Double Counting: The Effect of Wealth on College Admissions

Introduction

"I got in!!" These words barrel out of many high school seniors as they receive different acceptance letters from Universities across the country. Growing up, students are told they need to study hard, get good grades, engage in extracurriculars, and do well on standardized tests to gain admission into their dream school, but is that really true? College admissions is like a top-secret government program; few people really know what goes on behind closed doors. Universities across the country proclaim different admissions metrics that entice students to apply; however, they never tell you quite what they are looking for. Recall in the beginning of 2019, news broke of a large, preposterous college admissions scandal involving a plethora of applicants to some of the best collegiate institutions in the United States. This investigation, code named "Operation Varsity Blues", exposed many parents and their children for bribes to gain admission into prestigious universities. According to the New York Times, 53 parents have been charged as a part of this conspiracy, and there are many court cases that are yet to be resolved relating to this matter (Medina et. al. 6). These parents, many of them wealthy and famous, paid for their children's SAT scores to either be inflated or for someone else to take these exams on their behalf. This is cheating in the highest regard, but it does not stop there. These parents also paid many collegiate sports coaches hundreds of thousands of dollars, or in some cases, millions of dollars, to recruit their child for a sports scholarship to these universities. However, the worst part is many of these children that were falsely recruited did not even play the sport they were given a scholarship for and used it as a ploy to gain entrance. More than a year and a half after this news first broke, allegations continue to persist, and this entire scandal likely will not be fully resolved any time soon. I highlight this scandal to show just how much wealth and fame can influence even the "fairest" system in our society, college admissions. For the longest time, I

thought the college going process was the most accurate, sacred, and equitable system since these universities claim they want to support the social good in our world; however, how can that be true when so many students were getting admitted into colleges only because their family had the money to buy their way in? “Work hard, get good grades, and do your best in school” does not seem so enticing anymore if wealth plays such a large role in college admissions.

While the scandal I discussed lays bare the benefits of wealth on gaining admission into prestigious universities, there are more subtle ways in which wealth tips the playing field away from being level and towards the wealthy. According to Janet Lorin, a writer for Bloomberg news said, selective colleges have been removing their requirements for SAT and ACT scores. On the contrary, the amount of “Need blind schools” decreases every year (Lorin 2020). Need blind Universities do not take a student’s financial situation or ability to pay into consideration when determining admission. As universities remove these financial safeguards for underprivileged students, they expose this group to even more discrimination in the college admissions process due to the double counting of wealth. Money buys access. It purchases attendance to prestigious high schools, elite teachers, top tier SAT tutors, and extracurriculars like playing the violin or piano. It can even buy admittance into prestigious colleges these days. All of these are factors that almost every elite college institution in the United States considers when determining a student’s admission. However, these universities also examine a student’s ability to pay full tuition as a parameter for acceptance. This leads to a disproportionate weighting of wealth in the admissions process resulting in a larger percentage of affluent students gaining entrance into prestigious universities. Now why does this matter? In a perfect world, colleges would accept students based mainly on their merit and qualification with some regard to wealth to stay operational. Colleges prioritizing tuition income is not inherently a

problem since they need money to function, it is that the other admissions metrics are also based on wealth leading to a double counting of wealth in the college admission process. When a college accepts an affluent student, whose collegiate profile is heavily influenced by their familial wealth and income, and not necessarily their own intellectual ability, this causes the college to admit this student based

and hopefully one day gaining entrance into their dream school through hard work and dedication. In the introduction, I talked about how colleges are like a secret code that is uncrackable. Although it is impossible to know what goes on behind closed doors, they do give an outline for prospective students to follow to have the best chance of gaining entrance. Websites like PrepScholar detail the rigorous requirements that top colleges in the US demand from their applicants. A great high school GPA, top tier SAT scores, wonderful extracurriculars, and excellent interviews highlight the minimum qualifications.

application profile, specifically their SAT, the quality of their high school, and high school GPA, are not completely accurate representations of their academic ability.

and Lovenheim (2015). This idea is like that of a sifter. Students are “matched” or sorted into or out of different universities that would essentially optimize their intellectual output. Moreover, it creates categories of different universities that students would most likely succeed in. This idea

their race, and a measure of their family's wealth (this will be important to identify how much each student can pay for the college). Since this college has been around for a long time, they have formed beliefs as to the quality of each student's high school. Furthermore, the college will require an in-person interview as part of the application process and an admissions officer will assign an interview score to each student based upon the student's performance in that interview. After the college receives all this information, they begin the process of determining which A% of students to admit. To aid in this process, the college develops an admission score formula to assign each student an admission score based upon the information they received froy2tan

model of illustrating how wealth influences which students a college admits over-and-above the student's ability to pay for the college's tuition.

This equation also implies that a student's race will influence not only their Q_{Hs}, but also the success they achieve on their SAT. Race has two impacts on a student's SAT. The first is indirectly through the quality of a student's high school. As mentioned above, research shows that minority students are more likely to attend lower quality high schools and perform worse on math and science related topics. This suggests these students are less academically prepared for the SAT. I posit that this is due to the difference in the quality of teachers and access to educational resources compared to higher quality high schools. The second impact comes from financial disparities among minority students. According to the U.S. Department of Education, ethnic minorities make up a disproportionately large segment of the economically poor population in the United States (Gore 1998). This financial inequity means these students are unable to purchase the test prep, tutors, and curriculum that other wealthier, potentially majority students can afford. Intuitively, it is shown in the model under current admissions policies how majority and wealthy students are more likely to attend higher quality high schools and perform better on standardized tests. This is only the first of many instances showing how admissions offices are indirectly tilting their admissions policies in favor of wealthy, majority students.

The final admissions metric I want to examine and provide support for is a student's interview score. Most prestigious universities across the country encourage or require an in-person interview as a part of the admissions process; however, what exactly does this accomplish? Well college admissions offices want to determine if a student is a "good fit" for that school. In the model, the college requires each student to have an in-person interview to ensure that every student is assessed equally in their admission score. Specifically, the college

however, the specific mathematical weight does not impact the logic of the model and I take no stance on what these weights are. This will be important to remember as I investigate the theoretical results and intuition part of this paper.

Given all of the above assumptions, I can re-write the college's admissions score as a function of the exogenous student characteristics. Specifically, the admission score developed can be expressed in terms of the 4 student factors and parameter weights discussed:

$$\mathbf{A_{Score} = W_Q[Q_{Hs}] + W_S[ST] + W_I[IS] + W_w[Wealth] + W_R[|1\text{-}Race|]}$$

$$\mathbf{A_{Score} = [W_Q(Q_W) + W_S(S_W + S_Q Q_W) + W_I(I_W) + W_W]Wealth + [W_Q(Q_R) + W_S(S_Q)(Q_R) + W_I(I_R) + W_S(S_R)]Race + [W_R](|1\text{-}Race|) + [W_S(S_A) + W_I(I_A) + W_Q}$$

into the model was a student’s high school GPA,

This equation shows the race related inefficiency in the model. Similar to wealth, the intuition is the same here just looking at a different student characteristic. Whenever race and racial bias are more important in determining a student's admissions metrics, inefficiency is created. Meaning, each individual increase on any race related parameter other than W_R will result in unnecessary student misplacement. I assume the college wants to minimize the influence that race has on the A_{Score}, specifically, how it is imbedded inside the admissions metrics and the parameter W_R cannot completely account for this racial bias. The importance of this theorem is mainly to mathematically express how inefficiency is created whenever colleges positively weight any race parameter other than W_R (remember "Majority students are coded as a 1") in the model and should focus on minimizing the race related bias for "Majority" students.

True Admission Score

Now that there is an understanding of the student characteristics, admissions metrics, and the method I use to measure inefficiency, I turn to discuss a potential way the college can more efficiently admit students. Specifically, I aim create an admissions system that can more accurately predict a student's ability with the same admissions metrics used in the traditional A_{Score} discussed above. As I have mentioned throughout this paper, the college is unaware of each student's ability and noise value. They only know what a student submits in their admissions packet: Their SAT, name of their high school, admissions interview, race, and wealth. Is there a way to reevaluate these metrics in the student's admissions score to decrease the level of inefficiency and admit more students based upon their {S*}?

To do this, I assume the college has the same information they used to predict the A_{Score} for each student. I assume every college has different, but can be similar, beliefs about the level each student characteristic influences their individual admissions metrics. For example, one

college might believe wealth influences a student's SAT score more or less than others. These beliefs, although different, can be used to contextualize each student's admissions metrics in a way the college can remove the race and wealth related bias discussed above. Particularly, the college can adjust each student's admissions score to account for the positive or negative wealth and race related influence on each of the student's admissions metrics. To clarify, no matter the level of wealth or race of a given student, the college can use its beliefs about the individual impact both wealth and race have on the student's admissions metrics to gain a better understanding of the student's actual ability. There are two methods I use to adjust each student's admissions score. First, given the assumptions above, I developed the following formula, which I classify as T_W, to remove the wealth impact on each student's admissions score:

$$\mathbf{T_W = [W_Q(Q_W) + W_S[S_W + S_Q(Q_W)] + W_I(I_W)]}$$

This equation might look slightly similar and that is because it is. Recall Theorem 1 discussed above and you will find these formulas are identical. The theorem shows the influence that wealth has on each student's admissions score through their endogenous admissions metrics. Specifically, this encapsulates the entire wealth effect in the model, besides the necessary budget constraint W_W. As a result, the college can reduce a student's admissions score by T_W and eliminate the unnecessary wealth bias from each student's admissions profile. Let me pause here for a moment. This means the college, based upon their beliefs about wealth in the student's admissions profile, can more accurately contextualize each student's admissions packet. Now why does this matter for the model? Recall the four student characteristics I use to predict each student's admissions metrics. Reducing the admissions score by T_W means that wealth has no impact on a student's probability of being a

perspective of a student's ability since there is no unnecessary wealth influence anymore. The resulting change means that {S} and {S*} grow closer since the college can better predict a student's ability, and thus admit students more accurately based upon their ability. Therefore, inefficiency falls.

The second component I use to reduce inefficiency in a student's admissions score is race. Specifically, I aim to eliminate the positive or negative influence a student's race has on their admissions metrics and therefore their admissions score. Note, the college already uses the parameter W_R to help reduce some of the racial bias in each student's admissions score, meaning they positively weight a minority student's race; however, inside the model they fail to completely account for the race related influence on a student's admissions packet. Given the assumptions above, I developed the following formula, which I classify as T_R, to remove the racial influence on each student's admissions score:

$$\mathbf{T_R = [W_Q(Q_R) + W_S(S_Q)(Q_R) + W_I(I_R) + W_S(S_R)]}$$

Similar to T_W this equation should also be familiar. Recall theorem 2 above and you will find these two formulas are identical. Unlike T_W, the college has no racial budget constraint, meaning, in theory, they can admit any subset of racially diverse students. I assume the college wants to accept the most merited students with some respect to ethnic diversity on campus. This is purpose of W_R inside the admissions score. However, there remains race related bias imbedded in each student's admissions metrics that is unaccounted for in the parameter W_R. As a result, the college can use its beliefs about racial influence on a student's admissions metrics to reduce each majority student's admissions score by T_R to eliminate the race related bias majority students receive in society. This allows the college to contextualize each student's admissions score without the impact of a student's race. As a result, they gain an even clearer view of a student's

must establish its beliefs about how the four exogenous student characteristics influence each student's admissions metrics as well as how they choose to prioritize these admissions metrics inside the admissions score. That is, they must assign values for all parameter weights inside the model. The second step involves assigning each student an admission score the same way as before using the original A_{Score}. After the college has performed these two steps, they can use the above true admission score equation and reassign each student a new admission score. The resulting true admission score brings {S} and {S*} as close as possible inside the context of what the college believes each parameter is. To clarify, the level of inefficiency will vary depending on the college's beliefs about each individual parameter inside the model. However, the true admission score will minimize this level of inefficiency regardless of the college's beliefs.

Note, this true admissions score cannot completely predict ability. There remains some level of outside influence associated with the randomness or luck in life and the necessary financial constraint. The college cannot accurately predict how much noise exists for each student and will therefore make admissions decisions where $\{S\} \neq \{S^*\}$ even using the true admission score. However, for any positive parameter weight inside the model, the true admission score reduces inefficiency. Let me pause here for a moment to explain what this entails. The true admission score is really only useful whenever the college has beliefs about the individual parameters. This was one of the steps discussed above that the college must take to determine a student's true admission score. In the context of the model, for any possible positive value of any parameter, the true admission score reduces inefficiency. This means the college can assign whatever positive parameter values they believe on any of the student characteristics or admissions metrics and this model will still reduce inefficiency. How cool is that? No matter

wh

race with 1 being a “Majority’ student and 0 being a “Minority” student. This grouping is done to classify individuals that receive some level of positive or negative bias in their admissions metrics. Note, this bias refers to the racial bias we see in society. Furthermore, I do not take a stance on which ethnicities fall into “Majority” or “Minority”; the college can decide this for themselves. So, a race value of 1 just means a student that has experienced positive bias in society and their admissions metrics, whereas a 0 is the opposite. Thirdly, I assign each student an ability value that cannot be viewed by the college, but this is important to measure inefficiency. This is similar to wealth and is coded as a normal distribution with a mean of 5 and standard deviation of 1, allowing the college to have a wide variety of ability levels. Finally, I assume each student has some level of positive or negative noise/luck. This value was coded with a mean of zero and a standard deviation of 1, meaning a student can have either a negative or positive noise influence on their admissions metrics.

Given these assumptions and the formulas developed in the admission score, each student’s admissions metrics are calculated using the values for the four characteristics. This gives each student a numerical value for their SAT, quality of high school, and interview score. Note, these admissions metrics are not expressed in the traditional manner. Specifically, the SAT score is not valued from 0 to 1600, rather it will vary as the weights on each student characteristic inside this formula is changed. This holds true for the three admissions metrics used in the admissions score. Then, I must act similarly to the college and use different beliefs to assign specific values for each parameter inside the model. See the Appendix, Scenario 1 for the detailed parameter weights I assigned in the model. Once again, these values do not represent my beliefs, rather I arbitrarily bestow them with the constraint that they must sum to 1 in each formula to gain intuition inside the model. After assigning these weights, the Excel program

automatically calculates each student's A_{Score}, T_R, T_W, and TA_{Score} using the formulas described above. I then assume the college determines which 1,000 students to admit using both the original admission score and true admission score. This is where valuable intuition is gleaned from the model given the different parameter assumptions.

Before delving into the true admission score, let me first discuss the values of T_R and T_W. As previously stated, these are the race and wealth deductions inside the true admission score which removes all unnecessary racial and financial bias from the original admission score. The formula used to calculate these values is quite intriguing. Each parameter mathematically removes and aims to minimize the influence that wealth and race have on the student's true admission score. Graphically, in the Appendix, Figure 1 it is shown the minimum level of inefficiency for values of T_W from 0 to 1 holding constant all other parameters. Using the formula, I calculate T_W to be 0.264. Although this value is not the minimum of the function,

parameter T_R accounts for all unnecessary race bias inside the true admission score. Unlike T_W, there is no mandatory racial constraint, rather the college can choose to accept more minority students if they want to, but do not have to. In this scenario, I assume the college places a weight of 0 for W_R meaning T_R accurately accounts for all racial bias in the true admission score. If the college were to positively or negatively weight W_R, then T_R would still capture all the unnecessary racial bias in the student's true admission score; however, it would not minimize this function since the college places a preference on having more or potentially less minority students on campus than otherwise suggested by the true admission score.

Turning to the true admission score calculated for each student in my scenario, the level of inefficiency substantially improves compared to the original admission score. Using the same parameter assumptions, the number of misplaced students according to the original admission score is 1,340. That is, 1,340 students who either gained acceptance but should not have according to their [S*} or did not gain admittance but should have according to their {S*}. On the contrary, only 968 students were misplaced using the true admission score, a difference of 372 students or 18.6%. Given my parameter assumptions, this shows how even with the same admissions packet information, the college can reduce inefficiency by 18.6% through the introduction of the true admission score into the college's admissions process. Moreover, the college is much more likely to admit students with higher levels of ability using this true admission score. See Appendix Figures 3-6. These graphs show the acceptance rates of students in different wealth and ability quartiles. Recall, I assume the college only accepts 10% of the 10,000 applicants. Figures 3 and 4 show the acceptance rates of students among these different wealth and ability distributions according to their original admission score, whereas Figures 5 and 6 show the same metrics but according to the student's true admission score. Comparing

these graphs, it is clear that under the original admission score, students with higher wealth levels are disproportionately more apt to gain acceptance than students with lower wealth levels. Specifically, the college did not accept any students who fell in the bottom 2 wealth quartiles, but the top ability quartile. This indicates the wealth inefficiency expressed throughout this paper. Moreover, minority students had lower acceptance rates regardless of the student's ability or wealth showing the impact that racial bias has inside the student's admission score. Looking at Figures 5 and 6, it is clear that students who fall into the top ability quartiles regardless of their wealth have a much higher acceptance rate compared to Figures 3 and 4. Although some students of lower ability, but higher wealth levels are still accepted, this is to be expected since I assume the college has a positive weight on W_W. Also, the students who fall in the top ability, top wealth quartile still have higher acceptance rates than students with similar ability, but lower wealth. This is also because W_W is not zero. However, the acceptance rates for students in the top ability quartile regardless of wealth improves across the board compared to Figures 3 and 4. This further illustrates the influence that wealth and race have on a student's chances of being admitted into this college. Using the original admission score, top ability students coming from lower income families had no chance of being admitted, yet students from the bottom ability quartile but top wealth had a much higher acceptance rate. The introduction of the true admission score gave top tier ability, lower income students a much higher chance of attending this college even when having a positive weight on W_W.

This is just one specific example of how the model can be used to admit students more efficiently. However, since the model is generalized, any college can use this Excel sheet in their own admissions process to determine which students they should and should not admit according to their own preferences and beliefs. As I stated earlier, the true admission score improves

efficiency for every possible positive parameter value, meaning the college can express their beliefs about these dependent and independent terms differently, and the intuition, logic, and results still hold. Furthermore, the model allows the college to view the acceptance rates of students coming from different wealth, race, and ability backgrounds, enabling the college to see how the model improves the distribution of accepted students based upon these characteristics.

I outline a robust, realistic solution to the problems in our collegiate admissions system. As our country and our world continue along the path towards equality in all regards, this paper outlines an avenue forward to safeguard the financially and racially disadvantaged in society.

After completing this theoretical model, it is clear that there are numerous ways to expand upon this research. First, colleges were unwilling to give me access to data within their admissions systems due to confidentiality. However, if a researcher were to obtain this clearance, they could test this theoretical model on actual admissions and see if the logic, intuition, and assumptions still hold. This would allow the model to take another important step to becoming applicable to colleges in the real-world environment. Second, I analyzed four specific student characteristics that the literature identifies as crucial to each student's admissions metrics. Although they account for most of the variability inside each student's admissions packets, I did not add any interaction terms to the model that could also influence how colleges make their admissions decisions. It is likely that wealth and race are correlated with one another and adding this interaction term could help account for more of the variability inside the model. Finally, I assume colleges want to accept the most academically and athletically abled students subject to a budget and ethnic diversity constraint. It could indeed be true that colleges make their admissions decisions subject to other constraints this model did not address. A potential expansion of this model could be communicating with colleges about how they make their actual admissions decisions and if they are truly trying to obtain the most merited students subject to the two financial and racial constraints or if there are more factors they consider. I hope we all continue doing our part, as small as it might be, to make this world a better place one admissions decision at a time.

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Appendix

W_I	0.25
W_W	0.2
W_R	0

Figure 1

Figure 2

Figure 3: The acceptance rate of students in different wealth and ability quartiles with a

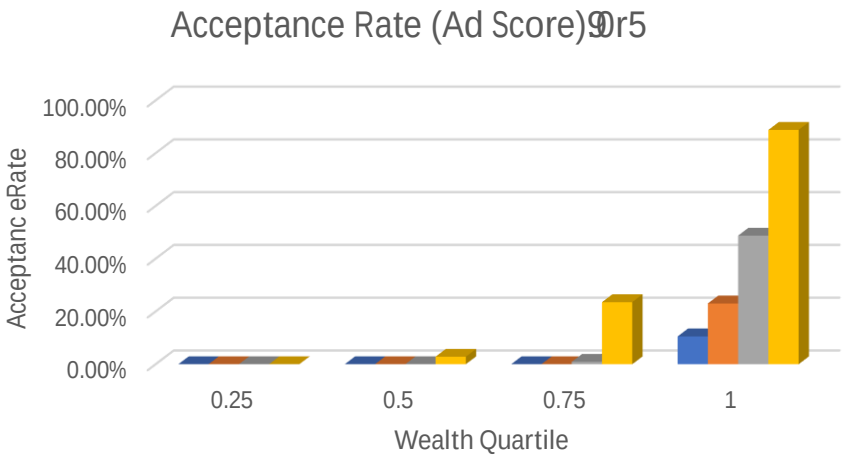

Figure 4: The acceptance rate of students in different wealth and ability quartiles with a race equal to 0 according to the original admission score

Figure 5: The acceptance rate of students in different wealth and ability quartiles with a race equal to 1 according to the true admission score

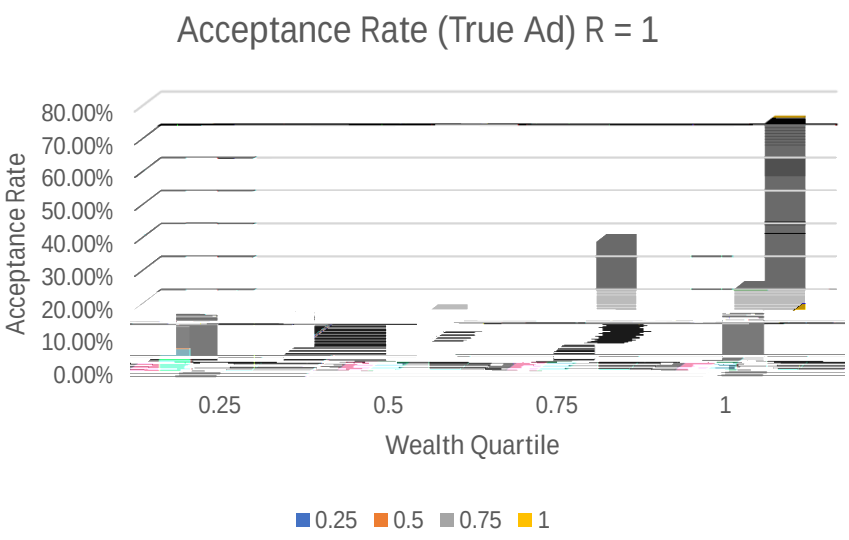

Figure 6: The acceptance rate of students in different wealth and ability quartiles with a race equal to 0 according to the true admission score