

**EXHIBIT 22**

**Expert Report of Caroline M. Hoxby, Ph.D., dated January 12, 2018**

IN THE UNITED STATES DISTRICT COURT  
FOR THE MIDDLE DISTRICT OF  
NORTH CAROLINA

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STUDENTS FOR FAIR ADMISSIONS, INC.,

Case 1:14-cv-00954-LCB-JLW

Plaintiff,

v.

UNIVERSITY OF NORTH CAROLINA, et al.,

Defendants.

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EXPERT REPORT OF CAROLINE M. HOXBY, PH.D.

January 12, 2018

CONTAINS CONFIDENTIAL INFORMATION SUBJECT TO PROTECTIVE ORDER

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## I. Introduction

1. I have been retained by counsel for Defendants in the litigation *Students For Fair Admissions, Inc. v. University of North Carolina, et al.*, No. 14-cv-954-LCB-JLW (M.D.N.C.). Among other things, I have been retained to consider so-called “race-neutral alternatives.” A race-neutral (or, as I prefer, race-blind) admissions plan is an admissions plan that does not consider the race or ethnicity of an applicant in making admissions decisions. Counsel has asked me to consider against the backdrop of Plaintiff’s allegations and the applicable governing framework whether there are workable race-neutral alternatives available to UNC that would allow UNC to maintain the diversity achieved through its current admissions program without sacrificing its current academic standards.

### A. Plaintiff’s Allegations

2. I begin by framing the allegations that Students for Fair Admissions (“Plaintiff” or “SFFA”) makes in the Complaint. Although not my exclusive frame of reference, I consider these allegations throughout this report. Plaintiff alleges that Defendants “have employed and are employing racially and ethnically discriminatory policies and procedures in administering the undergraduate admissions program at the University of North Carolina at Chapel Hill” (“UNC” or “the University”) in violation of the Equal Protection Clause of the Fourteenth Amendment to the United States Constitution.”<sup>1</sup> Among these allegations, Plaintiff claims that UNC “is using race in admissions decisions when race-neutral alternatives can achieve diversity.”<sup>2</sup> Plaintiff also alleges that “[t]here is now overwhelming evidence that race-neutral alternatives render reliance on racial preferences unnecessary.”<sup>3</sup>

3. Further, SFFA claims that UNC does not use race as part of a holistic evaluation but instead that race is “a dominant factor” in admissions decisions.<sup>4</sup> SFFA also contends that the use of race by UNC to pursue a critical mass of underrepresented minorities (“URMs”) “is nothing more than racial balancing in that it necessarily seeks to ensure a proportional number of

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<sup>1</sup> *Students for Fair Admissions, Inc. v. University of North Carolina*, Case No. 1:14-cv-954, The Middle District of North Carolina, dated November 17, 2014, (“Complaint”), p. 1.

<sup>2</sup> Complaint, ¶ 5.

<sup>3</sup> Complaint, ¶ 5.

<sup>4</sup> Complaint ¶ 51.

students of certain races or ethnicities in the entering class.”<sup>5</sup> On such an account, this claimed use of race in admissions would amount to UNC targeting certain quotas for URM students in its matriculating class.

4. Plaintiff makes several more specific allegations with respect to race-neutral alternatives that it claims are available to UNC.

- i. *First*, Plaintiff alleges that a top-ten percent plan similar to the plan of the University of Texas at Austin would increase the percentage of nonwhite and underrepresented students and would increase the average high-school GPA of UNC’s admitted students.<sup>6</sup>
- ii. *Second*, Plaintiff alleges that “[g]iven this strong correlation between socioeconomic status and race in UNC-Chapel Hill’s applicant pool, UNC-Chapel Hill could easily maintain or increase its racial diversity by emphasizing socioeconomic indicators instead of race” and that “an admissions plan emphasizing additional socioeconomic factors would have no impact on academic quality of the student body.”<sup>7</sup>
- iii. *Third*, Plaintiff claims that “UNC-Chapel Hill can achieve student body diversity by bringing more highly qualified, socioeconomically disadvantaged minorities into its applicant pool.”<sup>8</sup>
- iv. *Fourth*, Plaintiff alleges that UNC can achieve student body diversity without using racial preferences by eliminating certain aspects of its admissions process, such as (i) awareness of a student’s having a parent who is a UNC alumnus or alumna or (ii) its Early Action program.<sup>9</sup>

## B. Assignment and Summary of Opinions

5. Counsel for UNC has asked me to address Plaintiff’s allegations regarding UNC’s current use of race in its holistic evaluation of applicants to UNC (including the allegation that race is used as a dominant factor) as well as to evaluate potential race-neutral alternatives.

6. My opinions may be summarized as follows:

- i. Empirical analysis establishes that UNC admissions decisions cannot be explained using a formula containing verifiable student characteristics. Thus,

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<sup>5</sup> Complaint ¶ 219.

<sup>6</sup> Complaint ¶¶ 80–81.

<sup>7</sup> Complaint ¶¶ 111–12.

<sup>8</sup> Complaint ¶ 125.

<sup>9</sup> Complaint ¶¶ 141, 145. Plaintiff claims that UNC has an “early admission program” and defines it as “a practice in which schools allow students to submit their application in the early Fall if they apply to only one school or promise to attend the school if admitted” (Complaint, ¶142). As I discuss below, this is not an accurate representation of UNC’s Early Action program.

the decisions are consistent with a holistic review of candidates. Moreover, an applicant's race<sup>10</sup> does not determine UNC admissions decisions in a common and systematic way and it is not a dominant factor in admissions. Similarly, eliminating any preference for children of alumni, or the Early Action cycle would not, in itself, be a "workable race-neutral strategy." (**Section III**)

- a. Using UNC admissions data, I have employed a variety of statistical analyses and tools to determine what role race is playing in UNC's admissions decisions. My empirical analyses further show that:
  - b. UNC does not appear to be implementing any sort of racial quotas through its "School Group Review" process.
  - c. To the extent that the racial composition of the UNC class remained relatively stable across the period 2011-12 to 2014-15, I find that such a pattern is consistent with the racial composition of North Carolina high school students (and, in particular, high-achieving North Carolina high school students) remaining relatively stable over this period. The time pattern of the racial composition of the UNC class does not imply that UNC was using any sort of racial quotas or engaging in so-called racial balancing in admissions.
- ii. Because UNC has a stated goal of enrolling a racially diverse student body, the use of a race-blind admissions policy would necessarily reduce UNC's ability to both meet its diversity goals and maintain the level of academic preparedness of its admitted students. (**Sections IV - VIII**)
- a. Using data on all North Carolina public school students, I find that plausible race-neutral, or race-blind, alternative admissions procedures would not have allowed UNC to maintain the levels of academic preparedness and minority representation of its entering classes in 2015. I consider race-blind plans based on (1) socioeconomic status, (2) class rank in high school, and (3) geography, and I find that all of these plans would result in a predicted set of admitted students and a predicted entering class with lower academic preparedness, fewer URMs, or both, relative to the students UNC was actually able to admit and enroll.
- iii. The reduction in academic achievement under hypothetical race-neutral plans is large enough to materially reduce UNC's fulfillment of its mission to provide world-class educational and research opportunities to North Carolinians. Its standing would fall relative to that of other highly selective colleges and universities, with the consequence that it would find it harder to recruit talented students and distinguished faculty. (**Section IX**)
- iv. Based on my expertise in the study of high-achieving low-income students, I find that, contrary to Plaintiff's assertion, UNC is unlikely to be able to

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<sup>10</sup> I will use the term "race" throughout to refer to race and ethnicity.

achieve its student body diversity goals solely by improving its recruitment of socioeconomically disadvantaged, high-achieving minority students.  
(Section X)

### C. Qualifications

7. I am the Scott and Donya Bommer Professor in Economics at Stanford University, the Director of the Economics of Education Program at the National Bureau of Economic Research, and a Senior Fellow of the Hoover Institution and the Stanford Institute for Economic Policy Research. I have published extensively on the economics of education, including in the top economics journals and education journals. I was a presidential appointee to the National Board of Education Sciences and I serve on advisory committees for government agencies, the Brookings Institution, and organizations with an interest in education policy. I have received several awards and honors for my research, including the Smithsonian Institution's Ingenuity Award, the Thomas B. Fordham Prize for Distinguished Scholarship in Education, Global Leader of Tomorrow from the World Economic Forum, Carnegie Scholar, an Alfred P. Sloan Research Fellowship, a John M. Olin Fellowship, and a National Tax Association Award.

8. Much of my research focuses specifically on higher education. I have published papers on students' choices among colleges and universities, selectivity of American colleges and universities, the cost and value-added of college, and low-income students' college application and attendance behavior, among other topics. I have received several grants as principal investigator on the Expanding College Opportunities project, a project focused on the college-going behavior of low-income, high achieving students. A copy of my current *curriculum vitae* and prior testimony is attached as Appendix B.

9. Plaintiff cites some of my research in the Complaint.<sup>11</sup> I address their interpretation of my work later in this report.

10. I have been assisted in this matter by staff of Cornerstone Research, who worked under my direction, and I have relied upon the materials listed in Appendix C. I am being compensated at a rate of \$637.50 per hour. My compensation is not contingent in any manner upon the nature of my findings or on the outcome of this litigation.

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<sup>11</sup> Complaint ¶ 126.



## II. UNC's Current Admissions Program

11. As the starting point for my analysis of UNC's admissions program, I first consider the University's current admissions progress and desired objectives. My understanding of UNC's admission process is based on my review of documents that describe UNC's undergraduate admission goals and policies, documents provided to application readers as part of their training, UNC's applicant level data, and my discussion with UNC undergraduate admissions employees, including the Director of Admissions Stephen Farmer.<sup>12</sup> I do not endeavor to provide a comprehensive description of UNC's undergraduate admissions process, but rather to provide a high-level overview of that process and describe the features that are relevant for reaching my opinions in this matter.

### A. Brief Background on UNC Undergraduate Population and Admissions

12. UNC is the flagship public university in North Carolina. It was chartered in 1789 and enrolled its first students in 1795; it was the nation's first public university.<sup>13</sup> As of 2017, there are approximately 18,500 undergraduate students and 11,000 graduate students enrolled at the University.<sup>14</sup> For the entering class of first-year students in the Fall of 2017, the University received 40,918 applications, admitted 9,709 applicants, and enrolled 4,355 students.<sup>15</sup> As of 2017, approximately 32 percent of UNC's applicants and 83 percent of the matriculating class are North Carolina residents. Each institution in the University of North Carolina system is required to limit the proportion of out-of-state students in the entering first-year class to no more than 18 percent of the class (meaning that in-state students must comprise at least 82 percent of the class).<sup>16</sup> UNC's 2017 entering class is 61 percent female and 39 percent male. The racial/ethnic composition of the 2017 entering class is:<sup>17</sup>

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<sup>12</sup> I met with Stephen Farmer and the UNC undergraduate admissions staff on December 10, 2015.

<sup>13</sup> See, e.g., "About UNC," *The University of North Carolina at Chapel Hill*, <https://www.unc.edu/about>.

<sup>14</sup> "Facts & Figures, May 2017," *The University of North Carolina at Chapel Hill*, <http://uncnews.unc.edu/facts-about-carolina/facts-figures/>.

<sup>15</sup> "Class Profile," *The University of North Carolina at Chapel Hill*, <https://admissions.unc.edu/apply/class-profile-2>.

<sup>16</sup> Sec. 700.1.3, "Out-of-State Undergraduate Enrollment," *UNC Policy Manual*, available at <http://www.northcarolina.edu/apps/policy/index.php?pg=vs&id=450&added=1>.

<sup>17</sup> "Class Profile," *The University of North Carolina at Chapel Hill*, <https://admissions.unc.edu/apply/class-profile-2>. Note that the racial/ethnic categories presented here may not exactly match the racial/ethnic categories identified in the various data used in my analyses.

- i. Asian/Asian-American: 16 percent
- ii. African-American/black: 10 percent
- iii. Caucasian/white: 71 percent
- iv. Hispanic/Latino/Latina: 8 percent
- v. Native American or Alaskan Native: 2 percent
- vi. Native Hawaiian or Pacific Islander: 0.2 percent

**B. Goals of UNC's Admissions Program**

13. UNC's mission is, among other things, to "serve as a center for research, scholarship, and creativity and to teach a diverse community of undergraduate, graduate, and professional students to become the next generation of leaders."<sup>18</sup> To achieve that mission, UNC's admission policies "mandate comprehensive and individualized evaluations for all candidates, and articulate a broad range of criteria to be used in these evaluations," including:

- educational preparation,
- life experiences,
- factors that may contribute to diversity of presence,
- demonstrated ability and motivation to overcome disadvantage or discrimination,
- desire and ability to extend knowledge-based services to enhance the quality of life of all citizens, and
- motivation and potential to make a positive contribution to the educational environment of the University.<sup>19</sup>

14. As UNC's policies articulate, the University believes that diversity is "essential to the fulfillment of the University's educational and service missions."<sup>20</sup> As such, the race/ethnicity and national origin of applicants, which are some of the many aspects of diversity UNC aims to

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<sup>18</sup> UNC0079430; UNC0000010 (2016-17 Reading Document).

<sup>19</sup> *Ibid.*

<sup>20</sup> *Ibid.*

foster, may be considered as “one part of the comprehensive, holistic, and individualized review afforded to each candidate.”<sup>21</sup>

15. As part of the diversity goals of the University, it also “aims to enroll critical masses of students who identify themselves as members of groups the University deems underrepresented.”<sup>22</sup> For UNC, “the term ‘underrepresented’ means those groups whose percentage enrollment within the undergraduate student body is lower than their percentage within the general population in North Carolina.”<sup>23</sup> As of the 2016-17 admission cycle, the University considers students identifying themselves as members of the following racial/ethnic groups underrepresented: African-American; Native American or Alaska Native; Hispanic, Latino, or Latina.<sup>24</sup> For the sake of brevity, throughout the remainder of this report, I will refer to African-American or black students as “African American;” Native American or Alaska Native students as “Native American;” Hispanic, Latino, or Latina students as “Hispanic;” Caucasian or white students as “white;” Asian or Asian-American students as “Asian;” and Native Hawaiian or Pacific Islander students as “Pacific Islander.”

16. UNC also aims to admit students whose academic preparedness and performance will contribute to the University’s “commitment to excellence as one of the world’s great research universities.”<sup>25</sup> As such, UNC evaluates applicants on, among other things, academic performance, academic program, and standardized testing. These are just some of the many criteria of “fit” that UNC has considered relevant to its goal of admitting a class whose “collective strengths will foster excellence within the University community; enhance the education of everyone within it; provide for the leadership of the educational, governmental, scientific, business, humanistic, artistic, and professional institutions of the state and nation; and enrich the lives of all the people of North Carolina.”<sup>26</sup> In my report I use the term “fit” to refer

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<sup>21</sup> *Ibid.*

<sup>22</sup> *Ibid.* I was not retained to define or otherwise assess critical mass, including whether the University has achieved it. Thus, any attempts to define critical mass are beyond the scope of this report.

<sup>23</sup> *Ibid.* This framework was established in the 1981 consent decree between the University of North Carolina system and the United States Department of Health, Education, and Welfare.

<sup>24</sup> *Ibid.*

<sup>25</sup> *Ibid.*

<sup>26</sup> *Ibid.*

to how well an applicant to UNC “fits” the criteria that UNC has defined as relevant to its mission.

17. To achieve these goals, UNC states that it engages in a holistic undergraduate admissions process.<sup>27</sup> In the case of an admissions process, “holistic” translates into the admission staff assessing an applicant as a whole person or, put another way, as an individual. A holistic admissions process is one that requires judgment based upon the totality of the information known about an applicant. In a holistic process, application readers are trained to consider all information in qualitative terms as part of making an admissions decision.

18. UNC states that its process is holistic in that “the relative weight or credit assigned to any individual criterion may vary from candidate to candidate” and that “[c]andidates for admissions are evaluated on everything the admissions process reveals about them and not on the basis of formulas or preset scoring requirements.”<sup>28</sup> The race or ethnicity and national origin of applicants may be considered within this process. UNC states that race or ethnicity and national origin may be potentially used at any stage in the admissions process, but always as only one part of the comprehensive, holistic, and individualized review afforded to each candidate.<sup>29</sup> UNC also notes that “[a]t no point in the process are candidates of different racial or ethnic backgrounds reviewed in separate groups,” “[n]or does the University have explicit or implicit quotas for any particular racial or ethnic group, or for underrepresented students as a whole, or for students of color as a whole.”<sup>30</sup> Under UNC’s policy, any student “may—or may not—receive a ‘plus’ in the admissions decision process depending on the individual circumstances revealed in the student’s application,” but such a “plus” is not “automatically awarded, ... [is] not considered in terms of numeric points, ... [and] does not automatically result in an offer of admission.”<sup>31</sup>

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<sup>27</sup> *Ibid.*

<sup>28</sup> *Ibid.*

<sup>29</sup> *Ibid.*

<sup>30</sup> *Ibid.*

<sup>31</sup> *Ibid.*

### C. UNC's Admissions Process

19. As part of UNC's evaluation of an admissions file, applicants are judged on "more than forty criteria," grouped into the following eight categories: academic program, academic performance, standardized testing, extracurricular activities, special talent, essay, background, and personal.<sup>32</sup>

20. When reviewing an application, a reader is instructed to use his or her individual judgement to create summary "ratings" for each applicant along five dimensions, roughly corresponding to some of the application criteria listed above: "Program," "Performance," "Extracurriculars," "Essays," and "Personal Qualities."

- i. The "Program" summary rating is intended to be an overall assessment of the rigor, breadth, and pattern of courses taken by the applicant in high school.<sup>33</sup>
- ii. The "Performance" summary rating is intended to be an overall assessment of the applicant's academic performance in high school.<sup>34</sup>
- iii. The "Extracurriculars" summary rating is intended to be an overall assessment of the applicant's contributions through extracurricular activities of all sorts.<sup>35</sup>
- iv. The "Essays" summary rating is intended to be an overall assessment of the strength of the applicant's essays, along multiple dimensions.<sup>36</sup>
- v. The "Personal Qualities" summary rating is intended to an overall assessment of multiple qualities of an applicant such as intellectual curiosity, contribution to diversity, strength of character, impact on others, exceptional achievement, and overcoming adversity.<sup>37</sup>

21. Admission readers are also expected to identify and summarize applicants' "special talent." These special talents include athletics, music, dramatic arts, etc. The department with which an applicant's special talents are associated (e.g., the athletic department for student

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<sup>32</sup> *Ibid.* p. 6.

<sup>33</sup> *Ibid.* p. 6.

<sup>34</sup> *Ibid.* p. 6.

<sup>35</sup> UNC's admissions policy documents describe these criteria as "engagement outside the classroom; persistence of commitment; demonstrated capacity for leadership; contributions to family, school, and community; work history; unique or unusual interests." *Ibid.*

<sup>36</sup> UNC's admissions policy documents describe these criteria as "idea, organization, voice, vocabulary, sentence structure and grammar; evidence of self-knowledge and reflection; insightfulness; unique or unusual perspectives." UNC0000010 (2016-17 Reading Document). See also UNC0079290.

<sup>37</sup> UNC0326625.

athletes) is able to make a certain number of recommendations to the admission office based on its judgment of the applicant's special talents.

22. Although the reader generates a numeric summary rating in each of these five categories, none of the summary ratings is based on a formula. Even when creating the Program and Performance summaries, readers are instructed to use their individual judgment to make an overall assessment.<sup>38</sup> That is, a student's high school transcript data could not be fed into a computer that could generate the Performance summary ratings created by readers. The "Extracurriculars," "Essays," and "Personal Qualities" summaries require even more individual judgement and overarching assessment on the part of the reader. For instance, readers are trained to consider all of student's extracurricular activities, which may be diverse and not easily compared, to come up with overall summary. Readers are trained to consider these activities in context because not all students have access to the same range of extracurricular opportunities. A student from a small rural high school may have different opportunities, say, than a student from large urban high school.

23. UNC states that it trains each reader so that, after reviewing an application and assigning summary ratings, each reader considers the student "as a full person" in order to come to a provisional admit/reject decision. To explain how he or she came to that provisional decision, each reader provides comments about his or her overall assessment of the applicant.

24. If an application receives a second reading, then a so-called "second reader"—who is a more experienced member of the admission office staff—arrives at a separate provisional decision. This second and separate provisional decision may overrule the decision made by the first reader. The second reader may also provide comments explaining why the decision was made.

25. Once a provisional decision has been put forward for each applicant, UNC engages in a process it calls "school group review" (or "SGR"). This process is conducted by experienced members of the admission staff. UNC explained that SGR is meant to serve a few purposes: (i) to allow the University to adjust the total number of offers of admission to try to avoid over- or under-enrollment, (ii) to bring attention to individual applicants who may require another review based upon how decisions regarding them compare to decisions regarding other applicants in

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<sup>38</sup> See, e.g., UNC000022. For example, the "Program" summary rating for an applicant depends in part on the "professional judgment" of the reader in identifying post-AP coursework.

their high school class, and (iii) to correct inadvertent errors (e.g. an applicant being inadvertently marked as “deny” when the provisional decision was actually “admit”).<sup>39</sup> As part of this process, all applicants from the same high school are displayed together, listed in order of their high school class rank. Placing applicants in the context of their own high school classmates is intended to draw attention to inadvertent errors and provisional decisions that appear anomalous. For instance, admissions staff might re-review data on an applicant who was rejected despite being much more highly ranked than classmates who were accepted. This is not to say that UNC intends SGR to be a process in which provisional decisions that are reviewed are routinely reversed. UNC states that the goal of SGR is not to overturn holistic review.<sup>40</sup> Rather, the admission staff seek to understand the decisions fully and wish to have one last opportunity to review them. Following school group review, UNC admissions decisions generally become final.<sup>41</sup>

26. The process described above is used for both Early Action and Regular Decision admissions. UNC first-year applicants can apply either by a non-binding “Early Action” deadline of October 15 or by the “Regular Decision” deadline of January 15.<sup>42</sup> Applicants who apply Early Action receive one of three decisions: admit, deny, or defer. Applicants who receive the “defer” decision during the Early Action admission process have their application read again as part of the Regular Decision admission process.<sup>43</sup>

27. Students who are admitted under the non-binding Early Action program do not need to make their matriculation decisions before the spring deadline—they face the same deadline faced by students admitted in the Regular Decision process. I note that the Complaint appears to wrongly conflate UNC’s Early Action program with a binding early decision program, which UNC does not have.<sup>44</sup> Students who are admitted under the non-binding Early Action program

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<sup>39</sup> UNC0079438.

<sup>40</sup> UNC0079438: “Consistent with the University’s admission policy, the SGR committee members are mindful that admissions decisions are not based on any single criteria, formula, or scoring requirement. The evaluation of candidates during the SGR process retains the holistic, individual, and comprehensive review characteristics necessary to achieve the University’s admissions goals.”

<sup>41</sup> Decisions may change after SGR if an application is withdrawn or if new information on the applicant becomes available.

<sup>42</sup> “Deadlines,” *The University of North Carolina at Chapel Hill*, <http://admissions.unc.edu/apply/deadlines/>.

<sup>43</sup> See “Admissions,” *The University of North Carolina at Chapel Hill*, <http://admissions.unc.edu/counselors-and-colleagues/frequently-asked-questions/>.

<sup>44</sup> Complaint, ¶ 144 (“socioeconomically disadvantaged students and minorities face a disadvantage under early admission programs because they... lack the economic resources to commit to a school so early in the process.”)

have ample opportunity to assess their financial aid offers before making their matriculation decision.<sup>45</sup>

### III. Empirical Analysis of UNC's Admissions Process

28. Plaintiff alleges that “[a]lthough UNC-Chapel Hill claims to use an applicant’s race and ethnicity only as one of many factors within its ‘holistic’ system, statistical and other evidence establishes that race is a dominant factor in admissions decisions to the detriment of white and Asian-American applicants.”<sup>46</sup> Elsewhere, Plaintiff claims UNC uses race as a “dispositive factor.”<sup>47</sup>

29. I evaluate this allegation that race is serving as the dominant factor through an empirical analysis of UNC’s admissions process. If Plaintiff is correct, then the data will show that admissions decisions are formulaic and predicted by race. From a statistical perspective, this means that, if Plaintiff is correct, there exists a statistical formula of admissions decisions that accurately predicts outcomes and in which the race factor plays a dominant role. If no such formula can be derived, then that establishes that race is not a dominant factor and that the process is holistic.

30. Specifically, I perform two analyses: (1) whether UNC’s admission decisions can be explained using a formula based on the information and data available to the admission staff during their review of applications and (2) whether an applicant’s race or ethnicity is the dominant factor in admission decisions. In order to evaluate whether UNC assigns a numerical or otherwise formulaic plus factor to racial or ethnic groups, my analyses first consider whether race and ethnicity are additive factors and then consider whether they are multiplicative factors.<sup>48</sup>

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<sup>45</sup> “If you’re applying as a first-year student, you’ll choose one of our two deadline plans—Early Action or Regular Decision. We offer two deadlines simply because we want to give you more options. Neither of our deadlines results in a binding decision, and both have the same May 1 enrollment deadline.” (See <http://admissions.unc.edu/apply/deadlines/>).

<sup>46</sup> Complaint, ¶ 51; see also Complaint, ¶¶ 54, 56. From here on, I use the phrase “dominant factor” but observe that Plaintiff means “dominant” in the sense of being dispositive.

<sup>47</sup> Complaint, ¶ 54.

<sup>48</sup> UNC0079430.



Because I consider both additive and multiplicative factors, my evaluation would find nearly any plausible formulaic use of factors, were they in use.<sup>49</sup> (Section III.B.)

31. In subsequent analysis I also evaluate whether the data show that UNC is applying a separate formula for each racial/ethnic group that explains UNC's admission decisions within that group. (Section III.C.)

32. In short, I find that, consistent with the University's stated approach, UNC's admissions decisions are not explained by a formula. UNC's admission process is too holistic to be embodied by a model, even if that model is flexible and complex. Furthermore, I find that an applicant's race/ethnicity is not the dominant factor in whether an applicant is admitted or rejected. I arrive at these results based on my analysis of the data from six application cycles: 2011-12, 2012-13, 2013-14, 2014-15, 2015-16, and 2016-17.

33. Plaintiff further claims that UNC uses race in admissions to achieve certain quotas of URM<sup>50</sup> or that the SGR process is used for racial balancing or to achieve implicit quotas.<sup>51</sup> I empirically evaluate these allegations using UNC admissions data and data on North Carolina public high school students. I first consider whether the SGR process favors particular racial or ethnic groups, so as to systematically change the overall decisions made or substantially increase the number of URM<sup>50</sup> admitted. (Section III.D.) I then evaluate whether the UNC admissions process – considered in its entirety – appears to implement quotas. (Section III.E.)

34. I find that the empirical evidence does not support a conclusion that SGR operates to fill quotas, achieve racial balancing, or to change the admissions outcome on the basis of an applicant's race. Furthermore, the empirical evidence also does not support a conclusion that UNC is attempting to implement racial quotas via any other means.

#### **A. Connect Carolina Data**

35. In order to perform my analysis, I received data on UNC applicants for the six classes entering each fall between 2012 and 2017 (that is, the admissions processes that took place from

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<sup>49</sup> A factor is additive if each applicant with that factor (e.g., a certain race or ethnicity) receives the same increase in admissions probability regardless of the applicant's other qualifications. A factor is multiplicative if it acts as a scaling factor on one or more characteristics of an applicant (e.g., multiplying the applicant's SAT score by 1.2).

<sup>50</sup> Complaint, ¶ 219.

<sup>51</sup> Complaint, ¶¶ 48–49, 52.

the 2011-12 school year through the 2016-17 school year).<sup>52</sup> These data contain the information stored in UNC's application management system, called Connect Carolina, for each applicant.<sup>53</sup> The data contain, among other things, information on the applicant's standardized test scores, GPA, class rank, race/ethnicity, gender, North Carolina residency status, high school, and the five numeric ratings given to the applicant (described above). The data also includes the applicants' status, such as admitted and matriculated. The data include both in-state and out-of-state applicants and include applicants from all types of high schools (public, private, and home schools). For each student who was a North Carolina resident and who attended public schools, I received a potential match to the student's ID in the North Carolina Education Research Data Center (NCERDC) data.<sup>54</sup> I describe the NCERDC data in paragraph 77 below. The match may be imperfect and there are some students for whom a match was not provided because UNC could not make a match in which it felt reasonable confidence.

#### **B. UNC Admissions Cannot Be Explained by a Formula**

36. If UNC's admissions process is holistic, from a statistical perspective, that means it is not formulaic. That is, there should not be a formula that accurately determines whether an applicant is accepted or rejected, even if that formula uses all of the information available to the admissions staff.

37. To assess whether UNC admissions is holistic, I examine whether one can accurately predict the decision (admit/reject) using the information that is available to the admissions staff as a result of an individual's application. I do so based on "verifiable measures."

38. A "verifiable measure" is one that a reader at UNC or elsewhere would, with an application in front of them, report in the same way. For instance, a student's SAT "combined" (mathematics plus verbal) score and class rank are verifiable measures. In particular, I consider all verifiable measures observable within the Connect Carolina data that are do not reflect subjective judgment from a reader. Examples are:

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<sup>52</sup> UNC0379828-9, UNC001463-4, UNC0349041, UNC0349251. I also received more limited data on UNC applicants for the classes entering in 2010 and 2011 (UNC0379826-7).

<sup>53</sup> The comment fields that reviewers populate as part of the application review are not included. As I discuss below, because these comments reflect holistic evaluation, it would not be appropriate to use them in an analysis of whether UNC's admissions can be predicted formulaically.

<sup>54</sup> UNC0379834-7. The NCERDC ID is itself encrypted. That is, it is not information like a name or social security number that would allow an individual student to be identified.

- i. a student's test scores,
- ii. class rank,
- iii. high school grades,
- iv. high school coursework,
- v. sex,
- vi. being an in-state student,
- vii. other indicators of a student's residential location such as North Carolina county,
- viii. having a parent who is a UNC alumnus or alumna,
- ix. having a parent who is a UNC faculty or staff member,
- x. applying in the Early Action cycle (as opposed to the Regular Decision cycle),
- xi. playing a sport in high school,
- xii. intended major,
- xiii. parents' educational attainment,
- xiv. U.S. citizenship status,
- xv. being a foreign student,
- xvi. using a Fee Waiver rather than paying the application fee,<sup>55</sup> and
- xvii. the student's GPA relative to other applicants from the same high school. This last measure is relevant to the school group review process, as described above.

39. The summary ratings (Program, Performance, Extracurricular Activities, Essays, and Personal Qualities) should not be included in any analysis of whether a decision is formulaic. This is because, as discussed earlier, readers are trained to apply their individual judgement so that each rating represents their overall assessment of some aspect of a student. Thus, even if I could add up the summary ratings and predict the admissions decision accurately (which, in fact, I cannot), I would not have shown that the admissions decision was formulaic. Instead, I would have to demonstrate that I could derive each of the summary ratings via a formula based on verifiable measures. A decision based on ratings that cannot themselves be explained by formulas is *not* a formulaic decision.

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<sup>55</sup> I considered the array of socioeconomic factors available in the Connect Carolina data.

40. Furthermore, if I could derive each of the ratings via its own formula and if the resulting formulaic ratings were then added up via some other formula to make admissions decisions, then I could derive an overarching formula based on verifiable measures that would predict admissions decisions accurately. I would not have to test separately whether each rating was formulaic. I could test them all simultaneously by testing whether the admissions decision was formulaic.<sup>56</sup>

41. In statistics, an accepted way to assess whether a decision (here, admit/reject) is formulaic is via choice or decision regressions.<sup>57</sup> A regression analysis is a statistical procedure used to measure the formulaic relationship between multiple factors. A regression has two “sides”: (i) the “dependent variable” or outcome we are trying to explain and (ii) the “explanatory factors” or factors that might explain the outcome. There can be many explanatory factors and they can work together, simultaneously, to explain the outcome. For instance, one might use a regression in an attempt to explain why some students made the softball team and others did not (the outcome). Each student’s speed and visual acuity could be considered as

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<sup>56</sup> To the extent that such summary ratings could be formulaically determined, they will, by necessity, be based on the same available verifiable measures that I utilize in predicting the overall admissions decision. Thus, by including these measures in my overall analysis I am implicitly accounting for the possibility that the summary ratings are also formulaically determined. Comments provided by application reviewers are also not verifiable measures.

<sup>57</sup> An important consideration that affects my choice of analysis methods is “overfitting.” In statistics, overfitting is defined as “the production of an analysis which corresponds too closely or exactly to a particular set of data, and may therefore fail to . . . predict future observations reliably.” See Oxford English Dictionaries, <https://en.oxforddictionaries.com/definition/us/overfitting>. For example, there might only be one Native American applicant for the 2015 class who has a combined SAT score of 1160, has a GPA of 3.5, has a class rank at the 10th percentile, is male, and is a North Carolina resident. Suppose that he were admitted by UNC. An overfit model would produce estimates that said that all Native Americans with his SAT score, GPA, class rank, sex, and residency would be admitted—with a probability of 100 percent. This is because the overfit model would simply have identified this particular combination of characteristics with a particular admissions outcome (“admit”) based on an individual student. The model would appear to have fit the data but would really just be singling him out. Crucially, if the same model were used on applicant data for the next application cycle, it would do a poor job of predicting outcomes because it is based on a sample size of one. While this is a specific example designed to illustrate the problem, overfitting is a general and potentially serious statistical problem for analyzing this type of data because the number of well-qualified URM students is limited in any given admissions cycle. I assiduously avoid overfitting by employing regressions that I have validated to ensure that they predict about equally well “out-of-sample” as “in-sample.” By this, I mean that the regressions should fit the data on which they have not been estimated about as well as they fit the data on which they have been estimated. Later in the report, it will be extremely important for me to prevent overfitting when testing alternative admissions models that employ, say, a socioeconomic index or a geography-based index. Any such index, if legitimate and not overfit, must be fit on one set of data (e.g. one admissions cycle’s data) and then be used on another set of data (i.e. another admissions cycle’s data). If an index is employed otherwise, it is illegitimate in context of predicting potential UNC admissions outcomes the UNC context where overfitting is a potentially serious problem. Put another way, any socioeconomic or geography-based index must make similar predictions out-of-sample as it does in-sample. The regressions I have employed and validated do so. For the purposes of my analysis, I do not employ the alternative approach known as “machine learning” because the UNC admissions data are insufficiently “big” to allow for the out-of-sample validation or “discipline” that is crucial for making this technique work. It is my view that any legitimate machine learning-derived formula must fit out-of-sample data as well as it fits in-sample data.

explanatory factors. These factors could work together so that the analysis might show, for example, that only students who were both fast and visually acute made the team.

42. In the case of UNC admissions, the outcome is being admitted to UNC. The explanatory factors are all of the verifiable measures described above. The regressions can simultaneously take account of many dimensions of “fit” such as all of these verifiable measures. Furthermore, such regressions can take account of all “fit” factors in a flexible way. Such a regression analysis will statistically show which explanatory factors are associated with admission to UNC and the extent to which all of the explanatory factors (and each individually) can formulaically explain UNC admissions decisions. For example, if having a higher SAT score is an important factor that makes a student more likely to be admitted to UNC, regression analysis would capture that by reporting a positive “coefficient” on the SAT score. The coefficient would furthermore be “statistically significant” with a high level of “confidence.” Furthermore, statistical measures such as “R-squared” (or “R<sup>2</sup>”), which I discuss below, can establish overall whether the formulaic regression model does a good job of explaining admissions decisions.

43. Regressions can also show whether a specific variable is an additive or multiplicative factor.<sup>58</sup> For instance, regressions could show that 100, 200, or 300 points were effectively added to the combined SAT score of a certain group of applicants. This would be the discovery of an additive factor. Regressions could also reveal that any given verifiable measure (e.g. the SAT combined score) is effectively multiplied by 1.1, 1.2 or 1.3 for some group of applicants. This would be the discovery of a multiplicative factor. Note that the factors could be different for different verifiable measures. For instance, regressions can allow the discovery that, for a certain group of students, the SAT combined score is effectively multiplied by 1.1 but the GPA is effectively multiplied by 1.5.

44. The most widely accepted way to summarize whether a regression model (or formula based on one) explains a decision such as admit/reject is “R-squared”. R-squared is a statistical measure that indicates how well the factors included in the regression explain the outcome. Roughly speaking, it is the percentage share of the admit/reject decision that a formula can

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<sup>58</sup> A statistical method widely regarded as appropriate for assessing a yes/no decision such as admit/reject is the Probit model. This model assumes that factors that are not used by the statistician but potentially used by the admission staff are distributed according to a normal distribution. Probit models can make flexible use of the verifiable measures listed above. The main alternative to the Probit model is the Logit model which assumes that the factors not used by the statistical model but available to the admission staff are distributed according to a *natural logarithmic* distribution. In the case of UNC admission, the Logit model produces findings that are similar to the Probit model.

predict. For instance, if the regression discovered a formula with an R-squared of 1.00, I could use the formula to predict the admissions decision and the prediction would be correct 100 percent of the time. However, if the regression discovered a formula with an R-squared of only 0.50, predictions based on that formula would be correct only 50 percent of the time. Likewise, a regression that had an R-squared of 0.25 would produce a formula that predicted the admissions decision correctly only 25 percent of the time.

45. Thus, if the UNC admission process is based on a formula, the R-squared of some regression based on verifiable admission data will be 1.00 or 100 percent. If the UNC admission process is holistic, no regression based on verifiable admission data will produce an R-squared of 1.00 or 100 percent. For instance, if after trying many regressions (i.e. many possible configurations of factors that might explain admissions), the regression with the highest R-squared has an R-squared of only 0.50 or 50 percent, then a formula can predict the admissions decision correctly at most 50 percent of the time. That is, with an R-squared of 0.50, a formulaic model does not come close to explaining all admissions decisions. Rather, such an R-squared indicates that half of the variation in admissions decisions cannot be explained by a formula and must be due to readers appraising the candidate in a manner that is non-formulaic, that is specific to the candidate as an individual, that requires a reader to use his or her judgement, and/or that includes overall assessment.

46. R-squared can also be used to assess which factors drive the formula. For purposes of analyzing UNC's admissions process, R-squared can be divided into the portion of R-squared explained by (i) race or ethnicity factors and (ii) all other verifiable factors (test scores, grades, and so on).<sup>59</sup> For instance, an analysis might indicate that 20 percent of *the part of the admission decision that is explained by a formula* is due to race/ethnicity factors and 80 percent is due to other factors (test scores, grades, etc.). Thus, if 100 percent of the decision is formulaic, a 20/80 division would suggest that race or ethnicity factors explain 20 percent of the overall admissions decision. However, if only 40 percent of the decision can be explained by a formula altogether, a

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<sup>59</sup> I use the "Shapley Decomposition" to divide the R-squared into contributions from each of the individual factors in the model. See Chavez Juarez, Florian, "SHAPLEY2: Stata module to compute additive decomposition of estimation statistics by regressors or groups of regressors," Statistical Software Components S457543, *Boston College Department of Economics*, revised June 17, 2015.

20/80 division would suggest that race or ethnicity explain only 8 percent (0.4 times 0.2) of the overall admissions decision.

**1. Using Race or Ethnicity Indicators as Additive Factors**

**a) UNC's Admissions Process Is Not Formulaic**

47. Exhibit 1 Table 1 shows the R-squared and the Shapley Decomposition of R-squared for models of the UNC admissions process in which race or ethnicity indicators are allowed to be additive factors. Exhibit 1 Table 1 starts by assessing whether a model that uses college aptitude (SAT/ACT) scores and additive race/ethnicity factors explains the admissions decisions actually observed from UNC's applicant data from the 2013-14, 2014-15, 2015-16, and 2016-17 admissions cycles. Exhibit 1 Table 1 then goes on to consider more and more complex admission models that include not only aptitude scores and additive race/ethnicity but, increasingly, the other verifiable measures that an admissions officer might consider. In Exhibit 1, Table 1, each row is a different regression model. The second column lists the incremental explanatory factors added to the regression model in each row. Row 1 shows the results considering only SAT or ACT combined/composite scores, while the results in row 9 use those scores as well as class rank, GPA, sex, NC residency, whether the applicant has an alumni parent, whether the applicant is the child of UNC faculty/staff, and several other factors.

**Exhibit 1 Table 1 (Excerpt)<sup>60</sup>  
Analyzing UNC's Admissions Process:  
Race/Ethnicity as Additive Factors**

	(A)	(B)	(C)	(D)	(E)= (B) x (A)	(F)= (C) x (A)
Row	Description of Specification [2]	R <sup>2</sup>	Share of R <sup>2</sup> due to combined test scores	Share of R <sup>2</sup> due to race/ethnicity	Share of R <sup>2</sup> due to variables other than race/ethnicity and combined test scores	Share of admission decision due to race/ethnicity
(1)	SAT Combined, ACT Comp [3] [4]	0.121	93.2%	6.8%	-	11.3%
(2)	(1) + SAT Subscores, ACT Subscores [3] [4] [5]	0.127	44.9%	7.0%	48.2%	5.7%
(3)	(1) + Class Rank, GPA	0.254	33.0%	3.5%	63.5%	8.4%
(4)	(3) + Sex	0.254	32.8%	3.5%	63.7%	8.3%
(5)	(4) + NC Resident	0.364	29.3%	2.8%	67.9%	10.6%
(6)	(5) + Min Coursework, HS Sport, Faculty / Staff Child	0.398	28.3%	2.8%	69.0%	11.3%
(7)	(6) + Alum Parent, Early Action	0.406	27.5%	3.0%	69.6%	11.2%
(8)	(7) + Parents' Education, Foreign Citizenship, Fee Waiver	0.409	26.9%	2.8%	70.2%	11.0%
(9)	(8) + Within-School GPA Rank (SGR)	0.428	23.0%	2.8%	74.2%	9.8%

48. Exhibit 1 Table 1 demonstrates that if total college aptitude scores (SAT combined, ACT comprehensive) and additive race/ethnicity factors are used to predict admission, a formula explains only 12.1 percent of the admissions decision.<sup>61</sup> That is, R-squared of row 1, column A is 0.121. This means that 87.9 percent of the admission decision is too holistic to be embodied by the formula. If I add all of the SAT and ACT subscores (Math, English, Science, etc.) to the regression (row 2), I find that a formula explains only 12.7 percent of the admission decision, meaning that 87.3 percent of the decision is too holistic to be embodied by the formula.

49. The same pattern continues as additional factors are added into the regression. If I add class rank and high school grade point average (GPA) to the initial regression with SAT combined and ACT comprehensive scores, a formula explains only 25.4 percent of the admission decision, meaning that 74.6 percent is too holistic to be embodied by the formula. (See Exhibit 1 Table 1, row 3.) If I add a sex indicator variable to the model, it makes no difference. (See Exhibit 1 Table 1, row 4.) If I add being a North Carolina resident, a formula explains only 36.4 percent of the admission decision, meaning that 63.6 percent is too holistic to be embodied by the formula. (See Exhibit 1 Table 1, row 5.) If I add indicators for whether a student has completed the minimum high school coursework suggested by UNC, whether the student played a sport in high school, and whether a student is a child of a UNC faculty/staff member a formula

<sup>60</sup> See Exhibit 1 for full results, sources, and notes.

<sup>61</sup> I consider race and ethnicity as multiplicative factors in Section III.B.2 below.



explains only 39.8 percent of the admissions decision, meaning that 60.2 percent of the decision is too holistic to be embodied by the formula. (See Exhibit 1 Table 1, row 6.)

50. If I add indicators for whether a student is a child of a UNC alumni, or applied in the Early Action cycle, 59.4 percent of the admissions decisions remain too holistic to be embodied by the formula. (See Exhibit 1 Table 1, row 7:  $1.00 \text{ minus } 0.406 = 0.594$  or 59.4 percent.) It is worthwhile pausing here to note that the data show that any preferences for children of alumni and applying in the Early Action cycle are not important as a statistical matter. If having an alumni parent, or applying in the Early Action cycle, influenced an applicant's chance of admission substantially, we would expect the R-squared to increase by a greater amount than what it actually does—from 0.398 (39.8 percent) to 0.406 (40.6 percent)—when these factors are included. This small increase shows that eliminating any preference for children of alumni, or the Early Action cycle would not, in itself, make much difference to a workable race-neutral strategy.

51. If I then add socioeconomic indicators such as parents' educational attainment, the student's foreign status, and use of an application Fee Waiver (an indicator that the student comes from a low-income family), a formula explains only 40.9 percent of the admissions decision, meaning that 59.1 percent of the decision is too holistic to be embodied by the formula. If I then add a student's GPA rank within the applicants from his or her own high school, information used in the school group review process, a formula explains only 42.8 percent of the admissions decision, meaning that 57.2 percent of the decision is too holistic to be embodied by the formula. Adding additional verifiable factors (such as a student's intended major or his home county) to the regression makes almost no difference.

52. In conclusion, I could not discover or construct a formula with additive racial factors that explained much more than 43 percent of the admissions decision, suggesting that about 57 percent of it is too holistic to be contained in a formula, even if that formula takes advantage of all available verifiable information. I conclude that, even if I knew all of the verifiable characteristics of all applicants and kept pressing them into a more and more complex formula with additive factors, I would predict applicants' admissions outcomes wrongly more than 50 percent of the time. In my opinion, this data analysis demonstrates that UNC's admissions process is holistic, qualitative, and examines students as individuals.

**b) Race Is Not the Dominant Factor in an Applicant's Admissions Decision**

53. Next, I use the regression results displayed in Exhibit 1 Table 1 to assess whether an applicant's race or ethnicity is the "dominant" factor in an admissions decision. Columns B through F of Exhibit 1 Table 1 analyze this specific inquiry.

54. As I mention above, R-Squared can be divided to show how each specific factor contributes to the explanatory power of a model. Consider row 9 of Exhibit 1 Table 1 in which nearly all verifiable measures are included in the regression. Column A shows the overall R-squared based on the verifiable measures used: R-squared is only 0.428 meaning that only 42.8 percent of the admission decision is predicted by the model. (Exhibit 1 Table 1, row 9, column A.) Columns B through F of this Table break out the specific impact of the measures included in the regression. Of that 0.428, 2.8 percent is due to the race/ethnicity indicators, 23.0 percent is due to test scores, and 74.2 percent is due to the other measures listed (class rank, grades, and so on). (Exhibit 1 Table 1, row 9, columns B–D.) Because race/ethnicity factors account for only 2.8 percent of the 42.8 percent of admissions decisions that are predicted by the model, applicants' race and ethnicity predict only 1.2 percent (2.8 percent times 42.8 percent) of the overall admissions decisions. This is shown in Column F.

55. All of the other regressions result in the same conclusion. Column F of rows 1 through 8 of Exhibit 1 Table 1 show that, regardless of the regression used, an applicant's race/ethnicity never explains even 2 percent of admission decisions when race and ethnicity are allowed to be additive factors in a formula.

56. Thus, the empirical data from UNC's applicant pools demonstrates that race and ethnicity are not dominant factors in an applicant's admissions decision.

**2. Using Race or Ethnicity Indicators as Multiplicative Factors**

57. As discussed, for completeness, I also analyze regression models in which URM status generates multiplicative, as opposed to additive, factors. These are shown in Exhibit 1 Table 2. In these multiplicative-factor regressions, every variable is allowed to count differently for applicants who are URMs. For instance, a student's SAT combined score may count differently for URMs versus others. A student's status as a North Carolina resident may also count differently for URMs versus others. A student's participation in high school sports may also

count differently for URMs versus others. Moreover, the multiplicative factor that allows each of these variables (the SAT score, North Carolina residence, sports participation) to exercise a different influence for URMs versus others is allowed to change from variable to variable. Thus, the SAT combined score might be multiplied by 1.2 for URMs (versus 1.0 for others) but North Carolina residence might be multiplied by 1.1 and sports participation might be multiplied by 0.9. The regression model allows for such variations.

**Exhibit 1 Table 2 (Excerpt)<sup>62</sup>  
Analyzing UNC's Admissions Process:  
URM Status as a Multiplicative Factor**

Row	Description of Specification [2]	(A) R <sup>2</sup>	(B) Share of R <sup>2</sup> due to variables other than race/ ethnicity	(C) Share of R <sup>2</sup> due to race/ ethnicity	(D)= (C) x (A) Share of admission decision due to race/ethnicity
(1)	SAT Combined, ACT Comp [3] [4]	0.118	91.4%	8.6%	1.0%
(2)	(1) + SAT Subscores, ACT Subscores [3] [4] [5]	0.125	88.4%	11.6%	1.5%
(3)	(1) + Class Rank, GPA	0.253	87.6%	12.4%	3.1%
(4)	(3) + Sex	0.253	87.6%	12.4%	3.1%
(5)	(4) + NC Resident	0.371	88.8%	11.2%	4.2%
(6)	(5) + Min Coursework, HS Sport, Faculty / Staff Child	0.406	88.5%	11.5%	4.7%
(7)	(6) + Alum Parent, Early Action	0.413	88.4%	11.6%	4.8%
(8)	(7) + Parents' Education, Foreign Citizenship, Fee Waiver	0.417	87.3%	12.7%	5.3%
(9)	(8) + Within-School GPA Rank (SGR)	0.437	87.2%	12.8%	5.6%

58. The results in Exhibit 1 Table 2 are consistent with my opinions based on the results in Exhibit 1 Table 1. That is, even when allowing each explanatory factor to explain admissions decisions in flexible multiplicative ways, the data do not generate a formula that explains much more than 44 percent of the admission decision, suggesting that about 56 percent of the decision is too holistic to be embodied in a formula. This result occurs even though the formula takes advantage of numerous measures and allows URM status to be a different multiplicative factor on each and every other variable (test scores, class rank, grades, residence, etc.) included in the regression.<sup>63, 64</sup> I conclude that, even if I knew all of the verifiable characteristics of all

<sup>62</sup> See Exhibit 1 for full results, sources, and notes.

<sup>63</sup> As when using race and ethnicity as an additive factor, any preferences for children of alumni or applying in the Early Action cycle are not important as a statistical matter. If such preferences were important, R-squared would not rise by such a small amount as it does—from 0.406 (40.6 percent) to 0.413 (41.3 percent)—when parents' alumni status or applying in the Early Action cycle is considered.

<sup>64</sup> The models used in Exhibit 1 Table 2 allow URM status to generate multiplicative factors but do not allow each separate race or ethnicity indicator to generate its own set of multiplicative factors. This is because the latter would be an example of “overfitting” (which I discuss earlier in footnote 57). As I discussed earlier, the regression analyses I employ are designed to avoid the overfitting problem—that is, predicting significantly better in-sample than out-of-sample.

applicants and used a complex multiplicative formula, I would predict applicants' admissions outcomes wrongly more than 50 percent of the time. This is a further demonstration that UNC admissions decisions are made via appraisal processes that are holistic, qualitative, all-embracing, and that examine students as individuals.

**C. UNC Admissions Cannot Be Explained by Separate Formulas Within Ethnic or Racial Groups**

59. As discussed above, UNC not only states that its admission process is holistic but also that “[a]t no point in the process are candidates of different racial or ethnic backgrounds reviewed in separate groups.”<sup>65</sup> I test this statement from an empirical perspective by analyzing whether regression models can accurately predict the admissions decision if the models are estimated *separately* for URMs and for non-minorities. That is, if admission staff were in fact reviewing URMs and non-minority applicants *separately* and applying different, but formulaic, standards to each group, the regression model for URMs would have high R-squared and the regression model for non-minorities would have high R-squared. In other words, the two estimated models might be quite different but each would have high R-squared, demonstrating that the decisions were explained by a formula.

60. I estimated separate regressions for URM applicants and non-minority applicants that correspond to the regression specification in the bottom row of Exhibit 1 Table 1 in which nearly all available verifiable measures are included in the regression model. The regression for applicants who are URMs has an R-squared of 0.42. The regression for non-minority applicants has an R-squared of 0.44. That is, even if the regression models are estimated separately for URMs and non-minorities, about 56 to 58 percent of the admission decision is too holistic to be embodied in a formula.<sup>66</sup>

**D. School Group Review Does Not Appear to be Used to Implement Quotas or Racial Balancing**

61. As discussed above, Plaintiff specifically discusses the SGR process in the Complaint and effectively implies that UNC uses it to engage in racial balancing, to achieve implicit quotas,

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<sup>65</sup> UNC0079430.

<sup>66</sup> To avoid the overfitting issues described above, I do not run separate regressions for white, African American, Hispanic, or Asian applicants.

and/or to manipulate outcomes of the holistic reading process.<sup>67</sup> If SGR were being used to meet certain racial targets or outcomes, the data would indicate that provisional admissions decisions were changed systemically in such a way that each post-SGR admitted class was closer to a specific set of racial percentages than each pre-SGR admitted class. Put another way, provisional admissions decisions that were changed in SGR would routinely move the admitted class toward specific racial percentages.

62. To evaluate the possibility that SGR has been used to implement racial quotas, I use Connect Carolina and School Group Review data. I assess both Early Action and Regular Decision admissions.

### **1. School Group Review Data**

63. I received data on the provisional decision status of each applicant on the relevant days during the period in which School Group Review was taking place in the 2013-14, 2014-15, and 2015-16 admissions cycles.<sup>68</sup> I combined these data with information on when School Group Review took place during those admissions cycles, for both Early Action and Regular Decision admissions.<sup>69</sup> It is my understanding that any change between an applicant's provisional decision before the period when SGR took place and an applicant's provisional decision after SGR took place is due to SGR.

### **2. Analysis of Decision Changes During School Group Review**

64. At the outset, I explain the SGR process based on my understanding from my review of documentation and my communications with the UNC admissions staff. After the staff makes provisional accept/reject decisions, applicants from the same high school are reviewed together. They are ordered according to their GPAs, and the provisional decisions are shown. Such displays naturally focus attention on (i) provisionally rejected students who have a higher GPA than their provisionally accepted classmates and (ii) provisionally accepted students who have a lower GPA than their provisionally rejected classmates.

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<sup>67</sup> Complaint ¶¶ 48–49, 52.

<sup>68</sup> UNC0379667–9, UNC0379671, UNC0379797–8.

<sup>69</sup> Defendants' Responses and Objections to Plaintiff's Second Interrogatories, *Students for Fair Admissions, Inc., v. University of North Carolina*, et al., dated June 30, 2017, p. 6.

65. SGR is used in both Early Action and Regular Decision admissions. Because the Regular SGR process comes at the end of the entire admissions process, it also serves as an opportunity for UNC to adjust the total number of offers of admission to avoid over- or under-enrollment. Following SGR, UNC admissions decisions generally become final.

66. I focus on the Regular Decision SGR process and examine all applicants, both in-state and out-of-state. The reason for this focus is that, if UNC were using SGR to implement racial quotas, this is the larger pool of applicants who would logically be the subjects and most affected. Also, the logical time to enforce quotas would be at the end of the entire admissions process to have the greatest influence on the final admitted class rather than the admitted class after the Early Action deadline. For completeness, however, I also evaluate the Early Action SGR process and the Regular Decision SGR process for in-state applicants only. My results for Regular Decision and all applicants SGR are summarized in Exhibit 2 Table 1. My results for my other analyses are found in Exhibit 2 Tables 3 through 5.

67. Exhibit 2 Table 1 shows the admitted pool before and after SGR in 2013-14 (left-hand panel), 2014-15 (middle panel), and 2015-16 (right-hand panel). My main observation is that SGR hardly changes the racial and ethnic composition of the admitted pool, in any of the three years. In no year does the percentage of any racial or ethnic group change by more than 1 percent. For instance, in 2014-15, SGR increased the white percentage from 60.0 percent to 60.1 percent, increased the Asian percentage from 20.5 percent to 20.7 percent, left the Hispanic percentage unchanged at 8.5 percent, and lowered the African American percentage from 9.3 percent to 9.0 percent.

68. Furthermore, the small changes in racial and ethnic percentages shown in Exhibit 2 Table 1 are not even consistent with the possibility of stable quotas. For instance, the slight adjustments in 2013-14 move the admitted pool in the direction of 60 percent white (59.7 percent to 60.5 percent), 20 percent Asian (19.2 percent to 19.4 percent), and 8 percent Hispanic (9.3 percent to 8.3 percent); there is no movement in African American, which is unchanged at 10.1 percent. Critically, the 2014-15 adjustments are not consistent with any attempt to maintain these purported “quotas” because the changes in the percentages of white, Asian, and African American students all move the admitted pool *away* from these “quotas.” (There is no change in the Hispanic percentage in 2014-15.) Similarly, the 2015-16 adjustments also do not

consistently move the admitted pool in the direction of the purported “quotas.” The Asian percentage moves very slightly away (20.4 percent to 20.9 percent); the African American and Hispanic percentages move towards but the changes are small (9.4 percent to 9.2 percent and 10.1 percent to 10.0 percent, respectively).

69. I also review the results to consider whether the SGR process is used to generally increase the percentage of URMs within the admitted pool (rather than achieving a specific target or quota). These results show that, in fact, SGR does not so. Exhibit 2 Table 2 shows that, during the SGR process, the percentage of URM admitted applicants fell by 1.0 percent in 2013-14, 0.3 percent in 2014-15, and by 0.4 percent in 2015-16.

70. Overall, I conclude that the empirical evidence contradicts the claim that SGR operates in a way to pursue quotas, achieve racial balancing, or to change the admissions outcome on the basis of an applicant’s race. The Regular Decision SGR process changes the racial and ethnic percentages of UNC’s class so trivially that it could not plausibly be a significant part of any quota-implementing scheme. There is also no indication whatsoever that SGR increases the percentage of URMs in UNC’s admitted applicant pool.

71. Similarly, when I analyze the SGR processes among in-state Regular Decision applicants (Exhibit 2 Table 3) and Early Action applicants (Exhibit 2 Tables 4 and 5), I find that the data do not support a conclusion that these SGR processes are operating in a way to pursue quotas, achieve racial balancing, or change admissions decisions on the basis of an applicant’s race.

#### **E. UNC’s Admissions Process Does Not Use Quotas**

72. The Complaint also suggests that the current UNC admissions process—considered in its entirety—appears to implement quotas.<sup>70</sup> Therefore, in this section, I evaluate whether UNC appears to use quotas, separate from the SGR process.

73. To begin, I address whether *stability* in the racial and ethnic composition of the set of applicants admitted by UNC is, in and of itself, evidence of implicit quotas. From a statistical standpoint, such a conclusion would be unwarranted. The reason is that the population of students in North Carolina (from which the admitted North Carolina applicants will ultimately be drawn) is large. Therefore, if its racial and ethnic percentages are fairly stable and UNC

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<sup>70</sup> Complaint, ¶ 219.

admissions were to use any fairly stable admissions process, the resulting admitted class would have fairly stable racial and ethnic percentages. The fact of stability would generate no evidence regarding the use of quotas. What I have just stated is a consequence of the Law of Large Numbers, one of the most fundamental principles of statistics.

74. The Law of Large Numbers is what allows us to use statistics based on a large number of data points to confidently infer something about a population or an unknown quantity. For example, to determine if a coin is a “fair” coin (in the sense that it has a 50 percent probability of landing on “heads”), one can flip the coin many times. If, after a large number of coin flips, 50 percent of the flips resulted in “heads,” then it is very likely that the coin is fair. In another context, the Law of Large Numbers tells us that over a 162-game baseball season, during which a batter amasses hundreds of at-bats, the batters that finish the season with the best batting averages and on-base percentages are very likely to be the best batters as measured on those dimensions.

75. Applied to the current situation, the Law of Large Numbers says that if the admissions staff were to draw students from a stable pool of possible students using a stable selection process, the share of students who belonged to any racial or ethnic group would also be stable so long as the number drawn was sufficiently large. For instance, if the pool of Asian students had the same distribution of academic preparedness, personal qualities, geography, etc. each year and a parallel statement could be made for all other racial and ethnic groups, then UNC’s admits would have very similar racial and ethnic percentages each year—even without quotas or other formulaic systems.<sup>71</sup>

76. Of course, the pool of possible UNC students is not *perfectly* stable from year-to-year. However, as I demonstrate now, the pool’s stability is substantial. It varies about as little as does the admitted class. I first examine the population of public school students in North Carolina, then I analyze North Carolina resident applicants to UNC, and finally I analyze all applicants to UNC, regardless of residency.

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<sup>71</sup> The number that is sufficiently large depends on the variance of the distribution that generates the population. Because, in the current instance, I am computing statistics like the percentage Asian, the number that is sufficiently large will depend on the number of racial and ethnic groups and how evenly they are represented in the population from which the admissions process draws.



## 1. NCERDC Data

77. Data on public school students in North Carolina are collected by the North Carolina Education Research Data Center (NCERDC). I received data from NCERDC on North Carolina public high school students during the school years 2007-08 through 2014-15. These data include, among other things, information on the student's high school, the student's GPA, grades, class rank, graduation status, and standardized test scores. These data contain demographic information, such as the student's age, sex, and race/ethnicity. The data also contain information on whether the student qualified for a free or reduced price lunch under the National School Lunch Program.

## 2. North Carolina Public School Students

78. Exhibit 3 Tables 1 through 3 show the pool of North Carolina public school students who are reasonably well prepared for UNC by various measures including GPA, class rank, and adjusted test scores.<sup>72</sup> Each table shows the pool in four consecutive years—2011-12 through 2014-15. It is important to note that these tables include all North Carolina public school students—not just those who applied to UNC. Thus, these tables show the underlying population from which UNC draws applicants and admits.<sup>73</sup> Here I discuss Table 1, which uses GPA as the measure of academic preparedness, while Table 2, which uses class rank, and Table 3, which uses adjusted test scores, have a similar structure. In all cases, I define “well-prepared” based on the 20<sup>th</sup> percentile of UNC's actual admitted applicants. For instance, if a prospective student's GPA is at or above the GPA of the 20<sup>th</sup> percentile student in UNC's actual admitted class, the prospective student is classified as well-prepared and appears in Exhibit 3 Table 1. Percentages are rounded to whole numbers.

79. Consider Exhibit 3 Table 1. Among students classified as well-prepared based on their GPA, the percentage of students who are African American is in the narrow range between 6 percent and 7 percent in all four years (2011-12 to 2014-15). In all four years, the percentage of students who are Asian falls between 8 percent and 9 percent; the percentage who are white falls

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<sup>72</sup> I discuss adjusted test scores below. Briefly, the adjustment attempts to create parity between students who did and did not retake college admissions tests.

<sup>73</sup> Of course, UNC also draws students from private schools and schools outside of North Carolina. I consider them below.

between 78 percent and 80 percent; and the percentage who are Hispanic is within 4 percent and 5 percent. The percentage who are Native American rounds to 1 percent in all four years, and the percentage who are Pacific Islander rounds to 0 percent in all four years. Summing up, the well-prepared (based on GPA) pool is very similar, racially and ethnically, from year to year.

80. The result in Exhibit 3 Table 1 is not specific to using GPA as the measure of academic preparedness. Exhibit 3 Tables 2 and 3 show that this result holds (the pool of well-prepared North Carolina public school students is very similar, racially and ethnically, from year to year) when using other measures of academic preparedness. I conclude that the pool of North Carolina public school students exhibits a high degree of stability.

### **3. All North Carolina Applicants**

81. So far, using NCERDC data, I have examined the pool of North Carolina public school students who are well-prepared, regardless of whether they apply to UNC. No equivalent source of data exists for private school and home schooled students in North Carolina. Therefore, in order to include North Carolina private school and home schooled students as well, I use data on UNC applicants from 2011-12 through 2014-15. They are shown in Exhibit 3 Table 4. I include all UNC applicants from North Carolina, regardless of the school they attended. I observe similar results as those described above using all well-prepared North Carolina public school students. Among UNC applicants from North Carolina in these years, the African American percentage never falls outside a narrow 1 percent band (14-15 percent); the Native American percentage never falls outside a narrow 1 percent band (1-2 percent); the Asian percentage never falls outside a narrow 1 percent band (11-12 percent); the white percentage never falls outside a narrow 1 percent band (66-67 percent); the Hispanic percentage always rounds to the same whole number (6 percent), and the Pacific Islander percentage always rounds to the whole number (0 percent). Notice that these narrow bands or ranges are of the same order of magnitude (a few percent) as the ranges observed for all well-prepared North Carolina public school students regardless of whether they apply (Exhibit 3 Tables 1 through 3). That is, not only is the pool of well-prepared North Carolina public school students very similar racially and ethnically from year to year, the broader pool of well-prepared in-state UNC applicants is also very similar racially and ethnically from year to year.

#### 4. Out-of-State Applicants

82. Exhibit 3 Table 5 is analogous to the previous table except that it shows information on all UNC applicants, regardless of whether they are from North Carolina. Again, this is a very stable pool from year to year. In summary, even when out-of-state students are included, UNC's applicant pool still exhibits a high degree of stability. Its racial and ethnic percentages varied over only small ranges within the four years I studied. These ranges are of the same order of magnitude (a few percent) as the ranges observed for all North Carolina applicants and all well-prepared North Carolina public school students.

83. Having analyzed the stability in the racial and ethnic make-up of the pool of available students, I now turn to investigating whether UNC's *admitted* class has racial and ethnic percentages that vary by the same order of magnitude.

#### 5. Admitted Applicants

84. Exhibit 3 Table 6 shows the racial and ethnic composition of the North Carolina resident students whom UNC admitted in 2011-12 through 2014-15. These are the students drawn from the North Carolina resident applicant pool shown in Exhibit 3 Table 4. Among admits in these years, the African American percentage varies between 9 percent and 10 percent; the Native American percentage varies between 1 percent and 2 percent; the Asian percentage always rounds to the whole number of 13 percent; the white percentage varies between 70 percent and 71 percent; the Hispanic percentage varies between 5 percent and 6 percent; and the Pacific Islander percentage always rounds to the whole number of 0 percent.

85. The width of each of these ranges is very similar to the width of the same group's range in the applicant pool (Exhibit 3 Table 4). I observe next that UNC is not consistently narrowing the range of variation as it would if it were implementing quotas. In fact, if I compare the year-to-year variation in the racial and ethnic percentages in its *admitted* class to the year-to-year variation in the percentages of its *applicants*, I find that the width of ranges is very similar in the admitted class as in the applicant pool. This evidence is not consistent with UNC exercising a capacity to make its admitted class more stable, racially and ethnically, than the applicant pool.

86. Exhibit 3 Table 7 shows the racial and ethnic composition of all students, regardless of state of residence, whom UNC admitted in 2011-12 through 2014-15. These are the students drawn from the all-applicants pool shown in Exhibit 3 Table 5. Among admits in these years, the African American percentage varies between 9 percent and 10 percent; the Native American percentage always rounds to the whole number of 2 percent; the Asian percentage varies between 16 percent and 20 percent; the white percentage varies between 60 percent and 64 percent; the Hispanic percentage always rounds to the whole number of 8 percent, and the Pacific Islander percentage always rounds to the whole number of 0 percent. Observe that the width of each of these ranges is very similar to the width of the same group's range in the applicant pool (Exhibit 3 Table 5). This evidence is not consistent with UNC implementing stable racial and ethnic quotas.

87. It is worthwhile summarizing at this point because I have now compared data on plausible applicants, actual applicants, and admits. It is these comparisons that would be most likely to reveal if UNC were implementing quotas. Logically, the admissions staff, if enforcing quotas, would make the admit pool's racial and ethnic composition more stable than the composition of the pool of actual applicants or plausible applicants. The data do not show this. Instead, they show that all these pools are about equally stable. Thus, the data are consistent with UNC employing a fairly stable admissions process from a fairly stable pool of applicants, year after year.

88. UNC does not fully control whether an applicant who is admitted ultimately decides to enroll at the University. As a result, the period between admission and enrollment is unlikely to be used to implement quotas. Nor am I aware of any allegations in the Complaint that focus upon students' enrollment decisions. Nevertheless, for completeness, I examine the variation in the racial and ethnic percentages of UNC's matriculating class.

89. Exhibit 3 Table 8 shows the racial and ethnic composition of the North Carolina resident students who matriculated at UNC in 2011-12 through 2014-15. These matriculants come from the admitted applicants shown in Exhibit 3 Table 6, so the two tables can be compared. Among matriculants in these years, the African American percentage varies between 9 percent and 10 percent; the Native American percentage varies between 1 percent and 2 percent; the Asian percentage varies between 13 percent and 14 percent; the white percentage varies between 68

percent and 71 percent; the Hispanic percentage varies between 5 percent and 7 percent; and the Pacific Islander percentage always rounds to the whole number of 0 percent. Notice that the width of each of these ranges is again similar to the width of the same group's range in the admitted pool (Exhibit 3 Table 6). Notice that UNC is not consistently narrowing the range of variation as it would if it were implementing quotas. In fact, if I compare the year-to-year variation in the racial and ethnic percentages in its *matriculating* class to its *admitted* class, I find that for three racial groups, the range is wider in the matriculating class, and for three racial groups, the ranges are the same width. This evidence contradicts the notion that UNC attempts to make its matriculating class more stable, racially and ethnically, than its admitted pool.

90. I also repeated the same analysis for both in-state and out-of-state applicants (Exhibit 3 Table 9). This analysis yields a similar conclusion as with respect to in-state applicants. Thus, the data contradict the notion that UNC attempts to make its matriculating class more stable, racially and ethnically, than its admitted pool.

91. Overall, I find no evidence that UNC is attempting to implement racial and/or ethnic quotas. It is my opinion that the racial and composition of its applicant pool and eventual student body is fairly stable year-to-year because the underlying population of students from which UNC draws is fairly stable year-to-year.

#### **IV. Considerations for Analysis of Race-Blind Alternatives**

92. In this section, and the sections that follow, I evaluate whether there is a workable race-blind alternative available to UNC that would allow it to achieve racial and ethnic diversity while maintaining its achieved levels of academic preparedness and overall goals. As discussed in Section I.A., Plaintiff alleges that “[t]here is now overwhelming evidence that race-neutral alternatives render reliance on race preferences unnecessary.”<sup>74</sup>

93. I focus on three types of alternative race-blind admissions plans: (1) plans that incorporate criteria based on socioeconomic status (“SES”), (2) plans based on high school class rank (“Top X percent” plans), and (3) plans based on geographic location. For each alternative

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<sup>74</sup> Complaint, ¶ 5.

admissions plan, I have sought to implement the plan as flexibly as possible and have tested the robustness of my results to alternative ways of implementing the plan.

94. In part, I choose these alternatives because they are described in the Complaint as workable alternatives that UNC could use to achieve student body diversity and they are the types of alternatives examined in academic research on this topic, including in the book cited by Plaintiff, *The Future of Affirmative Action*.<sup>75</sup> For example, in the Complaint, Plaintiff states that “increased utilization of... socioeconomic preferences, can promote diversity about as well as racial preferences.”<sup>76</sup> This statement implicitly describes what I call a “socioeconomic status-based” plan without providing specificity as to exactly what sort of plan would allegedly work at UNC. In this report, I follow the research of Matthew Gaertner (cited by Plaintiff in the Complaint<sup>77</sup>) and his socioeconomic status-based plans described in *The Future of Affirmative Action*. In Section V below, I estimate the outcome of his plans, adapting them to UNC’s circumstances and the data available.

95. In Section VI below, I similarly analyze plans based on high school class rank because they are described in the Complaint as having “been successful in promoting community, socioeconomic, and racial diversity.”<sup>78</sup> For instance, Texas uses a class rank-based plan to admit students to its flagship universities.

96. With respect to geography-based plans, Plaintiff cites the geography-based plan of Danielle Allen<sup>79</sup> and I implement her plan (described in *The Future of Affirmative Action*) in the UNC setting in Section VII below. I am not aware of any other specific proposals for a geography-based plan that differs substantially from the Allen plan analyzed in this report.

97. In each instance, I also consider whether practical modifications to the above general types of plans could be made that would attain the same or better results in terms of racial/ethnic diversity and academic preparedness.

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<sup>75</sup> *The Future of Affirmative Action New Paths to Higher Education Diversity after Fisher v. University of Texas*, Richard D. Kahlenberg, editor, A Project of Lumina Foundation and The Century Foundation, New York: The Century Foundation Press, 2014 (“*The Future of Affirmative Action*”). I have also reviewed the report of Professor Bridget T. Long, which discusses race-blind alternative plans.

<sup>76</sup> Complaint ¶ 5.

<sup>77</sup> Complaint ¶ 69.

<sup>78</sup> Complaint ¶ 74.

<sup>79</sup> Complaint ¶ 75.

98. I find that in each instance the alternative race-blind admission plan I analyzed would not allow UNC to attain both the level of racial/ethnic diversity and the level of academic preparedness that it currently attains in the body of students whom it admits.

99. I further find that the alternative race-blind admission plans would not allow UNC to attain both the level of racial/ethnic diversity and the level of academic preparedness that it currently attains in the body of students who matriculate. I evaluate each alternative plan's likely impact on not just UNC's admitted class but also on its matriculating class because it is the students who *matriculate* who ultimately affect the University's ability to fulfil its educational mission. Since not all admits have an equal probability of matriculating, the admitted applicants will not generally be representative of the matriculating classes. In particular, admitted students with very high test scores and grades are less likely to matriculate. This is because they tend to have more admissions offers from institutions that are competitive.

100. Prior to presenting my analysis of these three types of alternative race-blind admissions plans, in the following subsections (IV.A through IV.E), I discuss some important inputs and context that apply equally to each type of alternative.

#### **A. Empirical Considerations in Analyzing Race-Blind Alternatives**

101. In assessing alternative admissions plans, it is necessary to recognize that if UNC were to implement a new admissions process, its pool of applicants would change. For instance, if UNC were to change its policy to admit all North Carolina applicants ranked in the top 10 percent of their high school class, the number of applicants who are in the top 10 percent (but whose other qualifications are less stellar) would likely increase. But, perhaps obviously, because these applicants are hypothetical, an application file for each of these potential applicants does not exist. Nonetheless, I have attempted to analyze the outcome of alternative admission plans making the fullest possible use of available data from external sources and minimizing the constraints placed on the analysis due to data availability.

102. To evaluate hypothetical alternative admissions programs, I used the following sources of data:

- i. Applicant data from UNC (Connect Carolina);

- ii. Data on all North Carolina public students from the North Carolina Education Research Data Center (NCERDC data);
- iii. U.S. Bureau of the Census' Census of Population and Housing (Census) data;
- iv. American Community Survey (an annual census-like survey of 1 percent of the U.S. population) data.

103. Using these data, I consider the likely outcomes of alternative race-blind admissions plans. My analysis typically proceeds in two steps:

- i. Under the plan's criteria, determine which hypothetical applicants would be *admitted* under the alternative admissions plan.
- ii. Determine the set of applicants who would *matriculate* at UNC among those that were admitted in the hypothetical alternative.

104. Approximately 82 percent of UNC's matriculating class are North Carolina residents for the classes entering between 2013-14 and 2016-17.<sup>80</sup> For each alternative admissions plan, my analysis is restricted to applicants who are public school students and who are residents of North Carolina.<sup>81</sup> I discuss the reasons why I do this in Section VIII.

105. After determining the applicants who would be hypothetically admitted under each alternative admissions plan, I compare the results of that hypothetical plan to the results that UNC obtained through its current admissions program (the "actuals"). This involves comparing either (i) a hypothetical set of admitted applicants under an alternative procedure to the actual set of UNC admitted applicants or (ii) a hypothetical set of matriculating applicants under an alternative plan to the actual set of UNC matriculating students.

106. In an ideal world, I would compute the effect of each alternative admissions plan on "fit," the holistic determination based on all of the criteria used by the university to assess whether an applicant should be admitted. However, measures of holistic "fit" could not possibly be available for students who did not actually apply to UNC because, as previously shown, the process by which readers assess a student is far from formulaic. For example, there are no data available that would allow me to factor in how readers would assess the essays or personal

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<sup>80</sup> 32 percent of UNC's applicants are students who attended North Carolina public schools.

<sup>81</sup> In order to be as current as possible, my analysis of alternative admissions plans is conducted for the 2014-15 admissions cycle. This is the most recent cycle for which I had the necessary data to conduct my analysis. In particular, the most recent NCERDC data available is for the 2014-15 school year.



qualities of students who did not apply to UNC. Consequently, I will use the available verifiable measures discussed earlier in Section III.B.

### **B. A Framework for Considering the Effect of Race-Blind Alternatives**

107. If a university maintains racial and ethnic diversity as a goal to be attained, but attempts to switch its admissions plan from a race-conscious to a race-blind one, it must put new weight on applicants' characteristics that are not race or ethnicity but that are associated with such diversity. These characteristics, which are not race/ethnicity but associated with diversity, can be called "race-blind proxies."

108. I offer no opinion as to what level of diversity is sufficient or should otherwise be sought by UNC. I measure diversity by considering the level that UNC achieves through its current admissions plans and evaluate the change that would happen under each alternative I analyze.

109. Plaintiff specifically alleges that students' socioeconomic characteristics are so highly correlated with their race and ethnicity that UNC would be able to consider socioeconomic factors and ignore race and ethnicity within the admissions process and nevertheless be able to achieve the same level of diversity without sacrificing academic preparedness in its incoming class.<sup>82</sup> That is, Plaintiff alleges that there are race-blind proxies available that would allow UNC to attain both its current level of academic preparedness and its current level of racial and ethnic diversity.

110. An evaluation of this allegation can be broken into two parts:

- i. Can any admissions process that relies on race-blind proxies attain the same combination of academic preparedness and race/ethnic diversity as an admissions process that can consider race and ethnicity as well as all other information on applicants' characteristics?
- ii. What is the magnitude of any losses in racial/ethnic diversity or academic preparedness caused by relying on race-blind proxies in admissions?

111. To make these two parts more evident, an example is a good starting place. Suppose that a university needed to have five highly talented basketball players in each incoming class in order to keep its team competitive. Suppose that university's recruiting process was made blind

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<sup>82</sup> Complaint ¶ 66. Plaintiff further alleges that "community-based preference is another means of achieving student body diversity by admitting more socioeconomically disadvantaged students" (Complaint ¶ 73). Plaintiff specifies plans based on high school rank (Complaint ¶ 74) and geographic location (Complaint ¶ 75) as examples of using community-based metrics.

to a student's previous performance in basketball but that the university could rely on any performance-blind proxies that it cared to use. For instance, the university might recruit students who were very tall and who attended high schools with winning records in state basketball championships. Suppose that, using all the performance-blind proxies available to it, the university admitted five students with the hope that they would turn out to be great basketball players. Suppose that some of the students—two, say—actually did turn out to be basketball players worthy of the university's team. But, the remaining admitted students turned out to be people who were just very tall who attended championship-winning high schools (and had the other characteristics, if any, that the university were using as proxies). In this situation, there would be two alternatives. Alternative one is that the university could be left with a less-qualified basketball team. Alternative two is that the university could admit more very tall students from championship-winning high schools in the hope of turning up more great players. Suppose the university admitted nine more students using its performance-blind process and, among them, there were three great basketball players. Then the university would have found its five players but only by using a total of 14 admission seats. Thus, in alternative two, the basketball team would be competitive, but the university's entering class would be less competitive on other dimensions because several students would have been admitted who did not actually contribute to the basketball team and who likely contributed less to the university's other goals (since they were recruited based on their height etc. rather than their artistic, political, other extracurricular or scholarly talents).

112. In this example, the performance-blind process does not attain what the university could have attained if it had been allowed to consider students' basketball prowess. The university either makes a sacrifice on the competitiveness of its basketball team or makes a sacrifice on the merits of its remaining entering class. These sacrifices are "losses" caused by the blind process. The *magnitude* of the losses depends on the degree to which performance-blind proxies can substitute for observing basketball prowess. For instance, if nearly every very tall person at championship-winning high schools was actually a great basketball player, then the losses would be small. If only half of them were great players, the losses would be larger. If only a quarter of them were great players, the losses would be even larger. The lower the correlation between the performance-blind proxies and basketball prowess, the greater the losses.

113. One can translate the basketball example into a race-blind admissions example. Consider an admissions process that relies on race-blind proxies like socioeconomic factors, high school class rank, geographic location, or some combination of them. Suppose, using the race-blind proxies, the university admitted a group of applicants whom, based on the race-blind proxies, it hoped would maintain racial/ethnic diversity as well as maintain academic preparedness. Some of the students admitted from this group would actually turn out to contribute to racial/ethnic diversity but some would not. In this situation, there would be two alternatives. Alternative one is that the university could be left with inadequate racial/ethnic diversity. Alternative two is that the university could admit a larger number of students from the pool whom, based on the race-blind proxies, it hoped would improve diversity. In alternative two, the university might admit enough students from the proxy-based pool to maintain racial/ethnic diversity, but the university's class as a whole would be less competitive on other dimensions, such as academic preparedness, because some students would have been admitted who did not contribute to diversity and who likely contributed less to the university's other goals (since they were targeted based on the proxies etc. rather than their academic or other talents).

114. The necessary existence of losses due to reliance on imperfect proxies is well understood by economists.<sup>83</sup> That *some* losses will certainly exist is a matter of pure logic or pure math. For instance, a recent formalization of the logic that imperfect proxies lead to losses in race or ethnic diversity, in the level of academic preparedness, or both, is found in research by Glenn Ellison and Parag A. Pathak.<sup>84</sup> They show that race-blind admissions necessarily induce a loss relative to race-conscious admissions if part of a student's contribution to the school's educational mission could be a function of her race/ethnicity and there exist only imperfect race-blind proxies for race or ethnicity.

115. Logic indicates that there will be losses. Furthermore, strict logic indicates that the magnitude of the losses is a function of how imperfect the proxies are for the characteristic for

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<sup>83</sup> Fryer, Roland G., Jr., Glenn C. Loury, and Tolga Yuret, "An Economic Analysis of Color-Blind Affirmative Action." *Journal of Law, Economics, and Organization* 24, no. 2 (2008): 319–55; Chan, Jimmy, and Erik Eyster, "Does Banning Affirmative Action Lower College Student Quality?" *American Economic Review* 93, no. 3 (2003): 858—872; Epple, Dennis, Richard Romano, and Holger Sieg, "Diversity and affirmative action in Higher Education," *Journal of Public Economic Theory* 10, (2008): 475–501.

<sup>84</sup> Ellison, Glenn, and Parag A. Pathak, "The Efficiency of Race-Neutral Alternatives to Race-Based Affirmative Action: Evidence from Chicago's Exam Schools," June 2016, available at <https://bfi.uchicago.edu/sites/default/files/research/Parag%20Pathak%20-%20AA30.pdf>. See sections 2.2 and 2.3 for a formal proof. The authors consider the particular case of Chicago public schools, but their findings can be adapted to college admission.

which they are trying proxy. The less correlated the proxies are with the characteristic, the greater the magnitude of the losses.

116. Thus, what is of particular relevance in assessing race-blind alternative admission plans at UNC is the degree to which the proxies are correlated with race. The way to evaluate alternative admissions plans is to consider various proposed alternatives (proxies) for the use of race in admission and then assess the magnitude or significance, of any corresponding losses. For instance, socioeconomics have been proposed as an alternative to the use of race, so it is useful to evaluate plans based on socioeconomic factors. For the UNC setting, I make these and similar evaluations through empirical analysis of data from UNC and North Carolina. I find that the losses would be of a magnitude that is meaningful, in the sense of affecting UNC's ability to achieve its educational mission (see Sections V, VI, and VII).

### **C. Measuring Losses to the University's Mission**

117. To assess the magnitude of losses to the university's mission, it is reasonable to consider how the *average* statistics, such as the *average* test scores, of UNC's student body change under each alternative admissions plan. Moreover, the importance of a given differential in an *average* statistic (such as a 100 point differential in average test scores) is not at all the same as the importance of the same differential when comparing two individuals. This is because of The Law of Large Numbers.

118. This can be a confusing point. Why might, say, a 100-point difference in a student body's *average* test scores make a meaningful difference to a university's ability to attain its mission while a 100-point difference between two individual students' test scores often fails to predict their ability to thrive at the university? An analogy to sports should help to clarify the issue. Consider building a competitive professional football team. The goal is to produce a world-class level of play with a prospect of winning the Super Bowl. Prospective players are likely to be evaluated holistically and on numerous dimensions: height, weight, speed, throwing ability, catching ability, statistics from prior games, leadership, sportsmanship, being a team player, and so on. An individual who is unusually short for a football player might make the team because he has other qualities that make him valuable. For instance, he might be a good leader or have unusually nimble footwork. However, it is unlikely that *all* short people have unusually great leadership skills or footwork. Thus, it is not unusual to find *some* short players

on excellent professional football teams but a team whose *average* height is short would usually not be competitive. A team might end up with a quarterback who had mediocre running speed because he had tremendous ability to throw the ball. If, however, a whole team's average running speed was slow, it would be a great cause for concern because not all the players would have other special skills that would offset their slowness.

119. Summing up, one would not expect, for example, a professional football team to be competitive if its average height was 5 inches shorter or its average 40-yard dash speed was one second slower. Yet, a player who was 5 inches shorter might be assessed—holistically—to be just as valuable in competition as another who was taller. A player who was one second slower might be assessed—holistically—to be just as valuable in competition as another who was faster. An average differential between two large bodies of people does not have the same meaning as the same differential between two individuals.

120. Moving from the professional football example to college admissions, a university might admit a student who has lower test scores because, when assessed holistically, she is determined to have other qualities that make her likely to thrive at the university. For instance, she might be a great leader or uniquely gifted in some activity (innovation in science, writing, etc.). However, it is unlikely that *all* students with her test scores have unusually great leadership skills or unique gifts. Thus, while first-rate research universities that practice holistic admissions admit individual students who thrive despite having lower test scores, a university whose student body had lower *average* test scores would usually be unable to maintain a world-class educational environment. Again, this is because the characteristics of an individual have a different meaning than average statistics computed over a large number of individuals.

121. The fact that a measure for an individual student has different implications than the same measure when averaged over many students is a well-known statistical result from The Law of Large Numbers (discussed in paragraph 74). The basic intuition is as that as we average over a large number of low-scoring students (or short athletes), the average of their *other* characteristics (e.g. leadership) will tend to equal the average of those other characteristics in the relevant population. That is, we would not expect to find a large university class of low-scoring students who were outstanding leaders unless the whole population of low-scoring students had outstanding leadership abilities.

122. Summing up, changes in *average* test scores, *average* GPA, etc. constitute a reasonable way to measure the loss to academic performance associated with an alternative admissions plan. There is no contradiction between this statement and the statement that the same indicator for an *individual* student might be only one of many factors that a sound admissions scheme would consider when evaluating a student’s capacity to thrive at a world-class university.

**D. Baseline for All the Alternative Race-Blind Plans**

123. Before analyzing various alternative race-blind plans, I establish baseline facts regarding the students who apply to, are admitted by, and matriculate at UNC. These students appear in the UNC Connect Carolina admissions data. It is also important to explain how one may compare North Carolina public school students in the admissions data to students who did not apply but who appear in the NCERDC data relating to all North Carolina public school students.

124. Exhibit 4 provides certain statistics on the North Carolina public school students who applied to, were admitted by, and enrolled at UNC for the 2014-15 freshmen year. As in-state public school students, these individuals should also be in the NCERDC data. Indeed, for a subset of North Carolina public schools students who applied to UNC, I received information on their potential matching ID in the NCERDC data. Hence, I can link them with their NCERDC information.

**Exhibit 4 (Excerpt)<sup>85</sup>  
Summary of Actual UNC Applicants, Admits, and Matriculants  
North Carolina Resident Public School Students, 2014-15**

Race/Ethnicity	All Applicants			Admitted Students			Matriculants		
	Number of Students	Percent of Applicants	Avg. Test Score [2]	Number of Students	Percent of Admitted Students	Avg. Test Score [2]	Number of Students	Percent of Matriculants	Avg. Test Score [2]
African American	1,187	14.6%	1067	372	9.1%	1215	245	9.6%	1192
Asian	978	12.0%	1289	519	12.7%	1380	365	14.3%	1356
Hispanic	525	6.4%	1160	229	5.6%	1256	152	5.9%	1235
Native American	131	1.6%	1167	74	1.8%	1272	46	1.8%	1262
Pacific Islander	8	0.1%	1229	4	0.1%	1270	2	0.1%	1325
White	5,051	62.0%	1268	2,727	66.7%	1342	1,656	64.7%	1329
Missing	268	3.3%	1305	161	3.9%	1378	95	3.7%	1359
Total	8,148			4,086			2,561		
Total URM [3]	1,843	22.6%		675	16.5%		443	17.3%	

125. 8,148 North Carolina public school students applied to UNC for the 2014-15 freshman year. Of these, 14.6 percent were African American, 1.6 percent were Native American, and 6.4 percent were Hispanic. Thus, 22.6 percent were URM. Among applicants, 62.0 percent were

<sup>85</sup> See Exhibit 4 for full results, sources, and notes.

white, 12.0 percent were Asian, 0.1 percent were Pacific Islander, and 3.3 percent had missing race and ethnicity.

126. There are some students who chose not to reveal their race or ethnicity on their application to UNC. I do not treat these applicants with “missing” race and ethnicity as URMs. In fact, their test scores are more like those of Asians than like those of any other group as Exhibit 4 shows.

127. In all groups, admitted students have higher scores than applicants. However, the difference between applicants and admitted students differs by group. For instance, African American admits’ average score is 148 points higher than African American applicants’ average score. In comparison, white admits’ average score is 74 points higher than white applicants’ average score. Overall, the difference between applicants’ and admits’ scores is larger for URMs than for non-URMs.

128. As a result, the percentage of URMs among admitted students (16.5 percent) is lower than among applicants (22.6 percent). The reverse is also true: the percentage of non-URMs among admitted students (83.5 percent) is higher than among applicants (77.4 percent). These changes in percentages show that the UNC is not admitting an equal percentage of each racial/ethnic group’s applicants but, rather, using a procedure that also weights test scores and other factors. Indeed, the admissions rate for URMs is 36.6 percent whereas it is a higher 54.1 percent for non-URMs.<sup>86</sup>

129. I also note that enrolling applicants, from every group, have slightly lower average scores than admitted students—by approximately 10 to 25 points.<sup>87</sup> This is not a surprising result because admitted students with higher scores tend to have, all else being equal, more options in the portfolio of colleges to which they have been admitted. In other words, they were likely admitted to other schools as well and may have chosen to enroll at one of those other institutions.

**E. Two Issues that Affect All the Alternative Race-Blind Plans: Test-Retaking and Application/Matriculation Probabilities**

130. Because the analyses that follow necessarily rely not just on UNC applicants (shown in Exhibit 4) but also on non-applicants from North Carolina public schools, I address an issue

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<sup>86</sup> The difference in admissions rates is statistically significant with 99 percent confidence.

<sup>87</sup> The one exception is Pacific Islanders, where the comparison is based on an extremely small number of students.

regarding the rise in test scores that typically occurs when a student takes multiple college assessment tests. The ACT is a mandatory test for nearly all high school students in North Carolina, and all students take the mandatory test around March 1 of their junior year in high school.<sup>88</sup> For the vast majority of students, this mandatory test is their first taking of the ACT. It is this mandatory score that appears in the NCERDC data, and I must rely on it for many students because it is the only college assessment score that appears for them in the database. However, applicants to UNC often take multiple college assessment tests. For instance, they may take the SAT later in the spring of their junior year or in the autumn of their senior year. They may also retake the ACT. When they apply to UNC, they need not reveal all of their college assessment scores. Instead, applicants tend to pick the score that makes them appear best (the “final score”). Research published by the ACT suggests that students who first take the ACT as a junior and who then take at least one more assessment will have a final ACT score (that is, the score probably reported on the application) that averages 1.1 points higher than the junior year score.<sup>89</sup>

131. Therefore, to promote comparability with UNC applicants, I construct an “adjusted score” in which I add 1.1 points to the ACT scores of students whose only available score in the NCERDC data is from the mandatory ACT taking. This is approximately equivalent to 40 SAT points. If a student in the NCERDC data has both ACT score and an SAT score (almost always from a date later than the mandatory ACT testing), then the student has a minimum of one test retake already so I do not add 1.1 ACT points (40 SAT points).<sup>90</sup> Similarly, if a student in the NCERDC data has multiple ACT scores, I do not add 1.1 points. Rather, for such students who have multiple scores, I set their adjusted scores to be the maximum of their scores (where all ACT scores are first translated into SAT points).<sup>91</sup> Throughout the analysis that follows, I show

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<sup>88</sup> “ACT Frequently Asked Questions,” *North Carolina Department of Public Instruction* available at <http://www.ncpublicschools.org/docs/accountability/policyoperations/1617actfaq.pdf>. The statewide administration of the ACT in North Carolina started in March 2012. See, e.g., <http://www.ncpublicschools.org/newsroom/news/2012-13/20120907-01>.

<sup>89</sup> See page 2 of Harmston, Matt, and Jill Crouse, “Multiple Testers: What Do We Know About Them?” *ACT Research and Policy, Technical Brief, ACT: 2016*. The following quotation is relevant: “Students first testing as juniors demonstrated an average Composite score increase of 1.1 points [in their final score].”

<sup>90</sup> ACT and SAT® Concordance Tables, The College Board, October 2009.

<sup>91</sup> SAT scores are the students’ maximum scores as of the date when the NCERDC requests the SAT data from the College Board. Therefore, the SAT scores that appear in the NCERDC data are not necessarily from the second college assessment that students ever took, assuming that the mandatory ACT is the first. Rather, the SAT score may reflect multiple takings of the SAT.



results with adjusted scores (and translating everything into SAT points) but parallel analyses with unadjusted scores would—if anything—strengthen all of my conclusions.

132. Additionally, because not all of the students made newly eligible for admission under an alternative plan would apply or, if admitted, would matriculate, I used data on the actual 2011-12 to 2014-15 UNC admits to predict each student’s probability of matriculation conditional on his or her test scores. Specifically, I estimated a probit regression model in which an indicator for matriculating is regressed on admits’ maximum test score for admits with test scores in the range that has reasonable density for UNC admits: 1080 to 1460.<sup>92</sup> I made this prediction separately for African American, Asian, white, and Hispanic students. Because there are such a small number of students whose race is Native American or Pacific Islander, I made a prediction across all students and used it for them. Once I had these predicted probabilities of matriculation among *admitted* students, I applied a data-based reduction of 25 percent to obtain a predicted probability of matriculation among *potential applicants*. This is because about 25 percent of North Carolina students who appear to be well-qualified for admission at UNC do not currently apply.<sup>93</sup> These students are probably not deterred from applying because they expect that their chance of admission is low. Probably, they do not apply for some other reason. A reasonable “base case” estimate is that, under an alternative admissions plan, about the same percentage of qualified students would not apply. However, I considered reasonable alternative estimates to this base case in “sensitivity tests” included in the backup to this report. Once I have the matriculation probabilities for potential applicants, I apply them to students in the NCERDC data who are made newly eligible for admission under each alternative plan.<sup>94</sup> When analyzing admits rather than matriculants I use the 25 percent reduction to establish an application probability of 75 percent among students made newly eligible.

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<sup>92</sup> This regression is based on Connect Carolina data. See footnote 58 for a description of the probit regression model.

<sup>93</sup> For instance, the number of North Carolina public school students with SAT scores of 1400 and above who apply to UNC (Connect Carolina) is slightly less than 75 percent of the total number of North Carolina public school students with SAT scores of 1400 and above (NCERDC).

<sup>94</sup> That is, the summary statistics for matriculants under each alternative plan are computed by weighting each admissible student by his or her predicted matriculation probability. Students who were identified only as multi-racial in the NCERDC data were given a weighted matriculation probability based on 2010 Census data for age-appropriate North Carolinians who reported themselves as multi-racial: 52.5% African American, 11.7% Native American, 12.7% Asian, 20.7% Hispanic, and 1.3% Pacific Islander.

**V. Socioeconomic Status-Based Race-Blind Admissions Plans Would Not Achieve UNC's Actual Level of Diversity and Academic Preparedness**

133. In this section, I consider race-blind alternative admissions plans that are based on indices of socioeconomic status. In the Complaint, Plaintiff claims that:

Colleges and universities that have eliminated race-based admissions have maintained or increased their student body diversity by placing greater emphasis on socioeconomic factors, which often strongly correlate with an applicant's race but are not exclusively reserved for applicants of a particular race or ethnicity. Using socioeconomic preferences thus increases racial diversity and achieves the broader diversity that UNC-Chapel Hill claims to seek by opening the door of opportunity for poor students of all races.<sup>95</sup>

134. It is worth reiterating at the outset of this section that attaining socioeconomic diversity could well be a goal of a university. A university's educational mission could cause it to consider *both* socioeconomic diversity and racial/ethnic diversity as valuable. Thus, what is under discussion in this section, is not whether UNC could use measures of socioeconomic status to achieve socioeconomic diversity in its class. What I analyze here is whether UNC could use measures of socioeconomic status in a race-blind process to attain racial and ethnic diversity it wished to attain. That is, is socioeconomic information enough to attain race and ethnic diversity?

**A. Effectiveness of Socioeconomic Proxies for Race or Ethnicity**

135. As a first step in assessing the likely outcome of socioeconomic status-based race-blind alternatives at UNC, I review the effectiveness of available race-blind measures to proxy for race or ethnicity. Whether a race-blind admissions program will achieve "fit," including a certain level of diversity, largely depends upon the proxy for race or ethnicity that the race-blind alternative uses. In other words, unless a socioeconomic indicator such as whether a student receives free or reduced-price lunch correlates with whether that student is a URM, a university is unlikely to be able to maintain its current level of diversity by substituting consideration of race or ethnicity (as one factor among many) with whether a student receives free or reduced-

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<sup>95</sup> Complaint, ¶ 66.

price lunch. Thus, as part of evaluating whether there are available, workable alternative race-blind admissions programs for UNC, based on indices of socioeconomic status, I consider the correlation between certain race-blind proxies and race or ethnicity in the context of the demographics of the state of North Carolina.

136. It is useful to explain how this analysis relates to alternative admissions plans. A less-than-perfectly correlated proxy for race and ethnicity will generate “false positives” and “false negatives.” A false positive is a student who is falsely identified as a URM by the proxy. For instance, if the proxy were poverty, then a poor white student would be a false positive. A false negative is a student who is falsely identified as a non-URM by the proxy. For instance, if the proxy were poverty, then a non-poor African American student would be a false negative. The higher the number of false positives and false negatives, the more that the race-blind policy will lead UNC to (i) not admit as many URM students and fail to attain its diversity goals, or (ii) experience a decline in academic preparedness because it only attain its diversity goals by admitting more students based on the proxy than it would have to admit if it could use race in admissions, or (iii) both of the above. This is the same logic as in the basketball example given above in paragraph 111. A tall person from a high school with a renowned basketball program who is, in fact, not a basketball player is a false positive. A great player who is shorter or not from that sort of school is a false negative. The greater the number of false positives and false negatives, the more that a performance-blind recruiting process would generate losses for a university.

137. In fact, I find that there are a large number of false positives and false negatives when I employ proxies for race and ethnicity. Not all low-income students in North Carolina are URMs, and not all North Carolina students who are URMs are low-income. More broadly, not all socioeconomically disadvantaged students in North Carolina are URMs, and not all North Carolina students who are URMs are socioeconomically disadvantaged.

138. For this analysis, the NCERDC data are especially useful because they (i) contain nearly all public school students from North Carolina (as opposed to elsewhere); (ii) contain measures

of students' academic preparedness; and (iii) identify a student's high school and residential neighborhood.<sup>96</sup>

139. Proponents of race-blind admissions programs cite a number of purported alternative socioeconomic proxies for race or ethnicity.<sup>97</sup> Among these proxies, the ones that tend to be cited often are:

- i. measures of family (or household) income,
- ii. parents' educational attainment.<sup>98</sup>

140. Other potential proxies include:

- i. parents' marital status,
- ii. parents' number of dependents (or the student's number of siblings),

141. Still other potential proxies are based on the student's neighborhood or high school:

- i. the area's median income,
- ii. educational attainment of adults in the area,
- iii. the percentage of families headed by a single parent,
- iv. whether the area is rural or urban,
- v. the percentage of fellow students who are eligible for free or reduced-price lunch (an often-used indicator of the income of a school's students).

142. As a framing point for my analysis of specific race-blind alternative admissions plans based on indices of socioeconomic status, I first consider one of the available and frequently cited proxies—family income—and begin by looking at the correlation between it and race or ethnicity. That is, if an applicant comes from a household with low family income, how likely is he or she to be a URM? I then analyze more complex statistics and relationships. For example, if

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<sup>96</sup> The neighborhood is indicated by a 13-digit code that can be linked to U.S. Census tract or block group. Census block groups and tracts are designed to have as much integrity (as neighborhoods or geographic areas recognized by people "on the ground") as is compatible with the goal of enumerating the population. The 13 digits are as follows AABBBCCCCCDE where A=State (2 digit FIPS code), B=County (3 digit FIPS code), C=Tract (6 digit FIPS code), D=Block Group (1 digit FIPS code), and E=Block (1st digit of the 3 digit FIPS block code).

<sup>97</sup> *The Future of Affirmative Action*.

<sup>98</sup> This is not consistently captured in the NCERDC data. However, it is found in the American Community Survey data discussed below.

I use several socioeconomic proxies simultaneously, with what accuracy can I predict an applicant's race or ethnicity? In other words, how effective would such a constructed composite proxy be?

### 1. Family Income

143. Exhibit 5 Tables 1 and 2 analyze the relationship between a student's URM status and his or her family's income. The indicator of family income in the NCERDC data (or available to public schools generally) is participation in the National School Lunch Program. Students with family income at or below 130 percent of the Federal Poverty Level (\$31,005 for a family of four in the school year ending in June 2015) are eligible for free meals. Students with family income between 130 percent and 185 percent of the poverty level (\$44,123 for a family of four in the school year ending in June 2015) are eligible for reduced-price meals.<sup>99</sup> If free or reduced-price lunch status is a strong proxy for race or ethnicity, then students with free/reduced lunch must usually be URMs and students without free/reduced lunch must usually be non-minorities. Exhibit 5 tests whether this is the case.

144. Exhibit 5 Table 1 shows the percentage of students who receive free or reduced-price lunch who are URMs, by the student's level of academic preparedness. The first row of Exhibit 5 Table 1 shows that, among *all* free/reduced-price lunch students in the graduating class of 2015 from North Carolina public high schools, 59 percent were URMs. However, this percentage rapidly shrinks if we consider hypothetical applicants who are likely to meet the academic preparedness standards for UNC. For illustrative purposes, a single indicator of academic preparedness is shown: the maximum of the student's SAT combined and ACT comprehensive score (translated into SAT points). Among those with SAT scores above 1120 (the bottom 20th percentile SAT score of in-state URMs admitted to UNC in 2014-15), only 31 percent of free/reduced-price lunch students are URMs (Exhibit 5 Table 1, row 4). The vast majority (69 percent) are non-minorities. Among those with SAT scores above 1260 (the bottom 20th percentile SAT score for in-state, non-URM candidates), only 24 percent of free/reduced lunch students are URMs. The vast majority (76 percent) are non-minorities. Thus, if UNC were to use

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<sup>99</sup> See "National School Lunch Program Fact Sheet," *USDA's Food and Nutrition Service*, accessed May 2017, <https://fns-prod.azureedge.net/sites/default/files/cn/NSLPFactSheet.pdf>; Income Eligibility Guidelines, <https://www.gpo.gov/fdsys/pkg/FR-2014-03-05/pdf/2014-04788.pdf>.

free/reduced-price lunch status as a proxy for URM status among its academically prepared applicants, UNC would be making a false positive error from 69 to 76 percent of the time. By false positive, I mean that UNC would have supposed the student to be a URM when he or she was, in fact, not one.

145. This proxy also leads to false negative errors. By false negative, I mean that by using this proxy UNC would fail to identify a significant number of academically prepared URM students. Exhibit 5 Table 2 illustrates this. For instance, among those with SAT scores above 1120, 32 percent of URM students receive free/reduced-price lunch but 68 percent of URM students have higher incomes. Among those with SAT scores above 1260, 27 percent of URM students receive free/reduced-price lunch but 73 percent of URM students have higher incomes. Thus, the vast majority of URM students who are academically prepared for UNC (based on a single measure of SAT score) would be not be identified as minorities if the admission process used free/reduced-price lunch status as a proxy for race or ethnicity. Anywhere from 68 to 73 percent of the “most qualified” URMs would be overlooked when relying on a socioeconomic measure.

## **2. Composite Proxy**

146. In addition to considering family income as the proxy for race and ethnicity, I analyzed all of the proxies simultaneously to create a composite socioeconomic proxy. In other words, I use the proposed socioeconomic proxies (all those discussed above in paragraphs 139 to 141) together in an attempt to create a composite that more effectively proxies for race or ethnicity than family income alone did. This process may be described as an attempt to form a “sufficient statistic” for race/ethnicity. As a statistical matter, a sufficient statistic is a combination of proxy variables that perfectly predicts an applicant’s race/ethnicity. Equivalently, a combination of proxy variables is a sufficient statistic when it results in an R-squared of 100 percent in a regression of race/ethnicity on the proxy variables. In such a regression formulation, the further R-squared is from 100 percent, the more imperfect the composite proxy is. Thus, as described above, if an imperfect composite proxy is used in a race-blind admissions plan, there will be a loss in race or ethnic diversity, or a loss in the level of academic preparedness, of the incoming class, or both.

147. The magnitude of the loss is therefore a function of how sufficient the composite proxy is in predicting race/ethnicity. That is, the less one can create a composite proxy that is a sufficient

statistic for race/ethnicity, the more academic preparedness or “fit” the admission process will be lost in an attempt to be race/ethnicity-blind while maintaining some level of racial and ethnic diversity. Or we can think about the same trade-off in the following way. The less one can create a composite proxy that is a sufficient statistic for race/ethnicity, the more race and ethnic diversity will have to be sacrificed to maintain the level of academic preparedness of the incoming class. This trade-off is at the heart of all analyses of race-blind alternative plans: the less sufficient the proxy, the more severe the trade-off will be.

148. Here, I evaluate how sufficient I can make a composite socioeconomic proxy for race or ethnicity. I do this using comprehensive data that is representative of United States as a whole, as well as data for North Carolina only. I utilized the national data in order to perform analysis on a larger sample, with more available input factors.

149. The best data for this purpose, that is representative of the United States as a whole, come from the American Community Survey (ACS), which surveys 1 percent of the U.S. population each year. I used the five most recent available ACS surveys (2010 through 2014) to obtain 5 percent of the population. I focused on persons of the ages most relevant to UNC admissions by restricting the data to survey respondents who were 18 or 19 years old. There are 448,955 of them in the dataset, and 14,205 are from North Carolina.

150. Because race/ethnicity is reported in categories, I used Multinomial Logit models. I used the following variables from the ACS<sup>100</sup>:

- i. household income (dollars)
- ii. family income (dollars)
- iii. home is owned (indicator)
- iv. home value if home is owned (dollars)
- v. single parent household (indicator)
- vi. non-parent household head (indicator, usually a grandparent or other relative)
- vii. number of siblings in household
- viii. is a household head or lives as a student in group quarters (indicator)

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<sup>100</sup> I added indicators when the variables were missing and some variables were automatically dropped in case of collinearity.

- ix. rural (indicator)
- x. in urban area but outside central city (indicator)
- xi. in urban area inside central city (indicator)
- xii. mother's education in 5 categories: less than high school diploma, high school diploma or GED, 1 year of college, 2 years of college, 4 years of college, 5+ years of college
- xiii. father's education in the same 5 categories as mother's education
- xiv. household head's education in the same 5 categories as mother's education
- xv. state of residence indicators

151. There are certain variables that I did not use because they are fairly transparent indicators of race or ethnicity. Examples of these variables would be birth in certain countries (e.g. Mexico, Haiti) or foreign languages spoken at home (e.g. Spanish, Yoruba).

152. Exhibit 6 Table 1 shows the results of my attempts to find sufficient statistics for URM status, making simultaneous use of all the proxies listed above. A model based on the entire U.S. population explains 12 percent of the variation in URM status (i.e. URM versus not). In other words, the model produces a statistic that is only 12 percent sufficient or, in other words, able to predict URM status accurately 12 percent of the time. (Exhibit 6 Table 1, row 1.) If state indicator variables are added to the model, it produces a statistic that is only 18 percent sufficient. (Exhibit 6 Table 1, row 2.) If the model is based on North Carolinians only, it produces a statistic that is only 10 percent sufficient. (Exhibit 6 Table 1, row 3).

153. Because racial/ethnic diversity at a university would be judged not merely by URM versus not but by the representation of specific races/ethnicities, Exhibit 6 Table 2 shows results from models that predict Asian, African American, Hispanic, Native American, Pacific Islander, white, and other race. The model based on the proxies listed above produces a statistic that is only 11 percent sufficient (Exhibit 6 Table 2, row 1). If state indicator variables are added to the model, it produces a statistic that is only 21 percent sufficient (Exhibit 6 Table 2, row 2). If the model is based on North Carolinians only, it produces a statistic that is only 10 percent sufficient (Exhibit 6 Table 2, row 3).



154. This same analysis can be performed by constructing models based on North Carolina-only data from the NCERDC database. Because the NCERDC database includes measures of academic preparation, they allow me to evaluate a more exact version of the question faced by UNC: Can proxies be used to substitute for race/ethnicity among the sort of students who are academically prepared to attend UNC? If I construct a composite socioeconomic proxy using data based on these students alone, would a UNC race-blind process generate a mild or severe trade-off between academic preparedness of their students and their racial and ethnic diversity?

155. To perform this analysis, I combine NCERDC database with data on the communities and high schools of each student. The NCERDC supplies measures of the students' academic preparation. The other data supply measures of the socioeconomics of the student's neighborhood and the student's high school. To get neighborhood statistics, I link each student to variables at the Census Block Group ("small neighborhood") level that are based on the American Community Survey.<sup>101</sup> For instance, each student is linked to the median family income in his or her small neighborhood. Each student is also linked to several variables indicating the educational attainment among adults in his or her small neighborhood. For instance, are they mostly people with a high school diploma (but no postsecondary education) or are they mostly people with 4-year college degrees? I also link each student to variables based on his or her high school from the Common Core of Data included in the NCERDC data, which includes data on every public school in the United States. For example, each student is linked to the percentage of students in his or her high school who participate in the free- or reduced-price lunch program. Each student is also linked to variables that might indicate how much college guidance he or she would receive—for instance, the student-teacher ratio in the high school.

156. Exhibit 7 shows the results my attempts to find sufficient statistics for URM status and race/ethnicity using the NCERDC database. I make simultaneous use of all of the proxies listed above. A regression based on all students, regardless of academic preparation, can predict URM status with 17 percent accuracy. That is, the regression can generate a statistic that is at most 17 percent sufficient (R-squared is 17 percent). This is not a high level of sufficiency: predicted URM status is wrong 83 percent of the time.

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<sup>101</sup> There are 6,155 Block Groups in North Carolina so these are small neighborhoods. Statistics such as family income or adult education are not available at any finer-grained area level than a Block Group.

157. Furthermore, sufficiency (or accuracy or R-squared) drops rapidly if I use data only on those students who are academically well-prepared for UNC. For instance, among those with an SAT combined score of 1120 or higher (row 4), the regression can produce a statistic that is only 9 percent sufficient (it predicts URM status accurately only 9 percent of the time). Among students with an SAT combined score of 1260 or higher (row 6), the regression can produce a statistic that is only 6 percent sufficient (it predicts URM status accurately only 6 percent of the time. See row 6).

158. Since racial/ethnic diversity at a university would be judged not merely by URM status versus non-URM status but also by the representation of specific races/ethnicities, rows 7 through 12 of Exhibit 7 shows results from regressions that predict Asian, African American, Hispanic, Native American, Pacific Islander, white, and multi-racial. A regression based on all students, regardless of academic preparation, is 13 percent sufficient. That is, it can predict race and ethnicity accurately only 13 percent of the time. Moreover, sufficiency drops if I focus on students who are well-prepared for UNC. For instance, among those with an SAT combined score of 1120 or higher, the regression can produce a statistic that is only 9 percent sufficient: it can predict race and ethnicity accurately only 9 percent of the time.

159. A few conclusions follow from these analyses. Not all low-income students in North Carolina are URMs and not all North Carolina students who are URMs are low-income. Not all socioeconomically disadvantaged students in North Carolina are URMs and not all North Carolina students who are URMs are disadvantaged. Socioeconomic proxies, even when they are based on all available data, have a low ability to predict race and ethnicity—predicting incorrectly at least 90 percent of the time among students well-qualified for UNC. That is, socioeconomic proxies are poor proxies. These results suggest that socioeconomic status-based admissions plans are unlikely to achieve racial and ethnic diversity at UNC while also maintaining its current academic preparedness standards.<sup>102</sup>

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<sup>102</sup> Because ACS- and NCERDC-based models produce statistics that are so insufficient, especially among academically prepared students, the UNC admission process could be expected to only achieve racial/ethnic diversity by suffering an important loss in the level of academic preparedness of the incoming class, if it were restricted to a race/ethnicity-blind model. Keep in mind that the exercises just discussed (Exhibits 6 and 7) are designed to show the upper limit of what might be achieved using a race/ethnicity-blind proxy. Any actual admissions process must be conducted expeditiously and would therefore probably be able to employ less data. It would thus probably generate even less sufficient statistics, and thus a worse proxy. The latter would occur especially if the modeling did not seek to maximize R-squared but were based on a particular theory of, say, socioeconomic disadvantage.

## B. Analysis of Socioeconomic Status-Based Admissions Plans

160. Now that I have considered the efficiency of socioeconomic proxies, I analyze race-blind admissions plans based on socioeconomic status. Recall that Plaintiff claims that UNC could achieve its diversity goals by using socioeconomic status in its admissions and not considering race and ethnicity. I evaluate this claim empirically by predicting the admitted and matriculating classes under each of several socioeconomic status-based plans. I compare these classes to UNC's actual admitted and matriculating classes.

161. As noted above, in constructing the plans I analyzed in this report, I consider publications cited in the Complaint such as the chapters in *The Future of Affirmative Action*. The chapter that provides the most specific guidance on socioeconomic indices is by Matthew Gaertner. In it, he relies upon his previous work, Gaertner and Hart (2013), in which he and Hart provide detailed instructions on constructing socioeconomic indices for use in race-blind college admissions.<sup>103</sup>

162. Gaertner and Hart (2013) suggest plans based on two types of socioeconomic indices. The first is an index that captures a student's likelihood of attending a four-year college. The logic behind it is that students with a low index value are unlikely to have received much help and encouragement to attend college so, if they apply, they are overcoming the odds. The second index suggested by Gaertner and Hart (2013) captures whether a student "outperforms" on standardized tests relative to other students with similar socioeconomic status. I discuss each type of index in turn. I also discuss an index that is not motivated by the type of logic used by Gaertner and Hart (2013) – that students who overcome odds or outperform should be given extra weight in admissions – but is rather an attempt, like that discussed above, to construct an index based on socioeconomic factors that as closely as possible proxies for race and ethnicity.

163. For each index, there are two steps to my analysis. The first step is constructing the index itself. This yields a socioeconomic index measure for each student in an applicant pool. The second step is modeling race-blind admissions utilizing these measures. Although each index that I analyze is different, I model race-blind admissions the same way for each. I walk through the evaluation for one index in detail so that each of my steps is clear. My evaluation of

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<sup>103</sup> The chapter in question is Matthew Gaertner, "Advancing College Access with Class-Based Affirmative Action." However, this chapter relies on the analysis in Gaertner, Matther, and Melissa Hart, "Considering Class: College Access and Diversity," *Harvard Law and Policy Review* 7, (2013): 367–403 ("Gaertner and Heart 2013"). Their article provides clear instructions on socioeconomic modeling that they propose as race-blind, alternative admissions plans.

the other indices follows the same steps (so that the details need not be repeated). In each instance I find that the index is a poor proxy for race and ethnicity and thus utilizing them in race-blind admissions is ineffectual, relative to UNC's current practices, at attaining race and ethnic diversity combined with academic preparedness.

## 1. Attending College-Related Socioeconomic Indices

164. The attending college-related socioeconomic indices are indices constructed using socioeconomic variables that together predict a student's likelihood of attending college. The logic of these indices is that students with low index numbers have low *predicted* probabilities of attending college. Gaertner and Hart (2013) argue that this is a sound summary measure of the ways in which low socioeconomic status affect a student's college-going probability. Thus, when students with low index numbers actually apply to a university like UNC, they have presumably had to overcome obstacles to prepare themselves for college and to get through the college application and financial aid processes. Thus, Gaertner and Hart (2013) argue that an admissions plan should give added weight to students with low numbers on these indices because they have demonstrated extra aptitude or motivation by overcoming the odds for students with their socioeconomic background. Another reason to give added weight to students with low index numbers is that they will typically be underrepresented at colleges (this is inherent in the design of the index). I initially analyze a Four-Year College-Related Socioeconomic Index. Below I also analyze a Two-or-Four-Year College-Related Socioeconomic Index.

165. To generate the Four-Year College-Related Socioeconomic Index, I follow Gaertner and Hart closely using NCERDC data.<sup>104</sup> The index is constructed using a Probit regression in which the dependent variable or outcome is attending a four-year college. The explanatory factors are all of the available relevant socioeconomic variables. Some of these variables were suggested by chapters in *The Future of Affirmative Action*, but I use a more comprehensive list of variables.<sup>105</sup> The list is:

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<sup>104</sup> Gaertner and Hart 2013, as well as other chapters in *The Future of Affirmative Action*, use data from the Educational Longitudinal Study of 2002 which includes students who were 12<sup>th</sup> graders in 2004. The data from this study would not be appropriate for the analysis in this report because they contain only a small number of North Carolina students (whereas the NCERDC data contain all North Carolina public school students) and because the data are outdated (whereas the NCERDC data are as up to date as possible).

<sup>105</sup> I added indicators when the variables were missing and some variables were automatically dropped in case of collinearity.

- i. student is eligible for free lunch (NCERDC);
- ii. student is eligible for reduced-price lunch (NCERDC);
- iii. household income (median and mean for Census block group);
- iv. family income (median and mean for Census block group);
- v. percentage of adults aged 25 years and older with educational attainment in each from none to doctoral degree (Census block group);
- vi. mean educational attainment of adults aged 25 years and older, in years (Census block group);
- vii. percentage of families headed by a single parent (Census block group);
- viii. mean number of dependents (Census block group);
- ix. rural/urban/central city/population size indicators (12 categories, based on high school);
- x. percent of students in high school on free lunch;
- xi. percent of students in high school on reduced-price lunch;
- xii. number of students in high school's 12th grade;
- xiii. student-teacher ratio in high school.

166. The Probit regression just described generates a prediction of the likelihood that each student will attend four-year college. It is this predicted likelihood that is the value of each student's Four-Year College-Related Socioeconomic Index. As foreseen by Gaertner and Hart (2013), students whose socioeconomic factors suggest that they are more disadvantaged are the students with low values of this index. For instance, students who live in a neighborhood where adults have low educational attainment have lower values of the index, all else equal.

167. I then assess what would occur if UNC used the Four-Year College-Related Socioeconomic Index as part of a race-blind admissions process. My analysis allows me to explore the limits of what could be attained by using the index to achieve racial and ethnic diversity while sacrificing academic preparedness as little as possible.

168. Whenever a socioeconomic index is used as part of a race-blind admissions process, there are two dimensions that admissions staff could adjust:

- i. the *emphasis* on the socioeconomic index. Should it play a large or small role in the admissions process? For the purposes of my analysis, an easy way to think about *emphasis* concretely is “About how many students who are considered disadvantaged should the staff aim to admit?”
- ii. what is the *threshold* for being considered socioeconomically disadvantaged? Should the admissions staff focus on very disadvantaged students—students, say, whose indices put them among the 5 percent most disadvantaged? Or, should the staff consider students who are fairly but not necessarily very disadvantaged—students, say, whose indices put them among the 25 percent most disadvantaged?

169. To evaluate the range of reasonable alternatives that an admissions staff could employ, I assess 20 cases for the Four-Year College-Related Socioeconomic Index and each of the other socioeconomic indices that I assess. These 20 cases are based on 4 different levels of *emphasis* on the socioeconomic index in admissions and 5 different *thresholds* for considering a student disadvantaged (4 emphases times 5 thresholds equals 20). Specifically, the 20 cases use:

- i. 4 different levels of emphasis, hypothetically implemented on the assumption that the admissions staff aim to admit 750, 1000, 1250, or 1500 disadvantaged students out of total of approximately 4,000 North Carolina resident public school students admitted in recent years to UNC.<sup>106</sup>
- ii. 5 different thresholds for being considered disadvantaged: the bottom 5 percent, bottom 10 percent, bottom 15 percent, bottom 20 percent, and bottom 25 percent on the socioeconomic index.

170. By illustrating 20 cases with a variety of *emphases* and *thresholds*, I mean to explore the capacity of the socioeconomic index: Could the index be used by UNC to attain its current levels of both academic preparedness and racial/ethnic diversity? In no way do I mean to imply that UNC would actually use “hard” numbers like those above to implement a socioeconomic plan or set any kind of target number. Such “hard” numbers might be misinterpreted as quotas. Rather, I assume that the socioeconomic index would actually be used holistically. The 20 cases are designed purely to facilitate exploration of whether such a socioeconomic approach would be workable.

171. For each of the 20 cases, I

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<sup>106</sup> Because I construct the alternative admissions plan for North Carolina resident public school students, it is the number of admits among them that is the relevant comparison. In 2014-15, it was 4,086. In the three previous admissions cycles, it also tended to be a number roughly around 4,000.

- i. apply the *threshold* to the socioeconomic index to categorize students as disadvantaged;
- ii. assume that the admissions staff aim to admit disadvantaged students according to the *emphasis* under consideration;
- iii. assume that the admissions staff evaluate students who are not categorized as disadvantaged (hereafter, “non-disadvantaged students” for simplicity) in a manner that is race-blind but otherwise akin to the manner in which UNC currently evaluates applicants;
- iv. assume that admitted students matriculate in the same way that they do currently.

172. Although an admissions staff would not actually work in stages, it is useful—for clarity—to think about the admissions process having two stages. The first two steps above make up the “disadvantaged stage” of the admissions process. The third step above, in which non-disadvantaged applicants are assessed, is the stage I call “completing the class.”

173. The fourth step above—the matriculation step—is implemented because UNC does not focus just on the class it admits, as I discussed above in paragraph 99. I present results for both the predicted admitted class and the predicted matriculating class.

174. To show how my evaluation of an alternative, socioeconomic status-based admissions scheme works, it is useful to work through a single one of the 20 cases for the Four-Year College-Related Socioeconomic Index. All of the other cases for this index and the other socioeconomic indices have a parallel structure so that, by working through one case in detail, I can illustrate the analysis. The case I work through in the text of my report has both a moderate threshold (the bottom 15 percent on the index) and a moderate emphasis (aiming to admit 1,000 disadvantaged students). However, I do not intend to give this case undue emphasis, so I show all 19 additional cases in a figure below and in Appendix A.

175. The left-hand portion of Exhibit 8 Tables 1 and 2 shows actual UNC 2014-15 matriculating and admitted resident students from North Carolina public schools, respectively. I hereafter call these numbers the “actuals” because this exercise is intended to determine whether the admissions staff could attain the actuals using the socioeconomic index in a race-blind process. For example, the tables show that UNC actually admitted 360 and matriculated 235 African American in-state public school students with average test scores of, respectively, 1214

and 1191. Also, UNC actually admitted 74 and matriculated 46 Native American in-state public school students with average test scores of, respectively, 1272 and 1262. UNC actually admitted 241 and matriculated 162 Hispanic students whose average test scores were, respectively, 1255 and 1234. Thus, the total number of URM admits was 675 and matriculants was 443. Their average test scores were, respectively, 1235 and 1214.

176. For comparison with the actuals, I now predict whom UNC would admit and matriculate from the disadvantaged pool of students. At this point, it is important to pause and recognize that—in making the predictions—I use assumptions that are very favorable to the alternative (socioeconomic status-based) admissions plan. I continue to use assumptions of this sort throughout my analyses so it is worthwhile underscoring them. Specifically, I assume that UNC:

- i. is able to consider *all* of the students who are classified as disadvantaged as potential applicants;
- ii. admits the highest-scoring disadvantaged students, in order, from the disadvantaged pool, up to the number given by the *emphasis*.

177. These assumptions favor the alternative admissions plan very greatly.

- i. First, because I assume that UNC can consider all of the classified-as-disadvantaged students as potential applicants, UNC does not have to “dig as deep” into the pool of disadvantaged students as it would if only some of them could be identified as disadvantaged. For instance, if I were to instead assume that only half of the students classified as disadvantaged were potential applicants, then I would have to make UNC admit about twice as many students to attain a similar number of disadvantaged admits. But, if it were to admit twice as many students, UNC would necessarily be admitting lower-scoring students. It is essential to realize that this first assumption is equivalent to assuming an unrealistic level of ability to identify disadvantaged students on UNC’s part. As a result, my conclusions could not be altered by UNC somehow improving its ability to identify disadvantaged students. I am already assuming that they are *all* identified.<sup>107</sup>
- ii. Second, because I assume that UNC admits the highest-scoring disadvantaged students, in order, I *minimize* the trade-off between test scores (the measure of academic preparation shown in the table) and racial/ethnic diversity. If I were able to, instead, mimic UNC’s holistic admissions process, some of the highest-scoring students would not be admitted because they are not stellar on

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<sup>107</sup> I am assuming that UNC could accurately identify all disadvantaged applicants. This would be challenging given the tight timing of real-world admissions processes. I apply data-based matriculation and application probabilities as noted in paragraph 132.



other dimensions (essays, recommendations, more subjective intellectual and other capacities, etc.). Thus, under any holistic admissions process, the admits' test scores would be lower. Because I assume that disadvantaged students are admitted purely on the basis of test scores and I then evaluate the alternative plan based on the same measure—test scores—my procedure is very favorable to the alternative plan.<sup>108</sup>

178. The middle portion of Exhibit 8 Tables 1 and 2 show UNC's predicted admits and matriculants from the disadvantaged pool, respectively. UNC is predicted to admit 178 and matriculate 138 African American students (compared to actuals of 360 and 235). Their average test scores are 1106 (predicted admits) and 1098 (predicted matriculants), compared to actuals of 1214 and 1191. UNC is predicted to admit 190 and matriculate 150 Hispanic students (compared to actuals of 241 and 162) with an average score of 1115 (predicted admits) and 1111 (predicted matriculants), compared to actuals of 1255 and 1234. UNC is predicted to admit 20 and matriculate 15 Native American students (compared to actuals of 74 and 46) with an average test score of 1143 (predicted admits) and 1138 (predicted matriculants), compared to actuals of 1272 and 1262. Putting all these numbers together, UNC is predicted to admit a total of 388 and matriculate 303 URM students (compared to actuals of 675 and 443) with an average score of 1112 (predicted admits) and 1106 (predicted matriculants), compared to actuals of 1235 and 1214.

179. Summing up, using the socioeconomic index in the "disadvantaged stage" of the admissions process, UNC is predicted to admit 287 fewer and matriculate 140 fewer URM students (decreases of 43 percent and 32 percent) whose average test scores are lower by 123 and 108 points.

180. Notice, in Exhibit 8 Table 2, for example, that although the disadvantaged predicted matriculants are more likely to be URMs than the average actual applicant, they are by no means all URMs. 60 percent of disadvantaged matriculants are non-URMs. This indicates that socioeconomic status, as measured by the Four-Year College-Related Socioeconomic Index, is a poor proxy for URM status.

181. Also notice, in Exhibit 8 Table 2, that disadvantaged predicted matriculants' average test scores of 1126 are about 188 points below the average test scores of UNC's actual matriculants

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<sup>108</sup> In fact, even if I wanted to, I could not mimic UNC's admissions process at all well. It is far too holistic, as shown in Section III.

of 1314. This is despite the fact that I assumed that UNC could identify all the disadvantaged students and would admit the highest-scoring disadvantaged students. This indicates that there is low availability of high-scoring, disadvantaged possible matriculants. If UNC were admitting disadvantaged students to attain socioeconomic diversity, it would necessarily be confronting this low availability. If it tries to admit disadvantaged students to attain racial/ethnic diversity as well, it is doubly facing this low availability.

182. I now proceed to “completing the class.” The question I am answering in this stage of my analysis is whether it is possible for UNC to attain its current actuals by admitting non-disadvantaged students to add to the disadvantaged admits just described. Completing the class has three steps:

- i. I first calculate how many students are needed from each racial/ethnic group to attain the actuals.
- ii. I then calculate what the average test score of the needed number of students must be for UNC to attain its actuals.
- iii. I determine whether UNC could admit or matriculate the needed number of students with the needed test scores. Are there enough students with high enough scores among UNC’s non-disadvantaged applicant pool?

183. For the third step, I take UNC’s 2014-15 applicants and set aside any who were already “admitted” in the disadvantaged stage. (By doing this, I avoid double-counting them.) I then set aside any of the remaining applicants who were not actually admitted by or did not actually matriculate at UNC.

184. By taking UNC’s actual applicants as given, I am favoring the alternative plan because, in fact, non-disadvantaged URM students would be *less* likely to apply under hypothetical race-blind admissions than they currently are. Under race-conscious admissions, non-disadvantaged URM students’ contributions to racial and ethnic diversity might have been considered. Under race-blind admissions, such contributions would necessarily not be considered. Since the admissions process would be less favorable to them under the alternative plan, they would be *less* likely to apply and the non-disadvantaged applicant pool would thus contain *fewer* URM students with whom UNC could complete the class. In short, taking the applicants as given is optimistic, by design, about the alternative plan.

185. I use UNC's actual admissions decisions in order to be as realistic as possible, trying to incorporate its true, holistic admissions process. However, by using the actual admissions decisions, I am also favoring the alternative plan. Since the actual admissions decisions were made using a race-conscious process, non-disadvantaged URM students' contributions to racial and ethnic diversity may have improved their admissions chances. In a race-blind process, they would be—if anything—less likely to be admitted. Thus, by taking UNC's admissions decisions as given, I am favoring the alternative plan. In reality, with a race-blind process, it is probable that fewer non-disadvantaged URM students would be admitted. Taking the admissions decisions as given is optimistic, by design, about the alternative plan.

186. I use the students' actual matriculation decisions in order to be as realistic as possible. Students base their matriculation decisions on many factors (aid, UNC's location, etc.), many of which would not change under an alternative plan. However, it seems unlikely that non-disadvantaged URM admits would matriculate at a substantially higher rate under a socioeconomic status-based alternative plan.

187. A final note on my procedure is that, in some cases, there will be more actual admits or matriculants in UNC's non-disadvantaged pool than are needed for completing the class. Since I want to compare predicted and actual classes that are of the same size, I choose the needed number of students at random from the available non-disadvantaged admits or matriculants. I employ a random number generator (like a lottery number generator) in this process. To ensure that the random number drawn could not influence my results, I draw the random number 100 times and repeat the entire process of completing the class 100 times for each case. By repeating the random draw 100 times, I ensure that the predictions I show are representative of what UNC could attain—under the very optimistic assumptions (described in the above paragraphs) that non-disadvantaged URM students would apply, be admitted, and matriculate at the same rate they do now.

188. The right-hand portions of Exhibit 8 Tables 1 and 2 show how many students are needed, from each racial/ethnic group, to attain UNC's actuals. They also show what the needed students' average test scores must be to attain the actuals. Finally, they have a column indicating the number of times out of the 100 trials where the plan is "feasible," showing the results of the third step in which I attempt to complete the class using the procedure just described. If the

value is greater than 0, then a non-zero number of trials for UNC's non-disadvantaged matriculants would fulfil the needs specified in the two previous columns.

189. Exhibit 8 Table 2, for example, shows that, to attain its actuals, UNC would need 97 African American non-disadvantaged matriculants with average test scores of 1324. UNC would need 12 non-disadvantaged Hispanic students with average test scores of 2779, and UNC would need 31 Native American non-disadvantaged matriculants with average test scores of 1322.<sup>109</sup> In each of these cases (African-American, Hispanic, Native American), it would be infeasible for UNC to attain its current actuals because there are either too few non-disadvantaged matriculants in the pool or their average test scores are not high enough or both of the above.

190. For URM students overall, the table shows that, to attain its actuals, UNC would need 140 non-disadvantaged URM matriculants with average test scores of 1448. Attaining these actuals is infeasible because, although there are enough non-disadvantaged URM matriculants in the pool, their average test scores are insufficiently high.

191. Although, in the particular case I examined, attaining the URM actuals is infeasible because the non-disadvantaged URM matriculants in the pool have average test scores that are too low, infeasibility could also occur because there are not enough non-disadvantaged URM matriculants in the pool to meet the "needed" number. In practice, cases with a low emphasis and high threshold on the socioeconomic index will tend to produce only a small number of URM admits or matriculants in the disadvantaged stage, causing the number of needed URM students to be large in the completing the class stage. Thus, in such cases, infeasibility generally occurs because the non-disadvantaged pool does not contain enough admits or matriculants who are URMs to produce a class that has as much race/ethnic diversity as UNC's actuals. Cases with a high emphasis and low threshold on the socioeconomic index tend to produce the opposite sort of infeasibility: there are enough URM students in the pool to attain UNC's actuals on race/ethnic diversity but the average test scores of the class produced is lower than UNC's actuals.

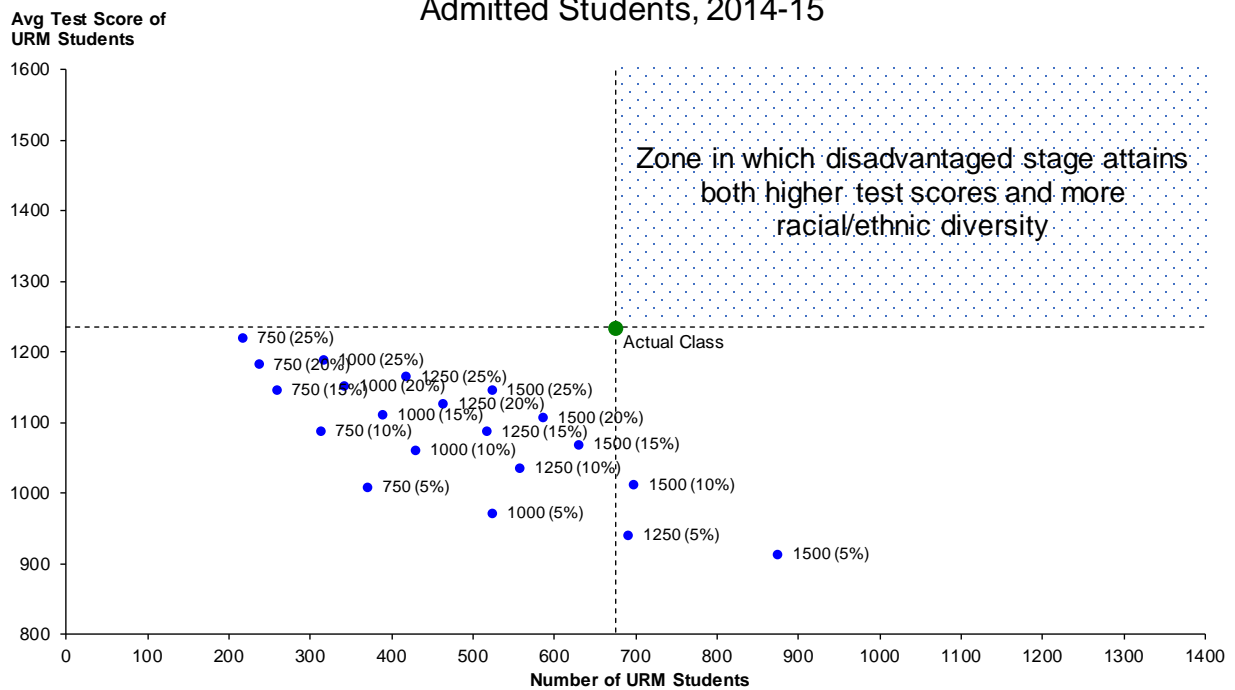
192. Having conducted the "disadvantaged stage" and "completing the class" stage for this case, I conclude that, using the alternative socioeconomic status-based admissions plan, UNC

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<sup>109</sup> An average test score of 2779 among Hispanics would be impossible to achieve since combined (math plus verbal) SAT scores cannot exceed 1600. Thus, the goal for Hispanics, after the disadvantaged stage, is unattainable.

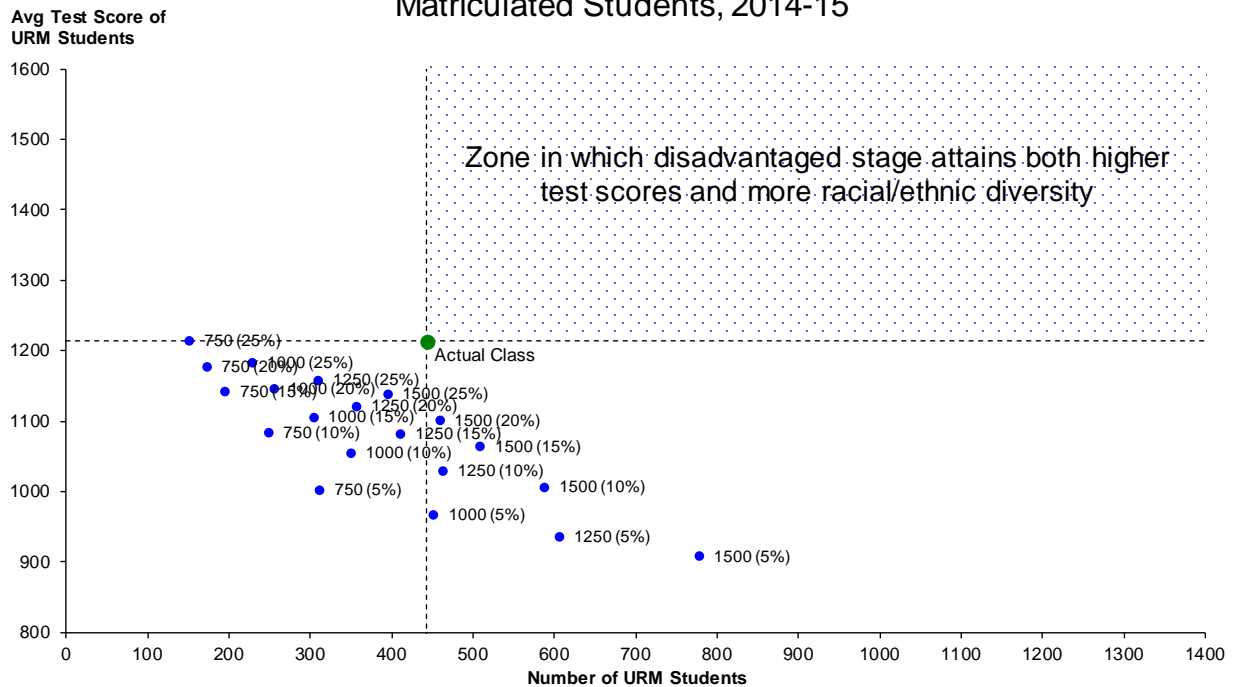
could not attain its current actuals on test scores and racial/ethnic diversity. This is despite the fact that my assumptions, in both stages, were extremely favorable toward the alternative plan. 193. I have now stepped through one case in detail, with moderate assumptions on the socioeconomic threshold and emphasis. However, I evaluated 20 cases that illustrate a range of assumptions on the threshold and emphasis. The “disadvantaged stage” for each of the 20 cases is illustrated in Exhibit 9 Figures 1 and 2.

**Exhibit 9 Figure 1<sup>110</sup>**  
**Admissions Modeling Based on Four-Year College-Related**  
**Socioeconomic Index: "Disadvantaged Stage"**  
**Admitted Students, 2014-15**



<sup>110</sup> See Exhibit 9 for full results, sources, and notes.

**Exhibit 9 Figure 2<sup>111</sup>**  
**Admissions Modeling Based on Four-Year College-Related**  
**Socioeconomic Index: "Disadvantaged Stage"**  
**Matriculated Students, 2014-15**



194. Exhibit 9 Figure 2 works as follows. The horizontal axis shows the number of URM students who are predicted to matriculate at UNC via the disadvantaged stage. There is a dashed black vertical line at UNC’s actual number of URM matriculants. The vertical axis shows the average test scores of URM students who are predicted to matriculate at UNC via the disadvantaged stage. There is a dashed black horizontal line at UNC’s actual URM matriculants’ average test scores. Thus, the dashed black lines divide the figure into four parts or “quadrants” with a green dot (representing UNC’s actuals) at the intersection.

- i. Any case shown in the bottom left-hand quadrant means that, in order to attain its actuals, UNC needs to complete its class with *more* URM matriculants who are *higher-scoring* that than UNC’s actual URM matriculants. That is, a case in the bottom left-hand quadrant sets up a double challenge for UNC in the completing the class stage: more URM matriculants are needed and they must be unusually high-scoring for URM students.
- ii. Any case shown in the upper left-hand quadrant means that, in order to attain its actuals, UNC needs to complete its class with more URM matriculants but,

<sup>111</sup> See Exhibit 9 for full results, sources, and notes.

on average, their test scores could be worse than that of UNC's actual average URM matriculant.

- iii. Any case shown in the lower right-hand quadrant means that, in the disadvantaged stage, UNC already attained its actuals on the number of URM students but *not* on their average test scores, which are below the actuals.
- iv. Only cases shown in the upper right-hand quadrant mean that UNC would not face a challenge to attain its actuals in the completing the class stage. Cases in the upper right-hand quadrant are ones in which the disadvantaged stage produces matriculants who are better than UNC's actuals on *both* the number of URM matriculants and their average test scores.

195. Each case appears on the figure, labeled with its emphasis and threshold. For instance, the position of "1000 (15%)" shows the number of matriculants and their average test scores for the case on which I have been focusing: admissions staff aiming to admit 1000 disadvantaged students, setting a disadvantaged threshold at the bottom 15 percent of the socioeconomic index.

196. There are no cases among the 20 that appear in the upper right-hand quadrant where the alternative plan, in the disadvantaged stage, attains better test scores and better racial/ethnic diversity than UNC actuals. Indeed, the vast majority of the 20 cases are in the bottom left-hand quadrant, where the alternative plan, in the disadvantaged stage, attains lower test scores and fewer URM students. Exhibit 9 Figure 1 shows similar results for admitted students.

197. The results shown in Exhibit 9 Figures 1 and 2 demonstrate that UNC is always set a challenge for the completing the class stage. That is, its admissions staff would always be "starting from behind" when trying to attain UNC's actuals from the non-disadvantaged pool of students. In fact, in the 20 cases in each figure, it is *never* feasible for UNC to attain its actuals by completing the class. Consistently, (i) there are too few non-disadvantaged URM matriculants relative to the number needed or (ii) their average test scores are too low or (iii) both of the above are true. This is despite my having used assumptions in completing the class that are very favorable to the alternative, socioeconomic status-based plan.

198. It might seem as though the above demonstration—the infeasibility of UNC attaining its current actuals using the Four-Year College-Related socioeconomic index—is an artifact of something in the methodology and assumptions I have made. However, it is not an artifact and, indeed, the assumptions I made greatly favor the socioeconomic status-based plan. Rather, the consistent infeasibility is the result of the fact that the socioeconomic index is a poor proxy for

race and ethnicity.<sup>112</sup> Because it is a poor proxy, it is ineffectual at achieving diversity combined with preparedness. By using it in a race-blind process, UNC would be matriculating students who are less prepared *and* contribute less to racial diversity than UNC's actual matriculants.

199. Having stepped through the evaluation process for one socioeconomic index, I can now show the results for the other socioeconomic indices concisely because the evaluation process is always the same. Only the index being used changes.

200. Another attending college-related socioeconomic index I analyze is the Two-or-Four-Year College-Related Socioeconomic Index. This yields Exhibit 8 Tables 3 and 4 as well as Exhibit 9 Figures 3 and 4. Exhibit 9 Figures 3 and 4 are exactly analogous to Exhibit 9 Figures 1 and 2 except that they each show the 20 cases in which the Two-or-Four-Year College-Related Socioeconomic index is used as the socioeconomic index. There are no cases among the 20 that appear in the upper right-hand quadrant where the alternative plan, in the disadvantaged stage, attains better test scores and better racial/ethnic diversity than UNC actuals. Indeed, nearly all of the 20 cases are in the bottom left-hand quadrant, where the alternative plan, in the disadvantaged stage, attains lower test scores *and* fewer URM students.

201. The results shown in Exhibit 9 Figures 3 and 4 demonstrate that, if were to use a socioeconomic index like the Two-or-Four-Year College-Related Socioeconomic index, UNC would always be set a great challenge for the completing the class stage. Its admissions staff would always be "starting from behind" when trying to attain UNC's actuals from the non-disadvantaged pool of students. In fact, in *none* of the 20 cases is it feasible to UNC to attain its number of URM admits or matriculants and their average test scores by completing the class. Consistently, (i) there are too few URM admits or matriculants relative to the number needed or (ii) their average test scores are too low or (iii) both of the above. This is despite my having used assumptions that are very favorable to the alternative, socioeconomic status-based plan.

202. I conclude that, using a Two-or-Four-Year College-Related Socioeconomic index, UNC would consistently fail to attain its current levels of academic preparedness and racial/ethnic diversity. This is not an artifact of the evaluation process I follow (which is very favorable to the alternative plans and explore a range of assumptions) but a consequence of the fact that the index is a poor proxy for URM status.

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<sup>112</sup> See Section V.A.



## 2. Striver Index

203. I now evaluate the other socioeconomic index proposed by Gaertner and Hart (2013): an index that captures a student's performance on standardized tests relative to other students with similar socioeconomic status. I call this alternative type of socioeconomic index suggested by Gaertner and Hart (2013) a "Striver" Socioeconomic Index (hereafter, "Striver Index"). It is logically intended to measure the degree to which a student has outperformed his or her peers from a similar background on standardized tests. In other words, a Striver is a person who, based on the data, is someone who has beaten the statistical odds in terms of his or her standardized test scores.

204. To construct a Striver Index (following the procedure proposed by Gaertner and Hart (2013)), I use a regression to estimate a model that predicts North Carolina public school students' admission test scores based on the same, extensive set of socioeconomic variables listed above.<sup>113</sup> The regression shows that socioeconomic background is correlated with test scores. Thus, if a student from a modest socioeconomic background attains the same test score as the average student from an advantaged socioeconomic background, he or she has outperformed his or her predicted score and has a positive Striver Index score. The more he or she outperforms, the higher the value of his or her Striver Index. If the student from the modest background underperforms his or her predicted score (i.e. scoring worse than the average student from an even lower socioeconomic background), he or she has a negative Striver Index.<sup>114</sup>

205. As a result of the way it is constructed, the standardized testing bar for a positive Striver Index is higher for students from advantaged backgrounds. Thus, students with high positive Striver Index numbers tend to be socioeconomically disadvantaged and students with low or negative Striver Index numbers tend to have affluent or highly educated parents. This is why, even though the Striver Index is constructed differently than the attending college-related indices discussed above, it is also socioeconomic-based index.

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<sup>113</sup> See paragraph 150.

<sup>114</sup> Although I follow the procedure proposed by Gaertner and Hart (2013), the concept of an Striver Index is far more general than their paper and has been long discussed. See, for instance, "How Increasing College Access Is Increasing Inequality, and What to Do about It," by Anthony P. Carnevale and Jeff Strohl in Richard D. Kahlenberg, editor, *Rewarding Strivers: Helping Low-Income Students Succeed in College*, The Century Foundation Press, 2010.

206. Because a higher score on the Striver Index means more *disadvantage*, a 75 percent threshold (i.e. the *top 25* percent) on the Striver Index is like a bottom 25 percent threshold on attending college-related indices. An 80 percent threshold on the Striver Index is like a bottom 20 percent threshold on the attending college-related indices. And so on. In other words, I test the same 20 cases (5 thresholds, 4 emphases) but the thresholds are expressed slightly differently.

207. Exhibit 8 Tables 5 and 6 and Exhibit 9 Figures 5 and 6 are analogous to Exhibit 8 Tables 1 and 2 and Exhibit 9 Figures 1 and 2, respectively, except that they use the Striver Index as the socioeconomic index.<sup>115</sup> They show if UNC were to use a Striver Index, it would be predicted to admit and matriculate only a tiny number of URM students in the disadvantaged stage. The average test scores of the predicted URM admits and matriculants would be high, but there would be hardly any of them so that, after the disadvantaged stage, UNC would have extraordinarily little racial and ethnic diversity.

208. This sets up a massive challenge for the “completing the class” stage. To attain its current actuals, UNC would somehow have to obtain nearly all of its URM admits or matriculants from the non-disadvantaged pool. This is never feasible. In *zero* of the 20 cases is it feasible to UNC to attain its number of URM admits or matriculants and their average test scores by completing the class. Consistently, (i) there are too few URM admits or matriculants relative to the number needed or (ii) their average test scores are too low or (iii) both of these things are true.

209. I conclude that, using Striver Index, UNC would consistently fail to attain its current levels of academic preparedness and racial/ethnic diversity. Once again, this is not an artifact of the evaluation process I follow (which is very favorable to the alternative plans and explore a range of assumptions) but a consequence of the fact that the index is a poor proxy for URM status.

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<sup>115</sup> Note that although it is not possible to read all of the labels on the blue dots in Exhibit 9 Figures 5 and 6, these dots span all of the 20 cases of *thresholds* and *emphases* described above. They are all outside of the zone in which the disadvantaged stage results in racial and ethnicity diversity comparable to or exceeding its actual admitted and matriculating classes.

### 3. Race Predicting Index

210. The preceding socioeconomic indices are inspired by articles cited in the Complaint. I do not stop my analysis there, however. In this subsection, I consider the question of whether, untied to the specific proposals advocated in the Complaint or sources that it cites, I could construct a socioeconomic index that does attain UNC's actuals. As I discussed above, the attending college-related indices and the Striver Index fail in large part because they are poor proxies for URM status. Therefore, I seek to analyze a socioeconomic index that is designed to be as successful of a proxy for race and ethnicity as it could be.

211. To be clear, there is no sociological, economic, or cultural logic that supports this index. Instead, it is an attempt to use non-racial, non-ethnic variables to predict race and ethnicity. I therefore call this a "Race Predicting Index." If a Race Predicting Index—which is designed to be as strong of a proxy for URM status as possible—cannot attain a combination of academic preparedness and diversity as well as UNC's current process, then it is implausible that any valid socioeconomic index could. It is important for me to state outright that this Race Predicting Index is not in the spirit of a "race-neutral" admissions policy, and therefore I consider it only as a way to analyze what could *possibly* be attained by a plan that was, at least on the surface, based on socioeconomic factors.<sup>116</sup>

212. To construct a Race Predicting Index, I use a regression to estimate a model that predicts URM status based on the most extensive set of socioeconomic variables available (see paragraph 150).<sup>117</sup> I perform my analysis using the Race Predicting Index exactly as I analyzed the attending college-related indices and the Striver Index. The only change is the index I use.

213. Exhibit 9 Figures 7 and 8 are analogous to the previous quadrant figures (Exhibit 9 Figures 1 through 6) except that they show cases in which the Race Predicting Index is used. In Exhibit 9 Figures 7 and 8, there are no cases among the 20 that appear in the upper right-hand quadrant where the alternative plan, in the disadvantaged stage, attains better test scores and

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<sup>116</sup> Any Race Predicting Index would stop working if the index were not often re-constructed—owing to the fact that the correlations between race/ethnicity and socioeconomic factors change over time. However, constructing a Race Predicting Index requires estimating a regression that is the *opposite* of race-blind since its whole purpose is to predict race and ethnicity. Thus, an admissions procedure that employed a Race Predicting Index could not be truly race-blind.

<sup>117</sup> Overfitting could be a serious problem with a Race Predicting Index. I have deliberately not overfit the regression: it predicts as well out-of-sample as in-sample. If an index does not satisfy this test, it is overfit and not legitimate. Even if it appeared to work well in a report like this, it would actually work poorly when applied in reality. I rejected machine learning as a method, as opposed to regression, to form the Race Predicting Index. I do this for the same reasons discussed in detail in footnote 57.

better racial/ethnic diversity than UNC actuals. About two-thirds to four-fifths of the 20 cases are in the bottom right-hand quadrant, where the alternative plan, in the disadvantaged stage, attains lower test scores but more URM students. This result is not surprising since the Race Predicting Index is, by design, a best available proxy for race and ethnicity. It is therefore sometimes effective in attaining racial diversity. What it is never effective at doing is allowing an admissions staff, in the disadvantaged stage, to attain *both* racial diversity and high academic preparation.

214. The results shown in Exhibit 9 Figures 7 and 8 demonstrate that, even if it were to use a Race Predicting Index, UNC would always face a challenge for the completing the class stage. Its admissions staff would always be “starting from behind” when trying to attain UNC’s actuals from the non-disadvantaged pool of students. In fact, in none of the 20 cases is it ever feasible for UNC to attain its number of URM admits or matriculants and their average test scores by completing the class. Even with a disingenuous Race Predicting Index, UNC would always find that it was unable to attain its current actuals because (i) there would be too few URM admits or matriculants relative to the needed number or (ii) their average test scores would be too low or (iii) both of the above.

215. This is a very strong finding because:

- i. The Race Predicting Index is constructed purely to test the limits of what could possibly be attained achieved by a plan that is, on the surface, based on socioeconomic factors.
- ii. I consistently used assumptions that are very favorable to the alternative, socioeconomic status-based plan. If I were to have used more realistic, less favorable assumptions (such as assuming that less than 100 percent of disadvantaged students were identified), I would find that it was even less feasible to attain the current actuals.

216. I conclude that, using almost any legitimate socioeconomic index, UNC would consistently fail to attain its current levels of academic preparedness and racial/ethnic diversity.<sup>118</sup> This is not an artifact of the evaluation process I follow because I have just used a Race Predicting Index which is extremely favorable to the alternative plans and much more

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<sup>118</sup> I use the word “legitimate” specifically to exclude (i) indices that are not truly race-neutral such as the Race Predicting Index which relies on race-based regressions or machine learning algorithms and (ii) overfit indices that would be excluded under proper statistical criteria such as their ability to predict out of sample.

favorable than any legitimate socioeconomic index I could construct. Also, the other assumptions I have employed are very favorable to the alternative plans, and I have explored a range of assumptions. My conclusion stems from the fact that any socioeconomic status-based index is a poor proxy for URM status.

217. Although the results just discussed are, of course, based on North Carolina and UNC data, the results are not really specific to North Carolina and UNC. Rather, they are due to the fact that when I tried to use socioeconomic variables to generate an effective substitute or sufficient statistic for race and ethnicity (Section V.A), I was unable to do it. Even using all of the socioeconomic variables available, the regression-based predictions of race and ethnicity were always inaccurate. The predictions of URM status, for instance, were wrong more than 80 percent of the time. It is this inaccuracy that makes socioeconomic plans cause the university to “use up” some of its seats enrolling students who do not further its academic preparedness and diversity goals as much as would some students for whom the university does not have space after “using up” those seats.

#### **4. Plan Based on Admissions Model and Race Prediction**

218. I have confidence in the analysis of socioeconomic status-based plans that I have just covered because I was able to explore a wide range of emphases and thresholds on each of several socioeconomic indices. Also, I was able to make as much use as possible of UNC’s actual, holistic admissions process—in the completing the class stage. Thus, I was able to introduce some realism—although when I had to make assumptions, I ensured that they favored the alternative plan. However, there is another way to analyze socioeconomic status-based plans. It is less flexible and is unable to employ any of UNC’s actual admissions process, but it has the virtue that it may feel more direct because a Race Predicting Index (based on socioeconomic variables) is substituted directly for race.

219. This next analysis proceeds as follows.

- i. Using UNC’s admissions data combined with NCERDC data, I model the current UNC admissions process as well as I can, including racial and ethnic indicators. This modeling is exactly analogous to what I did in Section III,

when assessing whether the admissions process was holistic.<sup>119</sup> I end up with an “estimated admissions model” that can be applied to other data to predict which students would be admitted to UNC. Note that this model will necessarily do a fairly poor job of predicting actual admissions because, as demonstrated above, the actual admissions process is insufficiently formulaic to be captured by a model.

- ii. Using NCERDC data, I predict the race and ethnicity of North Carolina public school students using all of the socioeconomic variables available. This is exactly analogous to what I did to create the Race Predicting Index and has the same purpose (and issues) as the Race Predicting Index: it aims to test the extremes of what could be achieved by a process that was race-blind *on the surface*, but it is not in the spirit of race-neutral admissions and is not truly based in socioeconomics.
- iii. I apply the admissions model from step i to the NCERDC data except that I do not use a student’s *actual* race in the model. Instead, in order to be race-blind *on the surface*, I substitute the student’s predicted race (from step ii) for his or her actual race.
- iv. I compare the predicted admitted and matriculating class from step iii to UNC’s actual admitted and matriculating class.

220. Note that there are two reasons why the predicted class will differ from the actual class in step iv. First, I have substituted predicted race for actual race. Second, the admissions model has low R-squared: it cannot mimic UNC’s actual, holistic admissions process well. This latter point makes the analysis favor the alternative plan. The reason is that test scores get more weight in the admissions model than they do in UNC’s actual process—this is necessarily true since UNC considers many characteristics of students that are not available to be used in the admissions model. Because the admissions model puts more weight on test scores, it tends to produce an admitted and matriculating class with higher test scores. This is shown in Exhibit 10 Tables 1 and 2 where the test scores for nearly every racial/ethnic group rise when I apply the admissions model (using race), as opposed to UNC’s actual, holistic process.<sup>120</sup> Compare the left-hand panel to the middle panel of the tables.

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<sup>119</sup> I use NCERDC information to model the UNC admissions process because I need to apply the model to students outside of the current UNC applicant pool to evaluate the hypothetical race-blind plan.

<sup>120</sup> Native Americans are the exception: their test scores drop very slightly. This is not surprising because they are a tiny group to whom almost anything can happen when a statistical model is applied.

**Exhibit 10 (Excerpt)<sup>121</sup>**  
**Admissions Modeling Using Estimated Admissions Model and Race Prediction**  
**Using Socioeconomic Proxies**

**Table 1**  
**Predicted Admitted Class, 2014-15**

Race/Ethnicity [6]	Actual UNC NC Resident Public School Admits [2]			Predicted UNC NC Resident Public School Admits, using Actual Races [3][4]			Predicted UNC NC Resident Public School Admits, using Predicted Races [4][5]		
	Number	Percent of Admits	Avg Test Score [7]	Number	Percent of Admits	Avg Test Score [7]	Number	Percent of Admits	Avg Test Score [7]
African American	360	8.8%	1214	275	6.7%	1258	170	4.2%	1270
Asian	519	12.7%	1380	365	8.9%	1408	371	9.1%	1406
Hispanic	241	5.9%	1255	169	4.1%	1314	143	3.5%	1321
Native American	74	1.8%	1272	57	1.4%	1201	20	0.5%	1260
Pacific Islander	4	0.1%	1270	3	0.1%	1353	5	0.1%	1355
White	2,727	66.7%	1342	3,083	75.5%	1360	3,255	79.7%	1355
Missing	161	3.9%	1378	-	-	-	-	-	-
Multi-racial	-	-	-	135	3.3%	1348	122	3.0%	1354
Total	4,086	100.0%	1330	4,086	100.0%	1353	4,086	100.0%	1355
Total URM [6]	675	16.5%	1235	615	15.1%	1285	438	10.7%	1306
Total non-URM [6]	3,411	83.5%	1349	3,471	84.9%	1365	3,648	89.3%	1360

**Table 2**  
**Predicted Matriculated Class, 2014-15**

Race/Ethnicity [6]	Actual UNC NC Resident Public School Matriculants [2]			Predicted UNC NC Resident Public School Matriculants, using Actual Races [3] [4]			Predicted UNC NC Resident Public School Matriculants, using Predicted Races [4] [5]		
	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]
African American	235	9.2%	1191	171	6.7%	1241	102	4.0%	1249
Asian	365	14.3%	1356	257	10.0%	1396	262	10.2%	1393
Hispanic	162	6.3%	1234	109	4.2%	1301	92	3.6%	1306
Native American	46	1.8%	1262	41	1.6%	1193	14	0.5%	1248
Pacific Islander	2	0.1%	1325	2	0.1%	1341	3	0.1%	1346
White	1,656	64.7%	1329	1,901	74.2%	1348	2,018	78.8%	1343
Missing	95	3.7%	1359	-	-	-	-	-	-
Multi-racial	-	-	-	80	3.1%	1323	70	2.7%	1330
Total	2,561	100.0%	1314	2,561	100.0%	1340	2,561	100.0%	1343
Total URM [6]	443	17.3%	1214	389	15.2%	1267	268	10.5%	1287
Total non-URM [6]	2,118	82.7%	1335	2,172	84.8%	1353	2,293	89.5%	1349

221. Exhibit 10 Table 2 shows the results of the analysis for the matriculating class. UNC is predicted to matriculate 175 fewer URM students than it actually does (268 versus 443). Its URM share drops from 17.3 percent to 10.5 percent. This is a substantial reduction in UNC's racial/ethnic diversity. Part of this drop is due to the admissions model putting more weight on test scores than UNC's actual admissions process does (compare the 17.3 percent in the left panel to the 15.2 percent in the middle panel). However, most of the drop (15.2 percent to 10.5 percent) is due to having substituted a socioeconomics-based index (the Race Predicting Index) for actual race. In other words, most of the drop in racial/ethnic diversity is due to imposing race-blindness (at least on the surface).

222. Moreover, the losses in racial/ethnic diversity are not offset by any meaningful gain in academic preparedness. While the average test scores of URMs rises, about three-quarters of

<sup>121</sup> See Exhibit 10 for full results, sources, and notes.

this rise is due to the admissions model putting much more weight on test scores than UNC's actual admissions process does. Imposing race-blindness only changes the average test scores of URM students from 1267 to 1287. Thus, when race-blindness is imposed, UNC is predicted to suffer a meaningful loss in racial/ethnic diversity with no meaningful offsetting gain in academic preparedness. Results are similar for the admitted class, as shown in Exhibit 10 Table 1.

223. Therefore, this analysis of socioeconomic status-based admissions also produces the result that UNC cannot attain its actuals on both academic preparedness and race/ethnic diversity. This is despite the fact that this type of analysis favors the alternative plan because the admissions model overweights test scores. This is also despite the fact that this type of analysis explores the extremes of what could be achieved by a socioeconomic status-based index by employing a Race Predicting Index that is only race-blind on the surface.

## **VI. Class Rank (Top X Percent) Admissions Plans Would Not Achieve UNC's Actual Level of Diversity and Academic Preparedness**

224. I now turn to examining the hypothetical admitted applicants if UNC were to adopt a Top X Percent plan. Recall that Plaintiff claims that such plans have "been successful in promoting community, socioeconomic, and racial diversity" and implies that such plans could be similarly successful in North Carolina.<sup>122</sup> I evaluate this claim empirically by modeling a hypothetical class of admitted or matriculating students under a Top X Percent plan and compare these results against UNC's actual admitted and matriculating classes.

225. It is worth noting at the outset of this section that class rank has traditionally been considered by universities' admissions processes. Class rank is widely believed to be one indicator of students' aptitude and possibly also their ambitiousness or grit. Furthermore, some universities have taken class rank into account because they value having at least some students from nearly every high school in the state. The purpose of this section is not to assess whether class rank ought to be given some weight in an admissions process. The purpose is to assess whether class rank ought to be given *all* the weight in admissions. A Top X Percent plan imposes a sharp cut-off on class rank and uses that cut-off exclusively to determine admissions.

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<sup>122</sup> Complaint ¶ 74.



226. If UNC were to adopt a Top X Percent plan, the “X” would necessarily be determined by a few factors—most importantly (i) the number of seats available at UNC and (ii) what percentage of students eligible for admission under the plan actually matriculated. For instance, I show below that North Carolina could not adopt a Top 10 Percent plan whereby students with class rank in their school’s top 10 percent were automatically eligible for UNC admission. With plausible matriculation rates, there would be too many students for UNC’s number of seats. Thus, throughout this section, my analysis considers Top X Percent plans that keep UNC’s admissions or enrollment about what it is now.

227. When I analyze a Top X Percent plan, I use the NCERDC data to identify all of the North Carolina public school students who would be eligible for UNC admission because their class rank put them above the X percent threshold. I then, as described above in Section IV.E, apply to each student an application probability of 0.75 and a matriculation probability based on regression models. For instance, suppose that UNC used a Top 5 Percent plan and that a white student qualified for admission because her class rank put her in the top 5 percent. I would apply an application probability of 0.75 to create her expected probability of application for admission. Then I would take the probability of matriculation among recent white students with similar test scores, based on the regression estimates—suppose this is a 60 percent probability of matriculation. I would then apply this 60 percent probability to the student. I would repeat this process for all students to create a hypothetical predicted UNC admissions and enrollment class.

228. Exhibit 11 Tables 1 and 2 show the results of the Top X Percent plans for admits and matriculants. These are the one I consider most plausible.<sup>123</sup> The Top X Percent plan based on matriculants has a 7.29 percent cut-off because this is the cut-off needed to create a UNC enrolled class of about the same size as the current class. The Top X Percent plan based on admits has similar cut-off, 7.95 percent, which is the cut-off needed to create a UNC admit class of about the same size as the current class.

229. Exhibit 11 Tables 1 and 2 have a similar structure. The left-hand part of Exhibit 11 Table 2 shows UNC’s actual matriculants from North Carolina public schools. Their numbers and

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<sup>123</sup> I consider these Top X Percent plans the most plausible because they rely on my estimates of the application and matriculation probabilities.

adjusted test scores are by now somewhat familiar.<sup>124</sup> The middle part of Exhibit 11 Table 2 shows UNC’s predicted class under the Top X Percent plan. The right-hand part of the table shows how the Top X Percent plan would change—vis-à-vis the actuals—the number and test scores of students from each racial and ethnic group. In the excerpts of Exhibit 11 Tables 1 and 2 below, I include only the left and middle parts of the tables.

**Exhibit 11 Table 1 (Excerpt)<sup>125</sup>**  
**Class Rank Admissions Modeling by Accepting Students in Top 7.95% by Class Rank Percentile**  
**Predicted Admitted Class, 2014-15**

Race/Ethnicity [4]	Actual UNC NC Resident Public School Admitted Students [1]			Predicted UNC NC Resident Public School Admitted Students from the Top 7.95% Pool [2]		
	Number	Percent of Admitted Students	Avg Test Score [5]	Number	Percent of Admitted Students	Avg Test Score [5]
African American	349	8.8%	1212	416	10.5%	1082
Asian	494	12.4%	1375	284	7.2%	1335
Hispanic	238	6.0%	1254	230	5.8%	1155
Native American	70	1.8%	1264	19	0.5%	1122
Pacific Islander	4	0.1%	1270	5	0.1%	1133
White	2,664	67.1%	1341	2,904	73.1%	1278
Missing	154	3.9%	1376	-	-	-
Multi-racial	-	-	-	113	2.8%	1232
Total	3,973	100.0%	1329	3,971	100.0%	1252
Total URM [4]	657	16.5%	1233	761	19.2%	1124
Total non-URM [4]	3,316	83.5%	1348	3,210	80.8%	1282

<sup>124</sup> Note, however, that the actuals differ very slightly from those shown in the previous tables because I can only employ students with non-missing data on rank (as well as test scores) in this analysis.

<sup>125</sup> See Exhibit 11 for full results, sources, and notes.

**Exhibit 11 Table 2<sup>126</sup>**  
**Class Rank Admissions Modeling by Accepting Students in Top 7.29% by Class Rank Percentile**  
**Predicted Matriculated Class, 2014-15**

Race/Ethnicity [4]	Actual UNC NC Resident Public School Matriculated Students [1]			Predicted UNC NC Resident Public School Matriculated Students from the Top 7.29% Pool [2]		
	Number	Percent of Matriculated Students	Avg Test Score [5]	Number	Percent of Matriculated Students	Avg Test Score [5]
African American	229	9.2%	1187	284	11.4%	1065
Asian	350	14.0%	1352	199	8.0%	1313
Hispanic	160	6.4%	1233	156	6.3%	1137
Native American	45	1.8%	1260	11	0.4%	1131
Pacific Islander	2	0.1%	1325	3	0.1%	1121
White	1,617	64.8%	1328	1,772	71.1%	1265
Missing	92	3.7%	1358	-	-	-
Multi-racial	-	-	-	69	2.8%	1208
Total	2,495	100.0%	1312	2,494	100.0%	1236
Total URM [4]	434	17.4%	1212	510	20.4%	1105
Total non-URM [4]	2,061	82.6%	1334	1,984	79.6%	1269

230. For instance, consider African American students. They make up 229 of actual matriculants with an average test score of 1187. Under the Top X Percent plan, they would account for 284 matriculants whose average test score would be 1065. Thus, the number of African American matriculants is predicted to change somewhat, but their test scores are predicted to drop by 122 points. More generally, the total number of URMs is predicted to change somewhat under the Top X Percent plan—from 434 actual to 510 predicted. However, their test scores fall by 107 points.<sup>127</sup>

231. It is worthwhile pausing here to explain why test scores fall when a Top X Percent plan is adopted. Some of the most academically prepared URM students in North Carolina attend high schools where other students are also well prepared academically. Thus, despite the fact that they are among the highest-scoring URM students in North Carolina, they miss the cut-off in their high school. This phenomenon is likely to occur if families who believe that their URM student is high aptitude or highly motivated choose a residence associated with a challenging high school. That is, a Top X Percent plan would discourage such families from finding a challenging high school for their child. They would, instead, be given an incentive to put their child in a school with weaker academic performance among highly ranked students. Indeed,

<sup>126</sup> See Exhibit 11 for full results, sources, and notes.

<sup>127</sup> The scores of non-URM matriculants fall as well, by about 64 points.

there is evidence that the Texas Top 10 Percent plan has in fact induced some families to move away from challenging high schools and toward less-challenging ones.<sup>128</sup>

232. More generally, the degree to which test scores fall under a Top X Percent plan depend on the degree of segregation in a state's schools. The logic behind such plans may rely on the schools' having more segregation than they have, in fact, in North Carolina. To see this, consider how a Top X Percent plan would function if schools were completely segregated: there were all-white schools, all-African-American schools, etc. Then, the plan would "admit" the top X percent of students in each racial/ethnic group in the state. Since the high-scoring students would tend to be in top X percent *within their group's schools*, the difference *between groups'* test score distributions would be irrelevant in admissions. For instance, it might be that the top X percent of white students who were "admitted" had higher average test scores than the top X percent of African American students who were "admitted," but no top-scoring African American student would likely be skipped over in the process and "rejected." In a state, though, where schools are desegregated, the logic behind a Top X Percent plan does not necessarily go through. Some of the highest-scoring URM students in the state may attend very desegregated schools where a Top X Percent plan "rejects" them in favor of lower-scoring URM students who attend more segregated schools.

233. Exhibit 12 shows that, in fact, high-scoring URM public school students in North Carolina usually have desegregated rather than highly segregated high school classes. Among URM students with test scores of 1100 and above, only 8 percent have highly segregated classes (classes that are 75 percent or more URM). 92 percent attend more desegregated high school classes. Among URM students with test scores of 1260 and above, only 6 percent have highly segregated classes. The remaining 94 percent attend more desegregated high school classes. Statistics like this explain why Top X Percent plans reduce URM "admits" test scores by skipping over some of the highest achieving URM students in North Carolina.

234. Another issue with Top X Percent plans is that they could encourage families to "game the system" more than admissions processes that are holistic and that rely on student characteristics that are unalterable or hard to alter. Logically, the greater "game-ability" of Top

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<sup>128</sup> Cullen, Julie Berry, Mark C. Long, and Randal Reback, "Jockeying for position: Strategic high school choice under Texas' top ten percent plan," *Journal of Public Economics* 97, (2013): 32–48. See Moffitt (2002) for a survey of the literature documenting strategic individual response to government welfare programs Moffitt, Robert, "Economic Effects of Means-Tested Transfers in the U.S." *Tax Policy and the Economy* 16, (2002): 1–35.

X percent plans has two sources. First, the admissions threshold is very clear and simple. Thus, a family trying to game the system knows where to put its effort. In a more holistic admissions process, a family would probably be forced to allow their child to excel in the areas in which he or she was authentically talented or motivated.<sup>129</sup> Simply getting him or her into a school where his or her class rank was higher would not necessarily improve his or her chance of admission. Second, class rank is more easily altered than a student's race, ethnicity, parents' education, parents' income, parents' marital status or any number of other socioeconomic variables. A student's class rank can be altered by moving schools or taking courses with easier grading: he or she need not improve actual academic preparation at all.

235. Students who stand to benefit most from “game-ability” in a Top X Percent plan are those who are themselves and whose families are most inclined to take advantage of opportunities such as switching schools or courses. While such families are not readily identifiable, there is evidence from the analysis of other education policies that such families tend not to be disadvantaged and tend to be sophisticated about making educational rules work for them more generally.<sup>130</sup>

236. Using the NCERDC data, it is fairly straightforward to determine which North Carolina public school students would be eligible for UNC admission under any cut-off in a Top X Percent plan—each student's class rank is recorded in the NCERDC data. Therefore, the only way this type of admission plan could lead to different results is if one were to make different assumptions about application and matriculation probabilities. My results are not sensitive to the choice of reasonable alternative probabilities.

237. Summing up, a Top X Percent plan that could plausibly be adopted by UNC is predicted to have relatively little effect on the university's racial and ethnic diversity but to have substantial effects on the academic preparedness of its class. Not only does the evidence indicate that academic preparedness would probably decrease under a Top X Percent plan, the decrease would be especially pronounced among URM students. These results are consistent with the

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<sup>129</sup> This is a standard implication of the multi-tasking problem. Holmstrom, Bengt, “Moral hazard and observability,” *Bell Journal of Economics* 10, no. 1 (Spring 1997): 74–91; Holmstrom, Bengt, and P. Milgrom, “Multitask Principal Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design,” *Journal of Law, Economics, and Organization* 7, (1991): 24–52; Baker, George P. “Incentive Contracts and Performance Measurement,” *Journal of Political Economy* 100, (1992): 598–614.

<sup>130</sup> See, for example, Abdulkadiroglu, Atila, Parag A. Pathak, Alvin E. Roth, and Tayfun Sönmez., “Changing the Boston School Choice Mechanism: Strategyproofness as Equal Access.” *National Bureau of Economic Research Working Paper* 11965, (2006).

tendency of some of North Carolina's most academically prepared URM students to attend high schools where academic preparation is so high in general that even students outside of the top tier have very strong test scores, grades, and other measures of academic preparedness. That is, there are URM students in these schools who are slightly below the top tier in their own schools but in the top tier by North Carolina and national standards. It is doubtful whether UNC wants to lose these highly prepared URM students to other universities. I also note that the evidence suggests that Top X Percent plans give some families and students an incentive to leave challenging high schools for less-challenging ones.

## **VII. Geography-Based Admissions Plans Would Not Achieve UNC's Actual Level of Diversity and Academic Preparedness**

238. I now turn to predicting UNC's admitted and matriculating students if the University were to adopt a Geography-Based admissions plan. Plaintiff claims that, with such a Geography-Based plan, "a university can achieve student body diversity by granting a preference within their existing admissions framework utilizing other community-based metrics, such as an applicant's zip code."<sup>131</sup> I evaluate this claim empirically by analyzing a hypothetical class of admitted or matriculating students under a Geography-Based plan, and I compare these results to UNC's actual admitted and matriculating classes.

239. At this point, it is worthwhile noting that a university, especially a state university, may believe that its educational mission is enhanced by enrolling students from all areas of the state. If a university values "area representation," it may well give weight to certain geographic variables in its admissions process. For instance, some state universities have divided their states into regions that they believe represent different cultural traditions. Their admissions processes then put some weight on having a student body that, based on these regional affiliations, is intended to be diverse in these cultural traditions. Putting weight on geography in such ways is not what I analyze under the heading of Geography-Based plans. Rather, the Geography-Based plans I analyze are inspired by book chapters cited in the Complaint, especially Allen (2014). Also, the Geography-Based plans studied here are, to some extent, inspired by language in

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<sup>131</sup> Complaint, ¶ 75.

Cashin (2014).<sup>132</sup> However, it should be noted that while Allen provides practical guidance about how a university might implement a Geography-Based plan, Cashin and most other commentators do not provide much, if any, logistical guidance.

240. Geography-Based plans are based on a theory of “concentrated disadvantage.” This is the theory, discussed by Allen and Cashin, that a small geographic zone’s historical admissions are highly predictive of a current student’s advantages or disadvantages related to attending selective colleges. In the case of UNC, the theory would indicate that if North Carolina were divided into small geographic zones, each zone’s historical admissions rate at UNC would predict that zone’s future admission rate at UNC. Such strong predictive power would suggest that some zones are much more advantageous for selective college attendance and other zones are much more disadvantageous.

241. Being based on this theory, a Geography-Based plan would treat a student as more disadvantaged if he or she came from a zone with a lower historical admissions rate. This is somewhat analogous, logically, to the attending college-related socioeconomic indices. However, in a Geography-Based Plan, it is not a student’s own socioeconomic characteristics or the socioeconomic characteristics of his or her neighborhood that determine his or her disadvantage. (Plans of that sort have already been evaluated in this report as Socioeconomic plans). Rather, in a Geography-Based Plan, it is the college-going history of a student’s zone that determines his or her disadvantage.

#### **A. Allen-Based Plan**

242. Allen (2014), cited in the Complaint, provides instructions for implementing such a plan. She proposes that each student ought to be associated with his or her local geographic zone. Then, she wants each student to be given priority in admission so as to minimize the difference in admissions rates among local zones. Exact instructions are provided in an appendix, authored by Eliassi-Rad and Fitelson, to Allen’s chapter. I assessed a plan that is as close as possible to the suggestions of Allen and the co-authors of the appendix. Specifically,

- i. I categorize each North Carolina student by his or her Census Tract.

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<sup>132</sup> Cashin, Sheryl, *Place not Race: A New Vision of Opportunity in America*, Boston, MA: Beacon Press, 2014.

- ii. I compute each Tract’s historical admissions rate which is the number of reasonably well qualified students admitted to UNC in recent history divided by the number of students who were reasonably well qualified for admission in recent history. If the concentrated disadvantage theory is correct for UNC, this historical admissions rate will be highly predictive of a current student’s probability of being admitted to UNC. If the theory is correct, a low historical admissions rate will be a strong indicator that the student lives in an area that obstructs his or her UNC attendance.
- iii. I order the Tracts so that those with lowest historical admissions rate come first and the Tracts with the highest historical admissions rate come last.
- iv. Taking the Tracts in the aforementioned order, I consider the students with the best academic preparation, using the basis suggested by Allen: test scores and grades. (Allen suggests combining test scores and grade point averages, so I weigh them equally). I “admit” qualified students in the top W percent of the qualified students of their Tract, where W is a percentage that is determined by when UNC class is filled up.

243. At the outset, there are several issues that arise in implementing Allen’s theoretical plan and comparing it to UNC’s actual admissions process. In each instance, I note how I have attempted to resolve the issue.

- i. The theory that a small geographic zone’s historical admissions rate is highly predictive of a current student’s probability of UNC admission is not borne out by the data. In fact, historical admissions rates only predict a zone’s current or future admission rate with about 4 percent accuracy.<sup>133</sup>
- ii. As a result, the procedure does not have the qualities Allen apparently intended it to have. It hardly matters whether zones are ordered by their historic admissions rate.
- iii. Although Allen (2014) proposes that the geographic zone used is the ZIP+4 area, but there are far too many ZIP+4 codes in North Carolina (upwards of 1,539,640<sup>134</sup>) to make this proposal workable. The vast majority of ZIP+4 areas have zero or only 1 qualified students, and—therefore—have unusable historic admissions rates. Consequently, I use Census Tracts, which are more reasonable in number and have greater neighborhood integrity owing to how they are defined by the Census.<sup>135</sup>

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<sup>133</sup> That is, a regression of zones’ current admissions rates on their admissions rate in the past 3 years has an R-squared of only 4 percent.

<sup>134</sup> “North Caroline United States Zip Code 5 Plus 4,” available at <https://nc.postcodebase.com/>.

<sup>135</sup> If I implement this plan using Census Block Groups than Census Tracts, it does not change my overall conclusions.



- iv. Allen’s proposal suggests that universities admit students using two criteria: test scores and grade point averages. This makes comparisons difficult because UNC does not actually admit students now using only these two criteria. In practice, a substantial part of the difference between the Allen plan predictions and UNC’s actual data come from the Allen plan’s reliance on just two factors while UNC weighs many more factors.<sup>136</sup> That is, the geography built into the Allen plan generates only part of the difference. Allen’s narrower admissions criteria account for substantial differences as well.
- v. Therefore, before examining the predictions from an Allen-type plan, it is necessary first to examine whom UNC would admit if its admissions staff admitted students strictly on the basis of their test scores and grade point averages, with no regard to geography. This gives us an informative baseline.

244. Exhibit 13 Tables 1 and 3 show how UNC’s admitted and matriculated students, respectively from North Carolina public schools would change if the university admitted students solely on the basis of their test scores and grade point averages—which is what Allen advocates. This table establishes the baseline against which I judge the results of implementing Allen’s plan. Notice that the predictions here take no account of geography. Therefore, the predictions show what would occur in an Allen-type plan if there were no segregation: every Tract was a miniature version of North Carolina. These “segregation turned off” predictions are worth noting because I later use them to demonstrate how Geography-Based plans are affected by the degree of residential segregation in North Carolina.

245. Exhibit 13 Tables 1 and 3 demonstrate that, if UNC admitted students based only on test scores and grades, it would admit and matriculate classes that contained a substantially smaller share of URMs. The admitted class would be 9.8 percent URM as opposed to the actual 16.5 percent. The matriculating class would be 9.3 percent URM as opposed to the actual 17.3 percent. The admitted and matriculated students would have higher test scores on average (1359 versus 1330 overall for admitted; 1351 versus 1314 for matriculating), but this finding is not surprising and is misleading because it is the necessary consequence of giving test scores much greater weight than UNC actually gives them in its holistic admissions process.

246. Exhibit 13 Tables 2 and 4 show the predictions produced by following Allen’s proposed geography-based procedure as closely as possible, using Tracts as the small geographic zones. Under the Geography-Based plan, UNC’s admitted and matriculating students are predicted to be

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<sup>136</sup> See the discussion of Exhibit 13 Table 1 below.

less likely to be URMs (14.3 percent versus 16.5 percent for admitted; 14.7 percent versus 17.3 percent for matriculating). The decrease in the African American percentage is especially notable: 6.5 percent versus 8.8 percent for admitted; 6.8 percent versus 9.2 percent for matriculating. The test scores predicted by the geography-based plan are very similar to actual current scores (1324 versus 1330 for admitted overall; 1312 versus 1314 for matriculating overall) but the test score result is, again unsurprising and misleading because the Allen-based plan relies on just test scores and grade point averages as admissions criteria.

**Exhibit 13 (Excerpt)<sup>137</sup>**

**Table 3**

**Admissions Modeling by Accepting Students Ranked within North Carolina Using a GPA and SAT Score Admission Index  
Predicted Matriculated Class, 2014-15**

Race/Ethnicity [6]	Actual UNC NC Resident Public School Matriculants [2]			Predicted UNC NC Resident Public School Matriculants [3][4]		
	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]
African American	234	9.2%	1191	82	3.2%	1290
Asian	363	14.2%	1356	272	10.7%	1388
Hispanic	162	6.4%	1234	86	3.4%	1328
Native American	45	1.8%	1260	4	0.1%	1360
Pacific Islander	2	0.1%	1325	4	0.1%	1299
White	1,648	64.7%	1329	2,026	79.5%	1350
Missing	95	3.7%	1359	-	-	-
Multi-racial	-	-	-	77	3.0%	1347
Total	2,549	100.0%	1314	2,549	100.0%	1351
Total URM [6]	441	17.3%	1214	236	9.3%	1321
Total non-URM [6]	2,108	82.7%	1335	2,312	90.7%	1354

**Table 4**

**Geography-Based Admissions Modeling by Accepting Top 21.51% of Qualified Students from Each North Carolina Census Tract Sorted by Descending Historical UNC Admissions Rate  
Predicted Matriculated Class, 2014-15**

Race/Ethnicity [6]	Actual UNC NC Resident Public School Matriculants [2]			Predicted UNC NC Resident Public School Matriculants [3][4]		
	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]
African American	234	9.2%	1191	174	6.8%	1189
Asian	360	14.1%	1356	222	8.7%	1386
Hispanic	162	6.4%	1234	128	5.0%	1246
Native American	45	1.8%	1260	6	0.2%	1316
Pacific Islander	2	0.1%	1325	3	0.1%	1274
White	1,648	64.7%	1329	1,934	76.0%	1319
Missing	95	3.7%	1359	-	-	-
Multi-racial	-	-	-	79	3.1%	1292
Total	2,546	100.0%	1314	2,546	100.0%	1312
Total URM [6]	441	17.3%	1214	375	14.7%	1229
Total non-URM [6]	2,105	82.7%	1335	2,171	85.3%	1326

247. Comparing the middle panels (which appear as the right panels in the excerpts included above) of Exhibit 13 Tables 1 and 2 (for admitted students) or Exhibit 13 Tables 3 and 4 (for matriculating students) shows that Allen’s plan depends heavily on North Carolina’s remaining as segregated as it is currently. The middle panel of each table (right panel of excerpts above)

<sup>137</sup> See Exhibit 13 for full results, sources, and notes.

uses Allen's proposed admissions criterion in which test scores and GPA are the only things that count. The difference between the middle panels (right panels of excerpts above) is that segregation is hypothetically "turned off" in Exhibit 13 Tables 1 and 3 while segregation is at its actual level in North Carolina in Exhibit 13 Tables 2 and 4. By segregation being "turned off," I mean that Exhibit 13 Tables 1 and 3's middle panels apply an Allen-type plan to a hypothetical North Carolina in which every Census Tract is assumed to have the same racial/ethnic composition as the state does overall. With segregation "turned off," the Allen plan produces admitted and matriculating classes that have substantially less racial/ethnic diversity than the same plan would produce with North Carolina as segregated as it is currently. For instance, among matriculating students, only 9.3 are URM with an Allen plan and segregation "turned off" but 14.7 percent are URM with an Allen plan and segregation as it currently is in North Carolina. This demonstrates that a geography-based plan would depend on continued segregation. A geography-based plan's capacity to produce racial/ethnic diversity would decline as the state became more desegregated.

248. It is worthwhile focusing briefly on the reason that Allen's Geography-Based Plan depends on segregation to produce racial/ethnic diversity. Essentially, Geography-Based Plans attain racial/ethnic diversity by implicitly using a student's neighborhood as a proxy for his or her race/ethnicity. If neighborhoods are desegregated, then a student's neighborhood is not a good proxy for his or her race/ethnicity. The more desegregation there is, the worse the proxy and the greater the losses associated with using a race-blind proxy rather than being race-conscious in admissions. This is analogous to the greater losses that occur if socioeconomic indices are worse proxies for race/ethnicity.

249. There are other reasons why Geography-Based plans would be problematic to implement in practice. The first is that people tend to find them to be arbitrary and thus unfair. This is perhaps most clearly seen if we compare them to Top X Percent plans, which have some similar features. Top X Percent plans are based on the logic that a student's educational opportunities are controlled, to at least some extent, by the high school that he or she attends. If this is true (and if students do not freely choose their high schools but are assigned them), then a student who has attained a top class rank in his or her high school has presumably done his or her most with the educational opportunities available. The high school itself is the venue at which

educational opportunities are offered, so it makes some degree of sense that the school's boundaries are the boundaries for class rank.<sup>138</sup>

250. Geography-Based plans have a different logic because they are based on the idea that the admissions history of the small geographic zone in which a student lives is highly predictive of his or her advantages vis-à-vis preparing for college. But, as noted above (paragraph 243.i), this is not true as an empirical matter for North Carolina. Instead, most of the small-zone differences in admissions rates are merely random—in other words, differences that exist but do not predict the differences among future residents of the zones.<sup>139</sup> Thus, Geography-Based plans are founded on logic that is inconsistent with the evidence.

251. A second reason why Geography-Based plans would be problematic to implement in practice is that they are so easily “gamed” by families who wish to increase their child's chance of admission. With small geographic zones forming an important basis for admissions, families would have strong incentives to move a few blocks or “trade” addresses with a friend or relative—not necessarily even changing their child's school.

## **B. Plan Based on Admissions Model and Race Prediction**

252. So far, my analysis of Geography-Based has followed guidance in Allen (2014) because it was cited by Plaintiff and is also, to the best of my knowledge, the only plan that has been proposed and that has any specificity. We have seen, however, that when applied to actual data, there are numerous problems with implementing the plan as written. Therefore, in an attempt to test the intentions for geography-based plans, I step away from the exact Allen plan and conduct a second analysis that attempts to embody the spirit of the ideas without the problematic details. My second analysis also favors the geography-based plan, by design.

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<sup>138</sup> Note, however, that the logic of Top X Percent plans is undermined if families choose high schools. Once the high school is a matter of choice, it may indicate the family's assessment of a child's aptitude and motivation—factors that would have affected the child's outcomes regardless of his or her school.

<sup>139</sup> If one makes a geographic zone sufficiently small, it contains so few students that their admissions rates differ by zone for no reason other than that people differ. That is, the “Law of Large Numbers” does not apply to small numbers of people. This is easy to illustrate. Suppose, for instance, that you had 100 friends and decided to have each of them over for a meal that would include 10 guests. Even if you pulled each 10-person guest list out of a lottery-ball-jar, there would be differences among the guest lists. Some meals might be dominated by humorous people, others by ambitious people, and so on.

By related logic, geography-based plans can be severely plagued by overfitting. In other words, using a plan based on last year's data will turn out to produce different results when applied to this year's data. If a geography-based plan is not designed to steer clear of overfitting, it is not legitimate. It may be that proponents of Geography-Based plans are insufficiently aware of the overfitting problem and are therefore misinterpreting the differences among students who live in small geographic zones.

253. To conduct this analysis, I adopt the following procedure<sup>140</sup>:

- i. Using UNC's admissions data combined with NCERDC data, I model the current UNC admissions process as well as I can, including racial and ethnic indicators.<sup>141</sup> I end up with a race-conscious admissions model that can be applied to other data to predict which students would be admitted to UNC.
- ii. Using UNC's admissions data matched to NCERDC data, I model the current UNC admissions as well as I can *without* including racial and ethnic indicators. This gives me a prediction of a student's "fit" with UNC that—deliberately—does not take account of his or her contributions to the university that may flow through contributions to racial/ethnic diversity. I use this predicted "fit" to rank students in their Census Tract.
- iii. Using NCERDC data, I generate a Race Predicting Index using *geography variables* as well as the socioeconomic variables. In addition to the socioeconomic variables, I include the historical UNC admissions rate for each student's Census Tract and indicators for the student's *rank in his Tract* (from step ii). As before, the purpose of the Race Predicting Index is to test the extremes of what could be achieved by a process that was race-blind *on the surface* but that made use of geographic as well as socioeconomic variables.
- iv. I apply the race-conscious admissions model from step i except that I do not use a student's *actual* race in the model. Instead, in order to be race-blind *on the surface*, I substitute the student's predicted race (from step iii) for his or her actual race.
- v. I compare the predicted admitted and matriculating class from step iv to UNC's actual admitted and matriculating class.

254. Note that there are two reasons why the predicted class will differ from the actual class in step iv. First, I have substituted predicted race (which includes geographic variables) for actual race. Second, the admissions model (step i) has low R-squared: it cannot mimic UNC's actual, holistic admissions process well. This latter point makes the analysis favor the alternative plan. The reason is that test scores get more weight in the admissions model than they do in UNC's actual process—this is necessarily true since UNC considers many characteristics of students that are not available to be used in the admissions model. Because the admissions model puts more

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<sup>140</sup> This is similar to the procedure followed above in Section V.B.4.

<sup>141</sup> I use NCERDC information as the factors to predict UNC admissions because I need to apply the model to students outside of the current UNC applicant pool to evaluate the hypothetical race-blind plan.

weight on test scores, it tends to produce a matriculating class with higher test scores—regardless of whether actual or predicted race is used.

**Exhibit 14 (Excerpt)<sup>142</sup>**  
**Admissions Modeling Using Estimated Admissions Model and Race Prediction Using Socioeconomic and Geographic Proxies**

**Table 1**  
**Predicted Admitted Class, 2014-15**

Race/Ethnicity [6]	Actual UNC NC Resident Public School Admits [2]			Predicted UNC NC Resident Public School Admits, using Actual Races [3][4]			Predicted UNC NC Resident Public School Admits, using Predicted Races [4][5]		
	Number	Percent of Admits	Avg Test Score [7]	Number	Percent of Admits	Avg Test Score [7]	Number	Percent of Admits	Avg Test Score [7]
African American	360	8.8%	1214	275	6.7%	1258	168	4.1%	1274
Asian	519	12.7%	1380	365	8.9%	1408	374	9.2%	1407
Hispanic	241	5.9%	1255	169	4.1%	1314	142	3.5%	1322
Native American	74	1.8%	1272	57	1.4%	1201	20	0.5%	1260
Pacific Islander	4	0.1%	1270	3	0.1%	1353	5	0.1%	1347
White	2,727	66.7%	1342	3,083	75.5%	1360	3,255	79.7%	1356
Missing	161	3.9%	1378	-	-	-	-	-	-
Multi-racial	-	-	-	135	3.3%	1348	122	3.0%	1355
Total	4,086	100.0%	1330	4,086	100.0%	1353	4,086	100.0%	1356
Total URM [6]	675	16.5%	1235	615	15.1%	1285	433	10.6%	1308
Total non-URM [6]	3,411	83.5%	1349	3,471	84.9%	1365	3,653	89.4%	1361

**Table 2**  
**Predicted Matriculated Class, 2014-15**

Race/Ethnicity [6]	Actual UNC NC Resident Public School Matriculants [2]			Predicted UNC NC Resident Public School Matriculants, using Actual Races [3] [4]			Predicted UNC NC Resident Public School Matriculants, using Predicted Races [4] [5]		
	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]
African American	235	9.2%	1191	171	6.7%	1241	101	3.9%	1252
Asian	365	14.3%	1356	257	10.0%	1396	262	10.2%	1395
Hispanic	162	6.3%	1234	109	4.2%	1301	91	3.5%	1307
Native American	46	1.8%	1262	41	1.6%	1193	14	0.5%	1248
Pacific Islander	2	0.1%	1325	2	0.1%	1341	3	0.1%	1346
White	1,656	64.7%	1329	1,901	74.2%	1348	2,020	78.9%	1344
Missing	95	3.7%	1359	-	-	-	-	-	-
Multi-racial	-	-	-	80	3.1%	1323	70	2.7%	1331
Total	2,561	100.0%	1314	2,561	100.0%	1340	2,561	100.0%	1343
Total URM [6]	443	17.3%	1214	389	15.2%	1267	265	10.4%	1288
Total non-URM [6]	2,118	82.7%	1335	2,172	84.8%	1353	2,295	89.6%	1350

255. The left-hand panels of Exhibit 14 Tables 1 and 2 show the familiar UNC actuals for admitted and matriculating students. The middle panels show who UNC’s admitted and matriculated students from North Carolina public schools would be if the university admitted students not via its actual holistic plan but, instead, according to the admissions model estimated in step i. These middle panels therefore establish the baseline against to judge the results of implementing the geography-based plan (step iv). The middle panels shows that, if UNC admitted students purely on the basis of the admissions model estimated in step i, it would admit and matriculate classes that contained smaller shares of URM students (15.1 percent versus 16.5 percent for admitted; 15.2 percent versus 17.3 percent for matriculating). The admitted and

<sup>142</sup> See Exhibit 14 for full results, sources, and notes.

matriculating students would have higher test scores on average, but this finding is unsurprising and misleading because test scores necessarily receive a greater weight in the estimated admissions model than UNC actually gives them in its holistic admissions process.

256. The right-hand panels of Exhibit 14 Tables 1 and 2 show the predictions produced by using a Race Predicting Index based on geographic as well as socioeconomic factors. Compare the middle and right-hand panels of each table in order to compare a race-conscious admissions model with one that is “race-blind” at least on the surface. Using the geography-based Race Predicting Index, UNC’s admitted and matriculating students are predicted to be less likely to be URMs (10.6 percent versus 15.1 percent for admitted; 10.4 percent versus 15.2 percent for matriculating). The decreases in the African American and Native American percentages are especially notable. For instance, the African-American shares are: 4.1 percent versus 6.7 percent for admitted; 3.9 percent versus 6.7 percent for matriculating. Under this geography-based plan, it is the decreases in racial/ethnic diversity that are most striking. The average test scores predicted by the geography-based plan are very similar (1356 versus 1353 overall for admitted; 1343 versus 1340 for matriculating).

257. Summing up, Geography-Based plans that could plausibly be adopted by UNC are predicted to meaningfully decrease the university's racial and ethnic diversity. Not only does the evidence indicate that URM representation would probably decrease under a Geography-Based plan, the decrease would be especially pronounced among African-American and Native American students. These results are consistent with the tendency of some of North Carolina's most academically prepared URM students to live in desegregated Census Tracts. That is, there are URM students in these desegregated tracts who are “ignored” by Geography-based plans because these plans essentially try to use a student’s neighborhood as a proxy for his or her race and that proxy turns out to be poor. I also note that the evidence suggests that Geography-Based plans would give some families and students an incentive to leave desegregated neighborhoods where students are higher-achieving for ones in which students are lower-achieving.



### **VIII. Including Out-of-State, Private School, and Home-Schooled Students in Alternative Admissions Plans**

258. As I mentioned earlier, in Sections V through VII, I consider only in-state students. Actually implementing alternative plans with out-of-state students would likely be very difficult because UNC could not compel out-of-state high schools to provide the information it would need. For instance, in order to implement its Top 10 Percent scheme, Texas requires its high schools to compute and report class rank using a specific procedure dictated by the Texas Education Agency.<sup>143</sup> This procedure is designed to ensure that all high schools produce comparable information on rank. However, Texas does not attempt to implement its plan with out-of-state students because it could not plausibly compel out-of-state high schools in all states to compute and report class rank according to its specific procedure. Notably, none of the states with plans analogous to the Top 10 Percent plan applies its plan to out-of-state students.

259. Additionally, there are not data that would allow me to predict the effects of Top X percent, geography-based, or SES-based plans with any real precision for out-of-state students. This same lack of data would make it nearly impossible for UNC to implement these out-of-state plans well. The problem is that data akin to the NCERDC data—accurate, comprehensive data on all North Carolina public school students—are not available for out-of-state students. While I could very roughly estimate the effect of alternative plans on out-of-state students using nationally representative surveys, these surveys are too small for accuracy and they would be of little use to UNC were it trying to apply an alternative plan to out-of-state students.

260. Finally, for the same reasons that it would be difficult to actually implement alternative plans with out-of-state high schools, it would be difficult to implement alternative plans with private high schools or home-schooled students. For example, UNC could not compel private high schools to compute and report class rank using a specific procedure. Moreover, many private high schools (and home schools) have graduating classes that are too small to effectively implement plans based on selecting just the Top X Percent of students in the class. In the 2014-15 admissions cycle, 128 applicants were homeschooled.

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<sup>143</sup> See Texas Administrative Code (Title 19, Part 1, Chapter 5, Subchapter A, Rule §5.5), available at [http://texreg.sos.state.tx.us/public/readtac\\$ext.TacPage?sl=R&app=9&p\\_dir=&p\\_rloc=&p\\_tloc=&p\\_ploc=&pg=1&p\\_tac=&ti=19&pt=1&ch=5&rl=5](http://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=19&pt=1&ch=5&rl=5)

## A. Out-of-State Students

261. In each recent year, UNC has matriculated fewer than 1,000 out-of-state students. I assume that UNC would enroll about the same number of out-of-state students if it implemented a race-blind alternative.

262. When applied to out-of-state students, race-blind alternative admissions plans along the lines of the Top X percent and geography-based plans suggested by the Complaint would force UNC to make arbitrary decisions as to how to implement these plans to admit out-of-state students, undermining the perceived integrity of the university's admissions process. There is also little reason to think that they would attain the combination of academic preparedness and racial and ethnic diversity akin to what the university attains now.

263. These points are perhaps most easily seen with a Top X percent plan. Suppose UNC attempted to apply such a plan to out-of-state high schools. Under such a plan, UNC would need to set the cutoff for eligibility to include only the very highest ranked students (perhaps the top 1 percent). Unless the eligible students matriculated at an extremely low rate, UNC may also be forced to use some arbitrary device to deny eligibility to some of them. Thus, UNC would have an admissions scheme that was obviously arbitrary. Such a scheme would likely undermine the public's belief in the integrity of the university.

264. Now consider a geography-based plan like that proposed by Allen (2014). There are approximately 7,100,000 ZIP+4 codes<sup>144</sup> and 71,000 Census Tracts<sup>145</sup> in U.S. states other than North Carolina. Most of these ZIP+4 codes and Census Tracts have never contained a student who was admitted to UNC so their historical admissions rate is 0. Therefore, the historical admissions rate would be nearly useless for prioritizing these geographic areas, as proposed by Allen and her co-authors. If, for instance, UNC were to set the minimum threshold for admission at the 20<sup>th</sup> percentile of UNC's current admits, all the out-of-state seats would be much more than filled by taking students from only the ZIP+4 codes with *no* history of admission to UNC. UNC would have to use some arbitrary device (with low odds) to allocate

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<sup>144</sup> The number of ZIP+4 codes changes from year to year. This is an approximation based on 2015, including only the ZIP+4 codes that have residents.

<sup>145</sup> "Geography: 2010 Census, Tallies of Census Tracts, Block Groups & Blocks," United States Census Bureau, available at <https://www.census.gov/geo/maps-data/data/tallies/tractblock.html>.

seats among such students. If it were even implementable, such a seemingly arbitrary scheme would likely undermine the perceived integrity of the university.

265. Suppose UNC attempted to implement an out-of-state admissions scheme based on a socioeconomic index such as those analyzed above in Section V. Recall that as the threshold for categorizing a student as disadvantaged is set higher, the percentage of URM students among the disadvantaged fall. For instance, if UNC were to classify students as disadvantaged only if they were in the bottom 5 percent on socioeconomics, then UNC would find that its disadvantaged matriculants contained more URMs than if it used a bottom 10 percent or 20 percent or 30 percent cut. (In fact, this is what my analysis of socioeconomic status-based plans found.) Thus, if UNC were to attempt to use a socioeconomic index to attain racial and ethnic diversity as well as academic preparedness, the university would need to give preference to students who were highly socioeconomically disadvantaged, not merely slightly disadvantaged. But, out-of-state students who were highly socioeconomically disadvantaged would be unable to pay anything like the current UNC out-of-state tuition. It is doubtful whether they could pay more than a fraction of in-state tuition, even. Thus, UNC might easily find that *no* out-of-state disadvantaged admits matriculated if it kept its out-of-state tuition and its out-of-state financial aid budget. Or, UNC would find itself needing to raise in-state tuition substantially in order to generously aid highly disadvantaged out-of-state admits so that they could attend. Since higher in-state tuition would disproportionately deter low- and middle-income North Carolinians from attending UNC, any gains from enrolling more disadvantaged out-of-state students would be offset by enrolling fewer disadvantaged in-state students.

#### **B. Private School and Home-Schooled Students in North Carolina**

266. My analysis throughout this report focuses primarily on public school students in North Carolina. These students comprise the majority of the North Carolina resident applicants to UNC and they make up the majority of the North Carolina residents in the UNC enrolling class. In this section, I briefly describe why my primary analyses do not include private school and home-schooled students and problems that would arise in implementing race-blind plans for these sets of students.

267. First, there are not sufficient data available for me to analyze hypothetical admitted applicants from private and home schools under potential race-blind alternative plans. There is

no analog to the NCERDC data for private school and home-schooled students and therefore I could not analyze the characteristics of the students who would be admitted or matriculate under hypothetical race-blind plans.

268. Second, the diversity in the sizes and compositions of private schools, as well as the idiosyncrasies of the circumstances for home-schooled students, would not make it practicable to implement some of the race-blind plans I analyzed. For example, in a small private school with only ten students in a graduating class, admitting the “top 5 percent” of the class would not be feasible, because the top 5 percent is the top 1/20<sup>th</sup> of the class. Relatedly, private schools and home schools do not calculate GPA in a consistent way, meaning that any class rank measure for these schools would be subject to the idiosyncrasies of the ways that these schools choose to calculate GPA. UNC would likely not be able to impose a standardized method of calculating GPA and class rank on all private schools and home-schooled students.

## **IX. The Magnitude of the Effect of Race-Blind Alternatives Would Likely Impact UNC**

### **A. What Is Required of a World-Class Research University**

269. So far, I have found evidence that leads me to conclude that, using a race-blind admissions plan, UNC could not attain both its current level of racial diversity and its current level of academic preparedness. That is, losses are consistently predicted for UNC under race-blind admissions. This conclusion holds for alternative plans based on socioeconomic indices, class rank (Top X percent plans), and geography. In this section, I address the question of whether the losses would impact UNC’s ability to fulfil its mission to be a world-class research university for the people of North Carolina.

270. A state like North Carolina that is able to support multiple public colleges and universities often aspires to have one (or more) that is a world-class research university. Such universities support their state's economy and society by training future leaders, innovators, and highly skilled professionals. They also support their state’s economy by conducting research that has benefits for industry, policy-making, and society more generally.

271. To attain world-class research status, a university must offer students a world-class undergraduate education, meaning that its graduates must be qualified for highly skilled jobs and

for the top graduate and professional programs that are often an intermediate step toward them. Students differ in the degree to which they can make full use of the opportunity to attain a world-class education, which is a demanding experience. It can be hard to deliver such an education or engage in it if the average student lacks the preparation or aptitude to meet the demands. It can also be hard to produce such an education if the student body's range of skills and experiences is too narrow to provide a challenging environment in which students must confront others whose skills and experiences differ from their own. Indeed, because highly skilled jobs require complex thinking and a wide array of competencies, it is important that a university's student body has abilities, talents, and preparation that are sufficiently multi-faceted to test students mentally, socially, and with unfamiliar views and material.

272. A world-class research university must have faculty who are able to deliver a world-class education and conduct cutting-edge research that is valued by industry, policy-makers, and society. Faculty are far from indifferent about the ability, talents, and preparation of the student body.

273. A world-class research university must have funding that supports its research endeavors as well as undergraduate and graduate training. Such funding comes from sources such as federal agencies (the National Institutes of Health, the National Science Foundation, etc.), philanthropists (The Gates Foundation, etc.), alumni donors, tuition revenue, and a variety of other sources.

#### **B. Universities Must Compete for Students, Faculty, and Funding**

274. No research university, however, operates in a vacuum. A research university that aspires to be first-rate must compete for students who have the preparation and aptitude that enables them to make full use of a world-class education. It must compete for faculty who are able to deliver such an education and conduct cutting-edge research. It must contend for funding from federal and philanthropic sources. Such funding is awarded in peer-reviewed competitions with the result that a weaker faculty means lower funding.

275. Since the end of World War II, the market for universities in the U.S. has grown steadily more competitive with each passing year. This is because students, faculty, and philanthropists have become less sensitive to their initial location when choosing among universities. Decades ago, even the most talented students in the U.S. often attended the college that was closest,

regardless of its student body, faculty, resources, and other measures of quality. Today, the most talented students in the U.S. carefully consider their options. They pay less and less attention to distance from their homes or whether a university is within their state of residence. Instead, they compare schools' student bodies, faculty, research opportunities, and other resources.<sup>146</sup>

Similarly, decades ago, the most able faculty often taught at a college or university that was nearby or that had trained them. Today, highly productive faculty are hired on a national market and universities compete intensely for them. Also, decades ago, philanthropists often funded research programs or infrastructure at the college they attended, regardless of whether it had the highest productivity researchers in the relevant area. Today, a philanthropist who wants to, say, fund genetic research is much more sensitive to whether a school already has demonstrated high productivity in that area.

276. The evidence shows that students, when choosing among the schools to which they have gained admission, are most likely to choose the school whose average student has the highest test scores and other academic qualifications.<sup>147</sup> Their choices are also sensitive to the diversity of the student body. For instance, they pay attention to whether a university has attracted talented students from all states and from foreign countries. High-achieving students are *especially* sensitive, when making choices, to their prospective.

277. Similarly, the evidence shows that leading faculty, when choosing among jobs, tend to choose the most selective university from which they have a job offer.<sup>148</sup> Their choices are also sensitive to the diversity of the student body. For instance, they pay attention to whether a university has attracted highly able students from all backgrounds.

278. As competition among universities has risen since World War II, there have been universities that that have competed successfully. They have grown more selective, produced a greater share of leaders (in private industry, government, and the non-profit sector), employed

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<sup>146</sup> See Hoxby, Caroline, "The Changing Selectivity of American Colleges," *Journal of Economic Perspective* 23, no. 4, (Fall 2009): 95–118. See also Hoxby, Caroline, "The Dramatic Economics of the U.S. Market for Higher Education," *The 2016 Martin S. Feldstein Lecture*, July 27, 2016, available at [http://www.nber.org/feldstein\\_lecture\\_2016/feldsteinlecture\\_2016.html](http://www.nber.org/feldstein_lecture_2016/feldsteinlecture_2016.html). A shorter text-based version is in *The NBER Reporter*, 2016:3 available at <http://www.nber.org/reporter/2016number3/#report>.

<sup>147</sup> See Avery, Christopher, and Caroline Hoxby, "Do and Should Financial Aid Packages Affect Students' College Choices?" in *College Choices: The Economics of Where to Go, When to Go, and How to Pay for It*, ed. Caroline M. Hoxby, Chicago: University of Chicago Press, 2004. See also the publications listed in the previous footnote.

<sup>148</sup> See Courant, Paul, and Sarah Turner, "Faculty Deployment in Research Universities", in *Productivity in Higher Education* (2017), Caroline M. Hoxby and Kevin Stange, editors, available at: <http://papers.nber.org/books/hoxb-2>.

faculty with greater research productivity, enjoyed additional funding, and attracted increasing donations from alumni and philanthropists. But, there are also institutions that have been losers as competition has intensified. They have lost their most able students, their most able faculty, and the resources that support world-class education and research.<sup>149</sup> Notably, I am not aware of any university that was highly selective in the past and that has become substantially less selective (as measured by the average student's academic preparation) that has not suffered a spiral of negative consequences. In other words, it is not merely the initial change in student preparedness that matters. It is all the follow-on reactions of other students, faculty, research funders, alumni donors and philanthropists. These reactions amplify the initial change and cause it to spiral out. Thus, no university that aspires to world-class status can alter its admissions scheme and expect no change in who enrolls, who comes to teach and research, who donates, and so on.

**X. Changing UNC's Recruiting Efforts Could Not Realistically Substitute for Considering Race in Admissions**

279. Plaintiff claims that UNC could, by improving its recruiting of able students who do not currently apply or matriculate (if they apply), offset any losses of racial and ethnic diversity caused by moving to a race- and ethnicity-blind admissions scheme. Plaintiff cites my research, Hoxby and Avery (2013) as support for this claim.<sup>150</sup> In fact, my research contradicts their claim and indicates their assertions about recruiting are incorrect.

280. What my research demonstrates is the following. There are numerous highly academically qualified, low-income students who do not now apply to UNC or to any other selective university. By highly academically qualified, I mean students who score at or above the 90<sup>th</sup> percentile on the SAT or ACT. (The 90<sup>th</sup> percentile is a combined SAT score of 1310.<sup>151</sup> Thus, these students would likely be given considerable attention in the admissions process if they were to apply to UNC.) The low-income, high-achieving students who do *not* apply to

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<sup>149</sup> For details, see Hoxby, Caroline, "The Changing Selectivity of American Colleges," *Journal of Economic Perspectives* 23, no. 4 (2009): 95–118.

<sup>150</sup> Hoxby, Caroline, and Christopher Avery, "The Missing "One-Offs": The Hidden Supply of High-Achieving, Low Income Students," *Brookings Papers on Economic Activity* 1, (2013):1–65.

<sup>151</sup> "SAT® Percentile Ranks for Males, Females, and Total Group" by College Board.

selective universities like UNC fit a certain profile. They are typically students who attend a high school or live in an area where they are one of the only students who are highly academically qualified. In the words of my research, they are “one-offs.” For instance, if a low-income North Carolina student attends a high school where she is the only person who has been well-qualified to attend UNC in the past few years, she is unlikely to apply to UNC or other selective universities. My other research (Hoxby and Turner 2015) indicates that her lack of information about selective universities explains, to an important extent, why she fails to apply.<sup>152</sup> For instance, applicants like her tend to be poorly informed about selective universities’ richer educational resources and more generous financial aid. My research also demonstrates that if she is provided with information customized to her individual circumstances, she is significantly more likely to apply to a selective university.<sup>153</sup> Thus, it is plausible that, if UNC were to engage in recruiting and information campaigns targeted to students who are one-offs, the university might affect the probability that such students apply.<sup>154</sup>

281. My research also demonstrates that low-income, highly-qualified students who are not “one-offs” or nearly “one-offs” are *already* fairly well-informed about selective universities, *already* apply, and *already* receive generous offers of admission and financial aid. For instance, if a low-income, highly-qualified North Carolina student attends a selective magnet school or attends an early college or other accelerated program, he or she is *already* likely to apply to UNC or other selective universities. More generally, a low-income high achiever is likely to apply to selective universities if his or her high school ordinarily graduates numerous students each year who are well qualified for universities with admissions standards like UNC. Moreover, having applied to selective universities, students like this are likely to matriculate at one of them. My research demonstrates that targeted information campaigns have little effect on such students

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<sup>152</sup> Hoxby, Caroline, and Sarah Turner, “What high-achieving low-income students know about college,” *American Economic Review: Papers & Proceedings* 105, no.5 (2015): 514–517.

<sup>153</sup> This statement is based on a massive, randomized controlled trial conducted by Sarah Turner and myself. Because it is based on a randomized controlled trial, we are confident that the statement made in the sentence represents a true causal effect. Hoxby and Turner (2015). *Ibid.*

<sup>154</sup> It is worth noting that, once a low-income high-achieving student has applied to a selective university, she tends to be admitted and matriculate at rates that are similar to those of high-income, high-achieving students. This statement is as true of “one-offs” as it is of low-income high achievers who are not “one-offs.” See Hoxby and Avery (2013). This means that if UNC were to engage in enhanced, targeted recruiting of “one-off” type students, the gains would mainly come from increasing the probability that “one-off” type students apply.



because they are already applying to and already matriculating (if admitted) at very selective universities like UNC.<sup>155</sup>

282. Thus, for the purposes of this report, in which I am asked to evaluate the effects that recruiting could have on UNC's racial/ethnic diversity and academic preparedness, the key question is: What share of North Carolina "one-offs" are URMs? It is the one-offs whose matriculation at UNC is likely to be affected by enhanced, targeted recruiting of low income students.

283. To be clear, there are reasons that have nothing to do with racial and ethnic diversity why a university might wish to pay attention to "one-offs." For instance, in order to fulfil its mission, a flagship university might wish to ensure that all qualified students in the state are equally well informed about the opportunities that the university offers. Or, a flagship university might believe that a "one-off" student who matriculates serves as a conduit of information about the university—an ambassador of sorts—to future students from the high school he or she attended. For the purpose of this report, however, what matters is not whether a university should pay attention to "one-offs" for the sake of their contributions to the school. What matters is whether attention to "one-offs" could *substitute* for race-conscious admissions

284. To answer this question, I have examined four years of data on North Carolina public school students from the NCERDC to identify the students who might reasonably be described as "one-offs." I set a standard for "one-offs" that is generous, given my research. Specifically, I identified a student as a "one-off" if he or she was himself or herself high-achieving and his or her high school produced, on average, no more than 3 high-achieving students per graduating class. The standard that I used to define "high-achieving" is a combined SAT (translated ACT) score of 1300, the same standard that I used in Hoxby and Avery (2013).<sup>156</sup>

285. Using data from four graduating classes (2011-12 through 2014-15) in North Carolina's public schools, I find that 7 percent of the students whom I classify as "one-offs" are African American. I find that 5 percent are Hispanic and 2 percent are Native American. The vast majority—86 percent—of the students classified as "one-offs" are non-URMs.<sup>157</sup>

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<sup>155</sup> This statement is based on a massive, randomized controlled trial. Thus, it is possible to make this statement with confidence that it represents a true, causal (lack of) effect. Hoxby and Turner (2015). *Ibid.*

<sup>156</sup> Hoxby and Avery (2013). *Ibid.*

<sup>157</sup> In calculating these numbers, I classify 85% of multi-racial students as URMs. This estimate is based on 2010 Census data.

286. Thus, an increase in UNC’s recruiting and information campaigns directed toward low-income students who are “one-offs” could not reasonably be expected to substitute for race-conscious admissions. The essential problem is that being a “one-off” is not a good proxy for being a URM. Thus, as a substitute for racial consciousness, this proxy would not work. The vast majority of “one-offs” are not URM students.

287. I conclude that targeted recruiting along the lines suggested by Hoxby and Avery (2013) would not, as claimed by Plaintiff, plausibly allow UNC to maintain its racial and ethnic diversity despite using a race-blind admissions process.<sup>158</sup>

288. I reserve the right to amend or supplement my report and opinions in light of any additional information produced in the discovery process.

Dated: January 12, 2018

A handwritten signature in black ink, appearing to read "Caroline M. Hoxby", written over a horizontal line.

Caroline M. Hoxby

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<sup>158</sup> Hoxby and Avery (2013). *Ibid.*

# **Exhibits**

# EXHIBIT 1 TABLE 1

## Analyzing UNC's Admissions Process: Race/Ethnicity as Additive Factors [1] All UNC Applicants, 2013-14 to 2016-17

Row	Description of Specification [2]	(A) R <sup>2</sup>	(B) Share of R <sup>2</sup> due to combined test scores	(C) Share of R <sup>2</sup> due to race/ethnicity	(D) Share of R <sup>2</sup> due to variables other than race/ethnicity and combined test scores	(E)= (B) x (A) Share of admission decision due to combined test scores	(F)= (C) x (A) Share of admission decision due to race/ethnicity
(1)	SAT Combined, ACT Comp [3] [4]	0.121	93.2%	6.8%	-	11.3%	0.8%
(2)	(1) + SAT Subscores, ACT Subscores [3] [4] [5]	0.127	44.9%	7.0%	48.2%	5.7%	0.9%
(3)	(1) + Class Rank, GPA	0.254	33.0%	3.5%	63.5%	8.4%	0.9%
(4)	(3) + Sex	0.254	32.8%	3.5%	63.7%	8.3%	0.9%
(5)	(4) + NC Resident	0.364	29.3%	2.8%	67.9%	10.6%	1.0%
(6)	(5) + Min Coursework, HS Sport, Faculty / Staff Child	0.398	28.3%	2.8%	69.0%	11.3%	1.1%
(7)	(6) + Alum Parent, Early Action	0.406	27.5%	3.0%	69.6%	11.2%	1.2%
(8)	(7) + Parents' Education, Foreign Citizenship, Fee Waiver	0.409	26.9%	2.8%	70.2%	11.0%	1.2%
(9)	(8) + Within-School GPA Rank (SGR)	0.428	23.0%	2.8%	74.2%	9.8%	1.2%

Source: College Board; Connect Carolina; UNC Admissions Website

Note:

[1] This analysis uses Connect Carolina's pooled 2013-14 to 2016-17 data.

[2] Each specification includes race/ethnicity indicator variables.

[3] When a student has multiple SAT or ACT scores, the maximum subscores are utilized, both individually and in constructing the SAT combined score and the ACT comprehensive score.

[4] A new SAT test was introduced in 2016 and accepted during UNC's 2016-17 admissions cycle. UNC continues to accept the old SAT and the ACT. In the analysis here, new SAT scores are converted to old SAT scales. The new SAT math score is converted to the old SAT math scale using the 2008 College Board Concordance Conversion table. However, the new SAT verbal score can only be converted into the combined score of the old SAT reading and writing sections. An algorithm is used to determine the students' old SAT reading and writing subscores.

a) If the student only took the new SAT, the converted reading and writing scores are half the converted combined reading and writing score.

b) If the student took both the new SAT and the old SAT, then if the new converted SAT verbal score is less than the combined old reading and writing scores, the old scores are utilized. Otherwise, the difference between the new converted SAT verbal score and the combined old reading and writing scores (X) is added to the old reading score and the old writing score equally (X/2), unless this pushes an individual score over 800. In this case, this score is capped at 800 and the remaining amount of X is added to the other score. These adjusted old scores are then utilized.

[5] Both the SAT and ACT writing score are set to missing in 2016-17. In this admissions cycle, UNC stopped considering the writing section in the admissions process.

# EXHIBIT 1 TABLE 2

## Analyzing UNC's Admissions Process: URM Status as a Multiplicative Factor [1][2] All UNC Applicants, 2013-14 to 2016-17

Row	Description of Specification [2]	(A) R <sup>2</sup>	(B) Share of R <sup>2</sup> due to variables other than race/ ethnicity	(C) Share of R <sup>2</sup> due to race/ ethnicity	(D)= (C) x (A) Share of admission decision due to race/ethnicity
(1)	SAT Combined, ACT Comp [3] [4]	0.118	91.4%	8.6%	1.0%
(2)	(1) + SAT Subscores, ACT Subscores [3] [4] [5]	0.125	88.4%	11.6%	1.5%
(3)	(1) + Class Rank, GPA	0.253	87.6%	12.4%	3.1%
(4)	(3) + Sex	0.253	87.6%	12.4%	3.1%
(5)	(4) + NC Resident	0.371	88.8%	11.2%	4.2%
(6)	(5) + Min Coursework, HS Sport, Faculty / Staff Child	0.406	88.5%	11.5%	4.7%
(7)	(6) + Alum Parent, Early Action	0.413	88.4%	11.6%	4.8%
(8)	(7) + Parents' Education, Foreign Citizenship, Fee Waiver	0.417	87.3%	12.7%	5.3%
(9)	(8) + Within-School GPA Rank (SGR)	0.437	87.2%	12.8%	5.6%

Source: College Board; Connect Carolina; UNC Admissions Website

Note:

[1] This analysis uses Connect Carolina's pooled 2013-14 to 2016-17 data.

[2] Under-represented minorities ("URM") include African American, Hispanic, and Native American students. Each specification includes URM status as a multiplicative factor. Thus, every other factor can be weighted differently for URMs.

[3] When a student has multiple SAT or ACT scores, the maximum subscores are utilized, both individually and in constructing the SAT combined score and the ACT comprehensive score.

[4] A new SAT test was introduced in 2016 and accepted during UNC's 2016-17 admissions cycle. UNC continues to accept the old SAT and the ACT. In the analysis here, new SAT scores are converted to old SAT scales. The new SAT math score is converted to the old SAT math scale using the 2008 College Board Concordance Conversion table. However, the new SAT verbal score can only be converted into the combined score of the old SAT reading and writing sections. An algorithm is used to determine the students' old SAT reading and writing subscores.

a) If the student only took the new SAT, the converted reading and writing scores are half the converted combined reading and writing score.

b) If the student took both the new SAT and the old SAT, then if the new converted SAT verbal score is less than the combined old reading and writing scores, the old scores are utilized. Otherwise, the difference between the new converted SAT verbal score and the combined old reading and writing scores (X) is added to the old reading score and the old writing score equally (X/2), unless this pushes an individual score over 800. In this case, this score is capped at 800 and the remaining amount of X is added to the other score. These adjusted old scores are then utilized.

[5] Both the SAT and ACT writing score are set to missing in 2016-17. In this admissions cycle, UNC stopped considering the writing section in the admissions process.

# EXHIBIT 2 TABLE 1

## Provisional UNC Admitted Applicants Before and After Regular Decision SGR for All Applicants [1]

Race/Ethnicity [2]	2013-14		2014-15		2015-16	
	Before	After	Before	After	Before	After
African American	10.1%	10.1%	9.3%	9.0%	10.1%	10.0%
Asian	19.2%	19.4%	20.5%	20.7%	20.4%	20.9%
Hispanic	9.3%	8.3%	8.5%	8.5%	9.4%	9.2%
Native American	1.7%	1.7%	1.6%	1.6%	1.5%	1.5%
Pacific Islander	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%
White	59.7%	60.5%	60.0%	60.1%	58.5%	58.5%
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Source: Connect Carolina; UNC School Group Review Data

Note:

[1] Regular decision School Group Review ("SGR") in 2013-14 occurred during 3/3/14–3/24/14; regular decision SGR in 2014-15 occurred during 2/23/15–3/17/15; regular decision SGR in 2015-16 occurred during 3/1/16–3/21/16.

[2] Students with missing race/ethnicity are excluded.

## EXHIBIT 2 TABLE 2

### URM Percentage of UNC Admitted Applicants Before and After Regular Decision SGR for All Applicants [1][2]

Admission Cycle	URM Percentage of All Admitted Applicants		
	Before	After	Change
2013-14	21.1%	20.1%	-1.0%
2014-15	19.4%	19.1%	-0.3%
2015-16	21.0%	20.6%	-0.4%

Source: Connect Carolina; UNC School Group Review Data

Note:

[1] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

[2] Regular decision School Group Review ("SGR") in 2013-14 occurred during 3/3/14–3/24/14; regular decision SGR in 2014-15 occurred during 2/23/15–3/17/15; regular decision SGR in 2015-16 occurred during 3/1/16–3/21/16.

## EXHIBIT 2 TABLE 3

### Provisional UNC Admitted Applicants Before and After Regular Decision SGR for North Carolina Applicants [1]

Race/Ethnicity [2]	2013-14		2014-15		2015-16	
	Before	After	Before	After	Before	After
African American	9.5%	10.1%	9.5%	9.2%	9.8%	10.2%
Asian	13.2%	13.2%	13.1%	13.4%	13.8%	13.8%
Hispanic	6.0%	6.2%	5.8%	5.8%	5.9%	6.0%
Native American	1.4%	1.5%	1.9%	1.9%	1.7%	1.7%
Pacific Islander	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%
White	69.8%	68.9%	69.6%	69.5%	68.8%	68.3%
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Source: Connect Carolina; UNC School Group Review Data

Note:

[1] Regular decision School Group Review ("SGR") in 2013-14 occurred during 3/3/14–3/24/14; regular decision SGR in 2014-15 occurred during 2/23/15–3/17/15; regular decision SGR in 2015-16 occurred during 3/1/16–3/21/16.

[2] Students with missing race/ethnicity are excluded.



## EXHIBIT 2 TABLE 4

### Provisional UNC Admitted Applicants Before and After Early Action SGR for All Applicants [1]

Race/Ethnicity [2]	2013-14		2014-15		2015-16	
	Before	After	Before	After	Before	After
African American	8.9%	9.3%	8.0%	8.0%	8.5%	9.2%
Asian	15.8%	16.9%	16.0%	16.9%	16.5%	16.9%
Hispanic	8.8%	8.5%	7.6%	7.8%	8.7%	8.9%
Native American	1.4%	1.5%	1.6%	1.6%	1.5%	1.4%
Pacific Islander	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%
White	65.0%	63.7%	66.7%	65.6%	64.8%	63.7%
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Source: Connect Carolina; UNC School Group Review Data

Note:

[1] Early action School Group Review ("SGR") in 2013-14 occurred during 1/14/14–1/24/14; early action SGR in 2014-15 occurred during 12/15/14–1/20/15; early action SGR in 2015-16 occurred during 1/1/16–1/25/16.

[2] Students with missing race/ethnicity are excluded.

## EXHIBIT 2 TABLE 5

### Provisional UNC Admitted Applicants Before and After Early Action SGR for North Carolina Applicants [1]

Race/Ethnicity [2]	2013-14		2014-15		2015-16	
	Before	After	Before	After	Before	After
African American	8.5%	9.0%	8.4%	8.5%	8.0%	9.1%
Asian	12.9%	12.9%	12.6%	12.9%	13.1%	13.7%
Hispanic	5.8%	5.7%	5.3%	5.4%	4.9%	5.6%
Native American	1.2%	1.3%	1.8%	1.7%	1.4%	1.7%
Pacific Islander	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%
White	71.5%	71.0%	71.7%	71.3%	72.6%	69.8%
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

Source: Connect Carolina; UNC School Group Review Data

Note:

[1] Early action School Group Review ("SGR") in 2013-14 occurred during 1/14/14–1/24/14; early action SGR in 2014-15 occurred during 12/15/14–1/20/15; early action SGR in 2015-16 occurred during 1/1/16–1/25/16.

[2] Students with missing race/ethnicity are excluded.

# EXHIBIT 3 TABLE 1

## Race/Ethnicity of All North Carolina Public High School Students with High GPA [1] 2011-12 to 2014-15

Race/Ethnicity [2]	Percent of Prepared Students				Percentage Range
	2011-12	2012-13	2013-14	2014-15	
African American	6%	7%	7%	7%	1%
Asian	9%	8%	9%	9%	1%
Hispanic	4%	5%	5%	5%	1%
Native American	1%	1%	1%	1%	0%
Pacific Islander	0%	0%	0%	0%	0%
White	80%	80%	78%	78%	2%

Race/Ethnicity [2]	Number of Prepared Students			
	2011-12	2012-13	2013-14	2014-15
African American	416	496	519	479
Asian	591	573	662	582
Hispanic	274	349	393	335
Native American	36	57	46	40
Pacific Islander	6	8	12	12
White	5,289	5,853	5,733	5,280

Source: 2010 Census; College Board; Connect Carolina; NCERDC

Note:

[1] Students with weighted GPA of 4.5 or above are considered students with high GPA. The top 20th percentile of GPA for UNC admitted students in 2013-14 and 2014-15 was approximately 4.5.

[2] Only students with non-missing observations for GPA, test score, and class ranking were included. Students identified only as multi-racial in NCERDC are given a weighted probability of ethnicity based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.

## EXHIBIT 3 TABLE 2

### Race/Ethnicity of All North Carolina Public High School Students with High Class Ranking [1] 2011-12 to 2014-15

Race/Ethnicity [2]	Percent of Prepared Students				Percentage Range
	2011-12	2012-13	2013-14	2014-15	
African American	13%	13%	13%	13%	0%
Asian	6%	6%	7%	7%	1%
Hispanic	5%	6%	7%	7%	2%
Native American	1%	1%	1%	1%	0%
Pacific Islander	0%	0%	0%	0%	0%
White	74%	73%	72%	73%	2%

Race/Ethnicity [2]	Number of Prepared Students			
	2011-12	2012-13	2013-14	2014-15
African American	1,222	1,281	1,106	922
Asian	603	562	576	495
Hispanic	509	599	597	483
Native American	112	143	118	55
Pacific Islander	13	9	11	14
White	6,925	7,109	6,255	5,253

Source: 2010 Census; College Board; Connect Carolina; NCERDC

Note:

[1] Students with weighted class rank in the 89.2nd percentile or above are considered students with high class ranking. The top 20th percentile of weighted class ranking for UNC admitted students in 2013-14 and 2014-15 was approximately the 89.2nd percentile.

[2] Only students with non-missing observations for GPA, test score, and class ranking were included. Students identified only as multi-racial in NCERDC are given a weighted probability of ethnicity based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.

# EXHIBIT 3 TABLE 3

## Race/Ethnicity of All North Carolina Public High School Students with High Adjusted Test Scores [1] 2011-12 to 2014-15

Race/Ethnicity [2]	Percent of Prepared Students				Percentage Range
	2011-12	2012-13	2013-14	2014-15	
African American	5%	6%	5%	6%	1%
Asian	8%	7%	8%	8%	1%
Hispanic	3%	4%	4%	5%	2%
Native American	1%	1%	1%	1%	0%
Pacific Islander	0%	0%	0%	0%	0%
White	83%	83%	81%	80%	3%

Race/Ethnicity [2]	Number of Prepared Students			
	2011-12	2012-13	2013-14	2014-15
African American	352	501	467	508
Asian	583	599	738	655
Hispanic	254	377	366	388
Native American	40	62	54	62
Pacific Islander	6	11	12	14
White	6,156	7,482	7,173	6,596

Source: 2010 Census; College Board; Connect Carolina; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC

Note:

[1] ACT test scores are used. ACT test scores were available beginning 2012-13. For 2011-12, SAT test scores were converted into ACT test scores (using the 2009 College Board Concordance Table). For other years, converted SAT scores replaced students' ACT scores if higher. For students who took the ACT and/or took the SAT multiple times, ACT scores are the maximum of students' highest combined ACT section scores and the corresponding ACT value for students' highest combined SAT section scores. For students who took only the ACT once but not the SAT, ACT scores are adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016). Students with ACT equivalent test scores of 27 or above are considered students with high scores. The top 20th percentile of ACT equivalent test scores for UNC admitted students in 2013-14 and 2014-15 was approximately 27.

[2] Only students with non-missing observations for GPA, test score, and class ranking were included. Students identified only as multi-racial in NCERDC are given a weighted probability of ethnicity based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.

# EXHIBIT 3 TABLE 4

## Race/Ethnicity of North Carolina Resident UNC Applicants 2011-12 to 2014-15

Race/Ethnicity [1]	Percent of NC Applicants				Percentage Range
	2011-12	2012-13	2013-14	2014-15	
African American	14%	15%	14%	14%	1%
Asian	11%	11%	12%	12%	1%
Hispanic	6%	6%	6%	6%	0%
Native American	2%	2%	1%	2%	1%
Pacific Islander	0%	0%	0%	0%	0%
White	67%	66%	66%	66%	1%

Race/Ethnicity [1]	Number of NC Applicants			
	2011-12	2012-13	2013-14	2014-15
African American	1,411	1,448	1,364	1,383
Asian	1,077	1,029	1,160	1,200
Hispanic	573	576	612	641
Native American	152	153	126	157
Pacific Islander	11	10	8	12
White	6,678	6,291	6,322	6,562

Source: Connect Carolina

Note:

[1] Students are considered NC residents when residency field is "RES." Students who did not self-identify or had missing observations for race/ethnicity were excluded.

# EXHIBIT 3 TABLE 5

## Race/Ethnicity of All UNC Applicants 2011-12 to 2014-15

Race/Ethnicity [1]	Percent of Applicants				Percentage Range
	2011-12	2012-13	2013-14	2014-15	
African American	11%	12%	11%	11%	1%
Asian	19%	19%	21%	22%	3%
Hispanic	7%	8%	8%	8%	1%
Native American	1%	1%	1%	1%	0%
Pacific Islander	0%	0%	0%	0%	0%
White	62%	60%	59%	58%	4%

Race/Ethnicity [1]	Number of Applicants			
	2011-12	2012-13	2013-14	2014-15
African American	3,254	3,393	3,274	3,245
Asian	5,350	5,477	6,425	6,651
Hispanic	2,001	2,283	2,405	2,414
Native American	354	352	315	293
Pacific Islander	30	30	40	38
White	17,815	17,153	17,799	17,579

Source: Connect Carolina

Note:

[1] Students who did not self-identify or had missing observations for race/ethnicity were excluded.

# EXHIBIT 3 TABLE 6

## Race/Ethnicity of North Carolina Resident UNC Admitted Applicants 2011-12 to 2014-15

Race/Ethnicity [1]	Percent of NC Admitted Students				Percentage Range
	2011-12	2012-13	2013-14	2014-15	
African American	9%	9%	10%	9%	1%
Asian	13%	13%	13%	13%	0%
Hispanic	5%	6%	6%	6%	1%
Native American	2%	2%	1%	2%	1%
Pacific Islander	0%	0%	0%	0%	0%
White	71%	70%	70%	70%	1%

Race/Ethnicity [1]	Number of NC Admitted Students			
	2011-12	2012-13	2013-14	2014-15
African American	455	452	484	457
Asian	651	611	655	682
Hispanic	239	284	300	293
Native American	75	75	71	89
Pacific Islander	5	8	3	7
White	3,504	3,406	3,539	3,612

Source: Connect Carolina

Note:

[1] Students are considered NC residents when residency field is "RES." Students who did not self-identify or had missing observations for race/ethnicity were excluded.



# EXHIBIT 3 TABLE 7

## Race/Ethnicity of All UNC Admitted Applicants 2011-12 to 2014-15

Race/Ethnicity [1]	Percent of Admitted Students				Percentage Range
	2011-12	2012-13	2013-14	2014-15	
African American	10%	10%	10%	9%	1%
Asian	16%	17%	19%	20%	4%
Hispanic	8%	8%	8%	8%	0%
Native American	2%	2%	2%	2%	0%
Pacific Islander	0%	0%	0%	0%	0%
White	64%	63%	61%	60%	4%

Race/Ethnicity [1]	Number of Admitted Students			
	2011-12	2012-13	2013-14	2014-15
African American	799	768	880	839
Asian	1,253	1,325	1,651	1,802
Hispanic	591	625	710	758
Native American	147	125	144	142
Pacific Islander	8	12	5	8
White	4,871	4,833	5,217	5,412

Source: Connect Carolina

Note:

[1] Students who did not self-identify or had missing observations for race/ethnicity were excluded.

# EXHIBIT 3 TABLE 8

## Race/Ethnicity of North Carolina Resident UNC Matriculants 2011-12 to 2014-15

Race/Ethnicity [1]	Percent of NC Matriculants				Percentage Range
	2011-12	2012-13	2013-14	2014-15	
African American	9%	10%	10%	9%	1%
Asian	13%	13%	13%	14%	1%
Hispanic	5%	7%	7%	6%	2%
Native American	2%	2%	1%	2%	1%
Pacific Islander	0%	0%	0%	0%	0%
White	71%	69%	68%	69%	3%

Race/Ethnicity [1]	Number of NC Matriculants			
	2011-12	2012-13	2013-14	2014-15
African American	295	301	329	289
Asian	427	410	423	444
Hispanic	149	204	212	195
Native American	54	49	47	57
Pacific Islander	3	5	2	5
White	2,279	2,159	2,155	2,169

Source: Connect Carolina

Note:

[1] Students are considered NC residents when residency field is "RES." Students who did not self-identify or had missing observations for race/ethnicity were excluded.

# EXHIBIT 3 TABLE 9

## Race/Ethnicity of All UNC Matriculants 2011-12 to 2014-15

Race/Ethnicity [1]	Percent of Matriculants				Percentage Range
	2011-12	2012-13	2013-14	2014-15	
African American	10%	11%	11%	9%	2%
Asian	13%	13%	15%	16%	3%
Hispanic	6%	7%	8%	7%	2%
Native American	2%	2%	2%	2%	0%
Pacific Islander	0%	0%	0%	0%	0%
White	69%	67%	65%	66%	4%

Race/Ethnicity [1]	Number of Matriculants			
	2011-12	2012-13	2013-14	2014-15
African American	384	397	426	367
Asian	494	508	569	612
Hispanic	227	266	295	277
Native American	75	64	69	72
Pacific Islander	3	5	2	5
White	2,655	2,524	2,550	2,602

Source: Connect Carolina

Note:

[1] Students who did not self-identify or had missing observations for race/ethnicity were excluded.

# EXHIBIT 4

## Summary of Actual UNC Applicants, Admits, and Matriculants North Carolina Resident Public School Students, 2014-15 [1]

Race/Ethnicity	All Applicants			Admitted Students			Matriculants		
	Number of Students	Percent of Applicants	Avg. Test Score [2]	Number of Students	Percent of Admitted Students	Avg. Test Score [2]	Number of Students	Percent of Matriculants	Avg. Test Score [2]
African American	1,187	14.6%	1067	372	9.1%	1215	245	9.6%	1192
Asian	978	12.0%	1289	519	12.7%	1380	365	14.3%	1356
Hispanic	525	6.4%	1160	229	5.6%	1256	152	5.9%	1235
Native American	131	1.6%	1167	74	1.8%	1272	46	1.8%	1262
Pacific Islander	8	0.1%	1229	4	0.1%	1270	2	0.1%	1325
White	5,051	62.0%	1268	2,727	66.7%	1342	1,656	64.7%	1329
Missing	268	3.3%	1305	161	3.9%	1378	95	3.7%	1359
Total	8,148			4,086			2,561		
Total URM [3]	1,843	22.6%		675	16.5%		443	17.3%	

Source: College Board; Connect Carolina; North Carolina Public High School List

Note:

[1] The baseline actual students' statistics were calculated using North Carolina public school resident students with non-missing test scores.

[2] SAT combined (math plus reading) are utilized. ACT test scores were converted into SAT (using the 2009 College Board Concordance Table). The highest test score for each student was selected.

[3] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 5 TABLE 1

## Probability of Being a URM if on Free/Reduced-Price Lunch: by Level of Academic Preparation [1] North Carolina Public School Students, 2014-15

	Share of Free/Reduced-Price Lunch Students	
	URMs [2]	Non-URMs [2]
All Levels of Preparedness	59%	41%
SAT Score Above 1000 [3]	39%	61%
SAT Score Above 1100 [3]	32%	68%
SAT Score Above 1120 [3]	31%	69%
SAT Score Above 1220 [3]	26%	74%
SAT Score Above 1260 [3]	24%	76%

Source: 2010 Census; College Board; Connect Carolina; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC

Note:

[1] North Carolina public school students for the graduating class of 2014-15.

[2] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

[3] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not the SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016). The bottom 20th percentile SAT score for the URMs admitted to UNC from North Carolina in 2014-15 was 1120. The bottom 20th percentile SAT score for all students admitted to UNC from North Carolina in 2014-15 was 1220. The bottom 20th percentile SAT score for non-URMs admitted to UNC from North Carolina in 2014-15 was 1260.

## EXHIBIT 5 TABLE 2

### Percent of URMs and Other Students on Free/Reduced-Price Lunch: by Level of Academic Preparation [1] North Carolina Public School Students, 2014-15

	Percent of URM Students [2]		Percent of Non-URM Students [2]	
	Free/Reduced Lunch	Higher Income (no lunch)	Free/Reduced Lunch	Higher Income (no lunch)
All Levels of Preparedness	50%	50%	20%	80%
SAT Score Above 1000 [3]	38%	62%	12%	88%
SAT Score Above 1100 [3]	33%	67%	10%	90%
SAT Score Above 1120 [3]	32%	68%	9%	91%
SAT Score Above 1220 [3]	27%	73%	8%	92%
SAT Score Above 1260 [3]	27%	73%	7%	93%

Source: 2010 Census; College Board; Connect Carolina; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC

Note:

[1] North Carolina public school students for the graduating class of 2014-15.

[2] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

[3] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not the SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016). The bottom 20th percentile SAT score for the URMs admitted to UNC from North Carolina in 2014-15 was 1120. The bottom 20th percentile SAT score for all students admitted to UNC from North Carolina in 2014-15 was 1220. The bottom 20th percentile SAT score for non-URMs admitted to UNC from North Carolina in 2014-15 was 1260.

# EXHIBIT 6 TABLE 1

## Ability to Generate a Sufficient Statistic for URM Status with Socioeconomic and Demographic Proxies in ACS Data [1] 2010–2014

Row	Description of model	R <sup>2</sup>
1	Predict: URM All U.S. 18-19 year-olds Proxies (i) through (xiii)	12%
2	Predict: URM All U.S. 18-19 year-olds Proxies (i) through (xiii) plus state indicators	18%
3	Predict: URM All North Carolina 18-19 year-olds Proxies (i) through (xiii)	10%

Source: 2010-2014 American Community Survey 5-Year Estimates

Note:

[1] The rows show Probit models based on respondents who were age 18 or 19 in the 2010-2014 ACS 5-year estimates. The proxies are listed in the text at ¶ 150.

## EXHIBIT 6 TABLE 2

### Ability to Generate a Sufficient Statistic for Race/Ethnicity with Socioeconomic and Demographic Proxies in ACS Data [1] 2010–2014

Row	Description of model	R <sup>2</sup>
1	Predict: African American, Asian, Hispanic, Native American, Pacific Islander, white, other All U.S. 18-19 year-olds Proxies (i) through (xiii)	11%
2	Predict: African American, Asian, Hispanic, Native American, Pacific Islander, white, other All U.S. 18-19 year-olds Proxies (i) through (xiii) plus state indicators	21%
3	Predict: African American, Asian, Hispanic, Native American, Pacific Islander, white, other All North Carolina 18-19 year-olds Proxies (i) through (xiii)	10%

Source: 2010-2014 American Community Survey 5-Year Estimates

Note:

[1] The rows show Multinomial Logit models based on respondents who were age 18 or 19 in the 2010-2014 ACS 5-year estimates. The proxies are listed in the text at ¶ 150.



# EXHIBIT 7

## Ability to Generate a Sufficient Statistic for URM Status or Race/Ethnicity for North Carolina Public High School Students 2014-15

Row	Description of model [1] [2] [3]	R <sup>2</sup>
1	Predict: URM Population: All levels of preparation	17%
2	Predict: URM Population: SAT score above 1000	11%
3	Predict: URM Population: SAT score above 1100	9%
4	Predict: URM Population: SAT score above 1120	9%
5	Predict: URM Population: SAT score above 1220	8%
6	Predict: URM Population: SAT score above 1260	6%
7	Predict: African American, Asian, Hispanic, Native American, Pacific Islander, white, multi-racial Population: All levels of preparation	13%
8	Predict: African American, Asian, Hispanic, Native American, Pacific Islander, white, multi-racial Population: SAT score above 1000	9%
9	Predict: African American, Asian, Hispanic, Native American, Pacific Islander, white, multi-racial Population: SAT score above 1100	9%
10	Predict: African American, Asian, Hispanic, Native American, Pacific Islander, white, multi-racial Population: SAT score above 1120	9%
11	Predict: African American, Asian, Hispanic, Native American, Pacific Islander, white, multi-racial Population: SAT score above 1220	9%
12	Predict: African American, Asian, Hispanic, Native American, Pacific Islander, white, multi-racial Population: SAT score above 1260	9%

Source: 2010-2014 American Community Survey 5-Year Estimates; Connect Carolina; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC

Note:

[1] Models 1 through 6 utilize Probit, models 7 through 12 utilize Multinomial Logit. The proxies utilized are the same for all models and are described in the text at ¶ 155.

[2] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

[3] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not the SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

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# EXHIBIT 8 TABLE 1

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,000 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 15% on Index Predicted Admitted Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Admitted Students [1]			Predicted UNC NC Resident Public School Admitted Students from Disadvantaged Pool [3]			Students Needed from Non- Disadvantaged Pool to Match Actual		Feasibility [4]
	Number of Students	Percent of Admitted		Number of Students	Percent of Admitted		[A]	[B]	Feasible Trials out of 100
		Students	Avg. Test Score [2]		Students	Avg. Test Score [2]	Number of Students	Avg. Test Score	
African American	360	8.8%	1214	178	17.8%	1106	182	1320	0
Asian	519	12.7%	1380	32	3.2%	1134	487	1396	0
Hispanic	241	5.9%	1255	190	19.0%	1115	51	1778	0
Native American	74	1.8%	1272	20	2.0%	1143	54	1320	0
Pacific Islander	4	0.1%	1270	2	0.2%	1076	2	1464	0
White	2,727	66.7%	1342	576	57.7%	1145	2,151	1394	0
Missing	161	3.9%	1378	-	-	-	161	1378	-
Total	4,086	100.0%	1330	998	100.0%	1132	3,088	1395	0
Total URM [5]	675	16.5%	1235	388	38.9%	1112	287	1401	0
Total Non-URM [5]	3,411	83.5%	1349	610	61.1%	1145	2,801	1394	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

[1] The baseline actual UNC admitted students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.

[2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

[3] Summary statistics are calculated across all students identified for admission using application probabilities as weights. Application probabilities are 0.75 to account for the likelihood that not all identified students will apply to UNC.

[4] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school admits for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 998 seats are filled in the disadvantaged step, then 3,088 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.

[5] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE 2

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,000 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 15% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	138	18.2%	1098	97	1324	0
Asian	365	14.3%	1356	27	3.6%	1130	338	1374	0
Hispanic	162	6.3%	1234	150	19.8%	1111	12	2779	0
Native American	46	1.8%	1262	15	2.0%	1138	31	1322	0
Pacific Islander	2	0.1%	1325	2	0.3%	1075	0	N/A	0
White	1,656	64.7%	1329	426	56.2%	1139	1,230	1395	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	758	100.0%	1126	1,803	1393	0
Total URM [6]	443	17.3%	1214	303	40.0%	1106	140	1448	0
Total Non-URM [6]	2,118	82.7%	1335	455	60.0%	1138	1,663	1389	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 758 seats are filled in the disadvantaged step, then 1,803 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE 3

## Admissions Modeling Based on Two-or-Four-Year College-Related Socioeconomic Index 1,000 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 15% on Index Predicted Admitted Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Admitted Students [1]			Predicted UNC NC Resident Public School Admitted Students from Disadvantaged Pool [3]			Students Needed from Non- Disadvantaged Pool to Match Actual		Feasibility [4]
	Number of Students	Percent of Admitted		Number of Students	Percent of Admitted		[A]	[B]	Feasible Trials out of 100
		Students	Avg. Test Score [2]		Students	Avg. Test Score [2]	Number of Students	Avg. Test Score	
African American	360	8.8%	1214	217	21.7%	1105	143	1379	0
Asian	519	12.7%	1380	37	3.7%	1116	482	1400	0
Hispanic	241	5.9%	1255	176	17.6%	1112	65	1643	0
Native American	74	1.8%	1272	35	3.5%	1130	39	1400	0
Pacific Islander	4	0.1%	1270	2	0.2%	1075	2	1465	0
White	2,727	66.7%	1342	531	53.2%	1148	2,196	1389	0
Missing	161	3.9%	1378	-	-	-	161	1378	-
Total	4,086	100.0%	1330	998	100.0%	1130	3,088	1395	0
Total URM [5]	675	16.5%	1235	428	42.9%	1110	247	1452	0
Total Non-URM [5]	3,411	83.5%	1349	570	57.1%	1145	2,841	1390	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

[1] The baseline actual UNC admitted students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.

[2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

[3] Summary statistics are calculated across all students identified for admission using application probabilities as weights. Application probabilities are 0.75 to account for the likelihood that not all identified students will apply to UNC.

[4] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school admits for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 998 seats are filled in the disadvantaged step, then 3,088 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.

[5] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE 4

## Admissions Modeling Based on Two-or-Four-Year College-Related Socioeconomic Index 1,000 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 15% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	168	22.1%	1097	67	1427	0
Asian	365	14.3%	1356	32	4.2%	1113	333	1379	0
Hispanic	162	6.3%	1234	139	18.3%	1107	23	2002	0
Native American	46	1.8%	1262	27	3.6%	1124	19	1458	0
Pacific Islander	2	0.1%	1325	2	0.3%	1073	0	N/A	0
White	1,656	64.7%	1329	392	51.6%	1141	1,264	1387	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	760	100.0%	1123	1,801	1395	0
Total URM [6]	443	17.3%	1214	334	43.9%	1104	109	1553	0
Total Non-URM [6]	2,118	82.7%	1335	426	56.1%	1138	1,692	1384	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 760 seats are filled in the disadvantaged step, then 1,801 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE 5

## Admissions Modeling Based on Striver Index 1,000 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Highest 15% on Index Predicted Admitted Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Admitted Students [1]			Predicted UNC NC Resident Public School Admitted Students from Disadvantaged Pool [3]			Students Needed from Non- Disadvantaged Pool to Match Actual		Feasibility [4]
	Number of Students	Percent of Admitted		Number of Students	Percent of Admitted		[A]	[B]	Feasible Trials out of 100
		Students	Avg. Test Score [2]		Students	Students	Avg. Test Score [2]	Number of Students	
African American	360	8.8%	1214	30	3.0%	1506	330	1187	0
Asian	519	12.7%	1380	155	15.5%	1515	364	1322	0
Hispanic	241	5.9%	1255	28	2.8%	1506	213	1222	0
Native American	74	1.8%	1272	5	0.5%	1517	69	1254	0
Pacific Islander	4	0.1%	1270	1	0.1%	1507	3	1191	0
White	2,727	66.7%	1342	780	78.1%	1505	1,947	1277	0
Missing	161	3.9%	1378	-	-	-	161	1378	-
Total	4,086	100.0%	1330	999	100.0%	1507	3,087	1273	0
Total URM [5]	675	16.5%	1235	63	6.3%	1507	612	1207	0
Total Non-URM [5]	3,411	83.5%	1349	936	93.7%	1507	2,475	1290	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC admitted students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] Summary statistics are calculated across all students identified for admission using application probabilities as weights. Application probabilities are 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school admits for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 999 seats are filled in the disadvantaged step, then 3,087 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE 6

## Admissions Modeling Based on Striver Index 1,000 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Highest 15% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	12	2.2%	1502	223	1175	0
Asian	365	14.3%	1356	97	17.8%	1512	268	1300	0
Hispanic	162	6.3%	1234	14	2.6%	1502	148	1209	0
Native American	46	1.8%	1262	2	0.4%	1512	44	1250	0
Pacific Islander	2	0.1%	1325	1	0.2%	1505	1	1145	100
White	1,656	64.7%	1329	419	76.9%	1503	1,237	1270	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	545	100.0%	1504	2,016	1263	0
Total URM [6]	443	17.3%	1214	28	5.1%	1503	415	1195	0
Total Non-URM [6]	2,118	82.7%	1335	517	94.9%	1504	1,601	1280	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 545 seats are filled in the disadvantaged step, then 2,016 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE 7

## Admissions Modeling Based on Race Predicting Index 1,000 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Highest 15% on Index Predicted Admitted Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Admitted Students [1]			Predicted UNC NC Resident Public School Admitted Students from Disadvantaged Pool [3]			Students Needed from Non- Disadvantaged Pool to Match Actual		Feasibility [4]
	Number of Students	Percent of Admitted		Number of Students	Percent of Admitted		[A]	[B]	Feasible Trials out of 100
		Students	Avg. Test Score [2]		Students	Avg. Test Score [2]	Number of Students	Avg. Test Score	
African American	360	8.8%	1214	429	42.9%	1109	-69	N/A	0
Asian	519	12.7%	1380	62	6.2%	1149	457	1411	0
Hispanic	241	5.9%	1255	199	19.9%	1113	42	1932	0
Native American	74	1.8%	1272	53	5.3%	1111	21	1678	0
Pacific Islander	4	0.1%	1270	2	0.2%	1159	2	1381	0
White	2,727	66.7%	1342	254	25.4%	1151	2,473	1361	0
Missing	161	3.9%	1378	-	-	-	161	1378	-
Total	4,086	100.0%	1330	999	100.0%	1123	3,087	1398	0
Total URM [5]	675	16.5%	1235	681	68.2%	1110	-6	N/A	0
Total Non-URM [5]	3,411	83.5%	1349	318	31.8%	1151	3,093	1370	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC admitted students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The index was estimated using NCERDC 2013-14 data and applied to NCERDC 2014-15 data. Summary statistics are calculated across all students identified for admission using application probabilities as weights. Application probabilities are 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school admits for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 999 seats are filled in the disadvantaged step, then 3,087 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.



# EXHIBIT 8 TABLE 8

## Admissions Modeling Based on Race Predicting Index 1,000 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Highest 15% on Index Predicted Matriculated Class, 2014-15

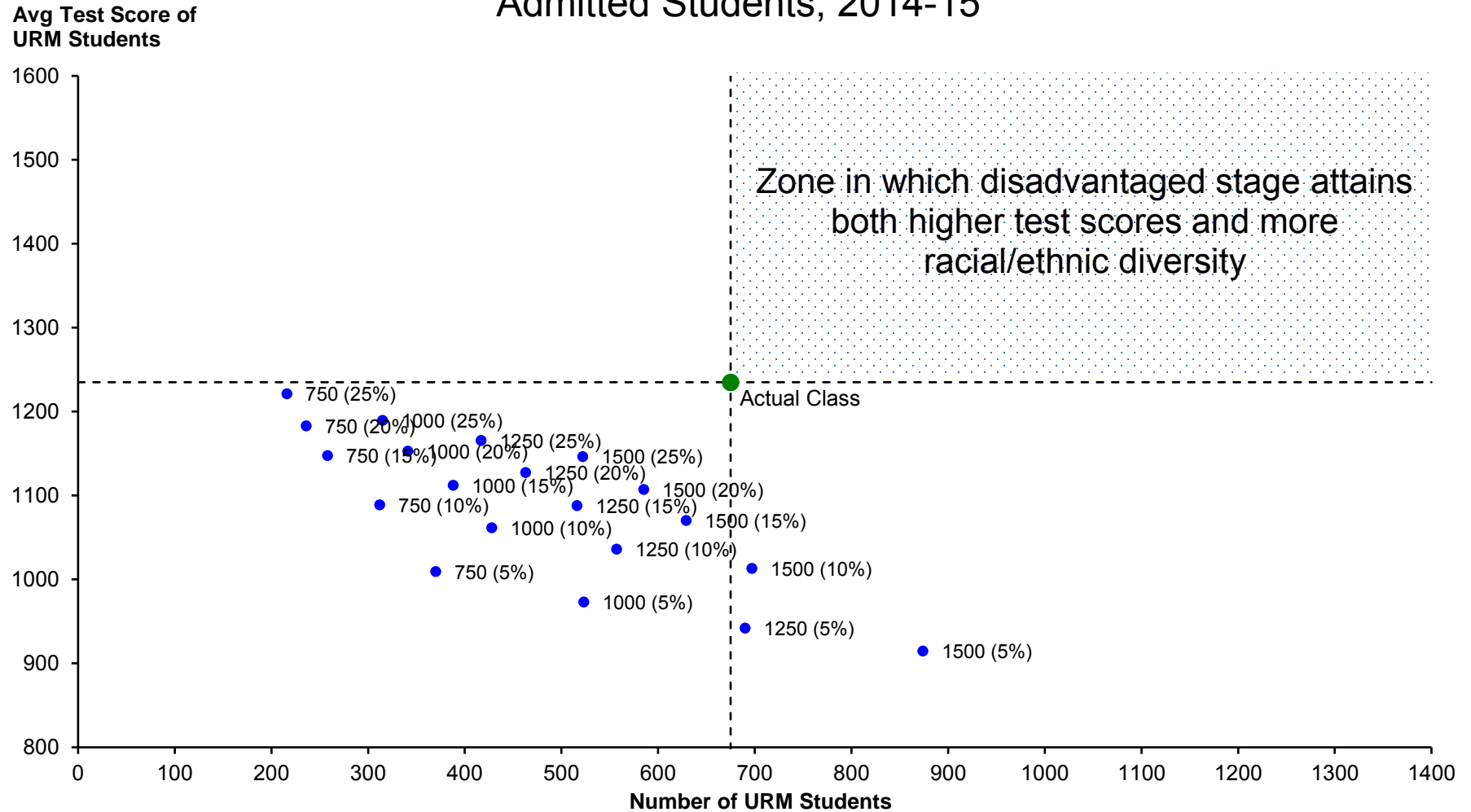
Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	331	42.9%	1101	-96	N/A	0
Asian	365	14.3%	1356	53	6.9%	1140	312	1393	0
Hispanic	162	6.3%	1234	157	20.4%	1106	5	5270	0
Native American	46	1.8%	1262	41	5.3%	1105	5	2543	0
Pacific Islander	2	0.1%	1325	2	0.3%	1151	0	N/A	0
White	1,656	64.7%	1329	187	24.3%	1143	1,469	1353	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	771	100.0%	1115	1,790	1400	0
Total URM [6]	443	17.3%	1214	529	68.6%	1103	-86	N/A	0
Total Non-URM [6]	2,118	82.7%	1335	242	31.4%	1142	1,876	1360	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The index was estimated using NCERDC 2013-14 data and applied to NCERDC 2014-15 data. The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, and White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 771 seats are filled in the disadvantaged step, then 1,790 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 9 FIGURE 1

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index: "Disadvantaged Stage" Admitted Students, 2014-15

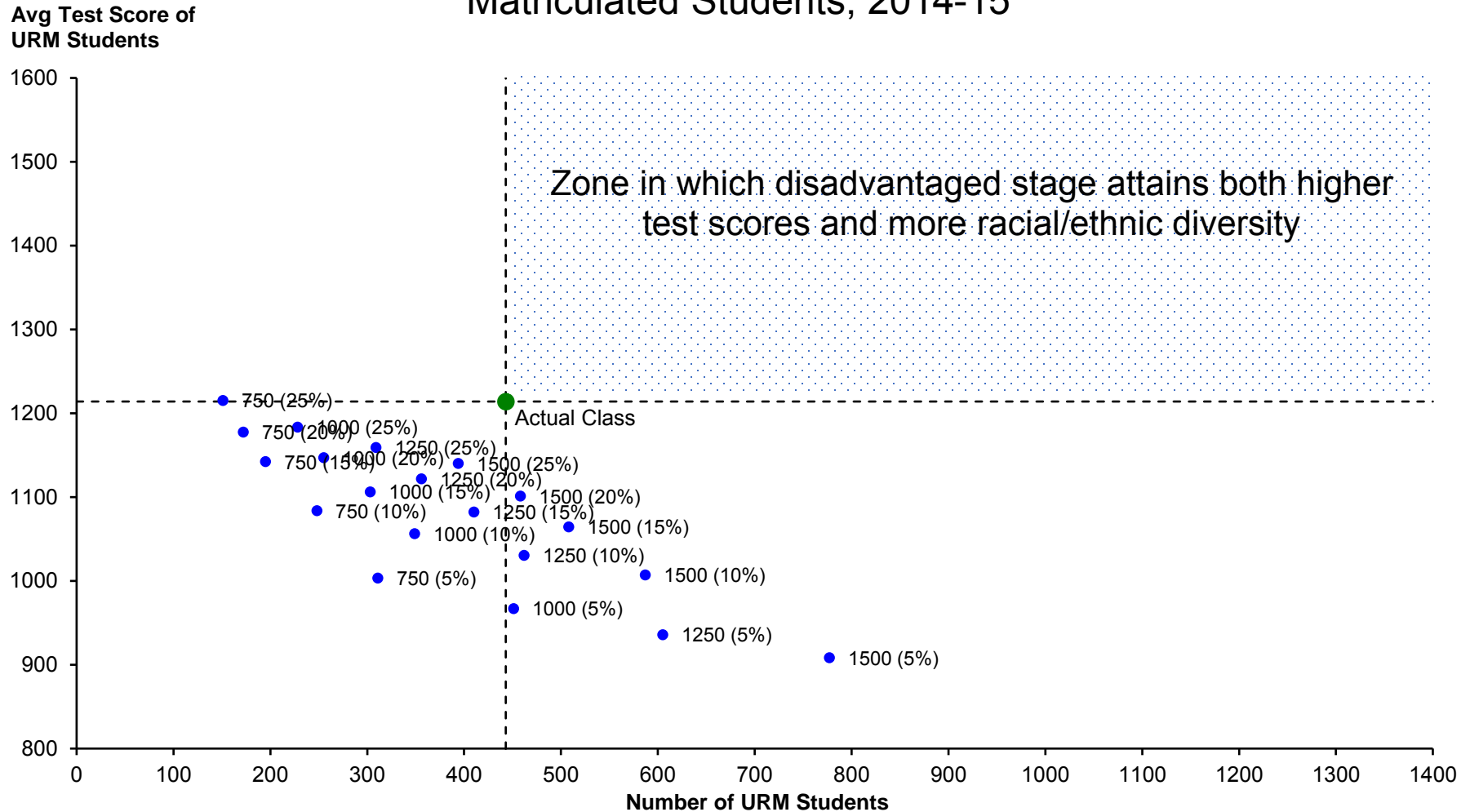


Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note: For each data point, the label indicates the number of seats reserved for the "disadvantaged stage" and the threshold used to categorize students as disadvantaged. For example, 1000 (10%) represents 1000 seats reserved for the bottom 10% of students on the SES index.

# EXHIBIT 9 FIGURE 2

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index: "Disadvantaged Stage" Matriculated Students, 2014-15

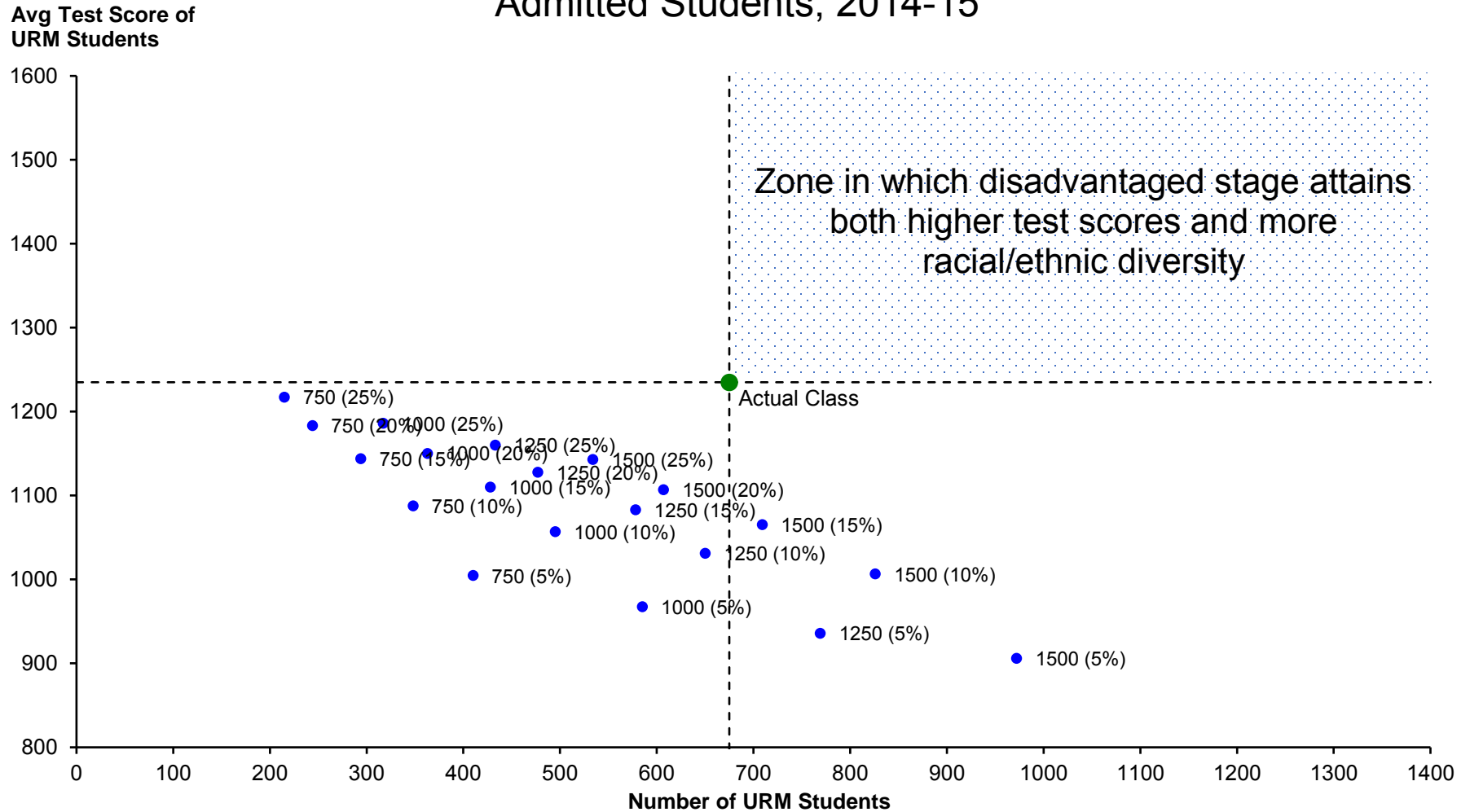


Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note: For each data point, the label indicates the number of seats reserved for the "disadvantaged stage" and the threshold used to categorize students as disadvantaged. For example, 1000 (10%) represents 1000 seats reserved for the bottom 10% of students on the SES index.

# EXHIBIT 9 FIGURE 3

## Admissions Modeling Based on Two-or-Four-Year College-Related Socioeconomic Index: "Disadvantaged Stage" Admitted Students, 2014-15

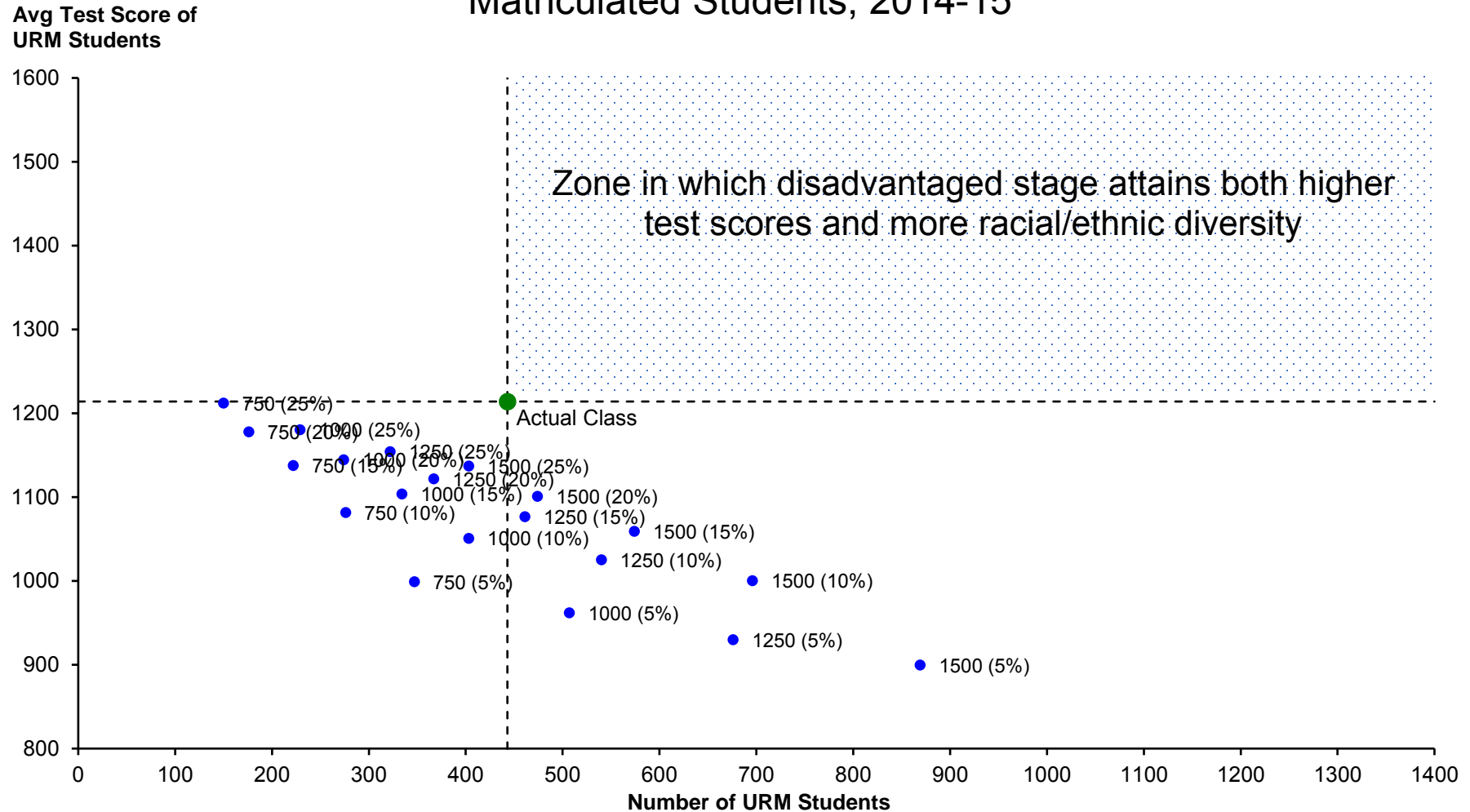


Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note: For each data point, the label indicates the number of seats reserved for the "disadvantaged stage" and the threshold used to categorize students as disadvantaged. For example, 1000 (10%) represents 1000 seats reserved for the bottom 10% of students on the SES index.

# EXHIBIT 9 FIGURE 4

## Admissions Modeling Based on Two-or-Four-Year College-Related Socioeconomic Index: "Disadvantaged Stage" Matriculated Students, 2014-15

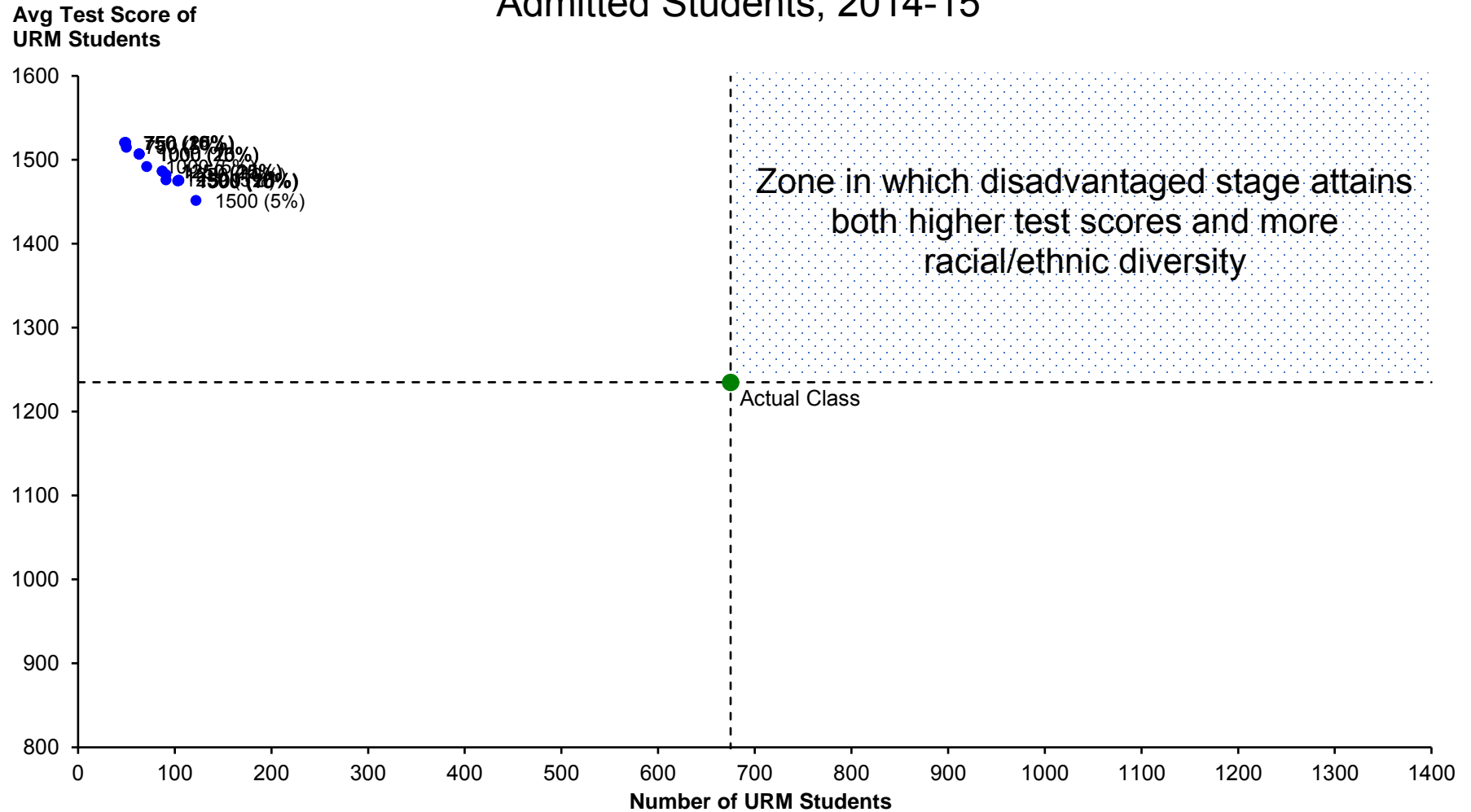


Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note: For each data point, the label indicates the number of seats reserved for the "disadvantaged stage" and the threshold used to categorize students as disadvantaged. For example, 1000 (10%) represents 1000 seats reserved for the bottom 10% of students on the SES index.

# EXHIBIT 9 FIGURE 5

## Admissions Modeling Based on Striver Index: "Disadvantaged Stage" Admitted Students, 2014-15

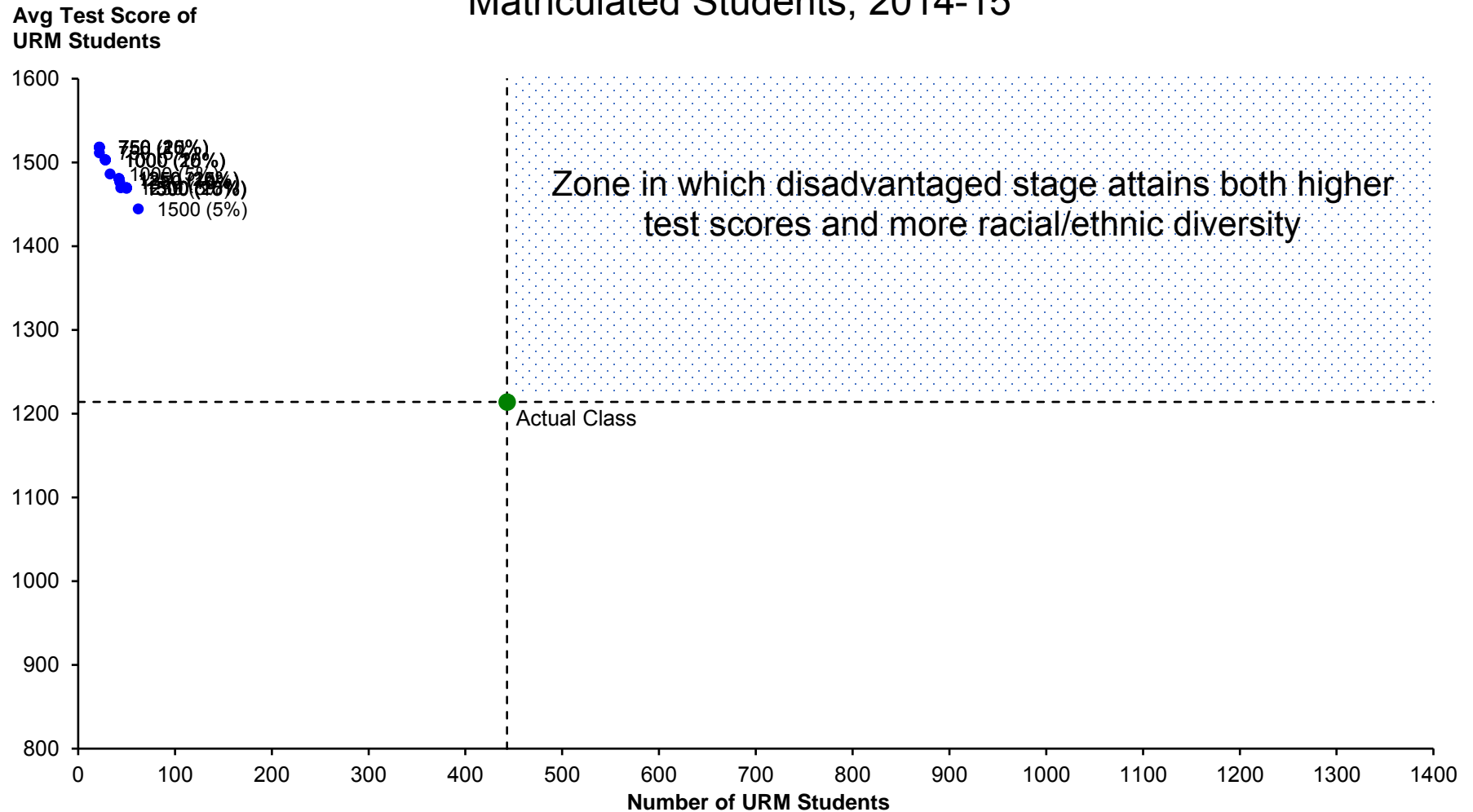


Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note: For each data point, the label indicates the number of seats reserved for the "disadvantaged stage" and the threshold used to categorize students as disadvantaged. For example, 1000 (10%) represents 1000 seats reserved for the bottom 10% of students on the SES index.

# EXHIBIT 9 FIGURE 6

## Admissions Modeling Based on Striver Index: "Disadvantaged Stage" Matriculated Students, 2014-15

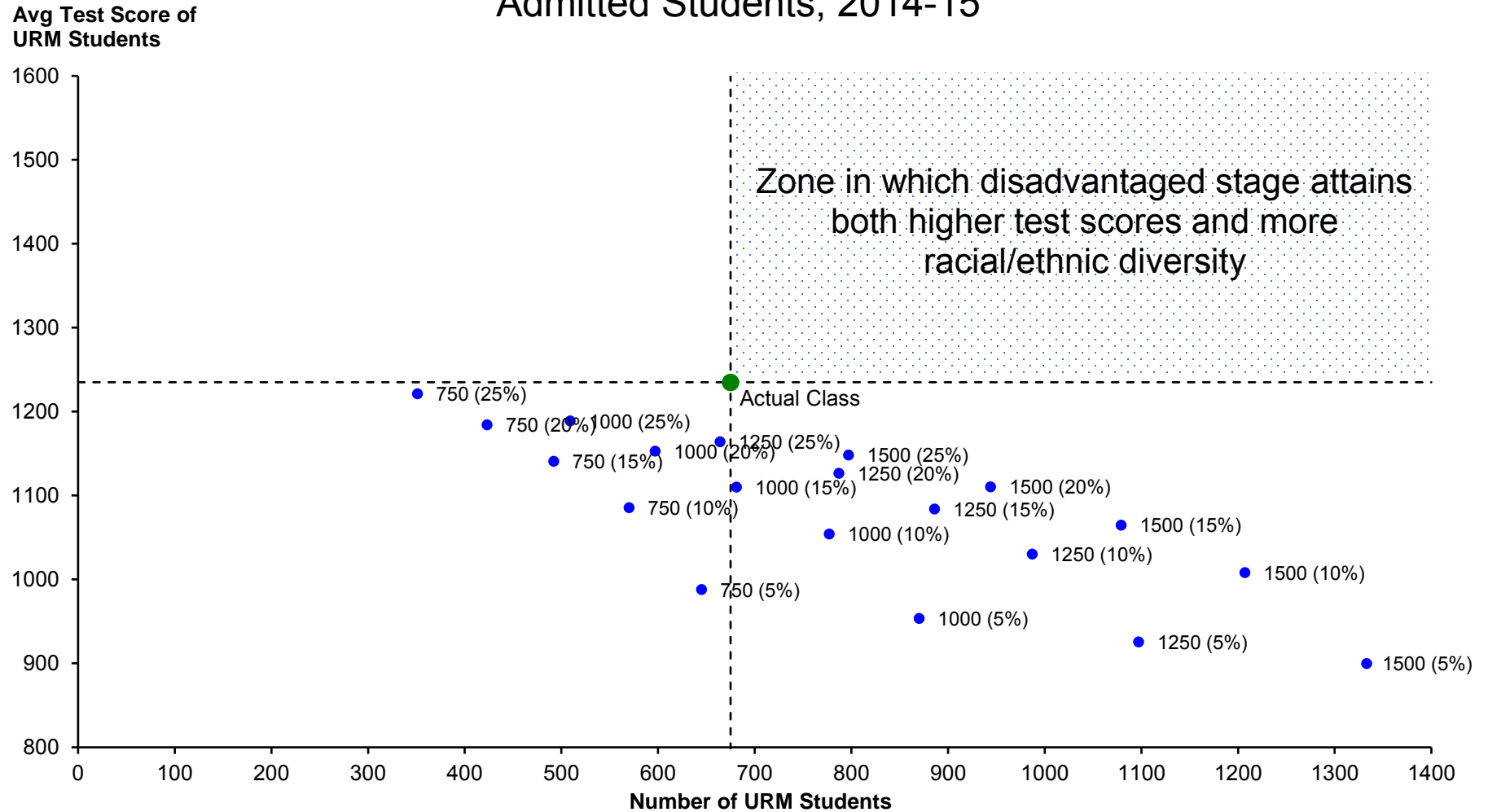


Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note: For each data point, the label indicates the number of seats reserved for the "disadvantaged stage" and the threshold used to categorize students as disadvantaged. For example, 1000 (10%) represents 1000 seats reserved for the bottom 10% of students on the SES index.

# EXHIBIT 9 FIGURE 7

## Admissions Modeling Based on Race Predicting Index: "Disadvantaged Stage" Admitted Students, 2014-15



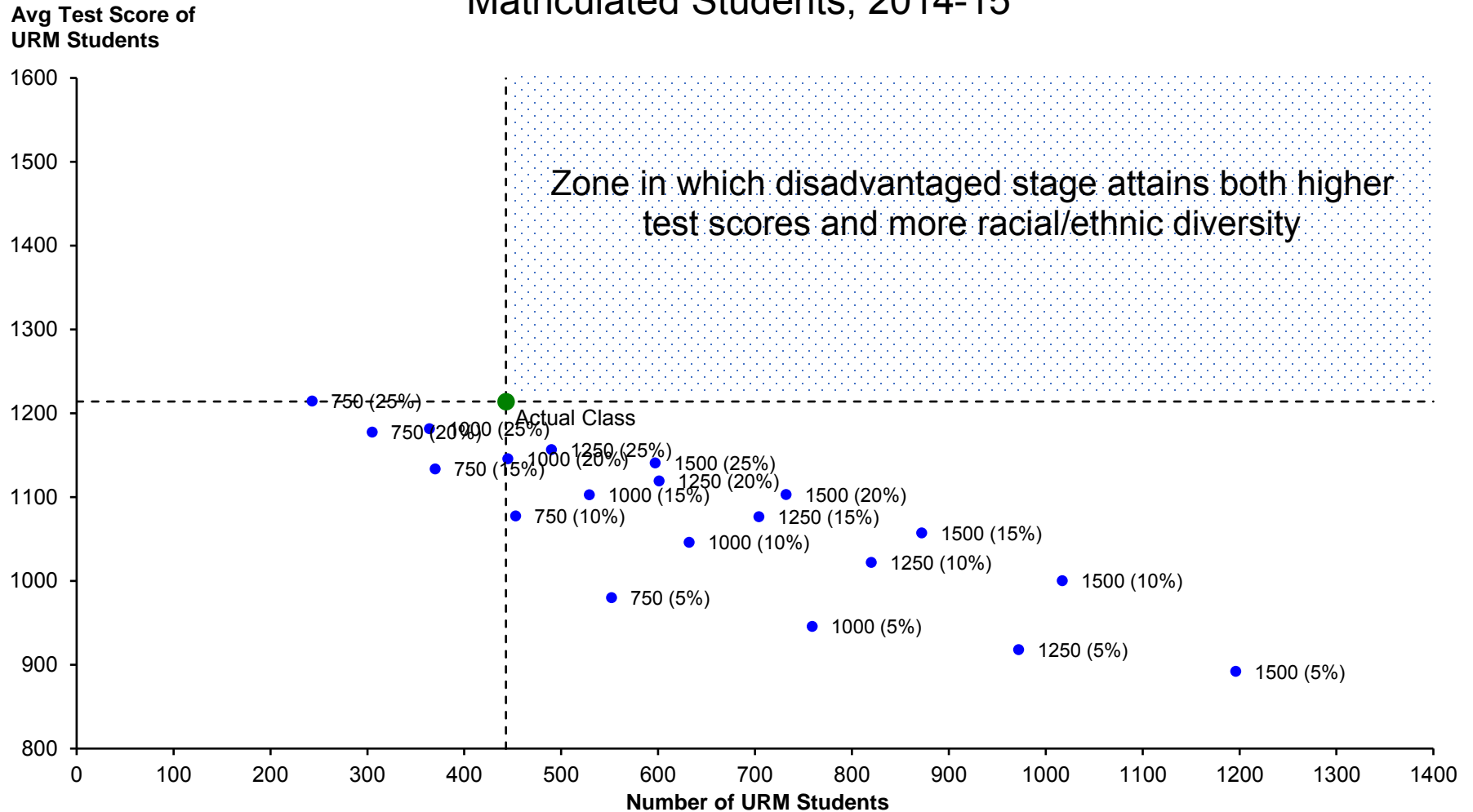
Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note: For each data point, the label indicates the number of seats reserved for the "disadvantaged stage" and the threshold used to categorize students as disadvantaged. For example, 1000 (10%) represents 1000 seats reserved for the bottom 10% of students on the SES index.



# EXHIBIT 9 FIGURE 8

## Admissions Modeling Based on Race Predicting Index: "Disadvantaged Stage" Matriculated Students, 2014-15



Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note: For each data point, the label indicates the number of seats reserved for the "disadvantaged stage" and the threshold used to categorize students as disadvantaged. For example, 1000 (10%) represents 1000 seats reserved for the bottom 10% of students on the SES index.

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# EXHIBIT 10 TABLE 1

## Admissions Modeling Using Estimated Admissions Model and Race Prediction Using Socioeconomic Proxies [1]

### Predicted Admitted Class, 2014-15

Race/Ethnicity [6]	Actual UNC NC Resident Public School Admits [2]			Predicted UNC NC Resident Public School Admits, using Actual Races [3][4]			Predicted UNC NC Resident Public School Admits, using Predicted Races [4][5]		
	Number	Percent of Admits	Avg Test Score [7]	Number	Percent of Admits	Avg Test Score [7]	Number	Percent of Admits	Avg Test Score [7]
African American	360	8.8%	1214	275	6.7%	1258	170	4.2%	1270
Asian	519	12.7%	1380	365	8.9%	1408	371	9.1%	1406
Hispanic	241	5.9%	1255	169	4.1%	1314	143	3.5%	1321
Native American	74	1.8%	1272	57	1.4%	1201	20	0.5%	1260
Pacific Islander	4	0.1%	1270	3	0.1%	1353	5	0.1%	1355
White	2,727	66.7%	1342	3,083	75.5%	1360	3,255	79.7%	1355
Missing	161	3.9%	1378	-	-	-	-	-	-
Multi-racial	-	-	-	135	3.3%	1348	122	3.0%	1354
Total	4,086	100.0%	1330	4,086	100.0%	1353	4,086	100.0%	1355
Total URM [6]	675	16.5%	1235	615	15.1%	1285	438	10.7%	1306
Total non-URM [6]	3,411	83.5%	1349	3,471	84.9%	1365	3,648	89.3%	1360

Source: 2010 Census; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

- [1] Historic data contains 285,591 NCERDC students in the high school graduation year 2011-12 through 2013-14. 2014-15 is the predicted year, containing 98,843 students, of which 6,309 are matched to Connect Carolina based on a crosswalk from UNC.
- [2] The baseline actual UNC admitted students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [3] A Probit regression of the actual UNC admission decision is run using only students in the 2014-15 NCERDC graduation year that are also in Connect Carolina data. Explanatory variables, from NCERDC, include SAT combined score, ACT Comprehensive score, percentile based on class rank, GPA, sex, high school sports participation, citizenship status, and race/ethnicity. For each NCERDC student in 2014-15, the coefficients from this regression are used along with his or her actual non-race and race/ethnicity data to determine an Admission Index. Of these students, those with test scores are then ranked from highest to lowest Admission Index and admitted going down the list until the predicted admitted class size is approximately equal to the actual number of NC resident public school admitted students at UNC in 2014-15.
- [4] Summary statistics are calculated across all admitted students using application probabilities as weights. Application probabilities are 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [5] For 285,272 students in the historic years that have non-missing race/ethnicity, a Multinomial Logit regression of race/ethnicity on several SES variables, listed in the text at ¶ 165, is run. The coefficients from this regression are used to generate predictions of race/ethnicity for each 2014-15 student. For each student in 2014-15, these predictions are used as inputs, along with the non-race data, into the estimated Probit regression of the actual UNC admission decision to determine a SES-Predicted Admission Index. Of these students, those with test scores are then ranked from highest to lowest SES-Predicted Admission Index and admitted going down the list until the predicted admitted class size is approximately equal to the actual number of NC resident public-school admitted students at UNC in 2014-15.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students. A number of students identified only as multi-racial in NCERDC whereas all students in Connect Carolina identified their specific race(s). Based on 2010 Census data, 85% of students self-reporting as multi-racial are considered as URM, and are included in Total URM.
- [7] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not the SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

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# EXHIBIT 10 TABLE 2

## Admissions Modeling Using Estimated Admissions Model and Race Prediction Using Socioeconomic Proxies [1]

### Predicted Matriculated Class, 2014-15

Race/Ethnicity [6]	Actual UNC NC Resident Public School Matriculants [2]			Predicted UNC NC Resident Public School Matriculants, using Actual Races [3] [4]			Predicted UNC NC Resident Public School Matriculants, using Predicted Races [4] [5]		
	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]
African American	235	9.2%	1191	171	6.7%	1241	102	4.0%	1249
Asian	365	14.3%	1356	257	10.0%	1396	262	10.2%	1393
Hispanic	162	6.3%	1234	109	4.2%	1301	92	3.6%	1306
Native American	46	1.8%	1262	41	1.6%	1193	14	0.5%	1248
Pacific Islander	2	0.1%	1325	2	0.1%	1341	3	0.1%	1346
White	1,656	64.7%	1329	1,901	74.2%	1348	2,018	78.8%	1343
Missing	95	3.7%	1359	-	-	-	-	-	-
Multi-racial	-	-	-	80	3.1%	1323	70	2.7%	1330
Total	2,561	100.0%	1314	2,561	100.0%	1340	2,561	100.0%	1343
Total URM [6]	443	17.3%	1214	389	15.2%	1267	268	10.5%	1287
Total non-URM [6]	2,118	82.7%	1335	2,172	84.8%	1353	2,293	89.5%	1349

Source: 2010 Census; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

- [1] Historic data contains 285,591 NCERDC students in the high school graduation year 2011-12 through 2013-14. 2014-15 is the predicted year, containing 98,843 students, of which 6,309 are matched to Connect Carolina based on a crosswalk from UNC.
- [2] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [3] A Probit regression of the actual UNC admission decision is run using only students in the 2014-15 NCERDC graduation year that are also in Connect Carolina data. Explanatory variables, from NCERDC, include SAT combined score, ACT Comprehensive score, percentile based on class rank, GPA, sex, high school sports participation, citizenship status, and race/ethnicity. For each NCERDC student in 2014-15, the coefficients from this regression are used along with his or her actual non-race and race/ethnicity data to determine an Admission Index. Of these students, those with test scores are then ranked from highest to lowest Admission Index and admitted going down the list until the predicted matriculating class size is approximately equal to the actual number of NC resident public school matriculants at UNC in 2014-15.
- [4] The matriculation probability for each NCERDC student is predicted based on a Probit regression using data for the actual 2011-12 to 2014-15 UNC admits: matriculation is regressed on maximum SAT combined test score for students with a maximum test score between 1080 and 1460. Regressions are estimated separately by race for African American, Asian, Hispanic, and white students. For Native American and Pacific Islander students, a regression is estimated across all students because of small sample size. Students identified only as multi-racial in NCERDC are given a weighted matriculation probability based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander. Summary statistics are calculated across all admitted students using matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are then calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [5] For 285,272 students in the historic years that have non-missing race/ethnicity, a Multinomial Logit regression of race/ethnicity on several SES variables, listed in the text at ¶ 165, is run. The coefficients from this regression are used to generate predictions of race/ethnicity for each 2014-15 student. For each student in 2014-15, these predictions are used as inputs, along with the non-race data, into the estimated Probit regression of the actual UNC admission decision to determine a SES-Predicted Admission Index. Of these students, those with test scores are then ranked from highest to lowest SES-Predicted Admission Index and admitted going down the list until the predicted matriculating class size is approximately equal to the actual number of NC resident public school matriculants at UNC in 2014-15.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students. A number of students identified only as multi-racial in NCERDC whereas all students in Connect Carolina identified their specific race(s). Based on 2010 Census data, 85% of students self-reporting as multi-racial are considered as URM, and are included in Total URM.
- [7] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not the SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

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# EXHIBIT 11 TABLE 1

## Class Rank Admissions Modeling by Accepting Students in Top 7.95% by Class Rank Percentile Predicted Admitted Class, 2014-15

Race/Ethnicity [4]	Actual UNC NC Resident Public School Admitted Students [1]			Predicted UNC NC Resident Public School Admitted Students from the Top 7.95% Pool [2]			Change vis-à-vis Current Actuals [3]		
	Number	Percent of Admitted Students	Avg Test Score [5]	Number	Percent of Admitted Students	Avg Test Score [5]	Number	Percent of Admitted Students	Avg Test Score [5]
African American	349	8.8%	1212	416	10.5%	1082	67	1.7%	-129
Asian	494	12.4%	1375	284	7.2%	1335	-210	-5.3%	-40
Hispanic	238	6.0%	1254	230	5.8%	1155	-8	-0.2%	-99
Native American	70	1.8%	1264	19	0.5%	1122	-51	-1.3%	-142
Pacific Islander	4	0.1%	1270	5	0.1%	1133	1	0.0%	-137
White	2,664	67.1%	1341	2,904	73.1%	1278	240	6.1%	-63
Missing	154	3.9%	1376	-	-	-	-154	-3.9%	-
Multi-racial	-	-	-	113	2.8%	1232	113	2.8%	-
Total	3,973	100.0%	1329	3,971	100.0%	1252	-2	0.0%	-77
Total URM [4]	657	16.5%	1233	761	19.2%	1124	104	2.6%	-109
Total non-URM [4]	3,316	83.5%	1348	3,210	80.8%	1282	-106	-2.6%	-65

Source: 2010 Census; College Board; Connect Carolina; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

[1] The baseline actual UNC admitted students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing ranking data and test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.

[2] Summary statistics are calculated across all admitted students using application probabilities as weights. Application probabilities are 0.75 to account for the likelihood that not all identified students will apply to UNC.

[3] The difference is calculated as the value under the hypothetical plan minus the value for the actual UNC admitted students.

[4] Under-represented minorities ("URM") include African American, Hispanic, and Native American students. A number of students identified only as multi-racial in NCERDC whereas all students in Connect Carolina identified their specific race(s). Based on 2010 Census data, 85% of students self-reporting as multi-racial are considered as URM, and are included in Total URM.

[5] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

# EXHIBIT 11 TABLE 2

## Class Rank Admissions Modeling by Accepting Students in Top 7.29% by Class Rank Percentile Predicted Matriculated Class, 2014-15

Race/Ethnicity [4]	Actual UNC NC Resident Public School Matriculated Students [1]			Predicted UNC NC Resident Public School Matriculated Students from the Top 7.29% Pool [2]			Change vis-à-vis Current Actuals [3]		
	Number	Percent of		Number	Percent of		Number	Percent of	
		Matriculated Students	Avg Test Score [5]		Matriculated Students	Avg Test Score [5]		Matriculated Students	Avg Test Score [5]
African American	229	9.2%	1187	284	11.4%	1065	55	2.2%	-122
Asian	350	14.0%	1352	199	8.0%	1313	-151	-6.0%	-39
Hispanic	160	6.4%	1233	156	6.3%	1137	-4	-0.2%	-96
Native American	45	1.8%	1260	11	0.4%	1131	-34	-1.4%	-128
Pacific Islander	2	0.1%	1325	3	0.1%	1121	1	0.0%	-204
White	1,617	64.8%	1328	1,772	71.1%	1265	155	6.2%	-63
Missing	92	3.7%	1358	-	-	-	-92	-3.7%	-
Multi-racial	-	-	-	69	2.8%	1208	69	2.8%	-
Total	2,495	100.0%	1312	2,494	100.0%	1236	-1	0.0%	-77
Total URM [4]	434	17.4%	1212	510	20.4%	1105	76	3.0%	-107
Total non-URM [4]	2,061	82.6%	1334	1,984	79.6%	1269	-77	-3.0%	-64

Source: 2010 Census; College Board; Connect Carolina; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

[1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing ranking data and test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.

[2] The matriculation probability for each NCERDC student is predicted based on a Probit regression using data for the actual 2011-12 to 2014-15 UNC admits: matriculation is regressed on maximum SAT combined test score for students with a maximum test score between 1080 and 1460. Regressions are estimated separately by race for African American, Asian, Hispanic, and white students. For Native American and Pacific Islander students, a regression is estimated across all students because of small sample size. Students identified only as multi-racial in NCERDC are given a weighted matriculation probability based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander. Summary statistics are calculated across all admitted students using matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are then calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.

[3] The difference is calculated as the value under the hypothetical plan minus the value for the actual UNC matriculated students.

[4] Under-represented minorities ("URM") include African American, Hispanic, and Native American students. A number of students identified only as multi-racial in NCERDC whereas all students in Connect Carolina identified their specific race(s). Based on 2010 Census data, 85% of students self-reporting as multi-racial are considered as URM, and are included in Total URM.

[5] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

# EXHIBIT 12

## Distribution of URMs and Other Students Across Highly URM Segregated and Desegregated Graduating Classes: by Level of Academic Preparation [1] North Carolina Public School Students, 2014-15

	Distribution of URM Students [2]		Distribution of Non-URM Students [2]	
	Highly URM Class	More Desegregated Class	Highly URM Class	More Desegregated Class
All Levels of Preparedness	13%	87%	1%	99%
SAT Score Above 1000 [3]	10%	90%	1%	99%
SAT Score Above 1100 [3]	8%	92%	0%	100%
SAT Score Above 1120 [3]	8%	92%	0%	100%
SAT Score Above 1220 [3]	6%	94%	0%	100%
SAT Score Above 1260 [3]	6%	94%	0%	100%

Source: 2010 Census; College Board; Connect Carolina; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC

Note:

[1] A high school class is considered highly URM if URMs make up 75 percent or more of the class.

[2] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

[3] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not the SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016). The bottom 20th percentile SAT score for the URMs admitted to UNC from North Carolina in 2014-15 was 1120. The bottom 20th percentile SAT score for all students admitted to UNC from North Carolina in 2014-15 was 1220. The bottom 20th percentile SAT score for non-URMs admitted to UNC from North Carolina in 2014-15 was 1260.

# EXHIBIT 13 TABLE 1

## Admissions Modeling by Accepting Students Ranked within North Carolina Using a GPA and SAT Score Admission Index Predicted Admitted Class, 2014-15 [1]

Race/Ethnicity [6]	Actual UNC NC Resident Public School Admitted Students [2]			Predicted UNC NC Resident Public School Admitted Students [3][4]			Change vis-à-vis Current Actuals [5]		
	Number	Percent of Admitted Students	Avg Test Score [7]	Number	Percent of Admitted Students	Avg Test Score [7]	Number	Percent of Admitted Students	Avg Test Score [7]
African American	357	8.8%	1,214	143	3.5%	1,302	-214	-5.3%	88
Asian	517	12.7%	1,380	382	9.4%	1,400	-135	-3.3%	20
Hispanic	241	5.9%	1,255	137	3.4%	1,337	-105	-2.6%	82
Native American	73	1.8%	1,271	7	0.2%	1,358	-66	-1.6%	87
Pacific Islander	4	0.1%	1,270	5	0.1%	1,301	1	0.0%	31
White	2,714	66.7%	1,342	3,260	80.2%	1,358	546	13.4%	16
Missing	161	4.0%	1,378	-	-	-	-161	-4.0%	-
Multi-racial	-	-	-	133	3.3%	1,361	133	3.3%	-
Total	4,067	100.0%	1,330	4,067	100.0%	1,359	-1	0.0%	29
Total URM [6]	671	16.5%	1,235	399	9.8%	1,332	-272	-6.7%	97
Total non-URM [6]	3,396	83.5%	1,349	3,667	90.2%	1,362	271	6.7%	13

Source: 2010 Census; Connect Carolina; College Board; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

[1] In comparison to an admissions plan that recruits students by, in part, considering the historical UNC admissions rate in their census tract, this plan recruits students based on their academic qualifications only, without considering the students' geographic area.

[2] The baseline actual UNC admitted students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing GPA, test scores, and census tract. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.

[3] Two z-scores are calculated for NCERDC students' weighted GPA and SAT score across all students in the 2014-15 cohort. The two z-scores are weighted equally and summed up to create an Admission Index value for each student. Of these students, those with GPA and test scores are ranked from highest to lowest Admission Index and admitted going down the list until the predicted admitted class is approximately equal to the actual number of NC resident public school admits at UNC in 2014-15.

[4] Summary statistics are calculated across all admitted students using application probabilities as weights. Application probabilities are 0.75 to account for the likelihood that not all identified students will apply to UNC.

[5] The difference is calculated as the value under the hypothetical plan minus the value for the actual UNC admitted students.

[6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students. A number of students identified only as multi-racial in NCERDC whereas all students in Connect Carolina identified their specific race(s). Based on 2010 Census data, 85% of students self-reporting as multi-racial are considered as URM, and are included in Total URM.

[7] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

# EXHIBIT 13 TABLE 2

## Geography-Based Admissions Modeling by Accepting Top 22.58% of Qualified Students from Each North Carolina Census Tract Sorted by Descending Historical UNC Admissions Rate Predicted Admitted Class, 2014-15 [1]

Race/Ethnicity [6]	Actual UNC NC Resident Public School Admitted Students [2]			Predicted UNC NC Resident Public School Admitted Students [3][4]			Change vis-à-vis Current Actuals [5]		
	Number	Percent of Admitted Students	Avg Test Score [7]	Number	Percent of Admitted Students	Avg Test Score [7]	Number	Percent of Admitted Students	Avg Test Score [7]
African American	357	8.8%	1,214	265	6.5%	1,208	-92	-2.3%	-6
Asian	514	12.6%	1,380	326	8.0%	1,397	-189	-4.6%	17
Hispanic	241	5.9%	1,255	194	4.8%	1,261	-47	-1.1%	5
Native American	73	1.8%	1,271	10	0.2%	1,328	-63	-1.6%	58
Pacific Islander	4	0.1%	1,270	4	0.1%	1,278	0	0.0%	8
White	2,714	66.8%	1,342	3,134	77.1%	1,330	420	10.4%	-12
Missing	161	4.0%	1,378	-	-	-	-161	-4.0%	-
Multi-racial	-	-	-	131	3.2%	1,314	131	3.2%	-
Total	4,064	100.0%	1,330	4,064	100.0%	1,324	-1	0.0%	-7
Total URM [6]	671	16.5%	1,235	580	14.3%	1,248	-91	-2.2%	13
Total non-URM [6]	3,393	83.5%	1,349	3,483	85.7%	1,336	90	2.2%	-13

Source: 2010 Census; Connect Carolina; College Board; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

[1] For all available census tracts in the 2014-15 NCERDC cohort, a historical UNC admissions rate is calculated as the total number of students in the tract with a GPA of at least 3.0 and SAT score of at least 1000 who were admitted by UNC, divided by the total number of students in the tract with a GPA of at least 3.0 and SAT score of at least 1000. Students in the 2011-12 to 2013-14 cohorts are pooled for this calculation.

[2] The baseline actual UNC admitted students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing GPA, test scores, and census tract. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic. The census tract must also be one that appears in the NCERDC data.

[3] Two z-scores are calculated for NCERDC students' weighted GPA and SAT score across all students in the 2014-15 cohort. The two z-scores are weighted equally and summed up to create an Admission Index value for each student. Qualified students (those with GPA of at least 3.0 and SAT score of at least 1000) are then sorted within census tracts and placed into within census tract percentiles. Census tracts are sorted (low to high) by historical UNC admissions rate. Qualified students in the top percentiles are then admitted, in census tract order, until the predicted admitted class size is approximately the total number of actual admitted students. This occurs when students in the top 22.58th percentile are admitted.

[4] Summary statistics are calculated across all admitted students using application probabilities as weights. Application probabilities are 0.75 to account for the likelihood that not all identified students will apply to UNC.

[5] The difference is calculated as the value under the hypothetical plan minus the value for the actual UNC admitted students.

[6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students. A number of students identified only as multi-racial in NCERDC whereas all students in Connect Carolina identified their specific race(s). Based on 2010 Census data, 85% of students self-reporting as multi-racial are considered as URM, and are included in Total URM.

[7] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).



# EXHIBIT 13 TABLE 3

## Admissions Modeling by Accepting Students Ranked within North Carolina Using a GPA and SAT Score Admission Index

Predicted Matriculated Class, 2014-15 [1]

Race/Ethnicity [6]	Actual UNC NC Resident Public School Matriculants [2]			Predicted UNC NC Resident Public School Matriculants [3][4]			Change vis-à-vis Current Actuals [5]		
	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]
African American	234	9.2%	1191	82	3.2%	1290	-152	-6.0%	98
Asian	363	14.2%	1356	272	10.7%	1388	-91	-3.6%	32
Hispanic	162	6.4%	1234	86	3.4%	1328	-76	-3.0%	94
Native American	45	1.8%	1260	4	0.1%	1360	-41	-1.6%	100
Pacific Islander	2	0.1%	1325	4	0.1%	1299	2	0.1%	-26
White	1,648	64.7%	1329	2,026	79.5%	1350	378	14.8%	21
Missing	95	3.7%	1359	-	-	-	-95	-3.7%	-
Multi-racial	-	-	-	77	3.0%	1347	77	3.0%	-
Total	2,549	100.0%	1314	2,549	100.0%	1351	0	0.0%	37
Total URM [6]	441	17.3%	1214	236	9.3%	1321	-205	-8.0%	106
Total non-URM [6]	2,108	82.7%	1335	2,312	90.7%	1354	204	8.0%	19

Source: 2010 Census; Connect Carolina; College Board; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

[1] In comparison to an admissions plan that recruits students by, in part, considering the historical UNC admissions rate in their census tract, this plan recruits students based on their academic qualifications only, without considering the students' geographic area.

[2] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing GPA, test scores, and census tract. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.

[3] Two z-scores are calculated for NCERDC students' weighted GPA and SAT score across all students in the 2014-15 cohort. The two z-scores are weighted equally and summed up to create an Admission Index value for each student. Of these students, those with GPA and test scores are ranked from highest to lowest Admission Index and admitted going down the list until the predicted matriculating class is approximately equal to the actual number of NC resident public school matriculants at UNC in 2014-15.

[4] The matriculation probability for each NCERDC student is predicted based on a Probit regression using data for the actual 2011-12 to 2014-15 UNC admits: matriculation is regressed on maximum SAT combined test score for students with a maximum test score between 1080 and 1460. Regressions are estimated separately by race for African American, Asian, Hispanic, and white students. For Native American and Pacific Islander students, a regression is estimated across all students because of small sample size. Students identified only as multi-racial in NCERDC are given a weighted matriculation probability based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander. Summary statistics are calculated across all admitted students using matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are then calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.

[5] The difference is calculated as the value under the hypothetical plan minus the value for the actual UNC matriculated students.

[6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students. A number of students identified only as multi-racial in NCERDC whereas all students in Connect Carolina identified their specific race(s). Based on 2010 Census data, 85% of students self-reporting as multi-racial are considered as URM, and are included in Total URM.

[7] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

# EXHIBIT 13 TABLE 4

## Geography-Based Admissions Modeling by Accepting Top 21.51% of Qualified Students from Each North Carolina Census Tract Sorted by Descending Historical UNC Admissions Rate Predicted Matriculated Class, 2014-15 [1]

Race/Ethnicity [6]	Actual UNC NC Resident Public School Matriculants [2]			Predicted UNC NC Resident Public School Matriculants [3][4]			Change vis-à-vis Current Actuals [5]		
	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]
African American	234	9.2%	1191	174	6.8%	1189	-60	-2.4%	-3
Asian	360	14.1%	1356	222	8.7%	1386	-138	-5.4%	31
Hispanic	162	6.4%	1234	128	5.0%	1246	-34	-1.3%	11
Native American	45	1.8%	1260	6	0.2%	1316	-39	-1.5%	56
Pacific Islander	2	0.1%	1325	3	0.1%	1274	1	0.0%	-51
White	1,648	64.7%	1329	1,934	76.0%	1319	286	11.3%	-10
Missing	95	3.7%	1359	-	-	-	-95	-3.7%	-
Multi-racial	-	-	-	79	3.1%	1292	79	3.1%	-
Total	2,546	100.0%	1314	2,546	100.0%	1312	0	0.0%	-2
Total URM [6]	441	17.3%	1214	375	14.7%	1229	-66	-2.6%	14
Total non-URM [6]	2,105	82.7%	1335	2,171	85.3%	1326	66	2.6%	-9

Source: 2010 Census; Connect Carolina; College Board; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

[1] For all available census tracts in the 2014-15 NCERDC cohort, a historical UNC admissions rate is calculated as the total number of students in the tract with a GPA of at least 3.0 and SAT score of at least 1000 who were admitted by UNC, divided by the total number of students in the tract with a GPA of at least 3.0 and SAT score of at least 1000. Students in the 2011-12 to 2013-14 cohorts are pooled for this calculation.

[2] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing GPA, test scores, and census tract. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic. The census tract must also be one that appears in the NCERDC data.

[3] Two z-scores are calculated for NCERDC students' weighted GPA and SAT score across all students in the 2014-15 cohort. The two z-scores are weighted equally and summed up to create an Admission Index value for each student. Qualified students (those with GPA of at least 3.0 and SAT score of at least 1000) are then sorted within census tracts and placed into within census tract percentiles. Census tracts are sorted (low to high) by historical UNC admissions rate. Qualified students in the top percentiles are then admitted, in census tract order, until the predicted class size is approximately the total number of actual matriculated students. This occurs when students in the top 21.51th percentile are admitted.

[4] The matriculation probability for each NCERDC student is predicted based on a Probit regression using data for the actual 2011-12 to 2014-15 UNC admits: matriculation is regressed on maximum SAT combined test score for students with a maximum test score between 1080 and 1460. Regressions are estimated separately by race for African American, Asian, Hispanic, and white students. For Native American and Pacific Islander students, a regression is estimated across all students because of small sample size. Students identified only as multi-racial in NCERDC are given a weighted matriculation probability based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander. Summary statistics are calculated across all admitted students using matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are then calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.

[5] The difference is calculated as the value under the hypothetical plan minus the value for the actual UNC matriculated students.

[6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students. A number of students identified only as multi-racial in NCERDC whereas all students in Connect Carolina identified their specific race(s). Based on 2010 Census data, 85% of students self-reporting as multi-racial are considered as URM, and are included in Total URM.

[7] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

# EXHIBIT 14 TABLE 1

## Admissions Modeling Using Estimated Admissions Model and Race Prediction Using Socioeconomic and Geographic Proxies [1] Predicted Admitted Class, 2014-15

Race/Ethnicity [6]	Actual UNC NC Resident Public School Admits [2]			Predicted UNC NC Resident Public School Admits, using Actual Races [3][4]			Predicted UNC NC Resident Public School Admits, using Predicted Races [4][5]		
	Number	Percent of Admits	Avg Test Score [7]	Number	Percent of Admits	Avg Test Score [7]	Number	Percent of Admits	Avg Test Score [7]
African American	360	8.8%	1214	275	6.7%	1258	168	4.1%	1274
Asian	519	12.7%	1380	365	8.9%	1408	374	9.2%	1407
Hispanic	241	5.9%	1255	169	4.1%	1314	142	3.5%	1322
Native American	74	1.8%	1272	57	1.4%	1201	20	0.5%	1260
Pacific Islander	4	0.1%	1270	3	0.1%	1353	5	0.1%	1347
White	2,727	66.7%	1342	3,083	75.5%	1360	3,255	79.7%	1356
Missing	161	3.9%	1378	-	-	-	-	-	-
Multi-racial	-	-	-	135	3.3%	1348	122	3.0%	1355
<b>Total</b>	<b>4,086</b>	<b>100.0%</b>	<b>1330</b>	<b>4,086</b>	<b>100.0%</b>	<b>1353</b>	<b>4,086</b>	<b>100.0%</b>	<b>1356</b>
Total URM [6]	675	16.5%	1235	615	15.1%	1285	433	10.6%	1308
Total non-URM [6]	3,411	83.5%	1349	3,471	84.9%	1365	3,653	89.4%	1361

Source: 2010 Census; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

- [1] Historic data contains 285,591 NCERDC students in the high school graduation year 2011-12 through 2013-14. 2014-15 is the predicted year, containing 98,843 students, of which 6,309 are matched to Connect Carolina based on a crosswalk from UNC.
- [2] The baseline actual UNC admitted students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [3] A race-conscious Probit regression of the actual UNC admission decision is run using only students in the 2014-15 NCERDC graduation year that are also in Connect Carolina data. Explanatory variables, from NCERDC, include SAT combined score, ACT Comprehensive score, percentile based on class rank, GPA, sex, high school sports participation, citizenship status, and race/ethnicity. For each NCERDC student in 2014-15, the coefficients from this regression are used along with his or her actual non-race and race/ethnicity data to determine an Admission Index. Of these students, those with test scores are then ranked from highest to lowest Admission Index and admitted going down the list until the predicted admitted class size is approximately equal to the actual number of NC resident public school admitted students at UNC in 2014-15.
- [4] Summary statistics are calculated across all admitted students using application probabilities as weights. Application probabilities are 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [5] For 285,272 students in the historic years that have non-missing race/ethnicity, a Multinomial Logit regression of race/ethnicity on several SES variables, listed in the text at ¶ 165, and geographic variables is run. Geographic variables include the historic admission rate among qualified students (GPA >= 3.0 and SAT adjusted score >= 1000) within the census tract, indicators for whether the student's predicted "fit" with UNC is within the top 0% to 5%, 5% to 10%, 10% to 15%, and 15% of 20% of qualified students in his/her tract, by year, and the student's best test score only if he or she is in the top 20% of qualified students in the tract, by year, as measured by "fit." Fit is calculated using a race-blind Probit regression of the actual UNC admission decision using students in the historic NCERDC data that are also in Connect Carolina data. Explanatory variables, from NCERDC, include SAT combined score, ACT Comprehensive score, percentile based on class rank, GPA, sex, high school sports participation, and citizenship status. Fitted values from this regression determine a student's fit. The coefficients from the Multinomial Logit regression of race/ethnicity are used to generate predictions of race/ethnicity for each 2014-15 student. For each student in 2014-15, these predictions are used as inputs, along with the non-race data, into the estimated race-conscious Probit regression of the actual UNC admission decision to determine a SES-and-Geography-Predicted Admission Index. Of these students, those with test scores are then ranked from highest to lowest a SES-and-Geography-Predicted Admission Index and admitted going down the list until the predicted admitted class size is approximately equal to the actual number of NC resident public school admitted students at UNC in 2014-15.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students. A number of students identified only as multi-racial in NCERDC whereas all students in Connect Carolina identified their specific race(s). Based on 2010 Census data, 85% of students self-reporting as multi-racial are considered as URM, and are included in Total URM.
- [7] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not the SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

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# EXHIBIT 14 TABLE 2

## Admissions Modeling Using Estimated Admissions Model and Race Prediction Using Socioeconomic and Geographic Proxies [1] Predicted Matriculated Class, 2014-15

Race/Ethnicity [6]	Actual UNC NC Resident Public School Matriculants [2]			Predicted UNC NC Resident Public School Matriculants, using Actual Races [3] [4]			Predicted UNC NC Resident Public School Matriculants, using Predicted Races [4] [5]		
	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]	Number	Percent of Matriculants	Avg Test Score [7]
African American	235	9.2%	1191	171	6.7%	1241	101	3.9%	1252
Asian	365	14.3%	1356	257	10.0%	1396	262	10.2%	1395
Hispanic	162	6.3%	1234	109	4.2%	1301	91	3.5%	1307
Native American	46	1.8%	1262	41	1.6%	1193	14	0.5%	1248
Pacific Islander	2	0.1%	1325	2	0.1%	1341	3	0.1%	1346
White	1,656	64.7%	1329	1,901	74.2%	1348	2,020	78.9%	1344
Missing	95	3.7%	1359	-	-	-	-	-	-
Multi-racial	-	-	-	80	3.1%	1323	70	2.7%	1331
Total	2,561	100.0%	1314	2,561	100.0%	1340	2,561	100.0%	1343
Total URM [6]	443	17.3%	1214	389	15.2%	1267	265	10.4%	1288
Total non-URM [6]	2,118	82.7%	1335	2,172	84.8%	1353	2,295	89.6%	1350

Source: 2010 Census; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

- [1] Historic data contains 285,591 NCERDC students in the high school graduation year 2011-12 through 2013-14. 2014-15 is the predicted year, containing 98,843 students, of which 6,309 are matched to Connect Carolina based on a crosswalk from UNC.
- [2] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [3] A race-conscious Probit regression of the actual UNC admission decision is run using only students in the 2014-15 NCERDC graduation year that are also in Connect Carolina data. Explanatory variables, from NCERDC, include SAT combined score, ACT Comprehensive score, percentile based on class rank, GPA, sex, high school sports participation, citizenship status, and race/ethnicity. For each NCERDC student in 2014-15, the coefficients from this regression are used along with his or her actual non-race and race/ethnicity data to determine an Admission Index. Of these students, those with test scores are then ranked from highest to lowest Admission Index and admitted going down the list until the predicted matriculating class size is approximately equal to the actual number of NC resident public school matriculants at UNC in 2014-15.
- [4] The matriculation probability for each NCERDC student is predicted based on a Probit regression using data for the actual 2011-12 to 2014-15 UNC admits: matriculation is regressed on maximum SAT combined test score for students with a maximum test score between 1080 and 1460. Regressions are estimated separately by race for African American, Asian, Hispanic, and white students. For Native American and Pacific Islander students, a regression is estimated across all students because of small sample size. Students identified only as multi-racial in NCERDC are given a weighted matriculation probability based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander. Summary statistics are calculated across all admitted students using matriculation probabilities conditional on admission are then calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [5] For 285,272 students in the historic years that have non-missing race/ethnicity, a Multinomial Logit regression of race/ethnicity on several SES variables, listed in the text at ¶ 165, and geographic variables is run. Geographic variables include the historic admission rate among qualified students (GPA >= 3.0 and SAT adjusted score >= 1000) within the census tract, indicators for whether the student's predicted "fit" with UNC is within the top 0% to 5%, 5% to 10%, 10% to 15%, and 15% to 20% of qualified students in his/her tract, by year, and the student's best test score only if he or she is in the top 20% of qualified students in the tract, by year, as measured by "fit." Fit is calculated using a race-blind Probit regression of the actual UNC admission decision using students in the historic NCERDC data that are also in Connect Carolina data. Explanatory variables, from NCERDC, include SAT combined score, ACT Comprehensive score, percentile based on class rank, GPA, sex, high school sports participation, and citizenship status. Fitted values from this regression determine a student's fit. The coefficients from the Multinomial Logit regression of race/ethnicity are used to generate predictions of race/ethnicity for each 2014-15 student. For each student in 2014-15, these predictions are used as inputs, along with the non-race data, into the estimated race-conscious Probit regression of the actual UNC admission decision to determine a SES-and-Geography-Predicted Admission Index. Of these students, those with test scores are then ranked from highest to lowest a SES-and-Geography-Predicted Admission Index and admitted going down the list until the predicted matriculating class size is approximately equal to the actual number of NC resident public school matriculants at UNC in 2014-15.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students. A number of students identified only as multi-racial in NCERDC whereas all students in Connect Carolina identified their specific race(s). Based on 2010 Census data, 85% of students self-reporting as multi-racial are considered as URM, and are included in Total URM.
- [7] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not the SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

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# **Appendix A**

# EXHIBIT 8 TABLE A.1

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 750 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 5% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	159	26.0%	996	76	1599	0
Asian	365	14.3%	1356	17	2.8%	1015	348	1373	0
Hispanic	162	6.3%	1234	143	23.4%	1010	19	2923	0
Native American	46	1.8%	1262	9	1.5%	1021	37	1320	0
Pacific Islander	2	0.1%	1325	1	0.2%	998	1	1652	0
White	1,656	64.7%	1329	282	46.2%	1038	1,374	1389	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	611	100.0%	1019	1,950	1406	0
Total URM [6]	443	17.3%	1214	311	50.9%	1003	132	1712	0
Total Non-URM [6]	2,118	82.7%	1335	300	49.1%	1036	1,818	1384	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 611 seats are filled in the disadvantaged step, then 1,950 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.2

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 750 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 10% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	112	19.3%	1076	123	1296	0
Asian	365	14.3%	1356	21	3.6%	1088	344	1372	0
Hispanic	162	6.3%	1234	127	21.9%	1088	35	1764	0
Native American	46	1.8%	1262	9	1.6%	1108	37	1299	0
Pacific Islander	2	0.1%	1325	0	0.0%	1086	2	1325	0
White	1,656	64.7%	1329	310	53.5%	1117	1,346	1378	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	579	100.0%	1102	1,982	1376	0
Total URM [6]	443	17.3%	1214	248	42.8%	1084	195	1381	0
Total Non-URM [6]	2,118	82.7%	1335	331	57.2%	1115	1,787	1376	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 579 seats are filled in the disadvantaged step, then 1,982 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.3

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 750 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 15% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	78	14.0%	1141	157	1216	0
Asian	365	14.3%	1356	20	3.6%	1164	345	1367	0
Hispanic	162	6.3%	1234	104	18.7%	1142	58	1400	0
Native American	46	1.8%	1262	13	2.3%	1154	33	1304	0
Pacific Islander	2	0.1%	1325	1	0.2%	1090	1	1560	0
White	1,656	64.7%	1329	340	61.2%	1164	1,316	1371	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	556	100.0%	1156	2,005	1358	0
Total URM [6]	443	17.3%	1214	195	35.1%	1142	248	1271	0
Total Non-URM [6]	2,118	82.7%	1335	361	64.9%	1164	1,757	1370	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 556 seats are filled in the disadvantaged step, then 2,005 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.



# EXHIBIT 8 TABLE A.4

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 750 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 20% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	72	13.4%	1178	163	1197	0
Asian	365	14.3%	1356	19	3.5%	1196	346	1365	0
Hispanic	162	6.3%	1234	89	16.5%	1176	73	1306	0
Native American	46	1.8%	1262	11	2.0%	1189	35	1285	0
Pacific Islander	2	0.1%	1325	0	0.0%	1163	2	1325	0
White	1,656	64.7%	1329	348	64.6%	1197	1,308	1364	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	539	100.0%	1191	2,022	1347	0
Total URM [6]	443	17.3%	1214	172	31.9%	1177	271	1238	0
Total Non-URM [6]	2,118	82.7%	1335	367	68.1%	1197	1,751	1364	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 539 seats are filled in the disadvantaged step, then 2,022 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.5

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 750 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 25% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	66	12.6%	1211	169	1184	0
Asian	365	14.3%	1356	20	3.8%	1231	345	1363	0
Hispanic	162	6.3%	1234	71	13.5%	1220	91	1246	0
Native American	46	1.8%	1262	14	2.7%	1214	32	1283	0
Pacific Islander	2	0.1%	1325	0	0.0%	1220	2	1325	0
White	1,656	64.7%	1329	354	67.4%	1225	1,302	1357	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	525	100.0%	1222	2,036	1338	0
Total URM [6]	443	17.3%	1214	151	28.8%	1215	292	1214	0
Total Non-URM [6]	2,118	82.7%	1335	374	71.2%	1225	1,744	1358	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 525 seats are filled in the disadvantaged step, then 2,036 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.6

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,000 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 5% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	240	28.8%	959	-5	N/A	0
Asian	365	14.3%	1356	21	2.5%	986	344	1379	0
Hispanic	162	6.3%	1234	197	23.7%	976	-35	N/A	0
Native American	46	1.8%	1262	14	1.7%	979	32	1386	0
Pacific Islander	2	0.1%	1325	1	0.1%	985	1	1665	0
White	1,656	64.7%	1329	359	43.1%	1005	1,297	1419	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	832	100.0%	984	1,729	1473	0
Total URM [6]	443	17.3%	1214	451	54.2%	967	-8	N/A	0
Total Non-URM [6]	2,118	82.7%	1335	381	45.8%	1004	1,737	1408	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 832 seats are filled in the disadvantaged step, then 1,729 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.7

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,000 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 10% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	171	21.7%	1046	64	1579	0
Asian	365	14.3%	1356	27	3.4%	1065	338	1379	0
Hispanic	162	6.3%	1234	167	21.2%	1065	-5	N/A	0
Native American	46	1.8%	1262	11	1.4%	1090	35	1316	0
Pacific Islander	2	0.1%	1325	1	0.1%	1018	1	1632	0
White	1,656	64.7%	1329	412	52.2%	1085	1,244	1410	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	789	100.0%	1072	1,772	1422	0
Total URM [6]	443	17.3%	1214	349	44.2%	1056	94	1801	0
Total Non-URM [6]	2,118	82.7%	1335	440	55.8%	1084	1,678	1401	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 789 seats are filled in the disadvantaged step, then 1,772 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.8

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,000 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 20% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	108	14.7%	1146	127	1230	0
Asian	365	14.3%	1356	26	3.5%	1166	339	1371	0
Hispanic	162	6.3%	1234	132	18.0%	1146	30	1624	0
Native American	46	1.8%	1262	15	2.0%	1164	31	1309	0
Pacific Islander	2	0.1%	1325	0	0.0%	1137	2	1325	0
White	1,656	64.7%	1329	454	61.8%	1171	1,202	1388	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	735	100.0%	1163	1,826	1375	0
Total URM [6]	443	17.3%	1214	255	34.7%	1147	188	1306	0
Total Non-URM [6]	2,118	82.7%	1335	480	65.3%	1171	1,638	1383	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 735 seats are filled in the disadvantaged step, then 1,826 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.9

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,000 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 25% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	97	13.5%	1182	138	1198	0
Asian	365	14.3%	1356	28	3.9%	1204	337	1369	0
Hispanic	162	6.3%	1234	113	15.7%	1183	49	1353	0
Native American	46	1.8%	1262	18	2.5%	1193	28	1306	0
Pacific Islander	2	0.1%	1325	0	0.0%	1184	2	1325	0
White	1,656	64.7%	1329	462	64.3%	1200	1,194	1379	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	718	100.0%	1195	1,843	1360	0
Total URM [6]	443	17.3%	1214	228	31.8%	1183	215	1247	0
Total Non-URM [6]	2,118	82.7%	1335	490	68.2%	1201	1,628	1375	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 718 seats are filled in the disadvantaged step, then 1,843 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.10

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,250 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 5% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	335	31.6%	927	-100	N/A	0
Asian	365	14.3%	1356	26	2.5%	963	339	1386	0
Hispanic	162	6.3%	1234	250	23.6%	948	-88	N/A	0
Native American	46	1.8%	1262	20	1.9%	936	26	1513	0
Pacific Islander	2	0.1%	1325	1	0.1%	969	1	1681	0
White	1,656	64.7%	1329	428	40.4%	980	1,228	1451	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	1,060	100.0%	954	1,501	1568	0
Total URM [6]	443	17.3%	1214	605	57.1%	936	-162	N/A	0
Total Non-URM [6]	2,118	82.7%	1335	455	42.9%	979	1,663	1432	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

[1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.

[2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

[3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.

[4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.

[5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 1,060 seats are filled in the disadvantaged step, then 1,501 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.

[6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.11

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,250 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 10% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	234	23.3%	1021	1	41093	0
Asian	365	14.3%	1356	31	3.1%	1051	334	1384	0
Hispanic	162	6.3%	1234	214	21.3%	1040	-52	N/A	0
Native American	46	1.8%	1262	14	1.4%	1055	32	1352	0
Pacific Islander	2	0.1%	1325	1	0.1%	1011	1	1639	0
White	1,656	64.7%	1329	509	50.7%	1060	1,147	1448	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	1,003	100.0%	1046	1,558	1487	0
Total URM [6]	443	17.3%	1214	462	46.1%	1030	-19	N/A	0
Total Non-URM [6]	2,118	82.7%	1335	541	53.9%	1059	1,577	1429	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

[1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.

[2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

[3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.

[4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.

[5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 1,003 seats are filled in the disadvantaged step, then 1,558 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.

[6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.



# EXHIBIT 8 TABLE A.12

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,250 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 15% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	195	20.2%	1074	40	1764	0
Asian	365	14.3%	1356	35	3.6%	1105	330	1383	0
Hispanic	162	6.3%	1234	194	20.1%	1088	-32	N/A	0
Native American	46	1.8%	1262	21	2.2%	1108	25	1391	0
Pacific Islander	2	0.1%	1325	2	0.2%	1049	0	N/A	0
White	1,656	64.7%	1329	518	53.7%	1117	1,138	1425	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	965	100.0%	1102	1,596	1442	0
Total URM [6]	443	17.3%	1214	410	42.5%	1082	33	2857	0
Total Non-URM [6]	2,118	82.7%	1335	555	57.5%	1116	1,563	1413	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 965 seats are filled in the disadvantaged step, then 1,596 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.13

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,250 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 20% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	164	17.5%	1116	71	1366	0
Asian	365	14.3%	1356	35	3.7%	1139	330	1379	0
Hispanic	162	6.3%	1234	173	18.5%	1125	-11	N/A	0
Native American	46	1.8%	1262	19	2.0%	1145	27	1344	0
Pacific Islander	2	0.1%	1325	2	0.2%	1077	0	N/A	0
White	1,656	64.7%	1329	544	58.1%	1153	1,112	1415	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	937	100.0%	1140	1,624	1414	0
Total URM [6]	443	17.3%	1214	356	38.0%	1122	87	1593	0
Total Non-URM [6]	2,118	82.7%	1335	581	62.0%	1152	1,537	1404	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 937 seats are filled in the disadvantaged step, then 1,624 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.14

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,250 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 25% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	136	14.9%	1156	99	1239	0
Asian	365	14.3%	1356	33	3.6%	1186	332	1373	0
Hispanic	162	6.3%	1234	150	16.4%	1160	12	2164	0
Native American	46	1.8%	1262	23	2.5%	1169	23	1355	0
Pacific Islander	2	0.1%	1325	0	0.0%	1165	2	1325	0
White	1,656	64.7%	1329	570	62.5%	1181	1,086	1407	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	912	100.0%	1173	1,649	1392	0
Total URM [6]	443	17.3%	1214	309	33.9%	1159	134	1342	0
Total Non-URM [6]	2,118	82.7%	1335	603	66.1%	1181	1,515	1396	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 912 seats are filled in the disadvantaged step, then 1,649 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.15

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,500 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 5% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	446	34.6%	898	-211	N/A	0
Asian	365	14.3%	1356	29	2.2%	947	336	1391	0
Hispanic	162	6.3%	1234	304	23.6%	924	-142	N/A	0
Native American	46	1.8%	1262	27	2.1%	905	19	1769	0
Pacific Islander	2	0.1%	1325	1	0.1%	955	1	1695	0
White	1,656	64.7%	1329	482	37.4%	962	1,174	1480	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	1,289	100.0%	929	1,272	1704	0
Total URM [6]	443	17.3%	1214	777	60.3%	908	-334	N/A	0
Total Non-URM [6]	2,118	82.7%	1335	512	39.7%	961	1,606	1454	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

Note:

[1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.

[2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).

[3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.

[4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.

[5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 1,289 seats are filled in the disadvantaged step, then 1,272 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.

[6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.16

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,500 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 10% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	299	24.5%	999	-64	N/A	0
Asian	365	14.3%	1356	36	3.0%	1032	329	1392	0
Hispanic	162	6.3%	1234	271	22.2%	1015	-109	N/A	0
Native American	46	1.8%	1262	17	1.4%	1033	29	1396	0
Pacific Islander	2	0.1%	1325	1	0.1%	1004	1	1646	0
White	1,656	64.7%	1329	596	48.9%	1040	1,060	1491	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	1,220	100.0%	1024	1,341	1578	0
Total URM [6]	443	17.3%	1214	587	48.1%	1007	-144	N/A	0
Total Non-URM [6]	2,118	82.7%	1335	633	51.9%	1040	1,485	1461	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 1,220 seats are filled in the disadvantaged step, then 1,341 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.17

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,500 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 15% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	252	21.5%	1055	-17	N/A	0
Asian	365	14.3%	1356	40	3.4%	1090	325	1389	0
Hispanic	162	6.3%	1234	231	19.7%	1072	-69	N/A	0
Native American	46	1.8%	1262	25	2.1%	1086	21	1471	0
Pacific Islander	2	0.1%	1325	2	0.2%	1047	0	N/A	0
White	1,656	64.7%	1329	624	53.2%	1096	1,032	1470	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	1,174	100.0%	1082	1,387	1511	0
Total URM [6]	443	17.3%	1214	508	43.3%	1064	-65	N/A	0
Total Non-URM [6]	2,118	82.7%	1335	666	56.7%	1095	1,452	1445	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 1,174 seats are filled in the disadvantaged step, then 1,387 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.18

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,500 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 20% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	218	19.1%	1094	17	2433	0
Asian	365	14.3%	1356	44	3.9%	1118	321	1389	0
Hispanic	162	6.3%	1234	216	18.9%	1106	-54	N/A	0
Native American	46	1.8%	1262	24	2.1%	1122	22	1414	0
Pacific Islander	2	0.1%	1325	2	0.2%	1073	0	N/A	0
White	1,656	64.7%	1329	638	55.9%	1135	1,018	1451	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	1,142	100.0%	1120	1,419	1470	0
Total URM [6]	443	17.3%	1214	458	40.1%	1101	-15	N/A	0
Total Non-URM [6]	2,118	82.7%	1335	684	59.9%	1133	1,434	1431	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 1,142 seats are filled in the disadvantaged step, then 1,419 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.

# EXHIBIT 8 TABLE A.19

## Admissions Modeling Based on Four-Year College-Related Socioeconomic Index 1,500 Admission Seats Set Aside for Disadvantaged Students where Disadvantage is Lowest 25% on Index Predicted Matriculated Class, 2014-15

Race/Ethnicity	Actual UNC NC Resident Public School Matriculants [1]			Predicted UNC NC Resident Public School Matriculants from Disadvantaged Pool [3]			Students Needed from Non-Disadvantaged Pool to Match Actual		Feasibility [5]
	Number of Students	Percent of Matriculants	Avg. Test Score [2]	Number of Students [4]	Percent of Matriculants	Avg. Test Score [2]	[A] Number of Students	[B] Avg. Test Score	Feasible Trials out of 100
African American	235	9.2%	1191	178	16.0%	1136	57	1364	0
Asian	365	14.3%	1356	41	3.7%	1163	324	1380	0
Hispanic	162	6.3%	1234	188	16.9%	1142	-26	N/A	0
Native American	46	1.8%	1262	28	2.5%	1154	18	1430	0
Pacific Islander	2	0.1%	1325	2	0.2%	1091	0	N/A	0
White	1,656	64.7%	1329	675	60.7%	1163	981	1443	0
Missing	95	3.7%	1359	-	-	-	95	1359	-
Total	2,561	100.0%	1314	1,112	100.0%	1155	1,449	1436	0
Total URM [6]	443	17.3%	1214	394	35.4%	1140	49	1812	0
Total Non-URM [6]	2,118	82.7%	1335	718	64.6%	1163	1,400	1423	

Source: 2010 Census; 2010-2014 American Community Survey 5-Year Estimates; College Board; Connect Carolina; Connect Carolina-NCERDC Crosswalk; "Multiple Testers: What Do We Know About Them?," Harmston, M. and J. Crouse, ACT Inc., 2016; NCERDC; North Carolina Public High School List; U.S. Department of Education

- Note:
- [1] The baseline actual UNC matriculated students' statistics were calculated from Connect Carolina using North Carolina resident public school students with non-missing test scores. The federal waterfall for race/ethnicity, which is used by NCERDC, identifies individuals as Hispanic or not Hispanic, then secondarily categorizes them as African American, Native American, Asian, Pacific Islander, or white (2007 USED Guidance on Maintaining, Collecting, and Reporting Race and Ethnicity Data). In contrast, Connect Carolina categorizes individuals that are both African American and Hispanic as African American. To allow for consistent comparisons, in this analysis, Connect Carolina race/ethnicity is converted according to the order of the federal race/ethnicity waterfall, such that a Hispanic and African American individual is categorized as Hispanic.
- [2] For students who took the SAT and/or took the ACT multiple times, SAT scores are the maximum of students' highest combined SAT section scores and the corresponding SAT value for students' highest combined ACT section scores (using the 2009 College Board Concordance Table). For students who took only the ACT once but not SAT, SAT scores are the corresponding SAT value for students' highest combined ACT section scores plus 40 points. The 40 points adjustment roughly corresponds to a student's ACT score being adjusted up by 1.1 points, as the ACT reports that students first testing as juniors increase their Composite score by 1.1 points by their final test session (Harmston and Crouse, 2016).
- [3] The matriculation probability for each NCERDC student is predicted based on a Probit regression model using data for the actual 2013-14 and 2014-15 UNC admits: matriculation is regressed on maximum test score for students with a maximum test score between 1080 and 1460. Regression is estimated separately by race for African American, Asian, Hispanic, White students. For Native American and Pacific Islander students, regression is estimated across all students because of small sample size. Summary statistics are calculated across all students identified for admission using application and matriculation probabilities as weights. Fitted matriculation probabilities conditional on admission are calculated and reduced by multiplying them by 0.75 to account for the likelihood that not all identified students will apply to UNC.
- [4] Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 Census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [5] Feasibility is determined as follows. The Connect Carolina – NCERDC Crosswalk is utilized to construct a pool of matched actual UNC NC resident public school matriculants for 2014-15. Students admitted in the SES disadvantaged step are removed. Students to fill the UNC class are then randomly drawn from this pool 100 times. For example, if 1,112 seats are filled in the disadvantaged step, then 1,449 students are drawn in each of the trials. A trial is considered "feasible" if 1) the number of students of a given race/ethnicity needed (shown in column [A]) is less than or equal to the number of students picked of that race/ethnicity in the trial, and 2) the average test score for students of a given race/ethnicity needed (shown in column [B]) is less than or equal to the average test score for students picked of that race/ethnicity in the trial. If the number of students needed (column [A]) is negative, then all trials are either feasible or not depending on whether the average test scores for the students in the disadvantaged pool are greater or less than the average test scores for the actual students. Students identified only as multi-racial in NCERDC are allocated to other race/ethnicity categories based on 2010 census data for those who self-reported as multi-racial: 52.5% African American, 12.7% Asian, 20.7% Hispanic, 11.7% Native American, and 1.3% Pacific Islander.
- [6] Under-represented minorities ("URM") include African American, Hispanic, and Native American students.



# **Appendix B**

**CAROLINE M. HOXBY**  
*Curriculum Vitae*

*Office Address:* Department of Economics  
Stanford University  
Stanford, California 94305  
telephone: (650) 725-8719  
fax: (650) 725-5702  
e-mail: [choxby@stanford.edu](mailto:choxby@stanford.edu)  
<https://economics.stanford.edu/faculty/hoxby>  
assistant: Samantha Pringnitz [spring1@stanford.edu](mailto:spring1@stanford.edu)

*Employment:* 2007-current: Scott and Donya Bommer Professor of Economics,  
Stanford University  
2005-07: Harvard College Professor, Harvard University  
2001-07: Allie S. Freed Professor of Economics, Harvard University  
1997-00 : Morris Kahn Associate Professor of Economics, Harvard  
University  
1994-97: Assistant Professor of Economics, Harvard University

*Other Affiliations  
and positions:* Senior Fellow, Hoover Institution; member, Hoover Koret Task Force on  
K–12 Education  
Director, Economics of Education Program, National Bureau of Economic  
Research  
Senior Fellow, Stanford Institute for Economic Policy Research  
Research Associate, Labor, Public Economics, and Children programs,  
National Bureau of Economic Research  
Visiting Professor, Paris School of Economics, 2006-07

*Education:* Ph.D., Economics, Massachusetts Institute of Technology, May 1994  
M.Phil., Economics, University of Oxford (England), June 1990  
A.B. *summa cum laude*, Economics, Harvard University, June 1988

*Honors and  
Fellowships* 2016: Fellow (elected), The Society of Labor Economists  
2014: [John and Lydia Pearce Mitchell University Fellow](#) in  
Undergraduate Education  
2013: The [Smithsonian Institution Ingenuity Award](#)  
2013: Stanford Economics Department Award, Teacher of the Year  
2008: Global Leader of Tomorrow, World Economic Forum  
2006: Thomas B. Fordham Prize for Distinguished Scholarship in  
Education

*Honors and Fellowships, continued*

2006: *Phi Beta Kappa* Prize for Excellence in Teaching  
 2002 and 2003: Global Leader of Tomorrow, World Economic Forum  
 2000: Carnegie Scholar, Carnegie Corporation of New York  
 1999: Alfred P. Sloan Research Fellowship in Economics  
 1997-2004: Fellow, MacArthur Foundation, Inequality and Social Interactions Network  
 1998: John M. Olin Junior Faculty Fellowship in Economics  
 1996: Bunting Institute Fellow  
 1994: National Tax Association Award, Best Dissertation in Public Economics.  
 1993: Ford Foundation Fellowship  
 1993: Spencer Foundation Fellowship for Research Related to Education  
 1990-93: National Science Foundation Graduate Fellowship  
 1990: Best M.Phil. Thesis in Economics, University of Oxford  
 1988: Rhodes Scholarship; Best Thesis in Economics, Hoopes Prize, *Phi Beta Kappa*, Harvard University.

*Keynote, Plenary, and Endowed Lectures (selected):*

Alfred Marshall Lectures, University of Cambridge, 2018.  
 The Joan Muysken Lectures, Maastricht University, 2018.  
 The Burt Weisbrod Lecture, University of Wisconsin, 2018.  
 The Snyder Lecture, University of California Santa Barbara, 2018.  
 Martin S. Feldstein Lecture, National Bureau of Economic Research, 2016.  
 The Fellows Lecture, Society of Labor Economists, 2016.  
 Irish Economics Association, Keynote Speaker (annual meeting), 2016.  
 Baxter Liberty Initiative lecture, University of California-Berkeley, 2015.  
 The Donald Gilbert Memorial lecture, University of Rochester, 2014.  
 The Council of Independent Colleges, Keynote Speaker, 2014.  
 The Provost's Forum on the Public University and Social Good lecture, University of California-Davis, 2013.  
 The Bocconi Lecture, Università Bocconi, 2011.  
 The American Enterprise Lecture, Furman University, 2011.  
 The 2010 Clarendon Lectures in Economics, University of Oxford.  
 Distinguished Lecture, Notre Dame University, 2010.  
 Canadian Economic Association, Plenary Speaker (annual meeting), 2007.  
 The Gorman Lectures, University College London, 2007.  
 Econometric Society, Plenary Speaker (summer meeting), 2007.  
 The J. Douglas Gibson Lecture, Queens University, 2006.  
 New Zealand Association of Economists, Plenary Speaker (annual meeting), 2005.  
 Royal Economic Society, Plenary Speaker (annual meeting), 2004.  
 European Association of Labour Economics, Plenary Speaker, September 2003.  
 Southern Economics Association annual meetings, Plenary Speaker, November 2003.

The University of Chicago Political Economy lecture, November 2003  
 National School Boards Association Annual Meeting 2003.  
 The 25th Anniversary Howard T. McMyler Memorial Lecture, 2003.

*Grants*

- 2016: Robin Hood Foundation grant to support the College Investment Project, \$350,000
- 2013: Smith-Richardson Foundation grant to support the College Investment Project, \$350,000.
- 2009: Bill & Melinda Gates Foundation grant to support the Expanding College Opportunities project, \$3,100,000.
- 2009: U.S. Institute for Education Sciences grant to support the Expanding College Opportunities project, \$3,000,000 .
- 2009: Smith-Richardson Foundation grant to support the Expanding College Opportunities project, \$300,000.
- 2008: Mellon Foundation grant to support the Expanding College Opportunities project, \$75,000.
- 2008: Lincoln Institute for Land Policy grant to support work on property tax salience, \$15,000.
- 2007: Spencer Foundation for Education Research grant to support work on college opportunities for low-income students, \$25,000.
- 2005-13: U.S. Institute for Education Sciences, Major Grant, \$1,550,000
- 2004-08: Bradley Foundation Grant, \$25,000 annually
- 2004: McNair Foundation Grant, \$25,000
- 2002-03: Mellon Full-Year Fellowship, Mellon Foundation
- 2002-03: Russell Sage Grant for research on School Finance Inequality
- 1998-2003: National Institute of Child Health and Development grant
- 1996-2006 : Mellon Foundation grant for higher education research
- 1995-98: National Science Foundation grant

*Public Service and Service to the Profession*

- 2014-current: Trustee, Grace Cathedral, San Francisco
- 2014-current: Consumer Financial Protection Bureau, Scientific Committee
- 2012-current: Senior Advisor, *Brookings Papers on Economic Activity*
- 2010-current: Editor, *Annual Review of Economics*
- 2009-2014: Board Member, College Track
- 2009-2012: American Economics Association, Honors and Awards Committee
- 2008-2012: Board Member, Foundation for Teaching Economics
- 2004-09: Presidential Appointee, National Board for Education Sciences
- 2009-10: Society of Labor Economists, Program Committee
- 2004-10: Editor, *The B.E. Journals in Economic Analysis and Policy*
- 2008: The Econometric Society, Program Committee

2008-2014: *Quantitative Economics*, the new journal of the Econometric Society, founding editorial board member

2005: The Econometric Society, Program Committee

2004-07: Review Panel, The Spencer Foundation

*Public Service and Service to the Profession, continued*

2003-05: Governor’s Appointee, Texas Joint Select Committee on Public School Finance

2003: American Economics Association, Program Committee

2003-06: Associate Editor, Review of Economics and Statistics

2002-03: Advisory Council on Education Statistics, U.S. Department of Education

2001-03: National Science Foundation Economics Panel

2001-current: *Education Next*, Editorial Board

2000: The Econometrics Society, Program Committee

1997-00: National Academy of Sciences Panel, Forecasting in Science and Engineering

1996-current : Advice and testimony for Texas, Massachusetts, California, New Hampshire, Ohio, Nebraska, Florida, Arkansas, other state legislatures/courts on school finance equalization, charter school legislation, accountability; testimony for U.S. Congress on higher education, elementary and secondary education initiatives, college costs

1994-current: Referee for *American Economic Review*, *Quarterly Journal of Economics*, *Journal of Political Economy*, *Journal of Public Economics*, *Journal of Labor Economics*, and numerous other journals.

*Graduate Teaching:*

Public Finance: 1996-current

Tax incidence and efficiency. Optimal taxation. Fundamental tax reform. Transfers intended to alleviate poverty. The effect of taxes on earnings. Fees designed to internalize externalities like pollution. Tax salience and evasion. School finance and fiscal federalism. Local public goods including schools. Sophisticated applications of modern applied econometric methods including synthetic controls, regression discontinuity and kink, advanced instrumental variables, integration of reduced-form and structural techniques.

Labor Market Analysis and Applied Methods: 1994-2007

Human capital investments, wage determination, personnel economics, labor supply and demand.

*Undergraduate Teaching:*

## The Economics of Education: 1994-current

How investment in education is determined by factors including ability and family. Topics such as vouchers and charter schools, accountability, teacher effects and incentives, peer effects, class size, the teacher labor market, spending equalization among schools. The market for college education. Effects of financial aid. How college tuition is determined and whether students are matched efficiently with colleges. The effect of education on economic growth, focusing on developing countries. Theory, current applied methods, and empirical research.

## Education as Self-Fashioning: 2012-current

Moving through history from the Rome of the Emperor Hadrian, to the city-states of Renaissance Italy, to the 18th century republic of the United States, we examine how self-made individuals fashion themselves and their surroundings by educating themselves broadly. We ask how a liberal education made their careers rich and transformational. We take up the great debate on whether a liberal education or vocational training is the surest path to advancement. We engage the debate through the works of W.E.B. Du Bois and Booker T. Washington and also through today's struggle over the same issues.

## Public Finance: 1999-2007

Social insurance, unemployment, disability, the effect of taxes on earnings, local public finance.

## Applied Econometrics: 1995-1997

Proof-based simultaneous equations, instrumental variables, measurement error, discrete choice. Current applied methods.

*University Committee Work:*

2017-current: Faculty Senate

2016-current: Committee on the Libraries (C-LIB)

2014-2016: Faculty Senate

2014-2016: Committee on Undergraduate Admissions and Financial Aid

2012-2016: Committee on Course Evaluation

2011-2013: Faculty Senate

2010-2012: Study of Undergraduate Education at Stanford (SUES), Breadth Subcommittee

2009-2013: Undergraduate Advisory Council (UGAC, H&S)

2007-08: Task Force on Undergraduate Expansion (University)

2007-10: Statistics Subcommittee, Committee on Undergraduate Admissions and

- 2006-07: Financial Aid (H&S)  
Advisory Committee to the President for the selection of the Dean of the Faculty of Arts and Sciences (University)
- 2001-07: The Resources Committee (FAS)
- 2004-05: Advisory Committee to the President for the selection of the Dean of the Graduate School of Education (University)
- 2003-07: The Committee on Research Policy (FAS)
- 2005-07: Subcommittee on university policy with respect to electronic publications, copyright, and archival storage (University)
- 1996-99: Faculty Council (FAS)

*Department Committee Work:*

- 2015-16: Co-chair, Graduate Student Recruiting
- 2010-16: Graduate Policy Committee
- 2008-09: Co-chair, Junior Faculty Recruiting
- 2008-09: Co-chair, Graduate Student Recruiting
- 1994-present: service on many departmental committees, including many search committees, Ph.D. student job placement (chair), junior faculty recruiting (chair), graduate admissions, prizes and honors (chair), graduate instruction, and undergraduate instruction.

*Selected Papers (most recent to least recent)*

Hoxby, Caroline. "The Returns to Online Postsecondary Education," in Valerie Ramey and Charles Hulten, editors. *Education, Skills, and Technical Change: Implications for Future U.S. GDP Growth*. Chicago: University of Chicago Press, 2018.

Hoxby, Caroline. "The Productivity of U.S. Postsecondary Institutions," in Caroline Hoxby and Kevin Stange, editors. *Productivity in Higher Education*. Chicago: University of Chicago Press, 2018.

Hoxby, Caroline and Kevin Stange. "Productivity in Higher Education, An Introduction," in Caroline Hoxby and Kevin Stange, editors. *Productivity in Higher Education*. Chicago: University of Chicago Press, 2018.

Hoxby, Caroline, Douglas Staiger, and Kevin Stange. "What Healthcare Teaches Us About Measuring Productivity in Higher Education," in Caroline Hoxby and Kevin Stange, editors. *Productivity in Higher Education*. Chicago: University of Chicago Press, forthcoming.

Hoxby, Caroline. "It's Not the Student's Major: It's the Student." NBER Working Paper (forthcoming).

Hoxby, Caroline. "The Value-Added of U.S. Postsecondary Institutions," U.S. Treasury, Statistics of Income Division Working Paper, 2015.

Hoxby, Caroline and George Bulman, "[The Returns to the Federal Tax Credits for Higher Education](#)," *Tax Policy and the Economy*, Volume 29, 2016.  
<http://www.nber.org/chapters/c13465.pdf>

Hoxby, Caroline and Sarah Turner, "[What High-Achieving Low-Income Students Know About College](#)," *The American Economic Review (P&P)*, May 2015.  
<https://www.aeaweb.org/aea/2015conference/program/retrieve.php?pdfid=1278>

Hoxby, Caroline and Jeffrey Brown, editors. [How the Financial Crisis and Great Recession Affected Higher Education](#). Chicago: University of Chicago Press, 2015.  
<http://press.uchicago.edu/ucp/books/book/chicago/H/bo19198130.html>

Dinerstein, Michael, Caroline Hoxby, Jonathan Meer, and Pablo Villaneuva, "Did the Fiscal Stimulus Work for Universities?" *How the Financial Crisis and Great Recession Affected Higher Education*. Chicago: University of Chicago Press, 2014.

Hoxby, Caroline, "[Endowment Management Based on a Positive Model of the University](#)," *How the Financial Crisis and Great Recession Affected Higher Education*. Chicago: University of Chicago Press, 2014.  
<http://www.nber.org/papers/w18626>

Hoxby, Caroline. "[The Economics of Online Postsecondary Education: MOOCs, Nonselective Education, and Highly Selective Education](#)," *American Economic Review (P&P)*, May 2014.  
<http://www.nber.org/papers/w19816>

Hoxby, Caroline and Christopher Avery, "[The Missing "One-Offs": The Hidden Supply of High-Achieving, Low-Income Students](#)," *Brookings Papers on Economic Activity*, 2014.  
[http://www.brookings.edu/~media/Projects/BPEA/Spring%202013/2013a\\_hoxby.pdf](http://www.brookings.edu/~media/Projects/BPEA/Spring%202013/2013a_hoxby.pdf)

Hoxby, Caroline, "[Covering the Costs](#)," in *What Lies Ahead for America's Children and Their Schools*, eds. Chester Finn and Richard Sousa, 2014.  
[http://www.hoover.org/sites/default/files/research/docs/finnsousa\\_whatliesahead\\_final\\_ch9.pdf](http://www.hoover.org/sites/default/files/research/docs/finnsousa_whatliesahead_final_ch9.pdf)  
See also an [abbreviated version](#) in *Defining Ideas*, March 2014.  
<http://www.hoover.org/research/global-achievement-gap>



Hoxby, Caroline, "[Rewarding and Employing Teachers Based on Their Value-Added](#)" *Education Next*, 2014.

[http://educationnext.org/rewarding-and-employing-teachers-based-on-their-value-added/?utm\\_source=feedburner&utm\\_medium=email&utm\\_campaign=Feed%3A+EducationNext+%28Education+Next%29](http://educationnext.org/rewarding-and-employing-teachers-based-on-their-value-added/?utm_source=feedburner&utm_medium=email&utm_campaign=Feed%3A+EducationNext+%28Education+Next%29)

Avery, Christopher, Mark Glickman, Caroline Hoxby, and Andrew Metrick, "[A Revealed Preference Ranking of American Colleges and Universities](#)," *Quarterly Journal of Economics*, 2013.

<http://qje.oxfordjournals.org/content/128/1/425>

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

<http://siepr.stanford.edu/?q=/system/files/shared/pubs/papers/12-014paper.pdf>

Hoxby, Caroline and Sarah Turner, "[Informing Students about Their College Options: A Proposal for Broadening the Expanding College Opportunities Project](#)," The Hamilton Project Discussion Paper 2013-03, June 2013.

[http://www.hamiltonproject.org/files/downloads\\_and\\_links/THP\\_HoxbyTurner\\_FINAL.pdf](http://www.hamiltonproject.org/files/downloads_and_links/THP_HoxbyTurner_FINAL.pdf)

Hoxby, Caroline, and Marika Cabral, "[The Hated Property Tax: Salience, Tax Rates, and Tax Revolts](#)," NBER Working Paper 18514, 2013.

<http://www.nber.org/papers/w18514>

Hoxby, Caroline and Sarah Turner, "[Expanding College Opportunities](#)," *Education Next*, Vol. 13, No. 4, 2013.

<http://educationnext.org/expanding-college-opportunities/>

Hoxby, Caroline, *Competitive New World: The Changing Market for Higher Education*, Princeton University Press, under contract.

Hoxby, Caroline, and Philippe Aghion, *Education and Economic Growth*, Princeton University Press, under contract.

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# **Appendix C**



## Appendix C: Materials Relied Upon

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