Merit Aid and Sorting: The Effects of HOPE-Style Scholarships on College Ability Stratification[1]

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October 2005
Preliminary: Do not cite

[1] We gratefully acknowledge the support of the NSF under grant SES-9986469, American Educational Research Association, and Terry College of Business through its Terry-Sanford Research Grant Program. The AERA receives funds for its "AERA Grants Program" from the NSF and National Center for Education Statistics of the Institue of Education Sciences. The opinions relect those of the authors and do not necessarily reflect those of the granting agencies.

We thank Brian Quinif for excellent work with the data. We thank Ross Rubenstein, Amy Ellen Schwartz, and participants at the annual meetings of the Association for Public Policy Analysis and Management and American Educational Finance Association for their helpful comments.

Abstract

In the last fifteen years there has been a significant increase in merit aid. Since the early 1990s nearly 30 state-sponsored merit programs have been started, about half of which are based largely on Georgia's HOPE Scholarship. Coincident with this increase in merit aid has been increased attention to sorting in various aspects of life, especially in education. This paper examines the extent to which merit-based aid exacerbates or ameliorates sorting by ability in higher education. We use data from Peterson's Guide to Colleges and the Integrated Postsecondary Education Data System (IPEDS) to evaluate this relationship. From these sources we create a large panel data set of institutions of higher learning in the Southern Regional Education Board (SREB), and test how merit aid affects sorting between and within states.

Our empirical strategy treats HOPE as a natural experiment and contrasts the quality of freshmen at Georgia colleges to their out-of-state counterparts. The difference-in-differences estimates show that HOPE increased the quality of entering freshmen in Georgia institutions relative to their out-of-state peers. At the highest-quality institutions HOPE raises all measures of student quality and the homogeneity of students by ability. The lowest-quality institutions experience no statistically significant effect from HOPE on any measure of student quality. We conclude that state-sponsored merit aid programs increase the retention of high ability students for college and also increase the ability stratification of institutions within states.

We also examine two indirect measures of student selectivity—acceptance and yield rates. HOPE decreases acceptance rates at all types of institutions, but the percentage change is largest at the universities, which are most space constrained. HOPE increases yield rates for universities but not for any other institution categories. Put together, these results suggest that HOPE substantially increased the selectivity at universities.

In addition to Georgia, five other states (Arkansas, Florida, Kentucky, Louisiana, Maryland, and South Carolina) in the SREB started large-scale merit aid programs during our sample period. The data show that in general universities in these states experience similar gains in verbal and math SAT scores and the percentage of students who graduate in the top 10% of their high school classes. There are two exceptions. Louisiana, which uses a relatively low threshold criterion to qualify for its merit award, experiences no statistically significant increase in SAT scores from its merit program. Florida's Bright Futures Scholarship appears to *reduce* the SAT scores of incoming students while increasing the fraction of students who graduated from the top 10% of their high school classes.

1. Introduction and Literature Review

Coincident with the recent growth in merit aid has been increased attention to sorting in various aspects of life. Fernandez (2001) contends that sorting is increasing in the US, and that school peers, neighbors, co-workers and spouses all play important roles in determining expenditures on and returns to human capital. From 1970 to 1990, segregation by income has increased in all metropolitan areas (Jargowsky (1996)), leading to primary and secondary schools that are more stratified by income and ability. Also, the probability that an individual with only a high-school diploma marries another with a college degree has decreased, indicating greater sorting in the marriage market (Mare (1991)). A report by Harvard University's Civil Rights Project released in July 2001 documents rising racial segregation in grades K-12.

Hoxby (1997) demonstrates that rising competition during the last 50 years (due in large part to geographic integration) has substantially widened the distribution of inputs, tuition and student aptitude across colleges, and narrowed the distribution of student aptitude within colleges.[2] The highest quality institutions have experienced both rising student quality relative to their peers and increasing homogeneity of student ability. This increasingly integrated US market for higher education has benefited the average student, as the erosion of local monopsonies over high-ability students increased the rewards to peer quality. However, Hoxby also argues that low-ability students may be worse off now, because a more highly integrated market places them in colleges with relatively few high-quality peers. Cook and Frank (1993) contend the clustering of top

[2] Ehrenberg (2001) discusses an interesting dimension of this competition—the *US News and World Report* annual rankings of colleges and universities. He notes that when an institution improves in the rankings, the following year it can expect to have more applicants, accept fewer of them, realize a higher

post-secondary students has increased in recent years. To what extent has the recent rapid increase in merit aid affected this growth in educational stratification?

Until the late 1980s, merit aid represented a relatively small fraction of total student aid, being largely confined to institutions' attempts to attract academically proficient students. The largest and most prominent merit-aid program in the nation was started in September 1993, when Georgia instituted a lottery-funded college scholarship for the purpose of "Helping Outstanding Pupils Educationally" (HOPE). Between its inception and June 2004, over $1.4 billion in merit awards have been distributed to over 600,000 students.[3] Cornwell, Leidner, and Mustard (2004) report that in the past fifteen years, nearly 30 state-sponsored merit scholarships have been started, 15 of which are "HOPE-like" in that they have three characteristics—the awards are entitlements for those who meet specified criteria, they offer multi-year coverage, and they have no limit on the number of qualifiers. Policymakers typically offer three reasons for implementing merit aid programs. One is to increase college enrollment by promoting access to higher education. The second is to provide a greater incentive for students to remain in state for their postsecondary schooling. The last is to reward and promote academic achievement.

This growing emphasis on merit has many important policy implications, especially as it influences the stratification of higher education by ability. As Heckman (1999) and others have argued, resources early in life determine in large part the level and quality of a person's postsecondary education. From the perspective of sorting, parental resources determine where you live and where you begin your schooling, which enhance

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yield, increase its average SAT score and reduce the amount of institutional grant aid required to attract its class.

[3] The cumulative number of HOPE recipients and value of scholarship awards since the program's inception is available from http://www.gsfc.org/gsfc/html_summary_grant_all_cov_H.htm. Because

a child's college prospects. A college degree, in turn, improves labor and marriage-market opportunities. Thus, to the extent merit is correlated with household income, programs like the HOPE Scholarship reinforce the effects of sorting patterns established prior to the college enrollment decision.

Ability sorting could enhance the efficiency of education production by allowing the most outstanding students to challenge and learn from their peers, matching students and teachers of comparable quality, and if having a critical mass of able students is a necessary condition for a high-quality teaching and learning experience. However, mixing student ability levels may increase efficiency by facilitating positive spillovers from high-quality students to lower-quality peers. Which effect dominates is an empirical question. McPherson and Schapiro (1998) maintain that although some research on these issues exists for primary and secondary education, there is little evidence about the optimal type of sorting at the postsecondary level.

Using a panel data set of the higher educational institutions in the Southern Regional Education Board (SREB) between 1989 and 2001, we estimate HOPE's influence on both the average and variance of student quality. We use four variables to measure average quality—the average math and verbal SAT scores and the fraction of incoming students who graduated in the top 10% and 25% of their high school classes. We use two measures of variance—the variance of the Math and Verbal SAT scores. If HOPE stratifies students by ability, we anticipate that the program will increase the measures of average student quality and reduce the variance of student quality as those institutions become more homogenous.

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transfer students are duplicated in the number of HOPE recipients, they must be subtracted from the website total to obtain the number of unique recipients.

Our empirical strategy treats HOPE as a natural experiment and contrasts the incoming quality of Georgia colleges to their out-of-state counterparts. For these comparisons we use the Peterson's categorization of educational institutions into universities, comprehensive institutions, and four-year institutions. The difference-in-differences estimates show that HOPE increased the quality of entering freshmen in Georgia institutions relative to their out-of-state peers. The average verbal SAT score of all Georgia institutions by 4.9 points and raised the average math SAT score by 6.3 percentage points. The highest-quality institutions (Peterson's "university" category) in Georgia especially benefit from HOPE, which increases verbal SAT scores by 14.3 points and math SAT scores by 9.4 points. In contrast, the lowest-quality institutions experience no statistically significant effect from HOPE on any measure of student quality. In addition, HOPE increases the percentage of students entering college at Georgia "universities" by 7.6 percentage points. No effect on HOPE is shown for any other institution type. The data also show that HOPE reduced the variance of math and verbal SAT scores in the Georgia "universities" but had no impact on the variances at any other institution type. In sum, the rising student quality and decreasing variance of quality at the top institutions provide clear evidence that merit aid increased stratification by ability.

The rest of this paper is organized as follows. Section 2 provides some background on Georgia's HOPE Scholarship. Section 3 provides a more detailed discussion of the relationship between merit aid and various aspects of sorting. Section 4 describes our data and presents our empirical framework. Section 5 presents our results for how merit aid affects sorting by ability, and Section 6 concludes.

2. Georgia's HOPE Scholarship

Started in 1993, Georgia's HOPE Scholarship created an ongoing, large-scale natural experiment for empirically testing many policy implications of merit aid. Under the HOPE banner, Georgia distributes two types of awards—the merit-based HOPE Scholarship and the HOPE Grant. To qualify for the scholarship students must have graduated from a Georgia high school after 1993 with a "B" average.[4] There is no income cap.[5] For HOPE Scholars entering degree-granting public institutions, the program covers tuition, HOPE-approved fees, and a book allowance. In the 2003-2004 academic year the award was valued at $4,378 at the state's flagship institutions.[6] HOPE Scholars attending private, degree-granting institutions receive a standard award of $3000 per academic year toward tuition.[7] Once in college, they must maintain a "B" average with a minimum number of credits to retain the award. Pell recipients who qualify for HOPE can stack the two awards.[8]

In contrast, the HOPE Grant is an entitlement that does not depend on high-school grade-point average. The grant covers tuition and HOPE-approved mandatory fees of non-degree programs at two-year and technical schools. As far as sorting is concerned, the scholarship is of primary interest, and we focus our analysis on the four-year institutions where the scholarship has its largest impact.

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[4] HOPE requirements have changed for high-school classes that graduated in 2000 and later. To receive HOPE members of these classes must have a "B" average in their core-curriculum courses.

[5] In the first year of the program, there was a household income cap of $66,000. The cap was raised to $100,000 in 1994 and eliminated entirely in 1995.

[6] For example, the tuition and fees were $3,208 and $870 at the University of Georgia during the 2003-2004 academic year. While tuition and fee charges vary widely at the state's public institutions, the book allowance is the same, $300 per year, at each.

[7] In 1995 HOPE increased its allocation to private institution students from $1,000 to $1,500, which was raised to $3,000 the following year.

[8] The scholarship initially included a Pell offset, which reduced the HOPE payment dollar-for-dollar for any federal Pell Grant aid received by the student. This offset was eliminated in 2002.

Table 1 disaggregates program disbursements in terms of the number of awards and dollars of aid from 1993-2002.[9] Degree-granting institutions accounted for 55 percent of all awards and 78 percent of total aid during this period, with four-year colleges and universities representing 44 and 60 percent of these totals, respectively. Thus, the lion's share of program resources is devoted to the merit-based scholarship—in particular, to high-school graduates matriculating at four-year schools. The other 45 percent of awards flowed to technical schools in the form of grants, but these institutions receive a relatively small proportion of total aid due to their low tuition.

Until the eligibility criteria for the scholarship were stiffened in 2000,[10] the share of HOPE funds allocated to the scholarship component of the program grew steadily. Between 1993 and 1999, the number of HOPE-eligible high-school graduates rose over 50 percent, from 29,840 to 45,149, and the proportion of high-school graduates satisfying the merit requirements increased from 48 percent to almost 65 percent. Even after the rule change in 2000, the fraction of high-school graduates qualifying for the scholarship has approached 60 percent.

Although cumulative HOPE awards have been evenly divided between scholarships and grants, the former account for nearly 80 percent of all aid disbursed. Just over 72 percent of HOPE Scholars attended 4-year, public institutions, which absorbed 77 percent of all scholarship aid. Another 8.4 percent took their scholarships to 4-year private colleges, which collected 12.5 percent of these funds. Thus, 4-year public and

[9] "Awards" do not equal "recipients" because a single recipient receives an award each year she qualifies and, in the case of the grant, she can receive multiple awards within the same year, depending on the nature of the vocational training program.

[10] Scholarship requirements changed for high-school classes that graduated in 2000 and later. Previously, the GPA requirement was defined in terms of college preparatory courses. Now, to receive HOPE, high-school students must have a "B" average in the strictly academic courses that make up the "core curriculum."

private schools together enrolled over 80 percent of HOPE Scholars, receiving almost 90 percent of all merit-based aid. Further, the share of program resources allocated to the HOPE Scholarship is growing. Between 1993 and 1999, the number of HOPE-eligible high-school graduates rose over 50 percent, from 29,840 to 45,149, and the percentage of high-school graduates satisfying the merit requirements increased from 48 to almost 65. At the same time, the rate of HOPE-eligible high-school graduates enrolling in Georgia institutions jumped from 23 to 70 percent. The dramatic rise in enrollment yield from the scholarship indicates the importance of HOPE's incentive to remain in state. It also suggests the scholarship's potential for increasing the stratification of Georgia colleges by ability.

3. Merit Aid and Sorting

Understanding how HOPE affects student enrollment decisions helps to anticipate how HOPE may influence the quality of entering students. Cornwell, Mustard, and Sridhar (2005) examined how the HOPE Scholarship affects enrollments by institution type. Although HOPE reduces the price of all in-state colleges relative to their out-of-state counterparts, CMS (2005) show that the impact of this change was realized almost exclusively at 4-year schools, because 4-year students are eight times more likely to attend college out-of-state (Dynarski (2000)), and the value of the awards is concentrated in four-year institutions, as shown in Table 1. The Scholarship reduces the prices of in-state public and private institutions relative to their out-of-state counterparts. HOPE should increase student quality most substantially at the highest-quality in-state institutions, because the academically proficient who could have attended college out of

state will be most likely to attend the elite institutions if they remain home. With the "best and brightest" encouraged to stay in-state for their college education, entrance requirements will rise at the top universities in the state. Furthermore, because these elite institutions are often capacity constrained, the increasing selectivity will decrease the variance in incoming student ability level.

HOPE's effect on student ability is more ambiguous at the lower-tier four-year institutions. Students denied admission at the flagship schools may not regard the state's less selective 4-year colleges as close substitutes, and therefore may choose an out-of-state alternative that they view as a substitute, like large public universities in the South. The comments of a recent Georgia high-school graduate who was not eligible for admission to the University of Georgia with an 1150 SAT score and a high-school grade-point average of 3.4 illustrate this point, "As a result of the HOPE Scholarship, above-average-but-not-quite-outstanding students are handing over the dough to schools like Auburn, Tennessee, Clemson, Alabama, Ole Miss and other large universities throughout the South."[11]

Epple, Romano and Sieg (2000) find that colleges whose average student quality is near the median of the quality distribution provide discounts to more-able students, suggesting that peer effects are important in the production of higher education. Thus, institutional merit aid is essentially a college's implicit wage payment for peer quality. By reducing the relative price to high-achieving residents, a HOPE-style scholarship operates in the same way for all in-state colleges. However, because the schools within a state typically differ in terms of quality (and other characteristics that enter the

[11] Kristen Roberts, "HOPE Handicaps some of Georgia's Best Students," *The Atlanta Constitution*, 25 Jun 2001.

enrollment decision), competition among scholarship recipients for admission to the top schools should further stratify by ability and income to the extent ability and household income are correlated. Part of the stratification process may involve less-able, affluent students leaving the state.[12]

Figure 1, which contrasts the SAT series for freshmen enrolled in Georgia public colleges with those of high-school seniors in Georgia and the rest of the US, supports the proposition that Georgia's scholarship program has affected student quality. Between 1992 and 2003 the SAT scores of Georgia freshmen increased by 67 points compared to increases of 36 points for Georgia high-school seniors and by 25 points for high-school seniors throughout the US. During the four pre-HOPE years the average score of Georgia college freshmen exceeded the score of Georgia high school seniors by 16 points and trailed the average score of high school seniors in the US by 35 points. By the end of the period Georgia college freshmen outscored the Georgia high school senior group by 52 points and the US comparison group by 10 points. Furthermore, between 1993 and 2000, Georgia's rate of retaining students with SAT scores greater than 1500 has climbed from 23 to 76 percent. While these data are instructive about HOPE's impact on average student quality, they don't directly speak to the scholarship's effects on sorting.

4. Empirical Analysis

4.1 Data

We use two main data sets to address HOPE's influence on sorting—Peterson's

[12] Groen and White (2001), in examining the objectives of state governments and public universities, claim that states are always better off (in terms of tax revenues) when a more-able student attends college in state, whether the school is public or private. In terms of degrees conferred, however, Bound, et al. (2001) find that the link between a state's production of higher education and its stock of human capital is

Undergraduate Database and the Integrated Postsecondary Education Data System (IPEDS). Peterson's Undergraduate Database is one of the most comprehensive sources of information on US institutions of higher education available. For 2001, the database includes 2,127 four-year and 1,732 two-year accredited colleges and universities. To be included, an institution must either have full accreditation or pre-accreditation status granted by an institutional or specialized accrediting body that is recognized by the US Department of Education. We start with data from 1989, four years before HOPE was implemented. Importantly, for each college, Peterson's reports the distribution of SAT and ACT scores of first-time freshmen across six separate groups.[13] The database contains other freshmen quality measures as well, including the distribution of students by high-school class rank and the number of National Merit Scholars. The freshmen quality data are combined with an extensive array of college characteristics, such as the Carnegie Classification, degree offerings, athletic programs and campus features. The IPEDS surveys collect enrollment, program completion, faculty, staff, and finance data from all Title-IV institutions of postsecondary education.

Figures 2-4 plot the trends for three student quality measures for Georgia and SREB institutions in Peterson's "university" category—their most elite group and the one we anticipate will be must likely affected by HOPE. Figure 2 shows that between 1990 and 1992 Georgia universities had SAT verbal scores about 5-10 points lower than their out-of-state counterparts. The in-state SAT scores exceed the out-of-state scores in 1993, the year HOPE started, and for all the subsequent years, and that this gap grew over time. In 2001, the last year of the sample, Georgia universities exceeded the SREB institutions

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weak.

[13] The student quality data do not exist for 1996.

in average verbal SAT score by nearly 50 points. Figure 3 provides a similar contrast for the math SAT averages, as the Georgia universities have lower scores during 1990-1992 and higher scores for all post-HOPE years. The difference in the average math SAT score is 52 points by 2001. The contrast is most explicit in Table 4, which documents the percentage of students among college freshmen that graduated in the top 10% of their high-school classes. Between 1989 and 2001, the out-of-state universities experienced some growth from 29.5% to 35.5%. Alternatively, over the same period Georgia universities grew dramatically from about 15% to about 70% by 2001.

Figures 4 and 5 plot the homogeneity of incoming student quality as measured by the variance of SAT verbal and math scores, respectively. Both figures show Georgia with slightly less variance in the pre-HOPE years. However, after HOPE the variance for both measures dropped precipitously, thus indicating that the incoming classes are becoming more homogenous. In sum, the trends plotted in Figures 2-6 indicate that both student quality and homogeneity of ability increased after HOPE at the top institutions in Georgia relative to their out-of-state peers. We next examine whether these trends in the raw data hold up after controlling for other factors.

Table 2 provides the summary statistics for the dependent variables in this analysis. The summary statistics are presented in a way that is foreshadows our difference-in-differences regression estimates. There are four sets of summary statistics—pre- and post-HOPE for Georgia institutions (test group) and pre- and post-HOPE for SREB institutions (control group). The set of seven dependent variables is repeated for each category of institutions we examine—all institutions, universities, comprehensive institutions, and four-year institutions. The last column contains the difference-in-

differences in the average values. For example, the first row indicates that Georgia institutions experienced an increase in their verbal SAT score of 9.3 more points than their out-of-state counterparts in the SREB. The largest differences for incoming quality measures are for universities. Georgia schools in this category experienced an increase in verbal SAT scores that was 27.1 points more than the increase in the SREB schools. Similarly, their math SAT and the percentage of incoming students who graduated in the top 10% of their high school classes increased by 34.9 and 19.3 more than the control group. While the quality of incoming students increased faster in Georgia relative to its SREB peers, its students became more homogenous in ability, as indicated by the difference-in-differences decreases in the standard deviation of the math and verbal SAT scores.

4.1 Empirical Models and Estimation

These data allow us to compare Georgia colleges with comparable sets of institutions in other states before and after HOPE. The basic framework for the analysis is a difference-in-differences regression of the form.

$$Q_{it} = \alpha + \beta_t Y_t + \gamma_i I_i + \delta_{GA,t} S_{GA} H_t + X_{it}^{'} \xi + \varepsilon_{it} \qquad (1)$$

where Q_{it} is a measure of freshmen quality in institution i in year t. Y_t and I_i are year and institution fixed effects, respectively. The variable S_{GA} is a dummy variable with a value of 1 for institutions located in Georgia, H_t is a HOPE indicator equal 1 in year t and 0 otherwise ($t = 1993,94...$) and X_{it} is a vector of covariates. Thus, the HOPE effect on Q_{it} is captured by $\delta_{GA,t}$.

We use six dependent variables (Q_{it})—the average SAT Verbal score, average SAT Math score, the percentage of incoming students in the top 10% and 25% of their high school graduating classes, and the variances of the SAT Verbal and Math scores. We estimate the SAT averages and variances, because Petersons does not report the actual data. Instead, Petersons reports the percentage of incoming students whose SAT scores are in 100-point intervals. To estimate the average for a given institution we multiplied the fraction of incoming students in each one-hundred-point category by the media score in each category and summed the results.

To provide a more detailed picture of HOPE-induced sorting we estimate (1) for comparable groups of institutions. Peterson's classifies undergraduate institutions as follows—university, comprehensive institution, four-year, and two-year. Universities offer four years of undergraduate work plus graduate degrees through the doctorate in more than two fields, and include institutions such as Emory University, Georgia Institute of Technology, and University of Georgia. Comprehensive institutions award bachelor's degrees and may also award specialists' or professional level, but not more than two doctoral programs. This category includes institutions such as Albany State University, Berry College, Georgia College, and Mercer University. Four-year colleges award Bachelor's and possibly associate degrees, but no graduate degrees. Some institutions in this category are Atlanta College of Art, Beula Heights Bible College, Brewton Parker College, DeVry Institute of Technology, and many of the HBCUs like Morehouse and Spelman Colleges. Two-year institutions award associate degrees and offer two years of work acceptable toward bachelor's and possibly associate degrees, but not graduate degrees.

As indicated in Section 3, we anticipate that the largest effects will occur at the top category of institutions, which is Peterson's "university" group. Students who would

have gone to college out of state, but who are induced to stay in state by HOPE will be most likely to attend institutions in this category. We expect that the comprehensive institutions, which are the next closest in-state substitute for the flagships, may experience some increase in student quality. To the extent that this trend at the flagship institutions leads some students to enroll in these "comprehensive institutions" we may observe some increases in selectivity. However, some students will enroll in out-of-state flagship institutions that they believe are better substitutes for the in-state flagships. Cornwell, Mustard, and Sridhar (2005) show that after HOPE enrollment by Georgia residents in out-of-state institutions is generally lower than it was pre-HOPE. However, out-of-state flagships experience a significant increase in enrollment a few years after HOPE. This effect will mitigate the increase in selectivity at the comprehensive institutions.

We anticipate little effect among the four-year institutions because they are less prestigious, and many of these schools are Bible Colleges or specialize in art or nursing, and therefore, are not good substitutes for the institutions in the university category. Furthermore, they are nearly all private, which means that the relative discount generated by HOPE is smaller than it is for public institutions.

5. Results

5.1 HOPE's Effects on the Average Quality and Homogeneity of Student

Table 3 presents the results for the estimation of equation 1 with the average SAT score.[14] The first four columns of the table are for the SAT verbal score and the second

[14] The results in Tables 3 and 4 report the results when all SREB states are included as controls. However, because some SREB states passed large merit programs during our sample (for example, Florida

four columns are for the SAT math score. The results shown in the table are consistent with our expectations that HOPE leads Georgia institutions to enroll higher quality students relative to SREB institutions, and that the extent of this difference is greatest at the most competitive institutions. When all institutions are included the estimated HOPE effect is 4.9 points on the SAT verbal and 6.2 points on the SAT math, both of which are statistically significant. As expected the largest effect is for the universities. For these institutions HOPE increases their average SAT verbal score by 14.3 and their SAT math by 9.4 points, both of which are statistically significant. The only other statistically significant HOPE effect is for comprehensive institutions for SAT verbal. Although the four-year institutions have a positive estimated effect of about 6 points for both the verbal and math SAT scores, both are very imprecisely estimated, and their standard errors are bout the same size as their estimated coefficients.

Table 4 provides the estimated HOPE effects of the fraction of college freshmen who graduated from the top 10% and 25% of their high school class. The only statistically significant result in this entire table is the HOPE effect for institutions in the Petersons "university" category. For these institutions HOPE increased this fraction of students by 7.6 percentage points, which is statistically significant at .011.

Tables 5 and 6 use the standard deviation of the verbal and math SAT scores, respectively. There is no statistically significant effect for all institutions and comprehensive institutions. The university category shows statistically significant decreases in the standard deviation of student ability—students are becoming more

started Bright Futures in 1997) these states may not be valid controls. We estimated the same regressions in these tables and excluded the states that implemented their own HOPE-like programs. Doing so generated qualitatively similar results in that the HOPE effect was positive for the total category and was the highest for universities.

homogenous by ability level. For universities HOPE reduces the standard deviation of incoming SAT verbal and math scores by 3.5 and 2.2 points, respectively, and both are statistically significant. In contrast, HOPE increases heterogeneity in the 4-year (lowest quality) institutions. The estimated effect in four-year institutions is 1.8 for the verbal SAT and 1.5 for the math SAT. The former estimate is statistically significant at about .05 and the latter estimate has a p-value of .14. HOPE may raise selectivity at the highest ranked institutions, thus dropping some high scoring students to four-year institutions because they could not get admitted to higher-ranked schools. Also, this increasing standard deviation may be explained by some relatively low quality students entering these institutions from the labor market or two-year schools.

In sum, these results provide strong evidence that merit aid programs exacerbate the stratification by ability in colleges that has been occurring for a variety of reasons. Compared to their out-of-state peers, the highest quality of post-secondary schools has experienced dramatic increases in average student selectivity and substantial drops in the variance of the qualifications of incoming students.

5.2 The Effect in Other States that Have Adopted Merit Aid Programs

Cornwell, Leidner, and Mustard (2005) documented that nearly 30 state-sponsored merit aid programs have been started since the early 1990s, and that about half of them are HOPE-like. This section extends the analysis from Georgia to examine how HOPE-like merit aid programs affect the three student quality measures. During our sample period, Arkansas, Florida, Kentucky, Louisiana, Maryland, and South Carolina also adopted large-scale merit programs. Table 7 reports the results of regressions based

on equation (1), but that allow for multiple states to adopt merit programs. In general, we anticipate that the large-scale merit programs should have similar impacts on the average quality of schools in the university category as they did in Georgia. The most likely exception to this is Louisiana, which uses a relatively low threshold criterion to qualify for its merit award. The results are quite consistent with this prediction. The first two columns measure the effect of merit aid on the verbal and math scores for incoming students. All but two of the states show positive and statistically significant increases in both the SAT verbal and math scores. Merit aid programs increase the SAT verbal and math scores at universities in Arkansas, Georgia, Maryland, and South Carolina.[15] One of the two exceptions to this result is Louisiana (TOPS), as is expected given its relatively low scholarship cutoff. The other exception is surprising—Florida's Bright Futures Scholarship, which was modeled explicitly after HOPE. The last column examines how merit aid affects the fraction of admitted students who were in the top 10% of their high school graduating classes. Again, consistent with our expectations, merit aid programs increase this fraction in Arkansas, Florida, Georgia, Kentucky, and Maryland, while having no statistically significant effect in Louisiana or South Carolina. A possible explanation for Florida's merit aid program having negative effects on SAT scores but positive effects on the fraction of incoming students who graduated from the top 10% of their high school classes is that Florida adopted a Top 20% rule in adopted in 2001.

Another interesting result is that the estimated effects of Georgia's HOPE for all three measures actually increase when all the other state programs are controlled for. Georgia's estimated impact increases from 14.3 to 14.6 for SAT verbal, from 9.4 to 9.6

[15] Kentucky did not report SAT scores and therefore no result is estimated for Kentucky.

for SAT math, and 7.6 to 9.0 for the fraction of students who graduate high school in the top 10% of their classes.

5.3 Indirect Measures of Selectivity

We next estimate equation (1) with two different dependent variables. Acceptance and yield rates are commonly utilized to determine the selectivity of higher educational institutions. HOPE's effect on both of these variables is uncertain and could vary by institution type. Because college attendance and applications are complements and HOPE decreases the price of attending college, HOPE should also increase the number of applicants. If yield rates remain constant and institutions expand enrollment, HOPE will lead institutions to accept more students. HOPE will also likely increase total enrollment, but the degree to which this occurs depends on the ability of the institutions to absorb more students. In Georgia, institutions in the university category were generally space constrained. Lower-tiered institutions experienced fewer physical constraints. Consistent with this Cornwell, Mustard, and Sridhar (2005) find that HOPE increased enrollment relatively more in lower-tiered institutions.

In general, a lower acceptance rate (percentage of applicants that an institution admits) is believed to reflect higher selectivity because a greater fraction of students who apply are rejected. In contrast, a higher yield rate (percentage of those admitted who enroll in an institution) is believed to reflect quality because the students who are accepted believe the institution is higher quality, and therefore, are more likely to enroll.

Tables 8 and 9 provide the estimated HOPE effects for acceptance and yield rates, respectively. In Table 8, the estimated program effect is negative and statistically

significant for all category types. HOPE reduces acceptance rates by 7.5 percentage points for all institutions, 8.4 percentage points at universities, 3.6 percentage points at comprehensive institutions, and 9.9 percentage points at four-year institutions. Based on the pre-HOPE mean for Georgia institutions in these categories, the percentage decrease was largest for universities (-12.9%), followed by four-year institutions (-12.6%), all institutions (-9.3%), and comprehensive institutions (-4.6%).

Table 9 indicates that the only statistically significant effect of HOPE on yield rates occurs at universities. The estimated program effect at these institutions is to increase yield rates by 4.1 percentage points, or 8.3% based on their pre-HOPE mean yield rate. HOPE has no statistically significant impact on the yield rates of any of the other institution types.

To summarize, HOPE decreases acceptance rates at all types of institutions, but the percentage change is largest at the universities that are most space constrained. HOPE increases yield rates for universities but not for any other institution categories. Put together, these results suggest that HOPE substantially increased the selectivity at universities.

6. Conclusion

During the last twenty years the number and size of state-sponsored merit aid programs has increased substantially. Since the early 1990s nearly 30 state-sponsored merit programs have been started, about half of which are based largely on Georgia's HOPE Scholarship. Coincident with this increase in merit aid has been increased attention to sorting in higher education. This paper examines the extent to which merit-

based aid exacerbates or ameliorates sorting by ability in higher education. We use panel data on higher educational institutions from Peterson's Guide to Colleges and the Integrated Postsecondary Education Data System (IPEDS) to evaluate this relationship. We identify the effect with a difference-in-differences estimation strategy. The data show that state-sponsored merit aid programs increase the retention of high ability students for college. Furthermore, they increase the ability stratification of institutions within states—the effect is largest for the highest ranked institutions. Consequently, the data show that merit aid contributes to the trend towards greater sorting by ability in US higher educational institutions.

Future work will report the results for controlling for time-varying characteristics, such as the number of computers and library volumes on campus, and the number of graduating high school seniors, in the ability sorting regressions. When we include these time-varying data as control variables the same qualitative story comes through with HOPE increasing student selectivity and homogeneity at the highest quality institutions and having little or no effect on the other institutions. However, typically (although not always) the estimated magnitude of the HOPE effect is slightly smaller.

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Table 1
Numbers of HOPE Awards & Dollars of Aid
by Institution Type, 1993-2002

Institution Type	Number of Awards (% of Total)	Aid in Millions of $ (% of Total)
4-Year Institutions	526,033	942.00
Public	389,452	840.09
	(32.0)	(53.7)
Private[a]	136,581	101.91
	(11.2)	(6.5)
2-Year Institutions	144,061	279.43
Public	109,362	237.48
	(9.0)	(15.2)
Private[a]	34,699	41.95
	(2.8)	(2.7)
Technical Schools[b]	547,078	342.86
	(44.9)	(21.9)
HOPE Program Total	1,217,172	1564.3

Notes: [a] Private two-year and four-year schools were eligible to participate only from 1996.
[b] Of the 34 HOPE-eligible technical schools, 13 offer Associate's Degrees, and therefore can award both the scholarship and grant.
Source: Cornwell & Mustard (2003, Fall)

Table 2
Summary Statistics of Dependent Variables
Georgia vs. SREB; Pre- and Post-HOPE
1989-2001

Dependent Variable	Pre-HOPE (1989-1992) SREB	Pre-HOPE (1989-1992) GA	Post-HOPE (1993-2001) SREB	Post-HOPE (1993-2001) GA	Diff-in-Diff
		All Institutions			
SATV (Ave.)	453.0	434.3	506.8	497.4	9.3
	(67.5)	(68.1)	(71.2)	(71.6)	
SATM (Ave.)	485.8	460.9	514.7	502.5	12.7
	(76.2)	(76.5)	(67.8)	(66.6)	
% Freshmen in Top	19.7	11.7	20.2	21.0	8.8
10 of HS Class	(18.2)	(18.9)	(16.2)	(21.9)	
SATV (St. Dev.)	34.6	35.0	35.1	34.2	-1.3
	(5.5)	(4.7)	(5.7)	(4.8)	
SATM (St. Dev.)	36.1	36.4	35.4	34.7	-1.0
	(6.2)	(4.9)	(5.8)	(5.2)	
Acceptance Rate	73.6	78.5	79.0	71.5	-12.4
	(17.7)	(15.1)	(17.8)	(16.8)	
Yield Rate	50.4	58.5	50.3	51.5	-6.9
	(17.1)	(18.0)	(20.3)	(20.1)	
		Universities			
SATV (Ave.)	502.2	497.1	539.9	561.9	27.1
	(58.4)	(59.4)	(67.1)	(75.6)	
SATM (Ave.)	554.9	549.1	562.8	591.9	34.9
	(65.2)	(92.1)	(64.9)	(81.8)	
% Freshmen in Top	29.6	22.2	32.8	44.7	19.3
10 of HS Class	(26.1)	(33.5)	(21.8)	(36.7)	
SATV (St. Dev.)	35.0	33.7	35.0	30.8	-2.9
	(3.2)	(2.8)	(4.4)	(2.7)	
SATM (St. Dev.)	36.1	33.3	35.1	30.0	-2.3
	(4.1)	(2.8)	(4.7)	(4.0)	
Acceptance Rate	65.5	68.0	70.1	61.3	-11.3
	(18.2)	(11.3)	(17.1)	(8.9)	
Yield Rate	47.7	43.2	47.8	42.2	-1.1
	(12.9)	(13.1)	(15.2)	(14.6)	
		Comprehensive Institutions			
SATV (Ave.)	451.5	437.3	510.4	514.4	18.2
	(58.6)	(61.9)	(61.5)	(59.3)	
SATM (Ave.)	483.2	469.6	517.2	514.9	11.3
	(60.5)	(62.2)	(53.1)	(44.1)	
% Freshmen in Top	19.0	8.6	21.1	21.4	10.7
10 of HS Class	(14.9)	(15.1)	(13.1)	(19.6)	
SATV (St. Dev.)	34.4	33.7	35.1	33.9	-0.5
	(4.4)	(3.8)	(4.9)	(4.5)	
SATM (St. Dev.)	36.2	35.3	35.5	34.2	-0.4
	(5.0)	(3.9)	(4.8)	(4.1)	

Acceptance Rate	73.6	76.5	77.3	74.5	-5.7
	(14.9)	(13.1)	(15.1)	(11.7)	
Yield Rate	47.2	54.9	46.9	49.6	-5.0
	(14.4)	(14.3)	(17.2)	(15.1)	
	Four-Year Institutions				
SATV (Ave.)	445.0	448.0	497.8	473.7	-27.1
	(71.3)	(61.3)	(77.1)	(59.8)	
SATM (Ave.)	473.1	461.7	498.4	473.1	-13.9
	(76.4)	(57.7)	(72.5)	(50.0)	
% Freshmen in Top	19.2	21.1	19.5	23.7	2.3
10 of HS Class	(15.4)	(19.6)	(15.5)	(19.3)	
SATV (St. Dev.)	34.4	35.1	35.1	34.7	-1.1
	(7.1)	(5.2)	(7.4)	(5.7)	
SATM (St. Dev.)	35.8	36.8	35.3	35.8	-0.5
	(2.8)	(5.0)	(7.3)	(5.8)	
Acceptance Rate	72.9	75.4	76.2	64.2	-14.5
	(17.7)	(19.3)	(17.8)	(21.5)	
Yield Rate	51.0	50.8	47.2	46.0	-1.0
	(17.3)	(18.7)	(18.9)	(24.3)	

Note: The averages are in the first row of each cell. The standard deviations are in the second row of the cell and are in parentheses.

Table 3
HOPE Effect Coefficient Estimates
On Average SAT Score

	SAT Verbal				SAT Math			
	All	Univ	Comp.	4-Year	All	Univ	Comp.	4-Year
HOPE Effect	4.9*	14.3**	6.9*	6.2	6.2**	9.4*	3.0	5.9
	(2.0)	(4.8)	(3.2)	(5.6)	(1.9)	(3.7)	(2.7)	(5.7)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	4992	868	2541	1416	4991	862	2239	1421
Adjusted R2	0.93	0.95	0.92	0.91	0.94	0.97	0.92	0.90

In each cell the first entry is the coefficient estimate and the second is the standard error.
** designates statistical significance at .01. * designates statistical significance at .10.

Table 4
HOPE Effect Coefficient Estimates
Fraction of Students who were in the Top 10% and 25% of their High School Class

	Top 10%				Top 25%			
	All	Univ	Comp.	4-Year	All	Univ	Comp.	4-Year
HOPE Effect	0.5	7.6*	1.7	-1.6	1.6	2.2	1.8	2.4
	(0.8)	(3.2)	(1.2)	(1.4)	(1.4)	(5.6)	(2.4)	(2.3)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	5750	894	2306	1605	5676	904	2322	1594
Adjusted R2	0.85	0.83	0.81	0.87	0.77	0.63	0.70	0.85

In each cell the first entry is the coefficient estimate and the second is the standard error.
** designates statistical significance at .01. * designates statistical significance at .10.

Table 5
HOPE Effect Coefficient Estimates
Standard Deviation of SAT Verbal Score

	SAT Verbal			
	All	Universities	Comprehensive	4-Year
HOPE Effect	0.04	-3.5**	0.02	1.77*
	(0.35)	(0.79)	(0.58)	(0.95)
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
No. of Obs.	4992	868	2241	1416
Adjusted R2	0.64	0.61	0.53	0.71

In each cell the first entry is the coefficient estimate and the second is the standard error. ** designates statistical significance at .01. * designates statistical significance at .10.

Table 6
HOPE Effect Coefficient Estimates
Standard Deviation of SAT Math Scores

	SAT Math			
	All	Universities	Comprehensive	4-Year
HOPE Effect	0.60	-2.15**	0.21	1.48
	(0.35)	(0.66)	(0.55)	(0.99)
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
No. of Obs.	4991	862	2239	1421
Adjusted R2	0.67	0.78	0.59	0.69

In each cell the first entry is the coefficient estimate and the second is the standard error. ** designates statistical significance at .01. * designates statistical significance at .10.

Table 7
Merit Aid Effect Coefficient Estimates for Universities
For Southeastern States that Adopt Large-Scale Merit Programs
1989-2001

	SATV	SATM	Top 10% HS
Arkansas (Academic	55.6**	53.9**	27.4**
Challenge)	(15.3)	(12.9)	(10.1)
Florida (Bright Futures)	-5.3*	-5.3*	12.2**
	(2.8)	(2.4)	(1.9)
Georgia (HOPE)	14.6**	9.6**	9.0**
	(4.3)	(3.7)	(3.1)
Kentucky (KEES)	.	.	16.0**
			(4.5)
Louisiana (TOPS)	2.1	-2.0	0.7
	(6.0)	(5.1)	(5.0)
Maryland (HOPE)	9.3*	9.1*	5.2*
	(5.4)	(3.7)	(2.9)
South Carolina (LIFE)	10.7*	10.5*	-3.2
	(5.4)	(4.6)	(3.6)
Year Fixed Effects	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes
No. of Obs.	866	862	894
Adjusted R2	0.96	0.97	0.84

In each cell the first entry is the coefficient estimate and the second is the standard error. ** designates statistical significance at .01. * designates statistical significance at .10.

Table 8
HOPE Effect Coefficient Estimates
Acceptance Rates

	SAT Verbal			
	All	Universities	Comprehensive	4-Year
HOPE Effect	-7.5**	-8.4**	-3.6*	-9.9**
	(1.0)	(2.2)	(1.5)	(2.7)
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
No. of Obs.	7012	1004	2756	1851
Adjusted R2	0.72	0.79	0.67	0.68

In each cell the first entry is the coefficient estimate and the second is the standard error. ** designates statistical significance at .01. * designates statistical significance at .10.

Table 9
HOPE Effect Coefficient Estimates
Yield Rates

	SAT Math			
	All	Universities	Comprehensive	4-Year
HOPE Effect	0.29	4.1*	-1.8	3.5
	(1.2)	(2.1)	(1.7)	(2.6)
Year Fixed Effects	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes
No. of Obs.	4077	649	1648	1178
Adjusted R2	0.72	0.79	0.70	0.72

In each cell the first entry is the coefficient estimate and the second is the standard error. ** designates statistical significance at .01. * designates statistical significance at .10.

Figure 1
Comparing SAT Scores of High-School Seniors and College Freshmen
United States and Georgia, 1989-90 to 1998-99

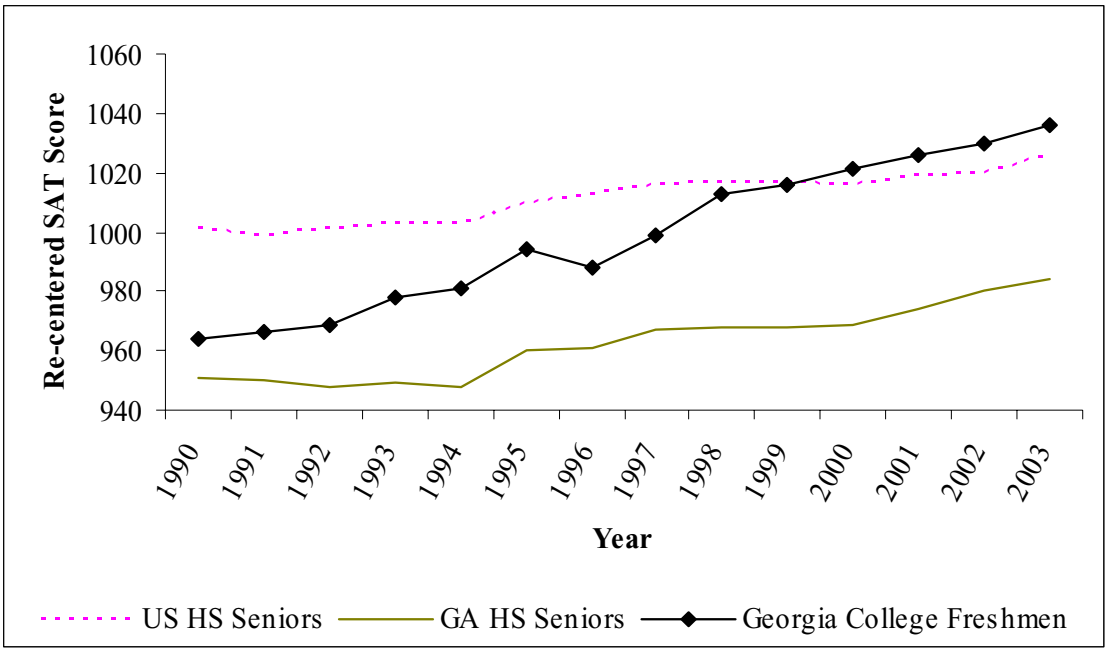

Figure 2
Comparing average SAT Verbal Scores of Entering Students
in Peterson's "University" Category

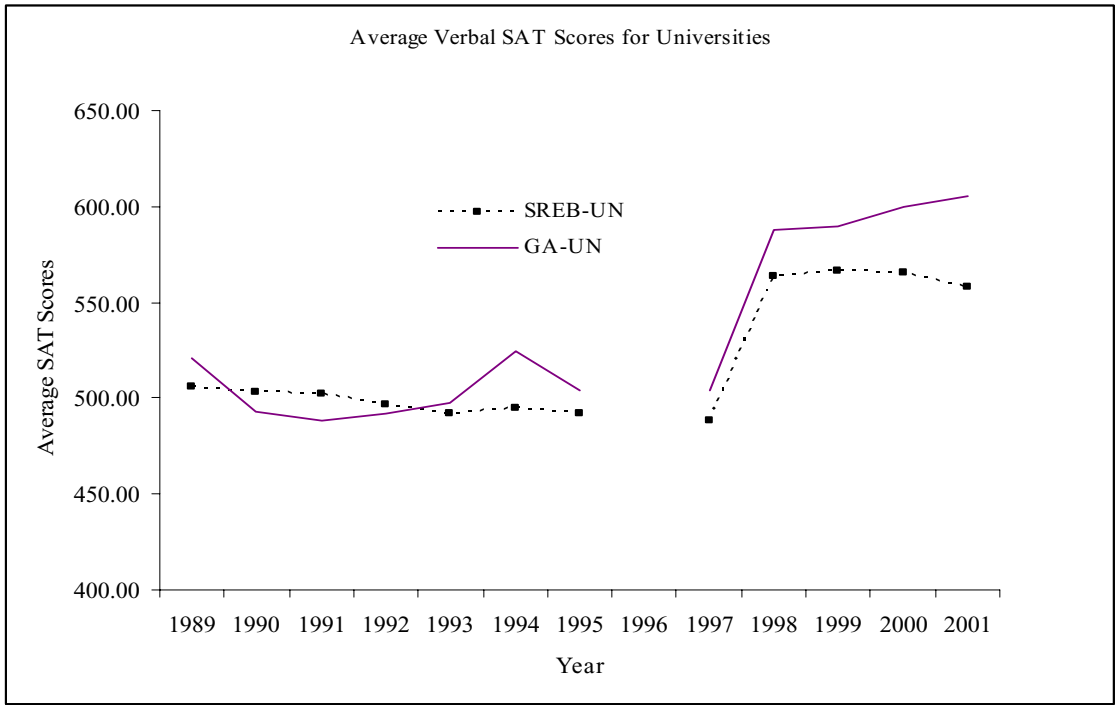

Figure 3
Comparing Average SAT Math Scores of Entering Students
in Peterson's "University" Category

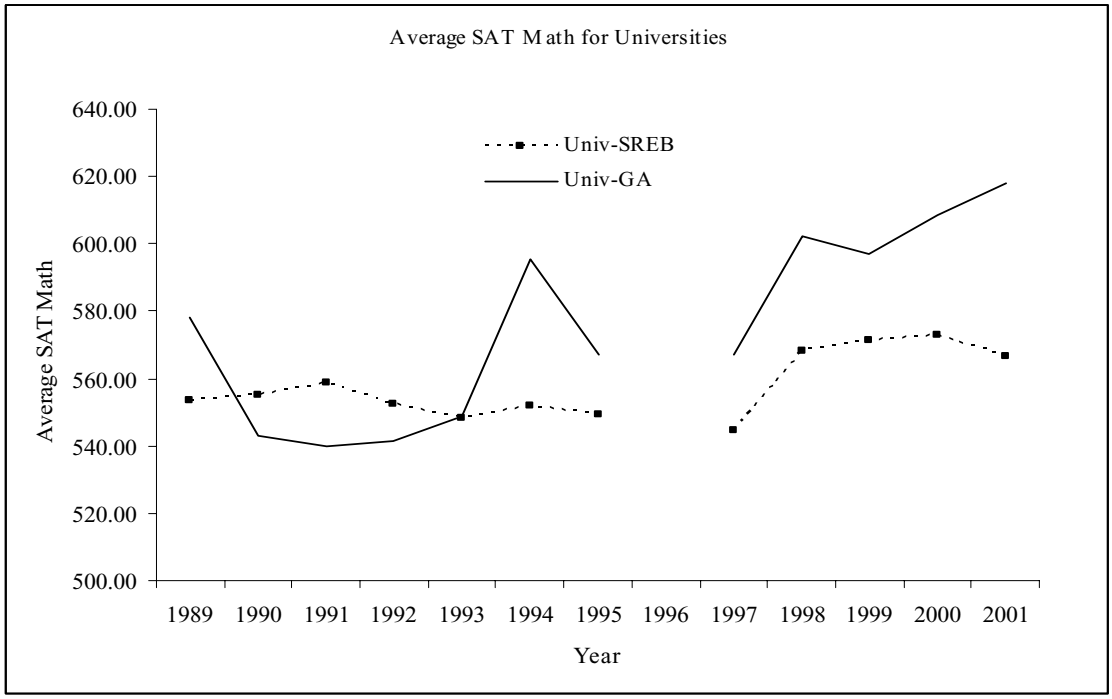

Figure 4
Comparing The Percent of Students
Entering Georgia in Peterson's "University" Category

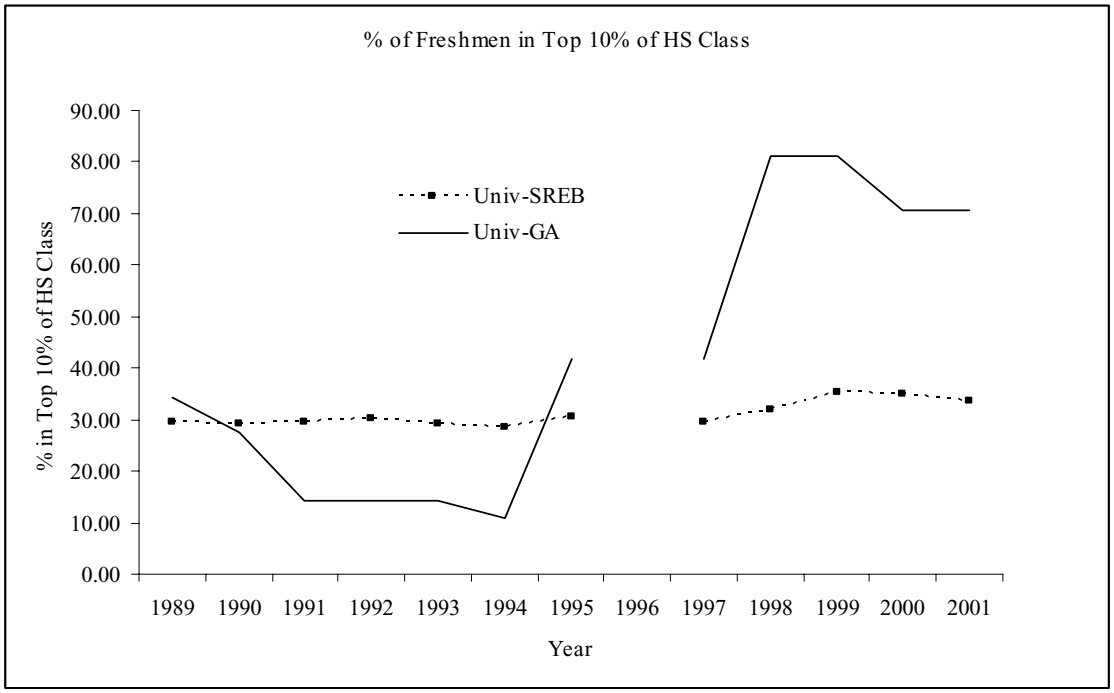

Figure 5
Comparing average SAT Verbal Scores of Students
Entering Georgia in Peterson's "University" Category

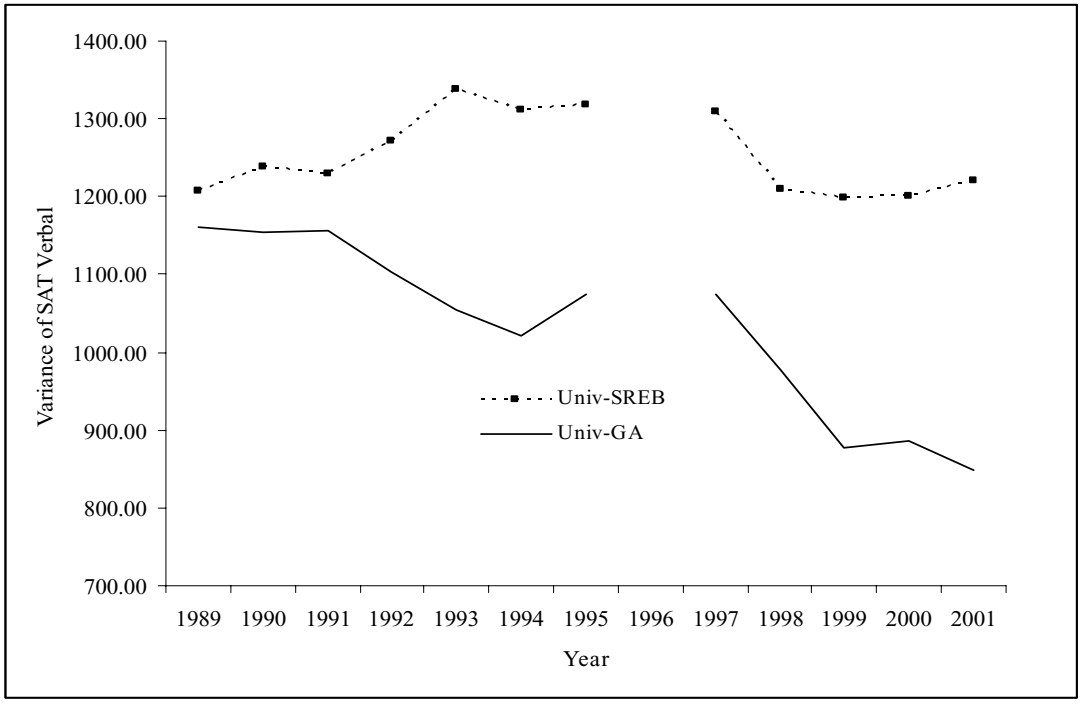

Figure 6
Comparing average SAT Verbal Scores of Students
Entering Georgia in Peterson's "University" Category