2022b.

Conlin, Michael, and Stacy Dickert-Conlin, "Inference by college admission departments," Journal of Economic Behavior and Organization, 141 (2017), 48-64.

Conlin, Michael, Stacy Dickert-Conlin, and Gabrielle Chapman, "Voluntary behavior and the strategic behavior of colleges," Journal of Economic Behavior and Organization, 96 (2013), 48-64.

Cruce, Ty and Edgar Sanchez, "Score-Sending to Test-Optional Colleges and First-Year College Success," NCME Conference presentation, April 13, 2023.

Dahlke, J. A., Sackett, P. R., & Kuncel, N. R. (2019). Effects of range restriction and criterion contamination on differential validity of the SAT by race/ethnicity and sex. *Journal of Applied Psychology, 104*(6), 814–831. https://doi.org/10.1037/apl0000382

Dessein, Wouter, Alexander Frankel, and Navin Kartik, "Test-Optional Admissions," University of Chicago working paper, 2023.

Dickhaut, John, Margaret Ledyard, Arijit Mukherji, and Haresh Sapra, "Information Management and Valuation: An Experimental Investigation." Games and Economic Behavior 44 (2003), 26–53.

Dranove, David, and Ginger Zhe Jin, "Quality disclosure and certification: Theory and practice." Journal of Economic Literature, 48 (2010), 935-963.

Espenshade, Thomas J., Chang Y. Chung, and Joan L. Walling, "Admission preferences for minority students, athletes, and legacies at elite universities." Social Science Quarterly, 85 (2004), 1422-1446.

Fishman, M. J., & Hagerty, K. M., "Mandatory versus voluntary disclosure in markets with informed and uninformed customers," Journal of Law, Economics, and Organization, 19 (2003), 45-63.

Freeman, J., Magouirk, P., and Kajikawa, T., "Applying to college in a test-optional admissions landscape: trends from Common App data," https://www.commonapp.org/about/reports-and-insights, 2021

Friedman, John, Bruce Sacerdote, and Michele Tine, "Standardized Test Scores and Academic Performance at Ivy-Plus Colleges," Opportunity Insights, 2024.

Goodman, J., Hurwitz, M., & Smith, J., "Access to 4-year public colleges and degree completion," Journal of Labor Economics, 35 (2017), 829-867.

Goyer, P., Howell, J., Hurwitz, M., Imlay, S., and Ma, J., "Updated Evidence on Changes in College Applications, Admissions, and Enrollments Focus on the Fall 2022 Admissions Cycle," (New York: College Board, 2023).

Grossman, Sanford, "The Informational Role of Warranties and Private Disclosure about Product Quality," Journal of Law and Economics, 24 (1981), 461–83.

Howell, Jessica, Michael Hurwitz, Sam Imlay, Greg Perfetto, "New Evidence on Recent Changes in College Applications, Admissions, and Enrollments," (New York: College Board, 2022).

Howell, Jessica and Matea Pender, "The costs and benefits of enrolling in an academically matched college," Economics of Education Review, 51 (2016), 152-168.

Hoxby, Caroline, and Christopher Avery, "The Missing 'One-Offs': The Hidden Supply of High-Achieving, Low Income Students," NBER working paper 18586, 2012.

Hoxby, Caroline, and Sarah Turner, "Expanding College Opportunities for High-Achieving, Low Income Students" SIEPR Discussion Paper No. 12-014, 2013.

Hurwitz, M., Mbekeani, P. P., Nipson, M. M., & Page, L. C., “Surprising Ripple Effects: How Changing the SAT Score-Sending Policy for Low-Income Students Impacts College Access and Success,” Educational Evaluation and Policy Analysis, 39 (2017), 77–103.

Jaschik, Scott, “The Full Story on Admissions,” Inside Higher Ed. URL: https://www.insidehighered.com/admissions/article/2021/02/01/full-story-admissions-isnt-just-what-youve-been-reading, February 1, 2021.

Jin, G. Z., M. Luca, M., and D. Martin, “Is no news (perceived as) bad news? An experimental investigation of information disclosure,” American Economic Journal: Microeconomics, 13 (2021), 141-73.

Jovanovich, Boyan, “Truthful Disclosure of Information,” Bell Journal of Economics, 13 (1982), 36-44.

Kim, Brian, Mark Freeman, Trent Kajikawa, Honeiah Karimi, and Preston Magouirk, “First-year applications per applicant.” Common App working paper, 2022.

King, Ronald R., and David E. Wallin. “Voluntary Disclosures When Seller’s Level of Information Is Unknown.” Journal of Accounting Research 29 (1991), 96–108.

Liu, Albert Yung-Hsu, Ronald G. Ehrenberg, and Jesenka Mrdjenovic, “Diffusion of Common Application Membership and Admissions Outcomes at American Colleges and Universities,” NBER Working Paper 13175, 2007.

Marini, Jessica, Linda Young, and Emily J. Shaw, “Re-examining the Accuracy of Self-Reported High School Grade Point Average (HSGPA),” (New York: College Board, 2021)..

Milgrom, Paul, “Good News and Bad News: Representation Theorems and Applications,” Bell Journal of Economics, 12 (1981), 380–91.

Milgrom, Paul, “What the Seller Won’t Tell You: Persuasion and Disclosure in Markets,” Journal of Economic Perspectives, 22 (2008), 115-131.

National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), 2019, Admissions Survey, 2019.

National Center for Educational Statistics, “Table 226.40. SAT mean scores of high school seniors, standard deviations, and percentage of the graduating class taking the SAT, by state: 2017 through 2020,” https://nces.ed.gov/programs/digest/d20/tables/dt20_226.40.asp, 2021a.

National Center for Educational Statistics, “Table 219.10. High school graduates, by sex and control of school; public high school averaged freshman graduation rate (AFGR); and total graduates as a ratio of 17-year-old population: Selected years, 1869-70 through 2030-31,” https://nces.ed.gov/programs/digest/d21/tables/dt21_219.10.asp. 2021b.

National Center for Educational Statistics, “Table 226.50. Number and percentage of graduates taking the ACT test; average scores and standard deviations, by sex and race/ethnicity; and percentage of test takers with selected composite scores and planned fields of postsecondary study: Selected years, 1995 through 2021,” https://nces.ed.gov/programs/digest/d21/tables/dt21_226.50.asp, 2022.

Rodriguez, Viviana, "Differential Test-Submission and Admission Implications of University Test-Optional Policies," University of Texas at San Antonio Working Paper, 2023.

Saboe, Matt, and Sabirina Terrizzi, "SAT optional policies: Do they influence graduate quality, selectivity or diversity?" Economics Letters, 174 (2019), 13-17.

Sackett, P. R., Kuncel, N. R., Beatty, A. S., Rigdon, J. L., Shen, W., & Kiger, T. B. (2012). The Role of Socioeconomic Status in SAT-Grade Relationships and in College Admissions Decisions. *Psychological Science*, *23*(9), 1000-1007. https://doi.org/10.1177/0956797612438732

Shaw, Emily J. and Krista Mattern, "Examinging the Accuracy of Self-Reported High School Grade Point Average," College Board Research Report No. 2009-5. (New York: College Board, 2009).

Shin, H.S., "News Management and the Value of Firms," RAND Journal of Economics, 25 (1994), 58-71.

Smith, Jonathan, "The Effect of College Applications on Enrollment," The B.E. Journal of Economic Analysis and Policy, 14 (2014), 151-188

Smith, Jonathan, Matea Pender, and Jessica Howell, "The Full Extent of Student-College Academic Undermatch," (New York: College Board, 2012).

Smith, Jonathan, Michael Hurwitz, and Jessica Howell, "Screening mechanisms and student responses in the college market," Economics of Education Review, 44 (2015), 17-28.

Westrick, P.A., J.P. Marini, L. Young, H. Ng, D. Shmueli, and E.J. Shaw, "Validity of the SAT for Predicting First-Year Grades and Retention to the Second Year," (New York: College Board, 2019).

Westrick, P.A., J.P. Marini, and E.J. Shaw, "An Updated look at SAT Score Relationships with College Degree Completion," (New York: College Board, 2022).

Westrick, P.A., J.P. Marini, L. Young, H. Ng, and E.J. Shaw, "The Consequences of a Low First-Year Grade oint Average on Later College Outcomes," (New York: College Board, 2023).

Wren, Kathy, "Q&A: Stuart Schmill on MIT's decision to reinstate the SAT/ACT requirement," MIT News, https://news.mit.edu/2022/stuart-schmill-sat-act-requirement-0328, 2022.

FIGURES AND TABLES

Table 1: Applicants

	Share in Group	SAT Mean	SAT Std. Dev.	HSGPA	Total AP Exams	Neighbrhd Challenge	2+ apps, Partial Disclosure
All Applicants	1.000	1200	189	3.73	3.52	28.5	0.107
Asian	0.149	1317	181	3.81	5.41	23.0	0.160
Black	0.115	1047	175	3.50	2.10	50.5	0.082
Hispanic	0.172	1123	176	3.66	3.34	45.0	0.089
White	0.498	1222	166	3.78	3.33	19.9	0.104
Other race	0.065	1235	188	3.76	3.64	24.4	0.099
First generation	0.250	1106	176	3.64	2.87	47.7	0.081
Not first gen.	0.720	1237	179	3.77	3.82	21.3	0.118
GPA A+	0.145	1320	164	4.33	5.26	28.4	0.143
GPA A	0.329	1259	172	4.00	4.35	26.6	0.131
GPA A-	0.244	1186	165	3.67	3.27	26.1	0.103
GPA B+	0.133	1108	160	3.33	2.19	29.5	0.075
GPA B	0.074	1061	157	3.00	1.65	32.7	0.059
GPA B-	0.026	1015	158	2.67	1.34	38.5	0.045
GPA C+ or Lower	0.015	961	161	2.15	0.95	47.1	0.036
6+ AP Exams	0.255	1349	149	3.94	8.23	23.7	0.168
3-5 AP Exams	0.272	1229	155	3.80	3.92	27.4	0.114
1-2 AP Exams	0.243	1138	156	3.65	1.47	30.1	0.081
0 AP Exams	0.230	1064	171	3.49	0.00	33.3	0.059

N = 275,920

Table 2: Applications

	Sample 1 N = 503,247		Sample 2 N = 99,900	
	Mean SAT	Disclose SAT	Mean SAT	Disclose SAT
All Applicants	1242	0.440	1334	0.535
Asian	1365	0.565	1428	0.601
Black	1082	0.251	1183	0.466
Hispanic	1155	0.318	1250	0.473
White	1252	0.469	1327	0.526
Other race	1269	0.445	1363	0.546
First-gen	1137	0.320	1237	0.477
Non-first gen	1277	0.479	1356	0.548
In-State College	1190	0.460	1286	0.603
Feeder High School	1249	0.483	1347	0.584
Public College	1198	0.472	1279	0.649
GPA A+	1351	0.551	1403	0.562
GPA A	1297	0.483	1369	0.548
GPA A-	1219	0.404	1292	0.511
GPA B+	1133	0.345	1213	0.497
GPA B	1080	0.329	1167	0.489
GPA B-	1029	0.312	1099	0.505
GPA C+ or Lower	969	0.272	1032	0.473
6+ AP Exams	1377	0.580	1417	0.578
3-5 AP Exams	1252	0.431	1311	0.509
1-2 AP Exams	1160	0.353	1237	0.493
0 AP Exams	1088	0.309	1196	0.489

Table 3: Summary Statistics on ARC Institutions

		Public		Private	
	All	Selective	Very Selective	Selective	Very Selective
N institutions	50	9	9	16	16
Admit rate	0.457	0.753	0.547	0.451	0.130
Share disclosed SAT	0.440	0.477	0.467	0.401	0.404
Mean SAT	1242	1197	1198	1238	1324
Mean GPA	3.79	3.69	3.73	3.79	3.92
Policy language rating	2.10	2.05	2.35	1.41	2.32
Student characteristics					
Asian	0.198	0.148	0.165	0.181	0.281
Black	0.106	0.069	0.158	0.092	0.096
Hispanic	0.158	0.135	0.148	0.189	0.169
White	0.476	0.588	0.471	0.482	0.384
Other race	0.062	0.060	0.058	0.055	0.071
First-generation	0.220	0.200	0.240	0.225	0.213
NH challenge	25.8	22.8	27.6	26.1	26.3

Note: Statistics calculated using sample 1 (N = 503,247). The policy language rating equals 1 if the college indicated that the scores are unimportant in admissions, 2 if scores are somewhat important, and 3 if scores are important.

Table 4: Institutions' Differences in Admissions Rates by Disclosure Choices

Applicant score quartile	Similar admit rate	Greater admit rate for disclosers	Greater admit rate for withholders
1	0.32	0.14	0.56
2	0.26	0.20	0.54
3	0.28	0.44	0.28
4	0.26	0.58	0.18

Note: "Similar admit rate" reports the share of 50 ARC institutions with admissions rates less than 3 percentages points different between score withholders and disclosers, separately by applicant-institution quartile. "Greater admit rate for disclosers" is the share with a greater than 3pp. difference favoring students who disclosed scores. "Greater admit rate for withholders" reports the same statistic for applicants who withheld scores.

Table 5: Disclosure and Differences between Actual and Expected Score

Dependent variable: Disclose (1) or withhold (0) SAT score

Actual – Expected SAT percentile	0.0141***		
	(0.0002)		
Interactions of (Actual – Predicted SAT percentile) with:			
Asian	-0.0001	A+	-0.0006***
	(0.0001)		(0.0001)
Black	-0.0019***	A-	0.0013***
	(0.0002)		(0.0001)
Hispanic	-0.0004**	B+	0.0019***
	(0.0002)		(0.0002)
Other Race	-0.0008***	B	0.0023***
	(0.0002)		(0.0003)
First Gen	-0.0002	B-	0.0016***
	(0.0001)		-0.0006***
High NH Challenge	-0.0014***	C+ or lower	-0.0002
	(0.0001)		(0.0006)
Feeder HS	0.0006***	1-2 AP Exams	0.0003*
	(0.0001)		(0.0002)
In-State	-0.0007***	3-5 AP Exams	0.0007***
	(0.0001)		(0.0002)
In-State X Public	-0.0027***	6+ AP Exams	-0.0007***
	(0.0002)		(0.0002)
N	503,247		

Note: See text for description of Expected SAT. Results show the marginal effects from a logistic regression where disclosure is the outcome. Omitted categories are White students, non-first-generation students, students with an "A" HSGPA, and 0 AP Exams. Percentiles are calculated based on SAT and concorded ACT scores of enrolled students from the 2018-2020 entering cohorts. “High NH Challenge” indicates that the neighborhood challenge score is in the top 50%. A feeder high school sent 10 or more applications to the college during the 2018-2020 admissions cycles. Statistical significance: *** p<0.01, **p<0.05, *p<0.10.

Table 6: Disclosure variation across applications

Dependent variable: Disclose (1) or withhold (0) SAT score			
SAT Percentile	0.73***		
	(0.04)		
Interactions of SAT percentile with:			
Asian	-0.04*	A+	-0.07***
	(0.02)		(0.02)
Black	-0.20***	A-	0.05**
	(0.04)		(0.02)
Hispanic	-0.01	B+	-0.02
	(0.03)		(0.04)
Other Race	-0.06	B	0.01
	(0.04)		(0.06)
First Gen	-0.02	B-	-0.04
	(0.03)		(0.14)
High NH Challenge	-0.14***	C+ or lower	-0.07
	(0.03)		(0.07)
Feeder HS	-0.02	1-2 AP Exams	0.02
	(0.01)		(0.04)
In-State	0.09***	3-5 AP Exams	-0.04
	(0.02)		(0.04)
In-State X Public	-0.35***	6+ AP Exams	-0.18***
	(0.02)		(0.03)
N	99,900		

Note: All results from a single linear probability model with fixed effects for student and college. Omitted categories are White students, non-first-generation students, students with an "A" HSGPA, and 0 AP Exams. Percentiles are calculated based on SAT and concorded ACT scores of enrolled students from the 2018-2020 entering cohorts. “High NH Challenge” indicates that the neighborhood challenge score is in the top 50%. A feeder high school sent 10 or more applications to the college during the 2018-2020 admissions cycles. Statistical significance: *** p<0.01, **p<0.05, *p<0.10.

Table 7: Disclosure variation and foot traffic reductions

	Dependent variable: Disclose (1) or withhold (0) SAT score									
Specification	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SAT Percentile	[0, 9)	[10,19)	[20,29)	[30,39)	[40,49)	[50,59)	[60,69)	[70,79)	[80,89]	[90,99]
Mean disclosure	0.190	0.345	0.463	0.574	0.649	0.698	0.771	0.799	0.839	0.901
Q2 Foot traffic decline	-0.007**	-0.027***	-0.025***	-0.025**	-0.013	0.007	-0.004	0.005	-0.005	0.002
	(0.003)	(0.007)	(0.009)	(0.010)	(0.011)	(0.010)	(0.008)	(0.008)	(0.005)	(0.003)
Q3 Foot traffic decline	-0.028***	-0.072***	-0.069***	-0.073***	-0.056***	-0.034***	-0.025***	-0.029***	-0.010**	-0.009***
	(0.003)	(0.007)	(0.009)	(0.011)	(0.011)	(0.010)	(0.008)	(0.008)	(0.005)	(0.003)
Q4 Foot traffic decline	-0.037***	-0.078***	-0.092***	-0.103***	-0.065***	-0.077***	-0.041***	-0.034***	-0.019***	-0.011***
	(0.003)	(0.008)	(0.010)	(0.011)	(0.012)	(0.011)	(0.008)	(0.008)	(0.005)	(0.004)
N	128,307	40,331	29,964	23,316	18,707	16,940	17,282	14,743	17,667	18,723

Note: Percentiles are based on enrolled students in the 2018-2020 application cycles. Foot traffic data are available for public high schools only. Foot traffic decline quartiles are created so that the number of Sample 1 observations are identical across all quartiles. The 25th, 50th and 75th percentiles of foot traffic decline are -78%, -59% and -40%. Specifications 1-10 are estimated as separate logit models, conditioned on the SAT percentile scores in the column headings. The reported estimates are marginal effects of a difference in foot traffic quartile relative to the base. In addition to the foot traffic measures, the models each include the full set of controls we use in generating Figure 1. Statistical significance: *** p<0.01, **p<0.05, *p<0.10.

Table 8: Disclosure Choices and Test Scores across Applicant Populations

	Applicants		Admitted Students		Enrolled Students	
Share Disclosed SAT	0.272		0.306		0.347	
Share Disclosed SAT/ACT	0.438		0.508		0.570	
	Withheld	Disclosed	Withheld	Disclosed	Withheld	Disclosed
SAT Percentile	16.9	49.4	25.4	58.3	18.6	50.6
Avg. First-Year College GPA	–	–	–	–	3.22	3.38
Share First-Year GPA < 3.0	–	–	–	–	0.278	0.206
Share First-Year GPA < 2.5	–	–	–	–	0.127	0.092
Avg. First-Year College Credits	–	–	–	–	28.3	28.7

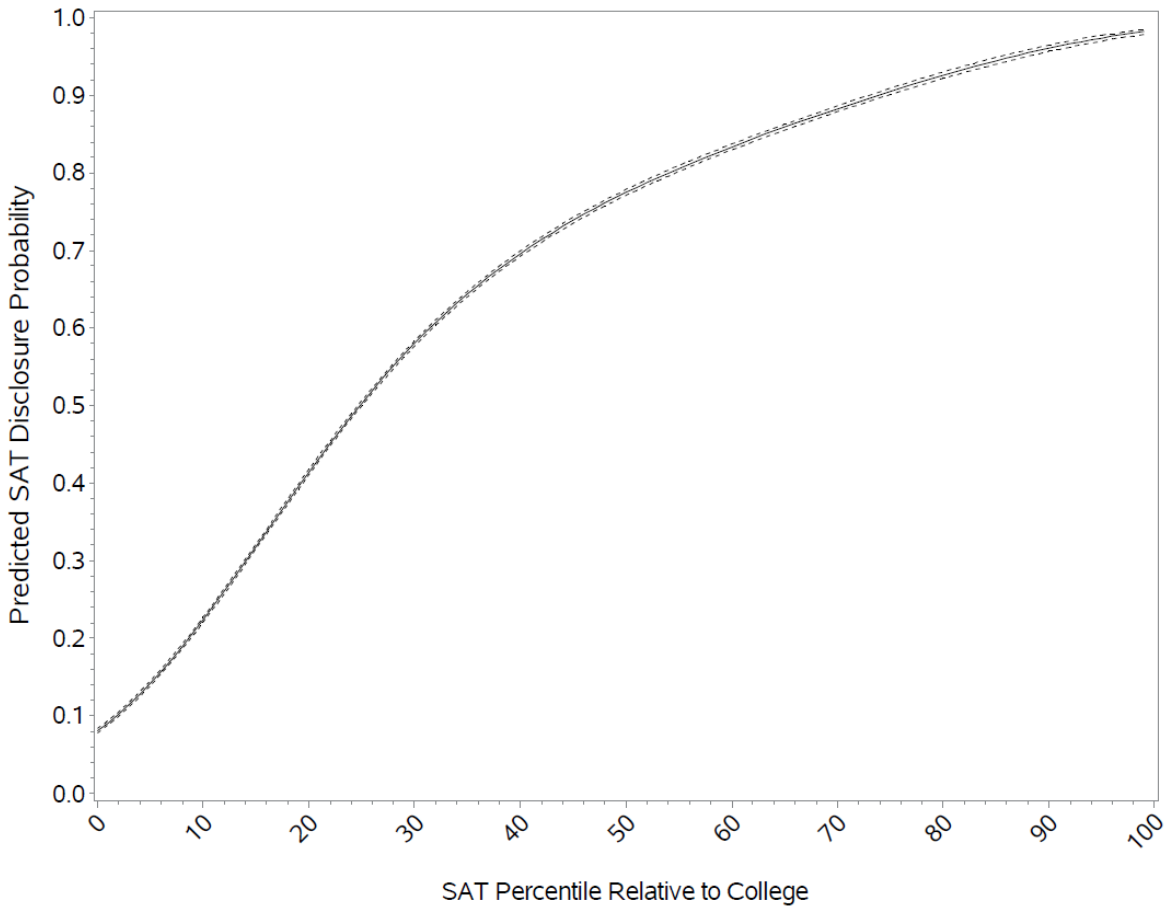
Note: SAT percentiles relative to 2018-20 enrolled students. First-year college performance data available for 47 of 50 ARC institutions.

Table 9: Academic performance in college and disclosure choices

Specification	Dependent variable: First year GPA (1)	(2)	(3)	(4)	Dependent variable: First year credits (5)	(6)	(7)	(8)
Disclose (*d*)?	0.186***	0.114***	0.039	-0.068	0.879***	0.421***	0.168	-0.254
	(0.006)	(0.005)	(0.043)	(0.042)	(0.051)	(0.051)	(0.404)	(0.403)
Disclose (*d*)			0.151***	0.119***			0.829***	0.589***
x score (*t*)			(0.002)	(0.002)			(0.022)	(0.024)
Withhold (1 – *d*)			0.162***	0.119***			0.899***	0.609***
x score (*t*)			(0.003)	(0.003)			(0.027)	(0.028)
Includes controls for HS academics (*a*)	N	Y	N	Y	N	Y	N	Y

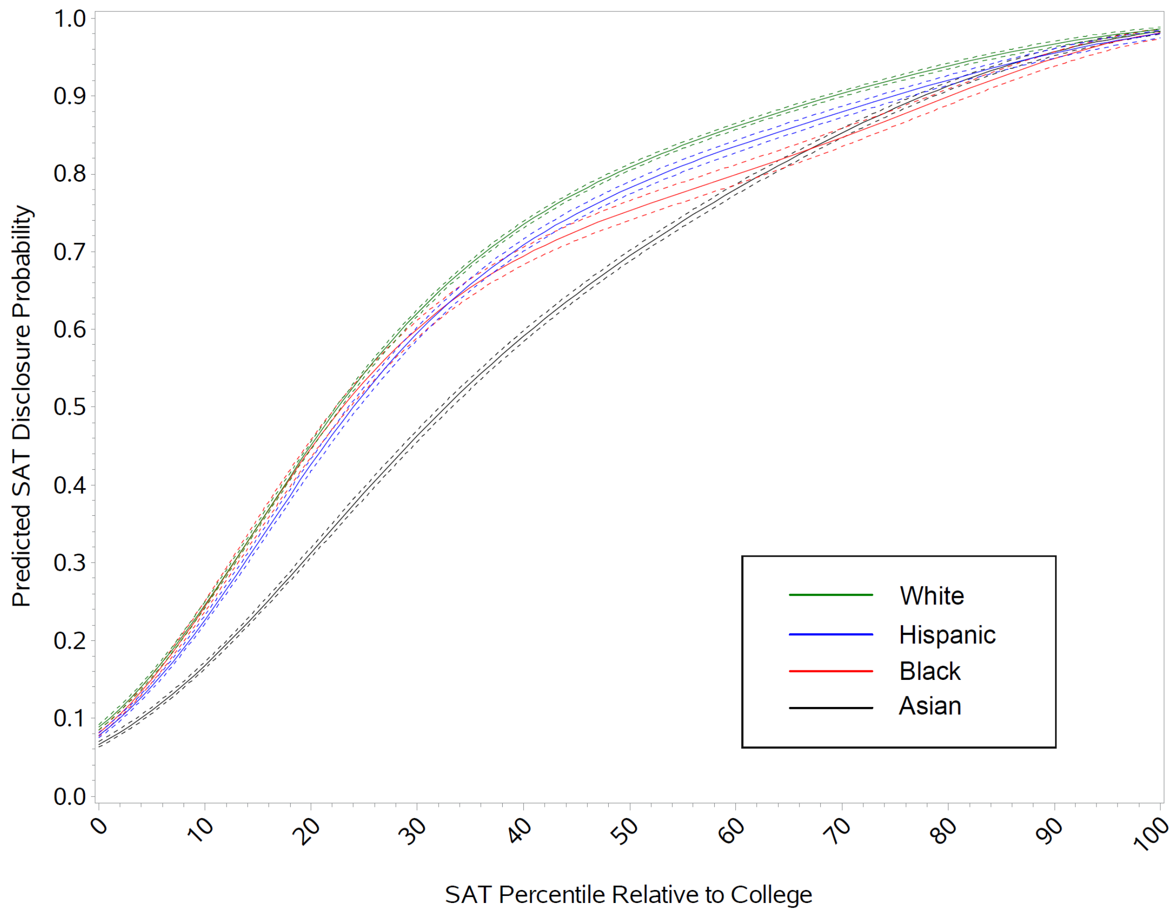
Notes: N = 57,672. All models include college-level fixed effects for the 47 institutions with data available on student performance. The controls for an individual's high school academic performance include bins for GPA and the number of AP exams, as in the analysis above.

Figure 1: Predicted Test Disclosure,
All Applications in Sample 1



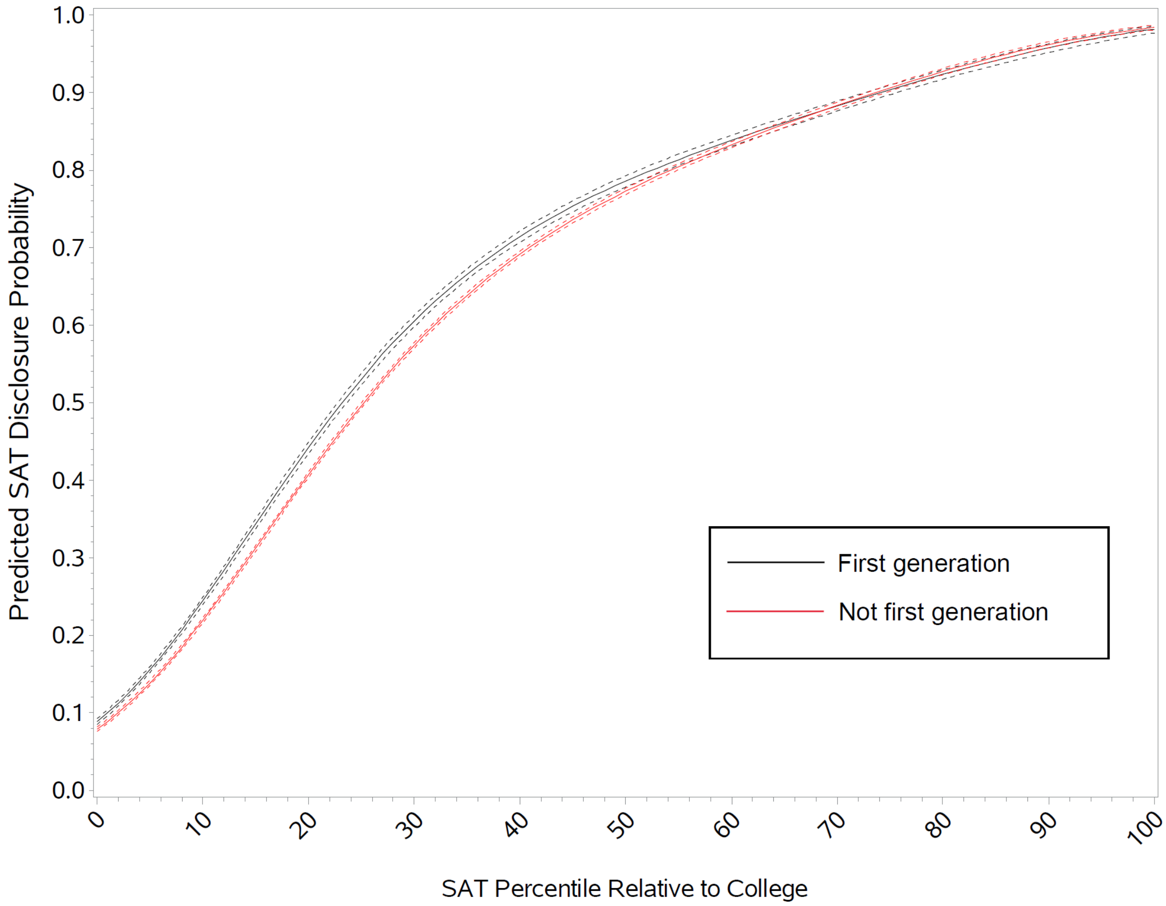
Note: Solid lines are model-predicted values, dashed lines indicate 95% confidence intervals.

Figure 2: Predicted Test Disclosure,
Sample 1 Applications by Applicant Race



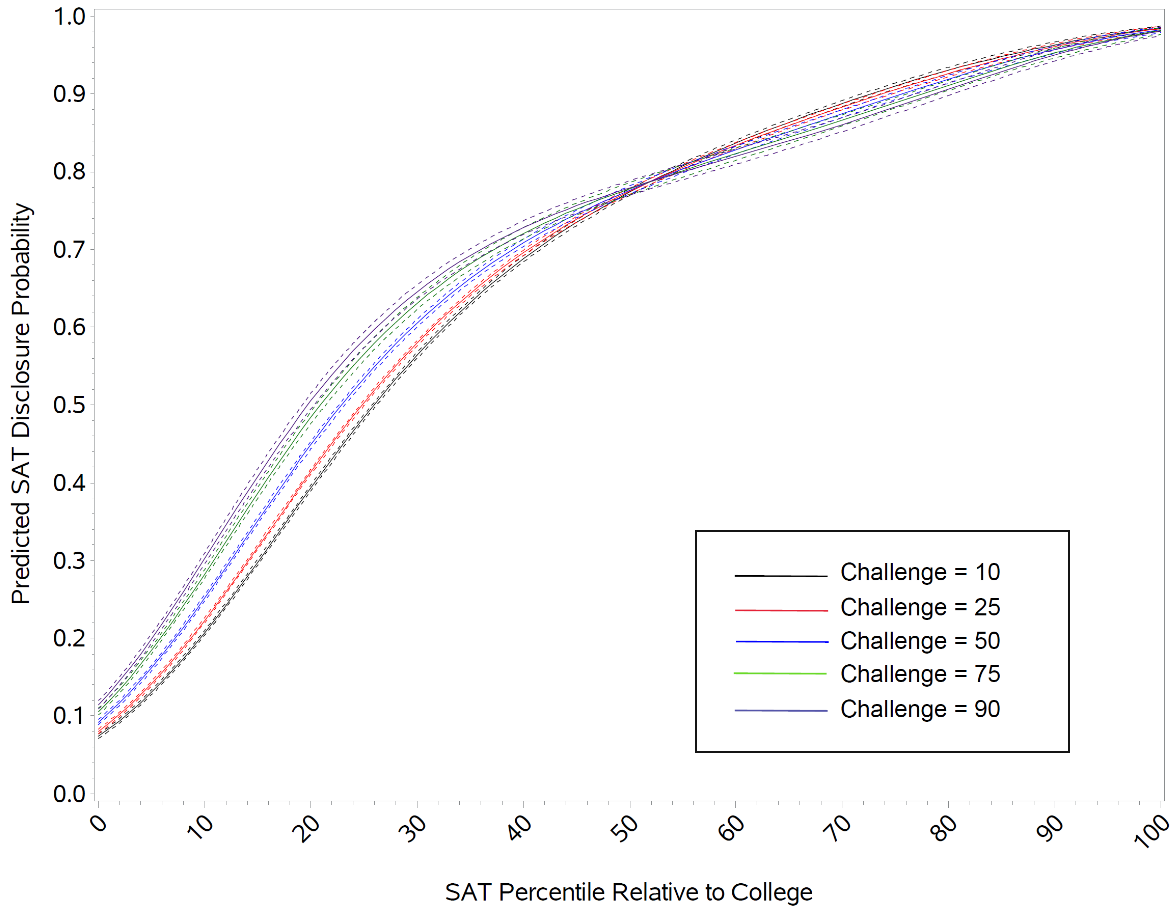
Note: Solid lines are model-predicted values, dashed lines indicate 95% confidence intervals.

Figure 3: Predicted Test Disclosure,
Sample 1 Applications by Applicant's Parents' Education



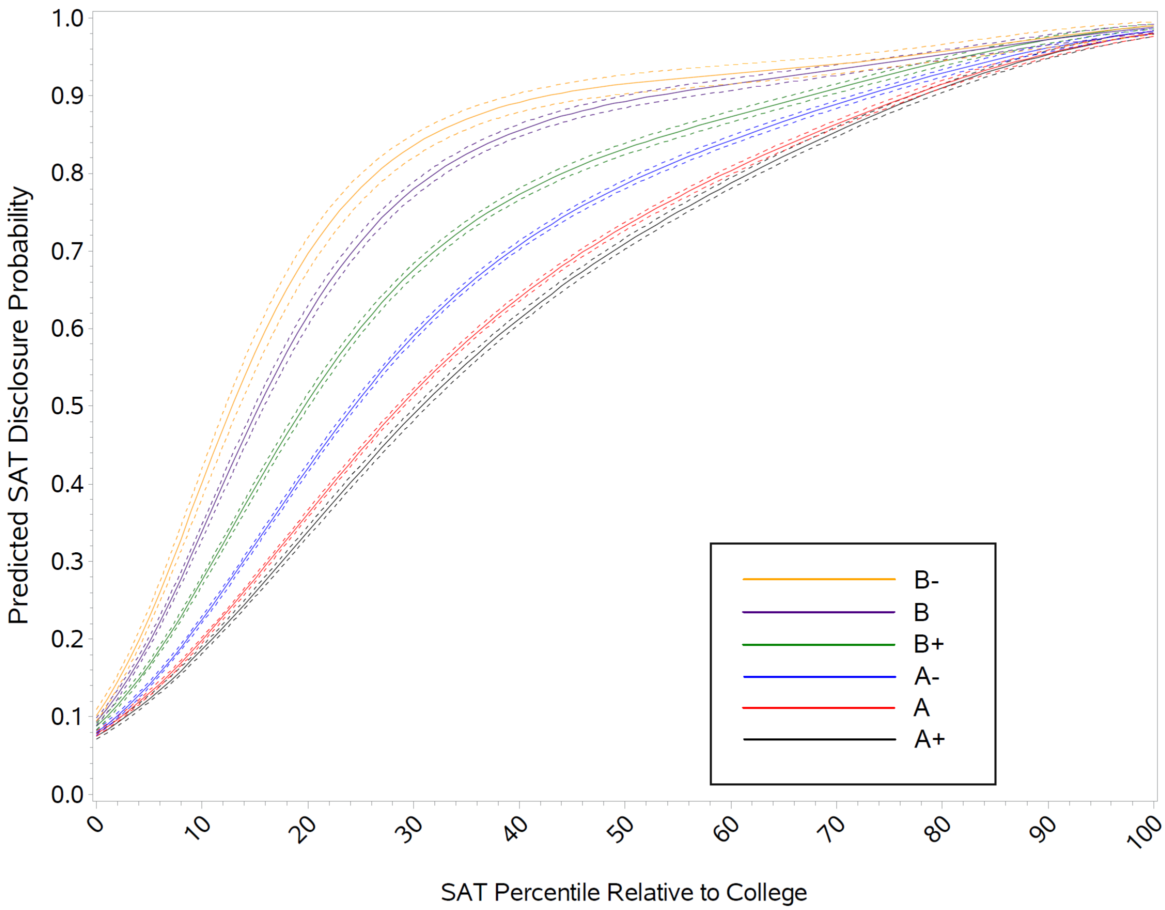
Note: Solid lines are model-predicted values, dashed lines indicate 95% confidence intervals.

Figure 4: Predicted Test Disclosure,
Sample 1 Applications by Applicant's Neighborhood Challenge



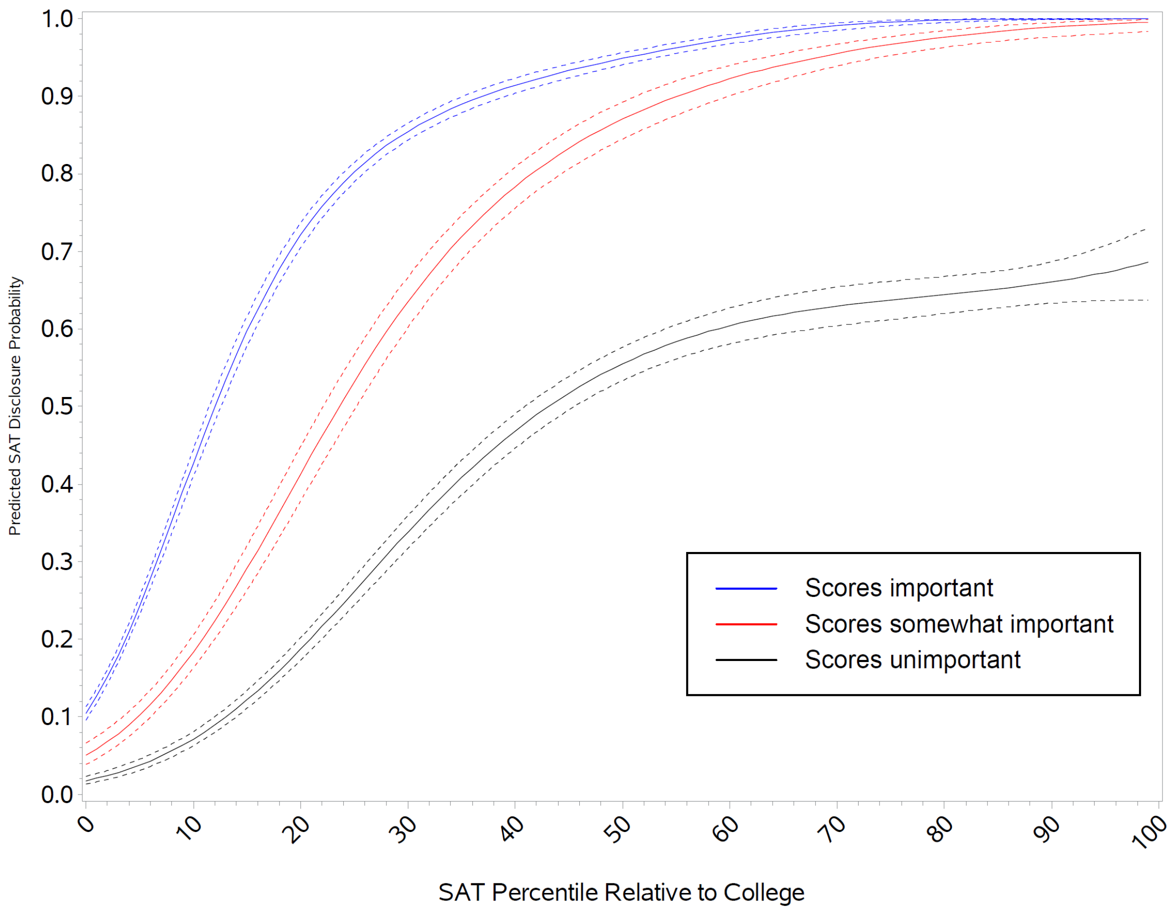
Note: Solid lines are model-predicted values, dashed lines indicate 95% confidence intervals.

Figure 5: Predicted Test Disclosure,
Sample 1 Applications by Applicant's High School Grades



Note: Solid lines are model-predicted values, dashed lines indicate 95% confidence intervals.

Figure 6: Predicted Test Disclosure,
Sample 1 Applications by Institutions' Test Policy Language



Note: Solid lines are model-predicted values, dashed lines indicate 95% confidence intervals.

ONLINE APPENDIX

A.1 Scoring Colleges' Test Policy Language

We scraped the admissions policy webpages of the 50 ARC institutions and collected the language they use to describe their test-optional policies. We used the Wayback Machine (https://archive.org/web/) to capture the policies that were posted in early autumn 2000. Institutions' policies varied in how strongly they encouraged applicants to submit their scores. Examples of brief excerpts of test policy language are:

- "When standardized tests are available for applicants, they can provide useful information we use as part of our holistic review."
- "Standardized tests may not provide the best measure of an individual student's potential for success…. It is the applicant's choice whether to provide scores."

We evaluated each institution's test policy on three dimensions:

1. Why is the institution test-optional? Policies less favorable to testing often cited institution goals to reduce barriers or bias in the admissions process. More favorable policies emphasized that the policy is prompted by the temporary pandemic emergency.
2. What is the test's role in admissions? Policies less favorable to testing emphasized other dimensions of applications and the possibility that tests do always accurately assess an applicant's ability. More favorable policies described relevant applicant qualifications that include test scores along with factors such as high school grades and curriculum.
3. Are applicants encouraged to submit scores? Policies less favorable to testing prompted applicants to consider whether scores reflected positively on their academic ability. More favorable policies often contained suggestions that applicants submit scores if they have them.

We then made a qualitative judgment of whether an institution's policy, in full, expressed a minimal desire for scores, a moderate desire for scores, and strong desire for scores. To create the statistics on Table 4, we assign a value of 1 for "scores unimportant," a value of 2 for "scores somewhat important," and a value of 3 for "scores important."

Table A1: Applicants by Sample Restrictions

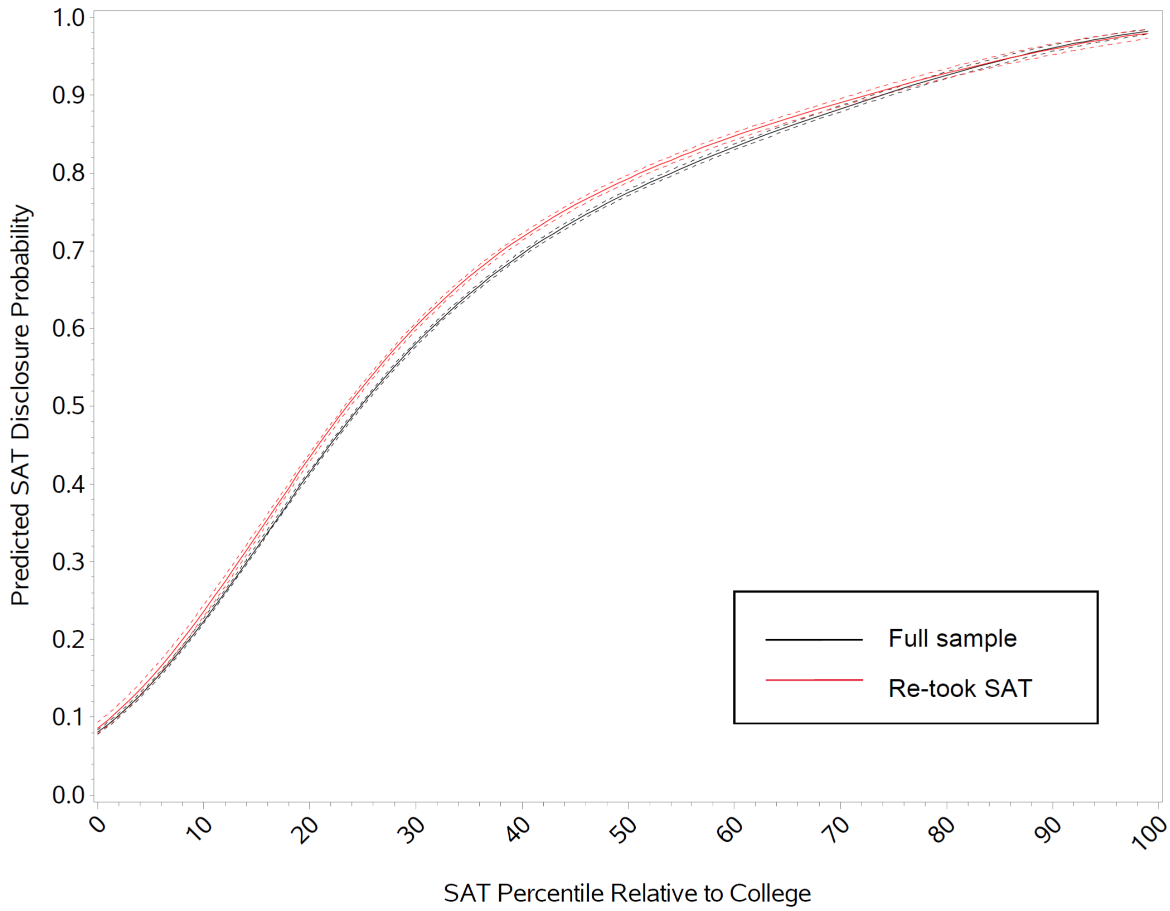
	All SAT Takers, 2021 Cohort	All ARC Applicants	Sample 1	Sample 2
N	1,509,133	685,229	275,920	29,558
Mean SAT	1060	1224	1200	1306
SAT 25^{th} percentile	890	1090	1070	1200
SAT 50^{th} percentile	1050	1230	1200	1320
SAT 75^{th} percentile	1210	1370	1340	1430
Asian	0.111	0.108	0.149	0.223
Black	0.112	0.094	0.115	0.088
Hispanic	0.233	0.143	0.172	0.144
White	0.421	0.441	0.498	0.485
Other race	0.123	0.061	0.065	0.060
International	N/A	0.153	0.000	0.000
Neighborhood chal.	39.3	29.1	28.5	23.6
First-gen	0.363	0.196	0.250	0.189
Non-first gen	0.526	0.599	0.720	0.793
Parents' ed. missing	0.111	0.206	0.030	0.017
GPA A+	0.091	0.120	0.145	0.194
A	0.219	0.264	0.329	0.401
A-	0.184	0.186	0.244	0.234
B+	0.141	0.101	0.133	0.093
B	0.111	0.057	0.074	0.040
B-	0.064	0.020	0.026	0.011
C+ or below	0.086	0.012	0.015	0.005
No GPA info	0.105	0.240	0.034	0.022
0 AP Exams	0.515	0.389	0.230	0.127
1-2 AP Exams	0.206	0.197	0.243	0.184
3-5 AP Exams	0.155	0.213	0.272	0.290
6+ AP Exams	0.124	0.201	0.255	0.399
Foot traffic change	-0.501	-0.520	-0.537	-0.560
SAT testing change	-0.341	-0.347	-0.309	-0.315

Note: Foot traffic changes are at the high school level and compare Oct. 2020 with Oct. 2019 school foot traffic. SAT testing changes reflect county-level cohort changes between the 2020 and the 2021 high school graduating cohorts. The main sample excludes ACT takers, students who took no college entrance examinations and international students.

Table A2: Disclosure Choices and Test Scores across Applicant Populations

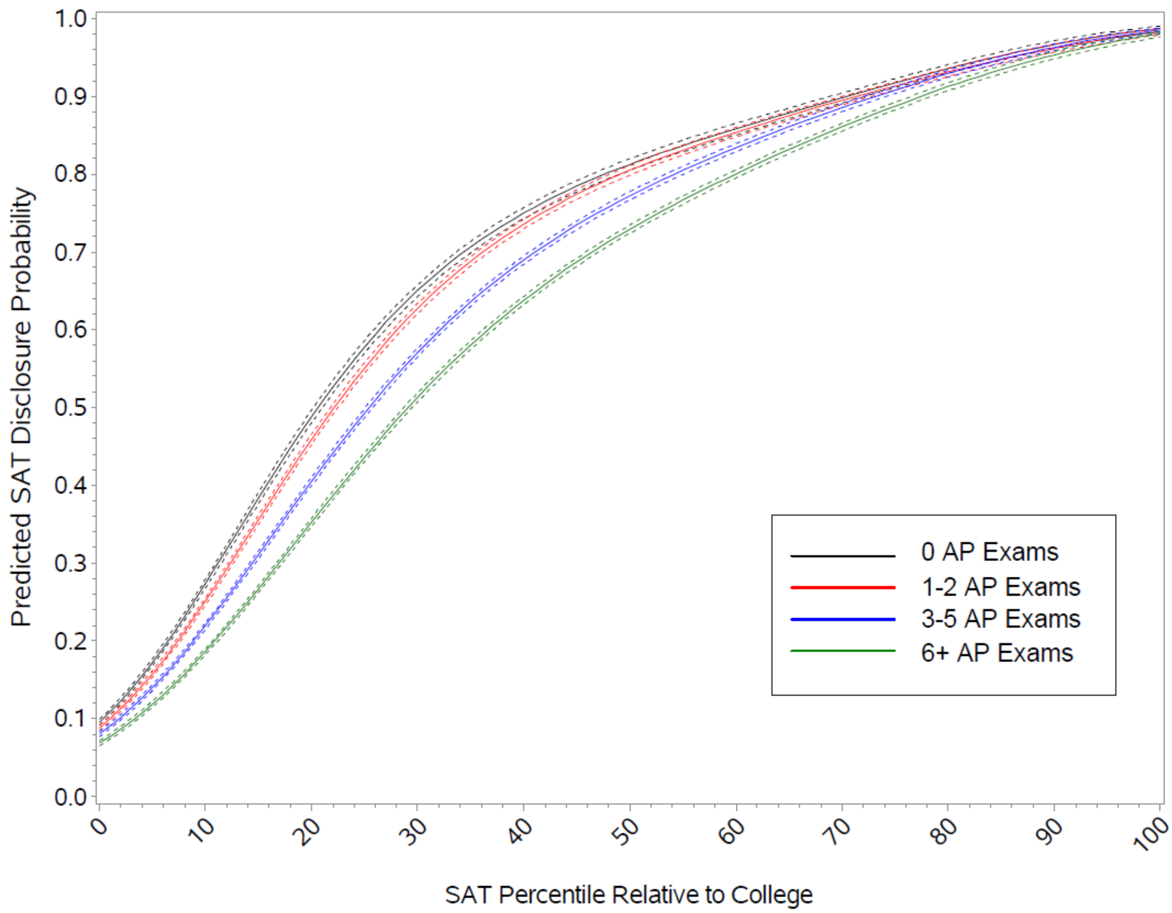
	Applications	Admissions	Enrollees
More Selective Private ARC Colleges			
Disclosed SAT	0.251	0.319	0.310
Disclosed SAT/ACT	0.412	0.546	0.542
SAT Percentile Among Withholders	13.8	19.6	13.4
SAT Percentile Among Disclosers	46.7	62.1	55.0
Selective Private ARC Colleges			
Disclosed SAT	0.247	0.273	0.282
Disclosed SAT/ACT	0.402	0.493	0.516
SAT Percentile Among Withholders	16.1	24.1	15.7
SAT Percentile Among Disclosers	53.2	62.1	53.1
More Selective Public ARC Colleges			
Disclosed SAT	0.300	0.331	0.386
Disclosed SAT/ACT	0.484	0.536	0.617
SAT Percentile Among Withholders	16.4	23.6	19.0
SAT Percentile Among Disclosers	46.5	56.7	48.2
Selective Public ARC Colleges			
Disclosed SAT	0.289	0.298	0.352
Disclosed SAT/ACT	0.453	0.485	0.560
SAT Percentile Among Withholders	23.7	28.8	22.5
SAT Percentile Among Disclosers	53.6	57.0	50.2

Figure A1: Predicted Test Disclosure,
Sample 1 Applications by Whether Applicant Re-took SAT



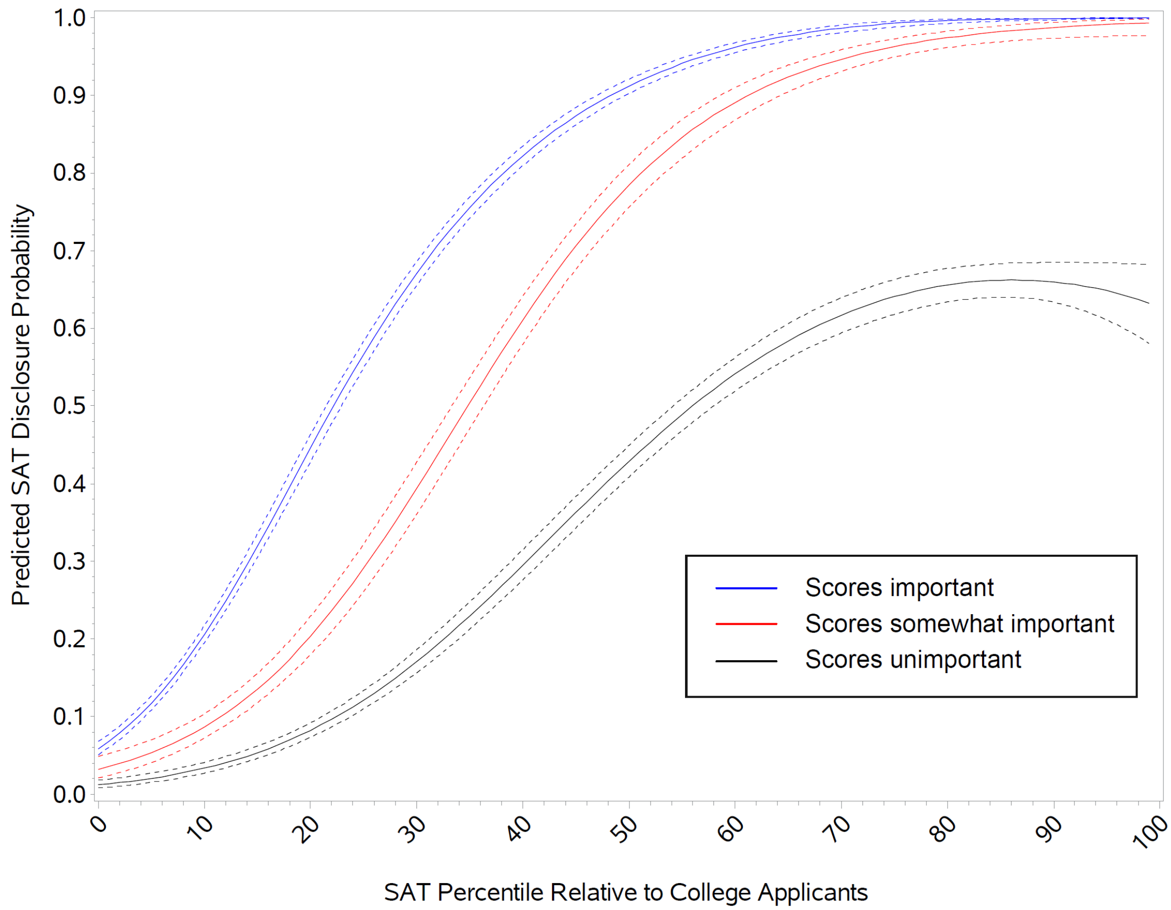
Note: Solid lines are model-predicted values, dashed lines indicate 95% confidence intervals.

Figure A2: Predicted Test Disclosure,
Sample 1 Applications by Applicant's AP Test Count



Note: Solid lines are model-predicted values, dashed lines indicate 95% confidence intervals.

Figure A3: Predicted Test Disclosure Relative to Applicant Score Distribution, Sample 1 Applications by Institutions' Test Policy Language



Note: Solid lines are model-predicted values, dashed lines indicate 95% confidence intervals.