High School Quality, Race, and College Achievement

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1 Introduction

This paper uses unique and rich data sets on enrollees from the University of Texas at Austin and Texas A&M-College Station to examine three important questions:

1. Does the inclusion of high school quality affect minority/white achievement gaps?

2. How does high school quality affect college achievement at selective universities?

3. Have the effects of high school quality changed across affirmative action regimes?

Texas's experience with alternative Affirmative Action policies provides an opportunity to address the above questions. The decision in *Hopwood v. Texas* ended the use of race and ethnicity as factors in both the admissions decision and the financial aid decision. Kain et al. (2005) report that in the two years following the *Hopwood v. Texas* decision the mean number of black and Hispanic high school graduates from Texas enrolling as freshmen at the University of Texas at Austin and Texas A&M-College Station Texas's declined by 28 percent and 14 percent, respectively. To reverse the decline in minority enrollment at Texas's elite public institutions, the Texas legislature passed *House Bill 588* or the Top Ten Percent Rule. The Top Ten Percent Rule grants automatic admission to any public college or university in Texas for Texas high school graduates who both finish in the top decile of their graduating cohort and submit a completed application for admission to a qualifying postsecondary institution within two years of graduating.[1]

Under the Top Ten Percent Rule, students who qualify for automatic admissions are granted admission irrespective of standardized test scores, the relative quality of the curriculum, or the quality of the high school. Montejano (2001) finds that the number of high schools sending students to the University of Texas at Austin increased from 622 high schools in 1996 to 792 high schools in 2000, a 27.3 percent increase. He states that most of the increase comes from schools that sent low numbers previously. Dickson (2006)

[1] *House Bill 588* also allows each public college or university in Texas to annually determine if it will offer automatic admission to graduates in the top quartile and provides each institution with a list of eighteen factors that can be used in making admissions decisions if a student does not qualify for automatic admissions

provides evidence that the Longhorn Opportunity Scholarship Program increased the set of students that are interested in attending Texas who are from high schools with few students who attended the University of Texas prior to the program. Domina (2007) finds that *House Bill 588* increased flagship enrollment rates at marginalized high schools in Texas. Montejano (2001), Dickson (2006), and Domina (2007) provide evidence that changes in Texas's Affirmative Action policies increased the set of high schools that send students to Texas and increased the variation in the quality of the high schools that sent students to selective universities in Texas. If one never observes significant numbers of students from lower quality high schools at selective universities, then it is impossible to estimate the effects of quality on academic performance. The changes in admissions policies in Texas have introduced sufficient variation in the high school quality of enrolled students to examine the effects of high school quality.

Fletcher and Tienda (2008) show that the inclusion of high school fixed affects that black-white differences and Hispanic-white differences in several measures of college achievement disappear. In this paper, I examine how race and high school quality impact performance. As such, in the estimating procedure I include proxies for high school quality. My proxies are the percentage of students at a high school who attempt an admissions examination, the average SAT score of the high school, and the percentage of students at a high school that are economically disadvantaged. I posit that high schools where students are taking admissions exams at a high rate are indicative of an environment where kids are interested in post-secondary opportunities, that schools with higher average SAT scores are higher quality schools, and that high schools with larger percentage of economically disadvantaged students are secondary schools where students are more likely to perform poorly academically. This approach is likely to reveal information on how background affects performance as Rothstein (2004) demonstrates that the ability of SAT scores to predict first semester grade point average is reduced when high school demographics are included in the specification.

Fletcher and Tienda (2008), through the inclusion of high school fixed effects, demonstrate that time invariant qualities of the high schools that students attended affect academic performance in college. I extend this approach by including high school level proxies for quality in the specification. By assuming that the effects of high school characteristics on performance are the same for all students, this approach allows one to infer how the high school background of potential students will impact academic performance

even if the student does not come from a high school that has sent students to a particular university as it is impossible to estimate a high school fixed effect if students from the high school have never shown up. This approach offers admissions officers the possibility of more effectively identifying students who may require additional resources to succeed academically.

The paper proceeds as follows. Section 2 describes the data used in the analysis. Section 3 discusses the estimation procedure. Section 4 discusses the results, and Section 5 concludes the paper.

2 Data

The data are derived primarily from administrative data on enrollees at the University of Texas at Austin and Texas A&M-College Station. The data sets provide information on an enrollee's grade point average (GPA), ACT or SAT[2], race/ethnicity, gender, and indicator for the enrollee's high school class rank. The individual level data are merged with data on public high schools in Texas. The public high school data, which is provided by the Texas Education Agency (TEA), provides information on the average SAT score at a high school, the percentage of the high school's graduates that attempt a standardized exam, and the percentage of students who are economically disadvantaged. To be included in the analysis, I require that an observation have no missing data elements from either data set. This means that the sample used in the analysis will consist of enrollees who are graduates from public high schools in Texas. [3]

The analysis focuses on first semester academic performance at the University of Texas at Austin and Texas A&M-College Station, respectively. For the University of Texas at Austin, the sample consists of 42,163 enrollees from 680 public high schools in Texas. For Texas A&M-College Station, the sample consists of 35,317 enrolles from 755 public high schools in Texas.

[2]For enrolles with only an ACT score I use the SAT equivalent as provided by a concordance table.

[3]The automatic admission granted by the Top Ten Percent Rule applies to any qualifying Texas high school graduate, regardless of whether the student graduated from a public or private school. Unfortunately, there is no high school level information available for students who attend private high schools in Texas.

3 Methodology

In this paper, I estimate variants of regression models of the following form:

$$Y_{is} = \alpha_s + \beta_1 \mathcal{I}_{(i=\texttt{Black})} + \beta_2 \mathcal{I}_{(i=\texttt{Hispanic})} + \beta_3 SAT_i + \beta_2 TT + \beta_4 TD_i + \beta_5' HQ_s + \beta_6' TT \times HQ_s + \beta_7' TD_i \times HQ_s + \varepsilon_{is}$$

The term α_s is a high school fixed effect. $\mathcal{I}_{(i=\texttt{Black})}$ and $\mathcal{I}_{(i=\texttt{Hispanic})}$ are indicator variables that assume a value of one if the enrollee is either black or Hispanic, respectively. SAT_i is the enrollees SAT score or its equivalent. TT is an indicator variable that assumes a value of one if the student is in the first semester after the passage of the Top Ten Percent Rule. TD_i is an indicator variable that assumes a value of one if the student is ranked in the top decile of her graduating class and assumes a value of zero otherwise. HQ_s are the high school quality measures. Again, the measures include the high School's average SAT score, the percentage of the high school's graduates that attempts an admissions examination, and the percentage of the high school's students that are economically disadvantaged. $TT \times HQ_s$ is an interaction term between the indicator for a student enrolling after the passage of the Top Ten Percent rule and the high school quality measures. $TD_i \times HQ_s$ is an interaction term between the indicator for an enrollee graduating in the top decile of her graduating class and the high school quality measures. I cluster at the high school level to allow for arbitrary correlation between enrollees from the same high school.

The above model is the complete specification. To assess the impact of various quality measures on minority/white achievement gaps,I first estimate models that include no regressors. I then add additional elements and note how the addition of other covariates to the model affect the magnitudes and signs of β_1 and β_2, the coefficients associated with the indicators for being black or Hispanic, respectively.

To address the second question, I inspect the signs of the coefficients associated with the high school measures. The third question is addressed by inspecting the coefficients associated with the interaction between the indicator for enrolling in college after the passage of the Top Ten Percent Rule and the high school quality measures.

4 Results

4.1 University of Texas at Austin

Table 1 contains the summary statistics for the sample of enrollees from the University of Texas Austin. The first semester enrollees that attend after the passage of the Top Ten Percent Rule perform better in the first semester by .24 points. and, on average, score sixteen points higher on the SAT. The demographic profiles are remarkably similar across the two regimes with some marked differences. There are a far higher percentage of students who were ranked in the top decile of their high school class following the passage of the Top Ten Percent Rule; however, this is to be expected as the Top Ten Percent Rule confers automatic admission status to Texas high school graduates who graduate in the top decile. The high school average SAT score increased by 97 points in the Top Ten Percent Regime. The means of the other quality measures are virtually unchanged across regimes.

Table 2 contains the results from estimating variants of the above model. The second column contains the results from regressing the first semester GPA of enrollees at the University of Texas at Austin on an indicator for being black and an indicator for being Hispanic. The coefficients associated with the indicators are the mean difference in first semester performance between the blacks and whites and Hispanics and whites for this sample. The differences are large and statistically significant, with both blacks and Hispanics earning, on average, lower first semester GPAs than whites. The first semester GPA of blacks are .32 points lower than whites, and the GPA of Hispanic enrollees are, on average, .23 points lower than whites.

The third column in Table 2 contains the results of the model where controls for the student's SAT score, an indicator for being ranked in the top decile, and an indicator that assumes a value of one if the student is in the first semester after the the passage of the Top Ten Percent Rule are added. First, note that the magnitude of the differences in first semester academic performance between blacks and whites and Hispanics and whites declines precipitously. For blacks, the difference in first semester performance changes from -.32 to -.03, which is nearly a 91 percent decline in magnitude. In this specification, the difference in first semester academic performance between black enrollees and white enrollees in the sample is statistically indistinguishable from zero. For Hispanics, the difference in first semester performance changes from -.23 to -.04, which is nearly a 83 percent decline

in magnitude. This difference is statistically significant at the five percent level.

Second, the controls add predictive power to the model. The R^2 increases from .02 to .23. The reduction in the magnitude of the racial/ethnic differences in academic performance is a result of adjusting for the differences in academic preparation between the racial/ethnic groups. The enrollees own SAT score enters the regression positively, .002 points per point on the SAT, and is statistically significant at the .1 percent level. A one hundred point increase in the student's own SAT score results in an increase of .2 points in first semester GPA. Students who are ranked in the Top Decile of their graduating class earn first semester GPAs that are, on average, .41 points higher than students who are not ranked in the top decile. This is a reasonable estimate as students who are so ranked have a demonstrated history of performing well in the classroom as evidenced by their ranking. Students who enroll after the passage of the Top Ten Percent Rule score .18 points higher in the first semester relative to students who enrolled prior to the Top Ten Percent Rule admissions regime.

The fourth column adds the high school quality measures and high school specific fixed effects to the specification. The signs of the coefficients associated with the race/ethnicity indicators change sign. The coefficient associated with the indicator for being black is .04 and is statistically significant at the five percent level. This means that a black, in this sample, is expected to score .04 points higher than a white enrollee from the same high school. The coefficient associated with being Hispanic is .02. This coefficient, however, is not statistically significant. The estimated effect of the SAT on first semester performance is the same as in the previous specification at .002 points per point on the SAT. The coefficient associated with being ranked in the top decile takes on a value of .56 points.

An increase of one point in the average SAT score of the high school the enrollee attended increases first semester GPA by .002 points. The coefficient associated with the average high school SAT score is statistically significant at the .1 percent level. The average high school SAT score shows significant variation—the difference between the maximum and minimum scores exceed five hundred points—so that its impact can be important. The percentage of the high school that attempts an admissions examination positively affects first semester performance at the University of Texas at Austin. An increase of one percentage point in this measure increases is associated with a .002 point increase in first semester GPA. This coefficient is statistically signifi-

cant at the .1 percent level. Surprisingly, the percentage of the high school that is economically disadvantaged enters the regression positively at .001 points per percentage point of the high school that is economically disadvantaged; however, this coefficient is not statistically distinguishable from zero. These estimates provide evidence that high school level quality variables are predictive of subsequent collegiate performance. This shouldn't surprise us given the results contained in Rothstein (2004). These results are stronger still as they retain predictive power despite the inclusion of high school fixed effects which account for all time invariant characteristics at the high school level.

The fifth column in Table 2 adds interactions between both the top decile rank indicator and the high school quality measures and interactions between the Top Ten Percent Rule regime indicator and the high school quality measures. The estimates associated with an enrollee being black or Hispanic are qualitatively similar to the results displayed in column four, as are the estimates for the effects of the enrollees own SAT score and the direct effects of the high school quality measures. However, the coefficient associated with being in the top decile increases relative to the results obtained in column four; it takes on a value of 1.33 points and is statistically significant at the .1 percent level. On the main, the interaction terms are economically small and statistically insignificant except for two estimates: 1.The interaction between the enrollee being ranked in the top decile of her graduating class and the average SAT score of the enrollees high school 2. The interaction between the enrollee coming to the University of Texas at Austin in the years following the the passage of the Top Ten Percent Regime and the percentage of the enrollees high school that is economically disadvantaged. The interaction term between between being in the top decile and the average high school SAT score of the enrollee enters negatively, -.0007, and is statistically significant. I find this estimate to be strange. It means that highly ranked students from high schools with higher average SAT scores are expected to score lower than similarly ranked students from high schools with lower scores. Still, the estimate is economically small. The coefficient associated with the interaction between the enrollee coming to the University of Texas at Austin in the years following the the passage of the Top Ten Percent Regime and the percentage of the enrollees high school that is economically disadvantaged enters negatively at -.0029 points and is highly significant. I interpret it to mean that after the passage of the Top Ten Percent Rule students coming from more disadvantaged schools are likely to do worse academically. Though it is

small, the estimate is consistent with there being a change in the quality of high schools that have students enroll at the University of Texas at Austin.

4.2 Texas A&M-College Station

Table 3 contains the summary statistics for the sample of enrollees at Texas A&M-College Station. Students at Texas A&M-College Station who enroll after the passage of the Top Ten Percent Rule earn slightly higher first semester grade point averages and slightly lower SAT scores. The demographics of first semester enrollees change across regimes. There are declines in the percentage of blacks and Hispanics are first semester enrollees at the Texas A&M-College Station, while there is a 3 percentage point increase in the percentage of white enrollees, from 80 percent to 83 percent. There is a two percentage point increase in the percent of students who were ranked in the top decile of their high school class, from 49 percent to 51 percent. The means of the high school quality measures are almost unchanged across the regimes except for the average SAT score of the high schools that the enrollees attended. The mean of the average SAT score of the high schools that the enrollees attended increased by 107 points, from 909 points to 1061 points, or nearly 1.6 times the standard deviation of the average SAT of the high schools in the period before the passage of the Top Ten Percent Rule.

Table 4 contains the results of estimating the regression models using data on first semester enrollees at Texas A&M-College Station. The second column presents the results of the variant of the model where I regress first semester grade point average on the indicator variable for being black and the indicator variable for being Hispanic. The coefficients associated with the indicators represent mean differences in first semester academic performance between blacks and whites and Hispanics and whites, respectively. Blacks, on average, score .33 points lower than whites. Hispanics, on average, score .28 points lower than whites. Both of these differences are statistically significant at the .1 percent level.

The third column of Table 4 contains the estimates from the variant of the model where I add the following controls: the student's own SAT score, an indicator for being ranked in the top decile, and an indicator that assumes a value of one if the student is in the first semester after the the passage of the Top Ten Percent Rule. Again, the addition of the controls greatly reduces the magnitude of the differences in first semester performance between blacks and whites and Hispanics and whites. The magnitude of the difference in first

semester performance between blacks and whites decreases by 66 percent; the estimated difference changes from -.33 points to -.11 points. The magnitude of the difference in first semester performance between Hispanics and whites also declines by nearly 43 percent, with the estimate changing from -.28 points to -.16 points. The difference, however, remains statistically significant at the .1 percent level.

Again, the predictive power of the model increases with the addition of the controls. The R^2 rises from .02 to .18. The enrollees own SAT score enters the regression positively, .002 points per point on the SAT, and is statistically significant at the .1 percent level. A one hundred point increase in the student's own SAT score results in an increase of .2 points in first semester GPA. Students who are ranked in the Top Decile of their graduating class earn first semester GPAs that are, on average, .36 points higher than students who are not ranked in the top decile. Students who enroll after the passage of the Top Ten Percent Rule score .07 points higher in the first semester relative to students who enrolled prior to the Top Ten Percent Rule admissions regime.

The fourth column of Table 4 adds the high school quality measures and the high school fixed effects to the specification. The coefficient associated with the indicator for being black changes sign, changing from -.11 points to .03 points. The coefficient, however, is statistically indistinguishable from zero. The coefficient associated with the indicator being Hispanic declines by fifty percent in magnitude, changing from -.16 points to -.08 points. The coefficient is statistically significant at the one percent level.

The coefficient associated with the dummy variable that assumes a value of one if the enrollee graduated in the top decile of her class takes on a value of .48 points, an increase of 33 percent over the value obtained in column three, and is statistically significant at the .1 percent level. The coefficient associated with the indicator variable for enrolling after the passage of the Top Ten Percent Rule changed signs, from .07 to -.02, and loses statistical significance.

The high school quality measures enter the regression with the expected sign, and all three are statistically significant at the .1 percent level. An increase of one point in the average SAT score of the high school the enrollee attended increases first semester GPA by .001 points. A one percentage point in the rate at which students from the enrollee's high school attempts admissions exams increases the first semester GPA, on average, by .004 points. A one percentage point increase in the percentage of the enrollee's high school

that is economically diadvantaged reduces first semester GPA by .002 points. Given the range of the latter two measures—which varies between 0 and 100 percent—the effects of these estimates are economically small.

The final column in Table 4 adds the interaction terms to the specification. The difference in academic performance between blacks and whites in first semester performance is .02 points and is not statistically significant at conventional levels. The difference in academic performance between Hispanics and whites is identical to the estimate obtained in column four, -.08 points, and the estimate is statistically significant at the .1 percent level. Students who are ranked in the top decile of their graduating class earn a first semester GPA that is, on average, .24 points higher than a first semester enrollee at Texas A&M with a smilar profile but did not finish in the top decile. The coefficient associated with the indicator for students who enroll after the the passage of the top ten percent rule is .28 points, a drastic change from the estimate obtained in the previous specification which is identical to the full model sans the interaction terms.

None of the interactions are statistically significant except one, and none of the coefficients are economically significant. The coefficient associated with the interaction term between the percentage of the high school that attempts an admissions examination and the indicator variable that assumes a value of one if the the enrollee is in the top decile enters the regression positively with a value of .0016 points and is statistically significant at the .1 percent level. However, this estimate is economically small. Taken together these results suggest that the effects of high school quality do not vary with either the rank of the enrollee or with the passage of the Top Ten Percent Rule.

5 Conclusion

This paper sought to add empirical traction to the three questions listed in the beginning. Certainly, the results presented in the test provide evidence that the of my high school quality metric further reduce the magnitude of racial gaps in performance even after accounting for the the enrollee's academic preparation via the inclusion of the student's own SAT score and an indicator for being ranked in the top decile. These results imply that admissions officers should strongly using high school characteristics to identify students who could possibly require additional resources to obtain academic

success.

This paper also demonstrates that the quality measures are statistically significant predictors of first semester performance and enter the regression with the expected sign, but the estimated coefficients are economically small. Still, the effects of quality may vary as one moves into the extremes of the distribution, so admissions officers perhaps should be prepared to offer additional assistance to students who come from high schools of lower quality.

In addition, I show that the effects of high school quality do not vary across the admissions regime. That is, the coefficients associated with those interaction terms are statistically insignificant, and, more importantly, are substantively small.

The question of who receives admission to elite public universities is a question that continues to generate a great deal of controversy, as there is much disagreement about who merits the opportunity to attend a selective institution. However, conditional on a student being admitted and enrolled, all interested parties should want the students to do well. This paper provides information on both student and high school characteristics that will allow universities to increase the efficacy of policies that are designed to promote college success.

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Table 1: Summary Statistics for The University of Texas at Austin

Variable	Pre Top Ten	Post Top Ten
GPA	2.81	3.05
	(.90)	(.81)
SAT	1196	1202
	(141)	(150)
% Black	04	03
	(20)	(19)
% Hispanic	14	14
	(35)	(36)
% White	64	61
	(48)	(49)
% Male	51	47
	(50)	(50)
% in Top Decile	44	54
	(50)	(50)
% Economically Disadvantaged	18	22
	(15)	(19)
High School SAT Average	929	1026
	(68)	(81)
% Taking Admission Exam	75	74
	(14)	(16)
N	9261	32902

Notes: The summary statistics are derived from data on enrollees in the first semester at the University of Texas at Austin who have no missing data for any of the covariates used in the analysis. Standard deviations are in parentheses.

Table 2: Effects of High School Quality on First Semester GPA: University of Texas at Austin

Dependent Variable: First Semester GPA				
Black	-.32	-.03	.04	.05
	(.02)***	(.02)	(.02)*	(.02)*
Hispanic	-.23	-.04	.02	.02
	(.02)***	(.02)*	(.02)	(.02)
SAT Score		.002	.002	.002
		(.00004)***	(.00003)***	(.00003)***
Top Decile		.41	.56	1.33
		(.01)***	(.01)***	(.14)***
Top Ten		.18	.02	.17
		(.01)***	(.02)	(.20)
High School Average SAT			.002	.002
			(.0001)***	(.0002)***
% Taking Admissions Exam			.004	.006
			(.001)***	(.001)***
% Economically Disadvantaged			.001	.001
			(.001)	(.001)
Top Decile×High School Average SAT				-.0007
				(.0001)***
Top Decile×% Taking Admissions Exam				-.0011
				(.0009)
Top Decile×% Economically Disadvantaged				-.0008
				(.0008)
Top Ten×High School Average SAT				.0001
				(.0002)
Top Ten×% Taking Admissions Exam				-.0029
				(.0011)***
Top Ten×% Economically Disadvantaged				.0016
				(.0012)
High School Fixed Effects	NO	NO	YES	YES
R^2	.02	.23	.28	.28
N	42163	42163	42163	42163
$N_{High\ Schools}$	680	680	680	680

Notes: Standard errors in parentheses. Standard errors are clustered at the High School Level. Signficance Levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ With respect to the race/ethnic variables, white is the omitted category; estimates for Native American and Asian/Pacific Islander categories are suppressed. Top Dec is an indicator variable that assumes a value of one if a student is in the top decile. Top Ten assumes a value of one for the years 1998–2002. The year 1997 is excluded.

Table 3: Summary Statistics for Texas A&M-College Station

Variable	Pre Top Ten	Post Top Ten
GPA	2.71	2.78
	(.79)	(.79)
SAT	1158	1153
	(138)	(139)
% Black	04	03
	(20)	(17)
% Hispanic	12	09
	(33)	(29)
% White	80	83
	(40)	(38)
% Male	49	48
	(50)	(50)
Top Decile	49	51
	(50)	(50)
% Economically Disadvantaged	20	22
	(16)	(17)
High School SAT Average	909	1016
	(68)	(68)
% Taking Admission Exam	72	71
	(14)	(15)
N	9348	25969

Notes: The summary statistics are derived from data on enrollees in the first semester at Texas A&M-College Station who have no missing data for any of the covariates used in the analysis. Standard deviations are in parentheses.

Table 4: Effects of High School Quality on First Semester GPA: Texas A&M University

Dependent Variable: First Semester GPA				
Black	-.33	-.11	.03	.02
	(.03)***	(.03)***	(.03)	(.02)
Hispanic	-.28	-.16	-.08	-.08
	(.02)***	(.02)***	(.02)***	(.02)***
SAT Score		.002	.001	.001
		(.000)***	(.000)***	(.000)***
Top Decile		.36	.48	.24
		(.01)***	(.01)***	(.14)
Top Ten		.07	-.02	.28
		(.01)***	(.02)	(.20)
High School Average SAT			.001	.001
			(.000)***	(.000)***
% Taking Admissions Exam			.004	.003
			(.001)***	(.001)**
% Economically Disadvantaged			-.002	-.001
			(.001)**	(.001)
Top Decile×High School Average SAT				.0001
				(.0001)
Top Decile×% Taking Admissions Exam				.0016
				(.0008)**
Top Decile×% Economically Disadvantaged				-.0012
				(.0008)
Top Ten×High School Average SAT				-.0003
				(.0002)
Top Ten×% Taking Admissions Exam				-.0005
				(.0009)
Top Ten×% Economically Disadvantaged				-.0005
				(.0009)
High School Fixed Effects	NO	NO	YES	YES
R^2	.02	.18	.24	.24
N	35317	35317	35317	35317
$N_{High\ Schools}$	755	755	755	755

Notes: Standard errors are in parentheses and clustered at the High School Level Signficance Levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ With respect to the race/ethnic variables, white is the omitted category; estimates for Native American and Asian/Pacific Islander categories are suppressed. Interaction Terms are between Top Ten dummy and Quality Measures and between being ranked in the Top Decile and Quality Measures.