

**The Effects of the Chicago Public School Socioeconomic Tier System on Minority
Enrollment at Top Selective Enrollment High Schools**

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A. Abstract

Since 2009, Chicago Public Schools (CPS) has employed a race-neutral, socioeconomic tier system to determine admission into its selective enrollment high schools (SEHS). Prior to 2009, CPS employed a race-based affirmative action system where seats at SEHS were determined by racial quotas. Since the change was implemented, the share of White students at the top five SEHS has increased from 32% to 38%, while the share of Black students has declined from 19% to 11%. Asian and Hispanic students as a share of the top five SEHS student body has remained relatively stagnant. First, I will examine if and how the tier system has disproportionately affected minority students. Then, I will propose modifications to the tier system that can be used to rebalance the percentages of minority students.

B. Literature Review

1. Affirmative Action Motivation and Definition

New analysis by researchers at Stanford University, funded by The Pew Charitable Trusts and the Russell Sage Foundation, finds that approximately half of parental income advantages in the United States are passed on to children. This indicates a very low level of economic mobility and meritocracy, both of which are pillars of American/Western/Capitalist societies (Pew Research 2015). One explanation for the lack of social mobility in the US is the institution of higher education. Indeed, income and wealth related gaps both in access to and in success in higher education are large and growing. Higher-income parents make great efforts and employ significant resources to ensure their children's academic success, while children of poor parents are “less well prepared academically; ill prepared to select colleges, apply for admission, and secure acceptance; and poorly informed about the cost of attending college and the availability of needs-based financial aid.” (Haveman, Smeeding 2006). As such, poor and minority students are less likely to attend top-tier higher education institutions (HEIs), as compared to their rich White

counterparts, even though wealth and race are uncorrelated with work-ethic, IQ, or other determinants of success in the US. The cycle continues as attendees of top tier HEIs are more likely to be wealthy and thus able to invest more in *their* children, who then become more likely to attend top tier HEIs and so on.

Affirmative Action (AA), whether race-based or race-neutral, has been a controversial response to the aforementioned cycle. Swaim (1996) defines AA as a “range of governmental and private initiatives that offer preferential treatment to members of designated racial or ethnic minority groups (or to other groups thought to be disadvantaged), usually as a means of compensating them for the effects of past and present discrimination.” In addition to the compensatory, ameliorative rationale for AA, proponents also cite the current value of such programs in enhancing diversity, particularly in educational institutions and in the workforce. (Bergman, 1996; Bok and Bowen, 1998).

2. AA History

From its first mention in a draft executive order written for the Kennedy administration in 1961, AA evolved into a set of common policies across the United States educational system. Beginning in the mid 60s, many universities began admitting minority students with significantly lower grades and scores than their White counterparts. (Swaim 2001).

In 1974, a White student named Marco DeFunis was rejected by the University of Washington Law School while a Black peer was admitted with lower qualifications through a special diversity program. DeFunis brought the matter to court, claiming reverse discrimination and a violation of the Title VI of the 1964 Civil Rights Act, as well as of the equal protection provisions of the U.S. Constitution. The Supreme Court ultimately ruled that DeFunis be granted admission, but HEIs in other states continued to heavily recruit minority students. (Swaim 2001).

The next highly publicized affirmative action case also came in 1974, when a White student, Alan Bakke, challenged a racial quota policy at UC Davis medical school. The Black students who were admitted under this policy had lower qualifications than Bakke. Again, the Supreme Court ruled that Bakke be admitted. However, Justice Powell notably declared that while students could not be admitted or rejected explicitly because of their race, race could be taken into account as one of many “plus” factors designed to enhance the diversity of a school’s student body. (Swaim 2001).

Race-based AA began facing more serious setbacks in the 90s. In 1995, in *Hopwood v. Texas* (78 F.3d 932 Fifth Circuit, 1995), Cheryl Hopwood, a White woman, was denied admission to the University of Texas Law School, despite having higher test scores and grades than some of the minorities admitted that year. The Fifth Circuit ruled in Hopwood’s favor, and race-based admissions were eliminated in the states of Louisiana, Texas and Mississippi. Similar lawsuits occurred in other states in the 90s (Swaim 2001).

Presently, AA in the US education system is for the most part race neutral. However, it is widely agreed upon that racial diversity in the classroom has a positive effect on all students. As such, many of the race neutral policies seen today are intended to be somewhat of a proxy for race.

3. Other Race Neutral Admission Policies and Their Results

a. Texas Top 10% Rule

Texas’s policy, known as the top 10% rule, is the most popular race neutral affirmative action system. Many states, including Florida and California, use a similar policy. Instead of granting

easier admission on the basis of race (race-based affirmative action), the top 10% of all Texas high school graduating classes are granted admission to any state funded university, including its flagship University of Texas at Austin and Texas A&M College Station. Proponents of this method believe that the guaranteed diversity of high school backgrounds would ensure sufficient ethnic and racial diversity. However, the data shows that the elimination of affirmative action in Texas has resulted in a 90% increase in the graduation gap between minorities and non-minorities (Cortes 2010).

b. New York's Merit Based System

Corcoran and Baker Smith examine New York's elite, public exam schools, which employ a strictly merit based system. The highest performers on the single entrance exam are granted admission to the most selective schools. As a result, the demographic breakdown of New York's elite exam schools does not mirror that of the greater NYC public school population. To be more specific, roughly 70% of all 8th graders in NYC's public schools are either Black or Latino. However, Blacks + Latinos only comprise roughly 15% of seats at NYC's exam schools. Roughly 60% of 8th graders are free lunch eligible, yet only 36% of exam school seats are comprised of free lunch eligible students. It is clear that, at least in NYC, the absence of an affirmative action policy has resulted in privileged students occupying the majority of seats in selective educational institutions.

c. Chicago Public School's Tier System

Chicago Public Schools (CPS) employs a race-neutral, socioeconomic tier system to determine admission into its SEHS. This system was created in response to the lifting of a consent decree by a federal judge, which ruled that the prior, race based system of affirmative action was unconstitutional. CPS's tier system will be the focus of this paper.

There are 11 SEHSs in Chicago, the five best of which (Payton #4 public school in the U.S., Northside #26, Jones #57, Young #70, Lane #79) consistently rank among the top public high schools in the nation. I have chosen to focus only on these top five schools because they are the most racially diverse, and most highly coveted SEHSs. Hancock Prep, the sixth rated SEHS, is 97% minority, and ranked 238th in the country. As will become clear later, the methods described in this paper are designed to rebalance racial percentages and are not applicable to schools that do not already have a racially diverse population.

Entry into an SEHS is predicated on the student's "score" out of 900 points. This score is calculated by combining a student's grades from 7th grade, their score on the MAP¹ exam, and their score on a selective enrollment² exam. Each of these categories account for 300 of the possible 900 total points. The score out of 900 points necessary to gain admission to an SEHS depends on the student's socioeconomic tier. Tier 1 neighborhoods are considered to be disadvantaged while tier 4 neighborhoods are considered advantaged. As such, the higher the tier, the more difficult it will be to get into an SEHS, because a higher score out of 900 is required. 30% of seats at all SEHS are given to students with the highest score out of 900, independent of tier. These are known as "rank" seats. Table 1 shows the cutoff scores for attendance to the top five SEHS based on tier.

¹ The NWEA MAP Test (Measures of Academic Progress) creates a personalized assessment experience by adapting to each student's learning level—precisely measuring progress and growth for each individual student. If your child correctly answers a question, the computer assessment provides a harder question next. If they miss that same question, then an easier question is asked. This provides essential information about what your child knows and is ready to learn.

² The Selective Enrollment Exam is the admissions test for entrance into the Chicago Public Schools' selective high schools. It is taken by students in eighth grade and measures knowledge and skills in the academic subjects of reading, mathematics, and language.

(Table 1)

	Tier 1	Tier 2	Tier 3	Tier 4	Rank
Payton	803	855	882	895	898
Northside	745	843	875	888	894
Jones	799	845	855	883	891
Young	808	831	854	872	883
Lane	747	810	838	862	875

A student's tier is calculated as follows:

1. The city of Chicago is broken down into 796 census tracts
2. Each census block is assigned a percentile for the following 6 variables: median family income, education score³, percentage of homes occupied by the owner, percentage of census block population that speaks a language other than English, percentage of families headed by a single parent, and the elementary school performance variable.⁴

For the single parent variable, the percentile is the percentage of tracts with a *larger* proportion of single-parent households. Likewise for the English speaking variable, the percentile is the percentage of tracts with a *larger* proportion of non-English speaking households.

For the other four variables, the percentile is the percentage of tracts with a *lower* proportion/score/income.

3. The percentiles for the six variables above are summed equally to attain an overall

³ = .2* % of census block less than HS diploma + .4*% HS diploma + .6*% Some college + .8*%Bachelor's degree + 1*%Advanced Degree

⁴ The elementary school performance variable is a weighted average of composite ISAT (Illinois Standard Achievement Test) scores of schools that students in a particular census block attend for elementary school. CPS students take the ISAT every spring from 3rd to 8th grade, and score from the 0th to 100th percentile in math and reading. The composite score is the average of the two (math and reading) percentiles. Example: suppose there were 300 elementary students in a given tract, and they all went to one of two schools. A hundred of the students went to a school with a composite ISAT score of 75 and 200 students went to a school with a composite score of 60. The weighted composite score would be 65

socioeconomic score.

4. Starting from the bottom, the neighborhoods with the lowest socioeconomic scores are assigned tier 1. For 2020, census tract 4607, located on Chicago's southeast side with a mostly Black and Hispanic population, had the lowest socioeconomic score of $\sim .8053$. This means that, on average, census tract 4607 was in the 13th percentile based on the six variables above.
5. Once 25% of the 8th grade population is reached, census tracts are considered tier 2. In 2020, census tract 5207 had a socioeconomic score of ~ 1.984 . Census tract 5207 is the last tier 1 neighborhood, as the cumulative summation of the 8th grade population of tracts with a *lower* socioeconomic score is 25% of the 8th grade population.
6. Once the cumulative summation of the 8th grade population of tracts with a lower socioeconomic score is 50% of the total 8th grade population, tracts are considered tier 3. A tract is tier 4 when the cumulative summation of the eighth grade population of tracts with a lower socioeconomic score is at least 75% of the total 8th grade population.
7. The city of Chicago is now divided into 4 tiers each with an equal sized 8th grade population

C. Data Description

In order to attain the data necessary for their tier system, CPS uses the PopStats data set. The PopStats data set uses a proprietary formula to map public census data onto census tracts. Included in the PopStats data set are the 6 variables used by CPS in the current tier system, in addition to hundreds of other variables broken down by census tract. As such, the tier system can be recreated and also manipulated. For example, a tier system can be simulated where median income counts twice as much as home ownership or where median household wealth is used

instead of median household income.

D. Origination of the Tier System as Currently Practiced

Ron Huberman, president and CEO of Chicago Public Schools during the lifting of the consent decree, was able to provide me with insights into the motivations for the socioeconomic tier system currently employed by CPS. Prior to the change in admission style, CPS SEHSs were to be at least 15% White, but no more than 35% White, with the remaining 85-65% of seats to be filled by minority students, including Asian, Hispanic or Black. Cutoff scores to attend the top five SEHSs were thus differentiated by race prior to 2009. Instead of a tier cutoff score, there was a “White” and “minority” cutoff score. A top priority of the new tier system was to legally maintain the diversity of the old system. Additionally, CPS wanted to make SEHSs more socioeconomically diverse, while maintaining academic rigor to the greatest extent possible. Huberman and his team were given nine months to create and implement the tier system, which was a notably short amount of time. It can safely be assumed that the socioeconomic variables (median income, home ownership, education score, elementary score, non-english speaking, single parent) and their weights (1, 1, 1, 1, 1, 1) were analyzed and chosen with the above goals in mind. Huberman was unable to give me additional information about the specifics of the system, as its origination was now over a decade ago.

E. The State of the CPS Tier System in 2020, Broken Down by Race

I simulated the 2020 tier system using the R code and the 2020 PopStats dataset mentioned above. In a typical year, there are roughly 30,000 eighth graders in the city of Chicago, with roughly 7600 students per tier. The results of the R code analysis, broken down by race, are below in table 2.

(Table 2)

	White	Asian	Hispanic	Black	Total
Tier 1	88	28	3271	4224	7611
Tier 2	213	134	4316	2878	7541
Tier 3	671	494	4210	2271	7646
Tier 4	2423	692	2699	1843	7657
Average Tier	3.599	3.371	2.437	2.155	

F. The CPS Tier System as a Proxy for Race

As noted above, one of the primary goals of the tier system was to maintain the racial diversity already present in SEHSs. In 2009, the first year after the change, 68% of the top five SEHSs student body was non-White, still above the lower bound of the old system’s 65% from before the admissions system change. Presently, only 62% of the student body of the top five SEHSs are minority, meaning that the tier system has not met its goal as a proxy for race. The 62% figure is notably under the 65% pre-2009 minimum and would have been impossible under the old system.

But what if minorities had hypothetically decreased as a percentage of CPS at large? What is the explanation for the decline in minorities as a percentage of SEHSs? When analyzing the merits of the tier system as a proxy for race, it is important to consider the trends in CPS and top five SEHS racial demographics, before and after the change in the admissions system as a possible explanation for the decline. Tables 3, 4 show CPS at large and top five SEHS demographics:

(Table 3)

Pct	Total	White		African American		Hispanic		Multit-		Asian		Not Available	
		No	Pct	No	Pct	No	Pct	No	Pct	No	Pct	No	Pct
5-Oct-00	434668	41890	9.6	226600	52	152031	35	0	0	14147	3.2	0	0
5-Oct-01	436751	41476	9.5	224494	51.3	156566	35.8	0	0.0	14215	3.2	0	0.0
5-Oct-02	437797	40520	9	223302	50.9	159738	36.4	0	0	14237	3.3	0	0
5-Oct-03	434419	39323	9.1	218330	50.3	161837	37.2	909	0.2	14020	3.2	0	0
5-Oct-04	426812	37503	8.8	212502	49.8	162194	38	764	0.2	13849	3.2	0	0
5-Oct-05	420379	33945	8.1	204664	48.6	158270	37.6	10139	2.4	13361	3.2	0	0
5-Oct-06	413147	33564	8.1	198205	47.9	158386	38.3	9633	2.3	13359	3.2	0	0
5-Oct-07	407823	32788	8	189973	46.5	159592	39.1	11951	2.9	13519	3.3	0	0
5-Oct-08	407266	36318	8.9	188316	46.2	168248	41.2	0	0	14384	3.5	0	0
5-Oct-09	409279	37505	9.2	184604	45.1	171633	41.9	685	0.2	14852	3.6	0	0
5-Oct-10	399168	34562	8.6	171462	42.6	175803	43.7	4342	1.1	12999	3.2	0	0
5-Oct-11	402106	35528	8.8	168020	41.6	178284	44.1	4390	1.1	13270	3.3	2614	0.6
5-Oct-12	401411	36415	9	163595	40.5	180274	44.7	4310	1.1	13581	3.4	3236	0.8
5-Oct-13	398628	36890	9.3	159134	40.1	181169	45.7	4223	1.1	13924	3.5	3288	0.8
5-Oct-14	394926	37444	9.4	155932	39.3	180790	45.6	4202	1.1	14228	3.6	2330	0.6
5-Oct-15	390704	37748	9.6	152413	38.9	180206	45.9	4192	1.1	14540	3.7	1605	0.4
5-Oct-16	379905	37691	9.9	143849	37.7	177492	46.5	4163	1.1	14935	3.9	1775	0.5
5-Oct-17	369598	37933	10.2	137495	37	173790	46.8	4185	1.1	15113	4.1	1082	0.3
5-Oct-18	359617	38016	11	132194	36.6	168888	46.7	4333	1.2	14933	4.1	1253	0.3
5-Oct-19	353489	38480	10.8	127601	35.9	165578	46.6	4461	1.3	14961	4.2	2408	0.7
5-Oct-20	339117	37198	10.9	122116	35.8	159163	46.7	4488	1.3	14810	4.3	1342	0.4

(Table 4)

Year	Total	White		African American		Hispanic		Asian	
		No	Pct	No	Pct	No	Pct	No	Pct
5-Oct-00	7332	1999	27%	1777	24%	2370	32%	1185	16%
5-Oct-01	8169	2310	28%	1898	23%	2640	32%	1320	16%
5-Oct-02	8529	2473	29%	1876	22%	2815	33%	1365	16%
5-Oct-03	8604	2520	29%	1825	21%	2955	34%	1304	15%
5-Oct-04	9121	2736	30%	2007	22%	3010	33%	1368	15%
5-Oct-05	9007	2837	32%	1797	20%	2932	33%	1419	16%
5-Oct-06	9008	2932	33%	1703	19%	2932	33%	1419	16%
5-Oct-07	9174	2945	32%	1669	18%	2945	32%	1571	17%
5-Oct-08	8982	2874	32%	1707	19%	2874	32%	1527	17%
5-Oct-09	9140	2925	32%	1737	19%	2925	32%	1554	17%
5-Oct-10	9236	2949	32%	1522	16%	3330	36%	1427	15%
5-Oct-11	9152	2951	32%	1523	17%	3331	36%	1333	15%
5-Oct-12	9340	3138	34%	1471	16%	3432	37%	1275	14%
5-Oct-13	9285	3149	34%	1476	16%	3445	37%	1181	13%
5-Oct-14	9328	3201	34%	1455	16%	3395	36%	1261	14%
5-Oct-15	9663	3417	35%	1407	15%	3417	35%	1407	15%
5-Oct-16	9825	3611	37%	1341	14%	3404	35%	1444	15%
5-Oct-17	10174	3746	37%	1396	14%	3543	35%	1456	14%
5-Oct-18	10594	3867	36%	1351	13%	3773	36%	1555	15%
5-Oct-19	10891	4026	37%	1324	12%	3844	35%	1645	15%
5-Oct-20	11114	4267	38%	1223	11%	3803	34%	1773	16%

The trends seen in the top five demographics must be evaluated in tandem with the

trends in CPS demographics. For example, while it appears alarming that Black students as a percentage of the top five student body has decreased from 24% to 11% since 2000, their share of total CPS enrollment has decreased an even larger amount: 52% in 2000 to 35% in 2020. Thus, the question when evaluating the tier system is: did the CPS at large demographic's effect on top five demographics change after 2009, the first year under the new system? The four below regressions test if the change in admission system in 2009 increased, decreased, or did not change the effect of CPS at large percentage on top five SEHS percentage for each race. The dependent variable is the percentage of top five SEHS for each race. The independent variables are each race's percentage of CPS, and a dummy variable that is 1 for years 2009 and later (post admissions system change), 0 for years 2008 and earlier, multiplied by the CPS at large percentage. (CPS% + an interaction)

1. % White Top 5 SEHS = $\beta_0 + \beta_1\%$ White CPS + β_2 Dummy * % White CPS
2. % Black Top 5 SEHS = $\beta_0 + \beta_1\%$ Black CPS + β_2 Dummy * % Black CPS
3. % Asian Top 5 SEHS = $\beta_0 + \beta_1\%$ Asian CPS + β_2 Dummy * % Asian CPS
4. % Hispanic Top 5 SEHS = $\beta_0 + \beta_1\%$ Hispanic CPS + β_2 Dummy * % Hispanic CPS

(Table 5)

	Estimate	Std. Error	Statistical Significance
Intercept	.09643	.02096	.000222***
β_1 Asian	1.95031	0.63396	0.006506 **
β_2 Asian	-0.69374	0.12690	3.42e-05 ***

(Table 6)

	Estimate	Std. Error	Statistical Significance
Intercept	0.24358	0.05743	0.000491 ***
β_1 White	0.66616	0.64442	0.314948
β_2 White	0.42985	0.10690	0.000802 ***

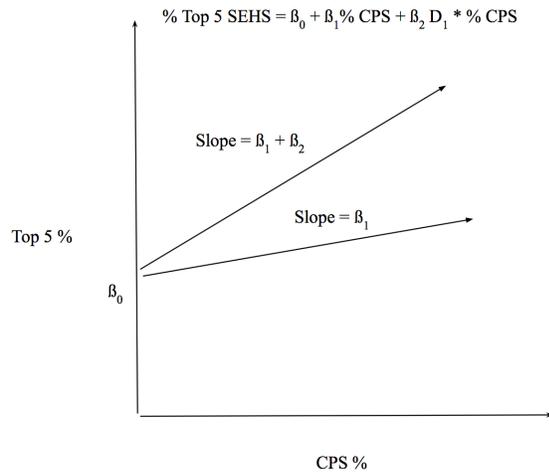
(Table 7)

	Estimate	Std. Error	Statistical Significance
Intercept	-0.16081	0.04106	0.00101 **
β_1 Black	0.74716	0.08331	4.64e-08 ***
β_2 Black	0.02377	0.02296	0.31424

(Table 8)

	Estimate	Std. Error	Statistical Significance
Intercept	0.41229	0.04002	5.65e-09 ***
β_1 Hispanic	-0.22378	0.10403	0.0453 *
β_2 Hispanic	0.10506	0.01992	5.16e-05 ***

G. Beta Interpretation



1. Black Student Analysis

Based on the calculations above, for every 1% increase in Black students as a percentage of CPS, there is a .74% (β_1 Black) increase in Black students as a percentage of top five SEHSs, to a very statistically significant degree ($4.64e-08$ ***). The inverse is also true for a decrease.

The change in the admissions system had little to no effect on the relation between Black CPS at large percentages and Black percentages at the top five SEHSs ($\beta_2 = 0.02377$, and not statistically significant). The tier system did not make it any easier or harder for Black students to attend a top five SEHS. Thus, a declining Black population in CPS means a proportionally declining Black population in top five SEHSs, regardless of admissions system.

2. White Student Analysis

For every 1% increase in White students as a percentage of CPS at large, there is a .66% (β_1 White) increase in White students as a percentage of top five SEHSs, to a non statistically significant degree (.314). Thus, it does not appear that White percentage in CPS at large has any effect on White percentages in the top five SEHSs. However, it does appear that the tier

system made it easier for White students to attend a top five SEHS (β_2 White = 0.42985, significance = 0.000802 ***).

3. Hispanic Student Analysis

For every 1% increase in Hispanic students as a percentage of CPS at large, there is a .22% (β_1 Hispanic) decrease in Hispanic students as a percentage of top five SEHSs, to a statistically significant degree (0.0453 *). An increasing Hispanic population in CPS has resulted in a decreasing (though small) Hispanic population at the top five CPS SEHSs. Thus, it appears that the tier system made it easier for Hispanic students to attend a top five SEHS (β_2 Hispanic = 0.10506, significance = 5.16e-05 ***). However, $\beta_1 + \beta_2$ is still negative.

4. Asian Student Analysis

For every 1% increase (decrease) in Asian students as a percentage of CPS at large, there is a 1.95% (β_1 Asian) increase (decrease) in Asian students as a percentage of the top five SEHSs, to a statistically significant degree (0.006506 **). An increasing Asian population as a percentage of CPS at large has resulted in an increase in Asian population as a percentage of the top five SEHSs. However, it appears that the tier system has made it more difficult for Asian students to attend a top five SEHS (β_2 Asian = -0.69374, significance = 3.42e-05 ***).

As evidenced by the statistically insignificant β_1 white, it cannot be concluded that CPS population demographics have had an effect on minority attendance at top five SEHSs.

H. The Problems With the Tier System

1. The Umbrella Problem: Too Many White Students/Too few Minority Students

a. Evidence of the problem

Despite White students having the highest average tier, the change in the admissions system has still made it easier for White students to attend a top five SEHS. The evidence for this is

two-fold: First, (β_2 White) from table 6 was positive and statistically significant. Second, White students now comprise roughly 38% of the top five SEHSs student body. Whereas, under the old system, they were only able to comprise a maximum of 35% of the student body.

b. Why Does the Problem Exist? Reason 1: The Current CPS Variables

Now that CPS at large demographics have been essentially eliminated as an explanatory variable for decreased minority attendance, a thorough analysis of the tier system’s variables and its mechanisms is required. Are the current variables and their weights responsible for the decline? Recall the racial breakdown of the 4 tiers, broken down in the table 9.

(Table 9)

	White	Asian	Hispanic	Black	Total
Tier 1	88	28	3271	4224	7611
Tier 2	213	134	4316	2878	7541
Tier 3	671	494	4210	2271	7646
Tier 4	2423	692	2699	1843	7657
Average Tier	3.599	3.371	2.437	2.155	

Although it may appear that the table would result in a minimum 65% minority at the top five SEHSs (majority of White students are in tier 4, and thus need the highest scores to get into the top five), the data show that this is not the case.

Average percentiles and average tiers tell the near complete story of the mechanisms of the tier system. The average percentiles represent how disadvantaged or advantaged a certain race is in a certain category. For example, the average White student resides in a neighborhood that is in the ~70th percentile of median income. An average Black student resides in a

neighborhood that is in the ~28th percentile of median income. A student’s average tier is the best representation of how difficult it is to attend a top five SEHS because the tiers are directly related to cutoff scores. The higher a race’s average tier, the harder it is for that race to attend a top five SEHS, and vice versa. Each of the six CPS variables and their weight has some effect on determining the average tier of each student. Which of the six CPS variables, however, have the largest effect on the average tiers by race? Which variables drive the average tiers? Do certain variables provide an “advantage” or “disadvantage” for a particular race?

Tables 10, 11 show the average percentile for each race for each variable, and the results of simulating the tier system under a number of scenarios, respectively. For the 2nd table, the first row of simulations reflect the results of the tier system if it was determined by one variable instead of six. In these simulations, the higher the average tier, the greater advantage conferred by that variable on a particular race. The second set of simulations reflects the results of the tier system if each variable was removed from use, while the others remain. If the removal increases the average tier, then that variable is viewed as helping that race *at the margin*, and vice versa. This analysis will determine which of the 6 variables have the greatest effect on average tier outcomes broken down by race. Recall the original tier averages, when all six CPS variables are included, is: White = 3.59, Asian = 3.37, Hispanic = 2.43, Black = 2.15

1. Variables Analysis: Average Percentile

Table 10 breaks down the six variables currently used in the CPS tier system by race and percentile.

(Table 10)

Race	White	Asian	Hispanic	Black
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Avg. Income Percentile	.696	.580	.461	.283
Avg. Homeownership Percentile	.671	.576	.562	.399
Avg. Single Parent Percentile	.703	.652	.519	.241
Avg. Education Score Percentile	.625	.564	.267	.365
Avg. Elementary School Percentile	.705	.699	.516	.288
Avg. Language Percentile	.397	.280	.168	.713
Avg. Tier Score (out of 6)	3.79	3.35	2.49	2.29

2. Tier Simulations

(Table 11)

Only homeownership		Only Elementary		Only language		Only income		Only education score		Only single parents	
Black	2.097927	Black	1.770206	Black	3.517874	Black	1.854633	Black	2.623999	Black	1.563184
White	3.099413	White	3.472107	White	2.634416	White	3.561413	White	3.503454	White	3.577401
Asian	2.786019	Asian	3.474073	Asian	2.241226	Asian	3.163185	Asian	3.340856	Asian	3.486196
Hispanic	2.65865	Hispanic	2.756671	Hispanic	1.711946	Hispanic	2.700533	Hispanic	2.102782	Hispanic	2.895476
Sans homeowner		Sans elementary		Sans language		Sans income		Sans education		Sans Single parents	
Black	2.263861	Black	2.320618	Black	1.803002	Black	2.264044	Black	2.048759	Black	2.357726
White	3.625342	White	3.558344	White	3.643978	White	3.578358	White	3.538712	White	3.545039
Asian	3.478145	Asian	3.18942	Asian	3.45783	Asian	3.36415	Asian	3.270789	Asian	3.247154
Hispanic	2.328925	Hispanic	2.333363	Hispanic	2.698065	Hispanic	2.354252	Hispanic	2.544154	Hispanic	2.311716

A. Black Students

If the tier system was solely determined by CPS’s language variable, Black students would have the most difficult time of any race getting into a top five SEHS. Their average tier in that scenario is nearly as high as the average White student’s tier under current CPS constraints (3.51 vs 3.59). Recall that the higher the average tier, the harder, on average, it is to attend a

top five SEHS. Moreover, its removal from the current CPS system would decrease the average Black student's tier by around .35, a significant change. This demonstrates that Black students are significantly harmed by CPS's language variable. Similarly, a CPS tier system solely determined by the education score variable has the average Black tier much higher than it is under the current system. Its removal results in a lowered average Black tier of about .1. The other four variables help black students in that they reflect Black students at a socioeconomic disadvantage, and, thus, Black students' average tier is the lowest among the other races when solely determined by these four variables. They are helped by the other four variables, in that their tier score is increased when they are removed.

B. White Students

Whites have a significantly lower average tier in simulations solely determined by home ownership, and solely determined by language. The removal of these variables fittingly results in a higher average tier for White students, when all other variables remain. This demonstrates that White students are being helped by the homeownership and language variables, all else being equal. Interestingly, although Whites have the highest homeownership percentile of all the races, their average tier is actually lower (allowing a lower cutoff score) as a result of its inclusion. Whites have a higher average tier than the other races in systems solely determined by: income, single parents, education score, and elementary school. Their percentiles (first table) also reflect this. They are thus considered 'advantaged' for these variables. Removal of these four variables results in a lower average tier for White students, meaning White students are hurt by these variables.

C. Asian Students

Similar to White students, Asian students have a significantly lower average tier in simulations

solely determined by home ownership or language. The removal of these variables fittingly results in a higher average tier for Asian students, when all other variables remain. Asians are therefore helped by these variables. Asians have an above average average tier and percentile in systems solely determined by: income, single parents, education score, and elementary school. They are thus considered ‘advantaged’ for these variables. Removal of these four variables thus results in a lower average tier for Asian students. In other words, they are helped by these variables.

D. Hispanic Students

Hispanic students are seen as the most disadvantaged race in systems solely based on language and education score. Removal of these variables results in a significant increase to Hispanic average tier, meaning these variables are a significant help to Hispanic students. For the other four variables, they are seen as the second most disadvantaged race, ahead of Black students. However, removal of these four variables actually decreases the average tier for Hispanics, which means they are hurt by these variables at the margin.

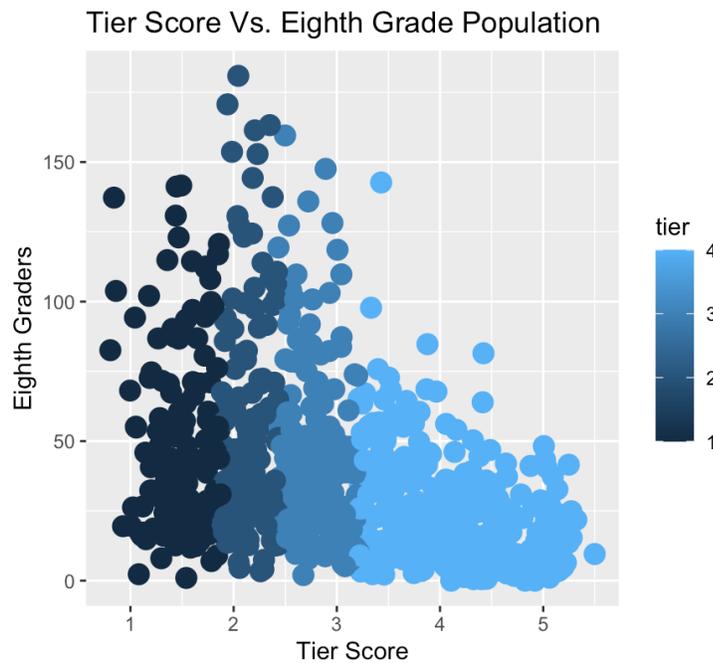
c. Reason 2: Within Tier Variation

Under the new system, White students are no longer competing against each other, but are now competing against other students in their tier. Indeed, before 2009, cutoff scores were based on race and now they are based on tier. Assuming that Huberman’s studies were correct and that the higher a student’s census tract’s tier score, (summation of the six CPS percentiles) the higher that student's test score. Within each tier 1-4, there is a differing range of tier score 0-6.

1. Skew

The range of tier scores within each tier is not equal. Consider the following example as an illustration: suppose there are eight census tracts with 7, 7, 4, 3, 3, 2, 1, 1 students in it. The tier

scores (sum of the six percentiles used in CPS) are as follows, 0.5, 1, 1.5, 2, 2.1, 3, 3.5, 5.5, respectively. In this instance, neighborhood #5 is still considered tier 4 even though it has a significantly lower tier score than neighborhood #8, which is also tier 4. The range of tier 4 is 2.4, while the range of tier 3 is .5. The actual skew under the current CPS tier system appears in the graph below:



Tier 1 range: .8 (score of the most disadvantaged neighborhood) - 1.87

Tier 2 range: 1.88 - 2.43

Tier 3 range: 2.43 - 3.41

Tier 4 range: 3.21 - 5.49 (score of the most advantaged neighborhood)

As you can see, there is an overall positive skew in CPS tier scores, like the above example. The nicest neighborhoods (denoted by highest tier scores) have fewer students in them. As discussed in the section below, this skew becomes important.

2. Each Race's Average Tier Score Within Each Tier, "Rank" Slots

Each tier is composed of some percentage of each race. But which race is best off within each tier? That is, within each tier, students of which race score the highest on the test (assuming it is correlated with tier score)?

(Table 12)

	White	Asian	Hispanic	Black
Tier 1	1.57	1.58	1.47	1.52
Tier 2	2.23	2.22	2.18	2.11
Tier 3	2.83	2.81	2.75	2.79
Tier 4	4.28	4.03	3.83	3.72

Table 12 table indicates that White students have the highest tier score within each tier, with the exception of tier 1. However, tier 1 only has 88 White students. So, statistically, the White tier 1 average does not mean much. More notable is White students' high performance within tier 4, where the majority of the White population lives. As indicated in Table 12, tier 4 has the widest range of tier scores, due to the overall skew of CPS. Consider a Black and White student in tier 4. On average, the White student has a tier score of 4.28, while the Black student has an average score of 3.72. This typically means that the White student on average has more income, has more well educated parents, went to a better elementary school, etc. than that Black student. Yet, both are still part of tier 4, and both will need the same cutoff scores to enroll at a top five SEHS. However, given the earlier assumption that the higher tier score correlates with a higher test score, the playing field is not level within tier 4. Although the playing field is also not level in tiers 2 and 3, the rank seats explain why the unlevel tier 4 playing field is the most important.

Recall that 30% of the top five SEHSs seats go to "rank" slots, the highest scoring students regardless of tier. White students' high performance in tier 4 not only means they will

take up most of the tier 4 seats, it also means they will take up most of the “rank” seats. Based on the assumption that tier score is correlated with test score, all of the rank seats will be given to tier 4 students because tier 4 students have the best tier scores in the city. In fact, 47.5% of seats at the top five SEHSs go to tier 4 or rank seats. And for the reasons above, a large percentage of that 47.5% will be White students.

Prior to the change in the admissions system, White students had to compete against each other for up to 35% of seats at any given top five SEHS. Assuming that within tier averages haven’t changed since 2009, the White cutoff scores (cutoff score was based on race prior to 2009) for the top five SEHSs would be similar to the current “rank” cutoff score, as both were basically competitions amongst students who came from neighborhoods with the highest tier scores in the city. Very few White students in tier 2 could get into Payton in 2008, just as there is very little chance they could get into Payton through a rank slot today. The change in admissions has allowed White students to attend a top five SEHS through tier 4 and tier 3 slots whereas previously, only the highest performing White students were able to attend.⁵

3. Simulating the Problem

Let us assume that all students in CPS would like to attend a top five SEHS. At the very least, let's assume that the highest performing students (based on their tier score) would like to attend. There are roughly 2,500 freshman class seats at these top five schools (Payton 337, Northside 257, Young 400, Jones 371, Lane 1200). Under CPS’s current system, 750 seats (30%) will be designated as “rank” slots. Under our assumptions, this means that the 750

⁵ I would once again like to reiterate that I am assuming tier score is perfectly correlated with test score. This assumption would mean that it is impossible to get a perfect score if you live in tier 3 as tier 3 students do not have as high tier scores as tier 4 students. In reality, many tier 3 students do get perfect or high scores. While the aforementioned correlation is not perfect, it is presumably positive and significant, though I do not have the data to prove it. Hopefully, Ron Huberman did have said data and used it to create the tier system practiced today.

students with the highest tier score will get these seats. After the rank slots are given out, ~438 seats will be given out to each tier 1-4. Under our assumptions, the 438 students with the highest tier score *within* each tier will get these seats. Results:

(Table 13)

	White	Black	Asian	Hispanic
Rank	490	74	59	127
Tier 4	266	37	46	88
Tier 3	73	130	59	176
Tier 2	21	158	8	251
Tier 1	4	254	1	179
% of total	34%	26%	7%	32%

The aforementioned problems are manifested in the results of the simulation. 756 out of the 1188 (~64%) total rank + tier 4 slots are White students. White students are heavily over represented as a result. But this does not paint the entire picture. In reality, White students are more than 34%, Black students are far less than 26% and Asian students are more than 7%.

What is missing?

d. Reason 3: Intra-Census Tract Disparity

There is reason to believe that within each census tract, there is additional variation. Take census block 101 as an example. 60% of the block lives in a household with income under \$50,000, and 20% of households have income over \$100,000. All students residing in this census block, however, are assigned a tier score of 2.194. Clearly, students living in the 20% of households with \$100,000 in income are at more of an advantage than students living in the 80% of households with under \$50,000 in income. Are certain races more likely to live in the

20% of households making over \$100,000? Is there racial disparity *within* a given census tract? Be it racial or not, this intra census tract disparity in advantage is not reflected in the tier score for that neighborhood. Real tier score is a new variable that I created to reflect intra-census block disparity. But should a White student's real tier score be higher than a Black student's real tier score for a neighborhood that is 50% White and 50% Black? To answer this question we will use the income measure, since there is readily available income data broken down by race.

1. Income

The Chicago income data indicates that there is racial disparity within each census tract. Here is an example to demonstrate. Suppose there is a 3 tract city, with population and median income data for each tract. Tract 1 has median income of \$500, Tract 2 has median income of \$2,000 and Tract 3 has median income of \$1,000. There are 20, 10 and 20 White people living in each tract, respectively. PopStats would say that the average White median income is \$1,000. However, suppose in the same tracts there are 20, 10, 20 Black people making \$250, \$1,000, and \$500, respectively, with no other people living in the tracts. PopStats would say that Black median income is also \$1,000. In reality, the White population is actually making \$750, \$3,000, and \$1,500, with an actual median income of \$1,500 and not \$1,000, while the Black median income would actually be \$500. We can thus compare PopStats medians for each race and actual medians for each race to determine whether each race is, on average, above, at, or below their neighborhood median income.

According to Popstats, White median income is \$84,000 ($\frac{\sum(\text{White population} * \text{tract median income})}{\sum \text{White population}}$), Black is \$42,000, Hispanic is \$55,000, and Asian is \$70,000. In 2016 (latest year where this data exists), actual White median income was \$80,000,

Black was \$37,000, Hispanic was \$52,000, and Asian was \$87,000. This means that within their census tracts, on average, Asians were far above the tract median (+24%), while Whites were slightly below the tract median (-4.4%), Hispanics even more so below the tract median (-5.5%), and Blacks the most below the tract median (-11.9%). Tier scores will now be adjusted accordingly to reflect the above *intra*-tier disparity, assuming that income disparity reflects the disparity in the other five CPS variables. Tier scores will be adjusted so that within each neighborhood, Asians will have the highest tier score, White students the second highest, followed by Hispanic and Black students. The scores will be reweighted such that the approximate, current demographic breakdown of CPS is achieved. A neighborhood with no Asian students will see all of its students have their tier score decrease. However, in such a neighborhood, White students would still have a higher tier score than Hispanics who would have a higher tier score than Black students. We can now simulate the outcome of the tier system with these adjustments.

(Table 14)

	White	Black	Asian	Hispanic	Tier Rank Avg
Rank	550	39	95	66	
Tier 4	221	48	68	101	4.96 ⁶
Tier 3	124	34	134	145	3.14
Tier 2	68	0	72	297	2.36
Tier 1	16	153	12	257	1.79
% of total	39%	11%	15%	35%	3.63

The weights on neighborhood tier score that result in table 14 are as follows, using an optimization in R.

⁶ 4.96 is the average for the 1188 students in tier 4 and rank

Asian tier score: $1.04 \times \text{neighborhood tier score}$

White tier score: $.998 \times \text{neighborhood tier score}$

Black tier score: $.956 \times \text{neighborhood tier score}$

Hispanic tier score: $.965 \times \text{neighborhood tier score}$

To reiterate, suppose there's a neighborhood with a tier score of 1, composed of five students of each race. The five Asian students will have a real tier score of 1.04, while the five White students will have a score of .998, followed by .965 and .956 for Hispanic students and Black students, respectively. The top 438 *real* tier scores will be drawn from each tier. We now expect an Asian student from a neighborhood with a tier score of 1 to score better on the test than a Black student from a neighborhood with a tier score of 1.01.

I. Solving the Tier Problem

It is clear that the current tier system has a multitude of shortcomings. These problems, however, are solvable through employing the solutions below.

A. Potential Solution I: Add and Reweight or Eliminate Variables to Increase the Average White Tier

The first prong of this solution involves adding new variables from the PopStats dataset.

1. Potential new variables from PopStats Dataset

Any new proposed variable must have a justification for how it reflects disadvantage when scoring on the 900 point test, as this is the purpose of the six variables.

Proposed variable 1: Vehicles Per Capita

Private transport from elementary school allows students to save time and avoid the sometimes dangerous Chicago public transportation system. Cars can also be driven to

tutoring sessions and extracurricular activities, which can help with scores on the 900 point test.

Proposed variable 2: Unemployment Rate

A higher neighborhood unemployment rate means that the student is more likely to take a greater fiscal responsibility for his or her family. This can take time away from studying for the CPS test and 7th grade grades

Proposed variable 3: Poverty Rate

A higher neighborhood poverty rate is correlated with crime in the neighborhood⁷ (crime data not available). Super low income also means many basic needs are not being met, such as food insecurity. It is additionally correlated with moving homes more often⁸. All of the above can distract heavily from studies.

Proposed variable 4: Median Wealth

This justification is very similar to median income. More wealth is correlated with more investment income, and a lesser need to work long hours. All of the above can add to the time dedicated to studies.

2. Reweighting + Adding Variables

a. Example 1

CPS is legally allowed to change the weights of variables in the tier system, potentially weighting some variables to 0 (discontinuing use of that variable). By using an optimization problem, the average White student's tier can be increased through the reweighting of the CPS variables, plus the 4 proposed new variables. The higher the average tier, the harder it becomes

⁷Marc Hooghe, Bram Vanhoutte, Wim Hardyns & Tuba Bircan 2011

⁸ Donovan 2020

for White students to attend a top five SEHS. This, in turn, will bring the percentage of White students at the top five SEHSs closer to the 35% cap under the old system (currently 38%).

Table 15 shows the new weights and the new average tiers for each race after the optimization.

(Table 15)

Variable	Old weight	New Weight
Median Income	1	.879
% Owner occupied	1	.006
Elementary Score	1	.940
% Single Parent	1	1.190
Education Score	1	1.177
% Non-English Speaking	1	.059
Median Wealth	0	.003
Unemployment	0	.908
Vehicles per Capita	0	.204
Poverty	0	.012

(Table 16)

Race	Old Average Tier	New Average Tier
White	3.599	3.702
Black	2.154	1.750
Asian	3.371	3.577
Hispanic	2.437	2.703

What this is essentially doing is pushing White students from tier 3 into tier 4, tier 2 into tier 3, and tier 1 into tier 2, so as to boost their average tier by the greatest amount

possible. As such, minority students will be pushed from tier 4 to tier 3, tier 3 to tier 2, and tier 2 to tier 1. Though many neighborhoods will change tiers, nothing is actually changing within each neighborhood, and students' score on the 900 point test will not change. As a result, we will continue to assume that the old tier system (six variables, each with a weight of 1) is the best predictor of test score. The neighborhoods will be reordered within each tier, but the students with the highest tier score under the Huberman system (weights of 1) will still be the ones getting in. Suppose a White neighborhood that was tier 3 with the Huberman weights becomes a tier 4 neighborhood under the new weights and variables. In all likelihood, this was a neighborhood that had some of the highest scoring students in tier 3, but now has some of the lowest scoring students within tier 4. As a result, this White neighborhood will no longer take as many seats at the top five SEHSs. To reiterate, nothing about the neighborhood has changed, and, in theory, the scores on the test will also not change. The results under this new tier system are in table 17. We will keep the same intra-census tract assumptions from above.

(Table 17)

	White	Black	Asian	Hispanic	Tier rank Avg
Rank	550	39	95	66	
Tier 4	221	48	68	101	4.96
Tier 3	23	360	6	49	2.99
Tier 2	6	422	1	9	2.14
Tier 1	1	427	0	10	1.47
% of total	32%	52%	7%	9%	3.51

This new system brings down White students as a percentage of the top five down to 32%, which is under the former 35% cap, and close to the 2009 level. Notice that the

demographic composition of rank and tier 4 remains identical to the old system. The top students in the entire city are still the top students in the city after the reweighting of variables. However, the top students of tier 3, 2, 1 now look a lot different racially. Before, they were mostly White, but those same White students have had their tier changed under the new system, and are now at the bottom of the next tier up. Recall that minority students will be pushed from tier 4 to tier 3, tier 3 to tier 2, and tier 2 to tier 1. The minority race that is being pushed down the most is Black students. Indeed, their average tier goes from a ~ 2.15 to a ~ 1.75 . Under the old system, they were at the bottom of tier 4, 3, 2, and 1. With the reweighting, they are now closer to the top of tier 3, 2, and 1. The compositions of tiers 1, 2, and 3 speak for themselves: Black students stand to benefit the most from this particular reweighting.

b. Example 2

As tables 15, 16 indicate, the weights of the 10 variables that made the White average tier the highest, also increased the Hispanic average tier score significantly. The reweighting sent Hispanic students from composing 34% of the top five SEHS to 9%. The only race who saw their average tier decrease was Black students. This shows that as Black students were cascading down the tiers, they displaced students of all the other races, but mostly Hispanic and White students. Under this particular reweighting, only Black students benefited while all the other races suffered, particularly Hispanic students.

However, as discussed above, another reweighting scheme only reduces overall minority attendance slightly in exchange for more Hispanic students as a percentage of those minorities. Their weights are in table 18.

(Table 18)

Variable	Current weight	Weight that maximizes minority attendance	Weight that increases minority attendance, but hispanic students do not see as big of a decline in attendance
Median Income	1	.879	.879
% Owner occupied	1	.006	.006
Elementary Score	1	.940	.940
% Single Parent	1	1.190	1.190
Education Score	1	1.177	1.5
% Non-English Speaking	1	.059	.85
Median Wealth	0	.003	.003
Unemployment	0	.908	.908
Vehicles per Capita	0	.204	.204
Poverty	0	.012	.012

(Table 19)

Race	Old Average Tier	Average Tier that maximizes minority attendance	Average Tier that increases minority attendance, but hispanic students do not see as big of a decline in attendance
White	3.599	3.702	3.673
Black	2.154	1.750	2.047
Asian	3.371	3.577	3.539
Hispanic	2.437	2.703	2.483

Notice that the only weights that changed (bolded) were the language variable and the education score variable. These are the variables that help Hispanic students the most, as discussed in an earlier section. The other reweighting remains, and does enough to keep the

White average tier significantly above 3.599, their average tier under the Huberman system.

The racial breakdown under this second reweighting is illustrated in table 20:

(Table 20)

	White	Black	Asian	Hispanic
Rank	550	39	95	66
Tier 4	221	48	68	101
Tier 3	37	340	13	48
Tier 2	12	198	4	224
Tier 1	7	299	7	125
% of total	33%	37%	7.5%	22.5%

As you can see, some diversity was sacrificed. Minorities compose 67% of the top 5 as opposed to 68% under the original reweighting. However, Hispanic students do not take nearly as much of a hit (35% down to 22.5% as opposed to 9%), while Black students still see a large increase in their percentage (11% up to 37% as opposed to 52%).

3. Eliminating Variables

As discussed above, the elimination of certain variables can have a dramatic effect on the average tier of each race. For example, the removal of the language variable from the current CPS system would decrease the average Black student's tier by around .35, a significant change. The removal of the language and the removal of the homeownership variables result in a higher average tier for White students, when all other variables remain. Removal of the language and the removal of the education score variable result in a significant increase to Hispanic average tier, meaning these variables are a significant help to Hispanic students.

B. Potential Solution 2: Increase the Number of Tiers

This more effectively takes into account the skew of the CPS tier system, by decreasing within tier variation. Students with a tier score of 5.4 will not be competing with students with a tier score of 3.3, as they are under the current system. Instead, they will be competing with students who have a much closer tier score to theirs, a potentially more equitable system. Because White students, on average, have higher tier scores than other races, this new system essentially has White students, theoretically, competing against each other instead of other races. Admission of a White student will now, in theory, be less likely at the expense of a Black student or other minority. Instead it will be at the expense of another White student. Overall White percentage would fall as a result. The results, using the same intra-tract assumptions are in table 21. I arbitrarily chose 8 tiers, however, any increase to the number of tiers probably has similar effects. 30% of slots will still be rank slots, meaning the remaining 70% will be divided by 8 instead of 4.

(Table 21)

Tier	White	Black	Asian	Hispanic	Avg. Tier Score
Rank	550	38	97	65	
8	82	34	36	67	5.02 ⁹
7	145	0	74	0	3.80
6	127	0	91	0	3.20
5	70	0	149	0	2.73
4	67	0	73	79	2.38
3	27	100	27	65	2.09
2	14	29	12	164	1.79

⁹5.02 is the average tier score for both Rank and Tier 8 combined

1	11	42	5	160	1.44
% of total	44%	10%	22%	24%	3.47

Based on table 21, this approach does appear to not work as a solution to the problem. White students are spread out such that they would still remain at the top of any equal division of tiers in the city.

C. Potential Solution 3: Decrease Rank Slots

Suppose rank slots were decreased from 30% to 20%. Recall that under our assumptions, most, if not all of the rank slots would be composed of students living in tier 4. Essentially, 47.5% of seats would be tier 4 (30% rank slots + 17.5% tier 4 slots). Because White students live mostly in tier 4, and score the highest within tier 4, they are getting most of that 47.5%. By decreasing the number of rank slots (assuming that percentage tier 1, 2, 3, 4 slots = $(1 - \% \text{ rank slots})/4$), we are effectively decreasing that 47.5% number to something lower. This would lower the overall White percentage.

(Table 22)

	White	Black	Asian	Hispanic	Avg Tier Score
Rank	386	5	78	30	
Tier 4	267	68	56	110	5.01
Tier 3	134	77	145	145	3.13
Tier 2	68	0	73	359	2.35
Tier 1	21	200	12	267	1.78
% of total	35%	14%	14%	37%	3.45

Lowering the number of rank slots does decrease the White student percentage to the 35% cap from before 2009, via the mechanism described above. Shares of Black and Hispanic students increase, while Asian students see a small decrease.

J. Academic Rigor

Recall that another stated goal of the tier system was to avoid the loss of academic rigor. I have decided to measure academic rigor by the average tier score¹⁰ of the entire school, which is in the bottom right corner of tables 17, 21, 22. Letting in more minority students tends to decrease the academic rigor of the school as, given our assumptions, Hispanic and Black students tend to score worse than White and Asian students. Prior to 2009, let's assume that of the 2,500 seats for the top five SEHSs, 35% will be White, and the remaining 65% minority. This means that the top scoring 875 White students will be admitted, while the top scoring 1,625 minority students will be admitted. I have made the assumption that neighborhood tier scores have not changed since 2008/2009¹¹. The table 23 shows the average tier scores under these circumstances:

(Table 23)

White Students	White Score Avg.	Black Students	Asian Students	Hispanic Students	Minority Score Avg.
875	4.93	370	439	816	4.38
35%		15%	17%	33%	

School Tier Score Average = 4.57

The tables indicate that academic rigor sharply declined with the introduction of the tier system. This is because all of the students admitted under the new system are from all tiers,

¹⁰ Tier score assumes 6 CPS variables with weights of 1

¹¹ Yes, tier scores would not have even existed in 2008/2009. However, they are still a good way to calculate hypothetically how the top 875 White Students and top 1625 minority students would have scored.

while the old system would likely only admit tier 4 students. Students from poor neighborhoods (who may not test well given our assumption) would not be able to get in under the old system. Under the current tier system, the average score is a 3.63/6. Under the old system, the average was a 4.57/6. All three solutions above have average scores even lower than 3.63:

Reweighting Average: 3.51

8 tier system Average: 3.47

Rank slot decrease system: 3.45

K. Socioeconomic Diversity

An interesting note is that the lower the school average tier score, the greater the socioeconomic diversity, another goal of the tier system. Prior to the change in the admissions system, a school like Payton was likely composed of mostly rich students. Now, students from low income neighborhoods have a chance at a spot. The three potential solutions, while they may decrease academic rigor, would, in theory, increase socioeconomic diversity.

L. Conclusion

After courts across the country struck down race based affirmative action admissions systems, CPS was faced with the same problem as many other top tier education institutions-- evaluating the tradeoffs between racial diversity, socioeconomic diversity, and academic rigor. CPS's response was the implementation of the race neutral socioeconomic tier system still employed today. It is clear that under the current, race-neutral tier system, White students have a better, and minority students worse, chance to attend CPS's top institutions (β_2 White = 4.3***, White students as a percentage of the top five SEHSs > 35%). Two of the three proposed solutions contained herein alleviate this issue: re-weighting the six CPS

variables/adding certain new variables to increase the average White student's tier, or decreasing the number of rank slots.

The solution where the variables are reweighted and others added not only was able to decrease the White percentage by 6%, but it was able to increase the Black percentage, which is currently the most underrepresented group (36% of CPS at large vs. 11% of the top five SEHSs), by a whopping 40%. The key to this solution stems from the fact that it is able to turn the highest scoring students in tier 1, 2, and 3 into the lowest scoring students in tier 2, 3, and 4, respectively. Likewise, the lowest scoring students in tiers 2, 3, and 4 can become the highest scoring students in tiers 1, 2, and 3, respectively. Because the neighborhoods themselves don't change, only their tier, a tier change can determine whether a student from a certain neighborhood attends a top five SEHS.

As demonstrated, there exist scenarios where minorities compose 67% (Asian 7.5%, Hispanic 22.5%, Black 37%) *and* scenarios where minorities compose 68% (Asian 7%, Hispanic 9%, Black 52%). Although this paper only discusses two potential options, the mathematical modeling suggested herein can be used to create many more. Indeed, CPS and its public stakeholders have the tools for a significant, yet legal, rebalancing of the racial composition of CPS's top five SEHSs through the reweighting and adding of variables mechanism.

The main potential cost of reweighting/adding variables is the decreased average test score out of 900 of an admitted student (under our 'tier score correlated with test score' assumption).¹² Despite the lower test score of an admitted student, CPS's top institutions remain competitive against its peers across the country. All five top SEHSs are ranked in the

¹² Current CPS average: 3.63, Reweighting Average: 3.51, Pre 2009 theoretical Average: 4.57

top 100 in the country, with Walter Payton College Prep ranked as the #4 public school in the country. These ranks have only improved since 2009. This begs the question: does admitting students with lower test scores out of 900 actually decrease the academic rigor of the school? Has academic rigor actually declined under the new system? CPS seems to indicate that the answer to these questions is “no.” However, an entire paper can be written about whether disadvantaged students succeed at top institutions, or whether they are bound to fail at top institutions. In essence, while the solutions may decrease the average score of an admitted student, they will likely not decrease the overall academic rigor of the school, and likely increase socioeconomic diversity.

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N. Bibliography

- Alon, Sigal, and Ofer Malamud. “The Impact of Israel’s Class-Based Affirmative Action Policy on Admission and Academic Outcomes.” *Economics of Education Review* 40 (June 2014): 123–39. <https://doi.org/10.1016/j.econedurev.2014.02.004>.
- Astin, Alexander. “Principles of Good Practice for Assessing Student Learning.” *Kellogg Foundation*, April 1993.
- Bowen and Bok. *The Shape of the River*. Princeton University Press, 1998.
- Carlton, Genevieve. “A History of Affirmative Action in College Admissions.” BestColleges.com, August 10, 2020.
- Cohen, Elizabeth. “Restructuring the Classroom: Conditions for Productive Small Groups.” *Review of Educational Research*, Vol. 64, No. 1, March 1994.
- Corcoran, Sean Patrick, and E Christine Baker-Smith. “PATHWAYS TO AN ELITE EDUCATION: APPLICATION, ADMISSION, AND MATRICULATION TO NEW YORK CITY’S SPECIALIZED HIGH SCHOOLS,” n.d., 24.
- Cortes, Kalena. “Do Bans on Affirmative Action Hurt Minority Students? Evidence from

the Texas Top 10% Plan.” W.E. Upjohn Institute, May 1, 2010.

<https://doi.org/10.17848/wp10-168>.

Ellison, Glenn, and Parag Pathak. “The Efficiency of Race-Neutral Alternatives to Race-Based Affirmative Action: Evidence from Chicago’s Exam Schools.”

Cambridge, MA: National Bureau of Economic Research, September 2016.

<https://doi.org/10.3386/w22589>.

Ellison, Glenn, and Parag A. Pathak. “The Efficiency of Race-Neutral Alternatives to Race-Based Affirmative Action: Evidence from Chicago’s Exam Schools.” National Bureau of Economic Research, September 1, 2016. <https://doi.org/10.3386/w22589>.

Haveman, Robert, and Timothy Smeeding. “The Role of Higher Education in Social Mobility.” *The Future of Children / Center for the Future of Children, the David and Lucile Packard Foundation* 16 (February 1, 2006): 125–50.

<https://doi.org/10.1353/foc.2006.0015>.

Oct 8, Doug Donovan / Published and 2020. “Poor Families Must Move Often, but Rarely Escape Concentrated Poverty.” The Hub, October 8, 2020.

<https://hub.jhu.edu/2020/10/08/stefanie-deluca-crises-force-families-to-move-frequently/>.

Pascarella. “Attitudes toward Campus Diversity: Participation in a Racial or Cultural Awareness Workshop.” *The Review of Higher Education*, 1996.

Research, Pew. “Parental Income Has Outsized Influence on Children’s Economic Future.” Accessed March 12, 2021. <http://bit.ly/1HJQIh7>.

Swaim, Carol. Read “*America Becoming: Racial Trends and Their Consequences: Volume I*” at *NAP.Edu*. Accessed March 12, 2021. <https://doi.org/10.17226/9599>.

Thernstrom, Abigail. *America in Black & White: One Nation, Indivisible - Race in Modern America*. Simon and Schuster, 1997.

Zhao, Haiyun, Zhilan Feng, and Carlos Castillo-Chavez. “The Dynamics of Poverty and Crime,” n.d., 11.