Supplemental Expert Report
of
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Gratz et al. v. Bollinger, et al., No. 97-75231

February 24, 2000

I. Introduction

This is a second supplemental expert report in response to expert reports prepared by Professor Kinley Larntz. In my original supplementary report, I examined admissions data from 1995-1997 collected from the College of Literature, Science, and Arts ("LS&A"). Since then, admissions data have become available for 1998. Professor Larntz has prepared a new report on data collected between 1995 and 1998. In this second supplemental report, I shall comment on the validity of the conclusions Professor Larntz has drawn from these data. I shall also assess the extent to which the results from the data collected in 1998 are comparable to the results of my earlier analyses of data collected from 1995-1997. I understand that a new "selection index" system was used for LS&A admissions in 1998. In conducting my inquiry, I have examined the 1998 guidelines for admission and analyzed database information regarding 1998 admissions. A post-doctoral fellow assisted with my work.

II. Opinions To Be Expressed

The first purpose of my further inquiry was to examine whether Professor Larntz's analysis of 1998 data fairly reflects the importance of students' under-represented minority status (hereafter referred to as "UMS") as a factor in admissions decisions at LS&A. In doing so, I considered the effect of this factor on the probability of admission of different groups of students and on the overall composition of the freshman class. My second purpose was to compare these results to results I had obtained from previous years in order to assess whether my previous conclusions required modification based on the new 1998 data.

(a). In his first report (dated January 22, 1999), Professor Larntz used a method known as logistic regression to assess the association between UMS and admission to LS&A. This method seeks to compare two groups with regard to the odds of admission, while statistically controlling other characteristics related to the odds of admission. This method produces an odds ratio that appears to provide a single answer to the question about the importance of UMS on admissions decisions. In my rebuttal, I noted that this approach does not (and cannot) adequately take into account the complexity of how various admissions factors interact in shaping admissions decisions. I argued that any attempt to summarize the evidence with a single odds ratio would be misleading.

In his supplementary report, Professor Larntz has adopted a different analytic strategy. Rather than computing a single odds ratio, an odds ratio was computed for many small sub-groups of admissions candidates. Each subgroup is defined by the cell of a matrix. Within each cell, students are quite homogenous on high school grades ("GPA") and standardized test scores ("test score"). The findings from this analysis seem to suggest that, for many cells, the relative odds of admission are "infinitely greater" for UMS than for non-UMS students. Based on this analysis, Professor Larntz concludes that "under represented minorities are given an extremely large allowance for admission" to LS&A.

However, this separate, cell-by-cell analysis of odds ratios is not statistically sound. In general, such separate analysis of many small subsets of data produces highly unstable results. This explains why the odds ratios computed in that analysis range from near zero to infinity. The results of such unstable analyses tend to be misleading.

Consider, for example, those students with GPA greater than 3.80 and test score between 1200-1290 in 1995. Fifteen minority students applied and all were admitted; 653 majority students applied and 647 were admitted. Thus 15/15 or 100% of minority applicants and 647/653 or 99% of all majority applicants were admitted. These results would appear to show that those two groups were treated nearly equally. Yet Professor Larntz computed the odds ratio of 1.00 * .01/(0 * .99) = "inf," which implies that minority applicants are infinitely more likely to be admitted than majority students. The technical explanation for such a result is that division by zero is prohibited. But this way of treating the data creates a false impression. This example is not exceptional.

The careful reader will also note that no results are reported for a large number of cells. These are cells in which minority and majority students are invariably treated equally: none are admitted. The method of analysis chosen by Professor Larntz thus leaves unreported those important cases, thus exaggerating the extent to which UMS and non-UMS applicants are treated differently.

It is precisely because of anomalies of the type noted above that separate analyses of many small cells has long been rejected as in the statistics literature as an inappropriate summary of evidence (c.f., Lindley and Smith, 1972). Other methods that use all of the data to describe the mean and variability of odds ratios across cells are described in the appendix of my original supplemental report.

Those methods presented in my original supplemental report provide stable estimates of the magnitude of variation of the odds ratios over the cells of the table. While that analysis did show that the odds ratios varied considerably over the cells of the table, it contradicts the extreme picture portrayed by the cell-by-cell analysis.

(b.) However, none of the analyses mentioned so far get to the heart of the question concerning the effect of UMS in admissions decisions. The School of LS&A takes UMS into account as one of many factors in making admissions decisions. The effect of such a policy on those who apply can be discerned only in comparison to an alternative policy, one that did not use UMS as a factor in admissions. In a series of analyses of data from 1995-1997, my earlier report showed that the decision to use or not to use UMS as a factor in admissions has much stronger effects on under-represented ethnic minority students than on other students. Specifically, a decision to eliminate UMS as a factor would have dramatically reduced the probability of admission of under-represented ethnic minority students while yielding only a very small increase in the probability of admission of other students. Moreover, such a decision would have strong negative implications for the racial and ethnic diversity of the LS&A student body.

It may seem counter-intuitive that a change in policy would quite dramatically affect the probability of admission of one group of applicants with comparatively little effect on the probability of admission of the non-UMS group. This occurs because LS&A has received comparatively few applications from students having UMS. Any change in policy with respect to UMS would therefore have had a considerably larger impact on the probability of admission of the UMS group than on the probability of admission of other students. Of course all of those admitted under such a change in policy, regardless of ethnic minority status, would have been affected by the expected substantial reduction in the diversity of LS&A.

To assess whether the 1998 data are consistent with data analyzed in my previous supplemental report, we again used data from 1998 to simulate two policy options:

a) the policy actually used for LS&A admissions, which did take UMS into account as one of many factors in admissions decisions; versus

b) eliminating UMS as a factor while retaining other criteria for admission.

While my previous supplementary report used two methods of simulation, each based on somewhat different assumptions, the current report, based on the 1998 data, used only one method ("method 1" -- see page 8 of the March 3, 1999 supplementary report). The results for 1998 were so consistent with the previous results that further analysis using alternative methods appeared unnecessary.

We caution that this simulation operates within the limits of the available data. We are able to control for GPA and test for score, alumni connection, gender, and Michigan residence. We are not able to control for quality of high school attended ("S"), rigor of high school curriculum ("C"), unusual accomplishments or "U" (athletics, arts, music), and resident in under-represented rural geographic area "G", as these data were not available.

Using the results of the best fitting regression analysis for 1998, (see Model 2 of the Appendix to this report), we can develop a predicted probability of admission under a "UMS-blind" policy, that is, policy b. Using the regression equation that best predicts admission for non-UMS applicants, we a) generated a predicted probability of admission for all applicants; b) rank-ordered the applicants in terms of their predicted probabilities; and c) selected the top 8167 applicants (the number actually admitted in 1998).[1] We then counted how many of these "accepted" applicants were of UMS and how many were not.

Table 1 displays how the probability of admission would change for each group under the two policies for 1998. Recall that policy (a) is the current policy of taking UMS into account as one of many factors in admissions, while policy (b) would eliminate consideration of UMS. The expected probability of admission for under-represented minority students would change from .83 to .30 as we move from policy (a) to policy (b). This is a very dramatic change. For those of non-UMS the change would be comparatively small: the expected probability would increase from .61 to .63.

The dramatic drop in the probability of admission of those of UMS combined with the extremely small increase in probability of admission of those not of UMS would lead to a significant reduction in the diversity of the freshman class. In 1998, the expected proportion of admitted students who are UMS would change

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[1] These analyses are restricted to U.S. residents. There is a very small reduction in sample size due to missing data.

from .14 to .06. In absolute terms, this is a reduction from 1324 to 452 admitted students of UMS.

These results are remarkably consistent with those reported in my original supplemental report for earlier years.

Summary of Simulation Analyses. We can reasonably conclude that a shift to a "UMS-blind" policy in 1998 would have dramatically reduced the probability of admission for members of under-represented minority groups while having a very small positive effect on the probability of admission for others.

These analyses are likely be quite conservative over the longer run: a substantially reduced probability of admission would almost certainly reduce future applications for the already under-represented group, further reducing its fraction in the student body. The dynamics of the system over time are hard to predict, but it is difficult to imagine a scenario in which a sharp reduction in the probability of acceptance at this university would increase the pool of currently under-represented applicants.

My analyses of the 1998 data confirm the opinions and conclusions I expressed in my earlier reports. In particular, elimination of the current policy of taking UMS into account would substantially reduce the probability of admission of under-represented minority candidates with only a slight increase in the probability of admission of other candidates. And such a policy would substantially reduce the diversity of the student body with respect to UMS.

III. Conclusions

Our analysis of the conditional probability of admission can now be combined to formulate some rather firm conclusions.

1. A cell-by-cell analysis of odds ratios produces unstable results that exaggerate the association between UMS and the probability of admission.

2. The decision to use or not to use UMS in admissions decisions is much more important for students of UMS than for other students. A decision to eliminate UMS as a factor in admissions decisions in 1998 would have dramatically reduced the probability of admission of under-represented ethnic minority students while yielding a very small positive increase in the probability of admission of other students.

3. The decision to use or not to use UMS in admissions decisions has strong implications for the diversity of the LS&A student body. In particular, a decision to eliminate UMS as a factor in admissions would substantially reduce the proportion of students from under-represented ethnic minority background.

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February 24, 2000

Table 1: Proportions of Applicants Admitted by Under-represented Minority Status (UMS): (i) as observed, and (ii) as expected under "UMS-blind" policy in 1998

Student Status	Observed	Expected
UMS	.83	.30
Non-UMS	.61	.63

[1]This method bases expected proportions on the logistic regression equation that predicts admissions for non-UMS students as described in the Appendix.

Appendix

Table A1 provides the means and standard deviations of all variables used in the simulation. Table A2 provides logistic regression analyses that provide predicted log-odds of admission for UMS and non-UMS students. The predicted log-odds are easily converted to predicted probabilities. Two models were estimated for each group: the first model used only GPA and test score; the second model used, in addition, information about Michigan residence, alumni relations, gender, and two-way interactions (residence by GPA and Residence by test score). Model 2 provided a better overall fit to the data and was used for the simulation.

Table A1: 1998 Means and Standard Deviations for all Variables in the Model for Minority and Non-minority Students

Measure	Majority Mean (SD)	Minority Mean (SD)
Grades (GPA1)[A]	3.546 (0.394)	3.264 (0.509)
Best test scores	1252.33 (170.37)	1057.86 (257.05)
Alumni connection	.45 (1.17)	.22 (.82)
Female[B]	.51	.57
Michigan resident[B]	.40	.46

[A]GPA and adjustment are both X 1000 in model
[B]Coded dichotomously

Table A2: 1998 Logistic Regression Models for Majority and Under-Represented Minority Students

Model 1: Just Grades and Test Scores

Predictor	Majority B	Minority B
Grades (GPA1)	.0059***	.0042***
Best test score	.0053***	.0034***
Constant	-26.759	-14.379

Model 2: Grades, Test scores, Michigan Residency, Interactions with Residency, Gender, Alumi Relations, and GPA adjustment

Predictor	Majority B	Minority B
Grades (GPA1)	.0060***	.0044***
Best test score	.0056***	.0043**
Michigan Res (ef-coded)	-.0784*	-.4059 ns
Interaction:		
Residence x GPA	-.0014***	-.0012***
Residence x Test	.0013***	-.0006 ns
Alumni relations	.7215***	.0494 ns
Female	.1265*	.1104 ns
Constant	-27.868	-15.838

References

Lindley, D., & Smith, A. (1972). Bayes estimates for the linear model. *Journal of the Royal Statistical Society, Series B, 34,* 1-41.