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Who Loses HOPE? Attrition from Georgia's College Scholarship Program

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Georgia's lottery-funded HOPE Scholarship program provides free tuition to in-state students who can maintain a B average at state universities. However, roughly half of HOPE Scholars lose their support after their freshman year. This study employs student-level administrative data to identify the observed characteristics that systematically relate to scholarship attrition. Conditional on measures of student ability, there are not statistically significant differences between white, black, and Hispanic students. However, there are dramatic differences across academic disciplines. Students majoring in science, engineering, and computing are 21 to 51 percent more likely to lose their HOPE Scholarships than students in other disciplines.

1. Introduction

In November 1992, voters in the state of Georgia approved a constitutional amendment that allowed the initiation of a state lottery. A large share of the funds from these lotteries has been dedicated to several education initiatives: structural investments in elementary and secondary schools, prekindergarten programs for at-risk children, and the Helping Outstanding Pupils Educationally (HOPE) Scholarship program.[1] The HOPE Scholarship program provides Georgia high school graduates who have a B average free tuition and a modest book allowance at the state's public colleges and universities.[2] In the 1996–1997 school year, this popular scholarship program supported roughly 124,000 students with $159 million in lottery revenues. There is evidence that this new spending was sufficiently popular to generate a migratory response in the metropolitan areas that straddle Georgia's borders with other states (Carey 1997; Dee 1998). Georgia's college scholarships have also inspired similar proposals in other states, as well as a 1997 proposal by the Clinton administration for a nationwide "HOPE Scholarship."[3]

The limited criticisms of these scholarship programs have emphasized that because these

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[1] Georgia law states that 31% of lottery revenues must be used for educational purposes. The remaining revenues are used for lottery prizes, operating costs, and commissions (Stanley 1994).

[2] The standards were recently tightened to require that high school students have a B average in required academic courses instead of an overall B average. The HOPE Scholarship program also provides some support for students seeking a vocational postsecondary education and those attending private colleges and universities in-state.

[3] The Taxpayer Relief Act of 1997 ultimately included a "HOPE Scholarship" which consisted of a nonrefundable tax credit of as much as $1,500 for families with students in their first two years of college (Kane 1998). Like Georgia's current program, earlier proposals by the Clinton administration had also included a grade point average standard for scholarship retention (Kane 1997). However, that standard was omitted from the final legislation.

programs largely benefit middle- and upper-class families, they are regressive relative to the more traditional approach of providing directed financial aid (Cronin 1997; Jaffe 1997; McPherson and Schapiro 1997).[4] However, there has been less scrutiny of other intended and unintended consequences of the incentives created by such scholarships. For example, Georgia's HOPE Scholarship program only guarantees support for one year. Support for a subsequent year is conditional on the student maintaining a sufficiently high grade point average. More specifically, Georgia's HOPE Scholars are initially guaranteed support only through the academic quarter (semester) in which they have scheduled their 45th (30th) credit hour (typically one academic year). Support for every additional year is continued only for those who have earned at least a B average (a 3.0 grade point average on a 4.0 scale). The B-average standard clearly creates incentives that may promote academic achievement. However, this standard may also create important patterns of scholarship attrition that constitute another dimension along which these scholarships are inequitable. For example, disadvantaged or minority students may be more likely to lose this support soon after entering college. Furthermore, a standard based on grade point averages may also create funding inequities among similarly qualified HOPE Scholars who happen to choose courses of study with historically different grading standards. Notably, the existence of such differentials across disciplines could have further unintended consequences by creating new incentives that influence course and major selection as well as the length of time spent in college.[5] At first glance, Georgia's early experience with HOPE Scholarships suggests the determinants of scholarship attrition deserve closer scrutiny: roughly half of HOPE Scholars lose their support after only their freshman year (Vickers 1994).[6]

This empirical study provides novel and policy-relevant evidence on some of these questions by exploiting unique individual-level administrative data on a single cohort of undergraduate students at Georgia Tech. More specifically, this study presents evidence on how important observed student characteristics systematically relate to the probability of losing a HOPE Scholarship. The evidence is particularly intended to address whether there are inequities in who retains their HOPE Scholarship and the extent to which the benefits of the HOPE Scholarships are distributed evenly across students in academic disciplines with various grading standards.[7] The results of these estimations indicate that, conditional on measures of student ability, there are not dramatic differentials with respect to race or ethnicity. For example, in models that include measures of student ability as regressors (e.g., verbal and math SAT scores, high school grade point average), black and Hispanic students appear less likely than white students to lose their HOPE Scholarships.[8] However, these results also demonstrate that there is a strong relationship between scholarship attrition and the measures of student ability. These links are likely

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[4] This is particularly so for Georgia's program because HOPE support is offset by other support for low-income students, like Pell Grants, Federal Supplemental Educational Opportunity Grants (FSEOG), and Job Training Partnership Act (JTPA) assistance.

[5] Unfortunately, empirical evidence on this interesting question is beyond the scope of this study and the currently available data. Furthermore, it should be noted that a full evaluation of the HOPE Scholarship program raises many other issues beyond those considered here. These include its effects on high school and college achievement, college matriculation, and persistence and its effects on grade inflation (e.g., Healy 1997).

[6] There are now provisions for students to regain the HOPE Scholarship by satisfying the eligibility requirements after a period of paying their own tuition.

[7] It should be emphasized that the implicit definition of inequity concerns only the participants in the HOPE Scholarship program. There are, of course, a variety of other inequities associated with the program given that it raises money regressively and directs it largely toward those middle- and upper-class families who happen to have children in college.

[8] These effects are relatively small and statistically indistinguishable from zero. There is somewhat robust evidence of a gender differential. Females are at least 7% less likely to lose their HOPE Scholarships.

to reflect, in part, the influence of unobserved socioeconomic priors. In particular, the empirical relevance of unobserved student attributes is underscored by the joint significance of fixed effects for each student's county of origin and how the introduction of these fixed effects influences the estimated marginal effects associated with the ability measures.

The results presented here also indicate that there are dramatic differentials in retention of the HOPE Scholarship by the student's chosen course of study. For example, these models demonstrate that students whose major course of study is in engineering, computing, or the natural sciences are 21 to 51% more likely to lose their HOPE Scholarships than students in other disciplines. These results suggest that the eligibility standards used in Georgia's HOPE Scholarship program may have some important and unintended consequences. In particular, such standards appear horizontally inequitable in that they financially punish those HOPE Scholars whose chosen course of study provides fewer opportunities to earn high grades. This differential may also be noteworthy since it could constitute a strong incentive that influences the course and major selection of subsequent college students. Such a change in the incentives facing college students could be particularly relevant to policy given the recent evidence on the growing importance of science and math skills for the distribution of wages (Murnane, Willett, and Levy 1995).

2. Data

The data for this study were drawn from confidential administrative records on students at Georgia Tech. More specifically, this study is based on data from freshmen who first matriculated in the summer or fall of 1996.[9] This 1996 freshman cohort is appropriate, in part because, by this time, participation in the HOPE Scholarship program was no longer means-tested. In the 1996 academic year, more than 2,500 undergraduates had freshman status at Georgia Tech. However, only 2,069 individuals of this group had actually matriculated over this period. Furthermore, only 1,350 of these students had the Georgia residency that would allow them to be considered for the HOPE Scholarship program. For these students, participation and retention in the HOPE Scholarship program was determined directly from their high school and college academic records and the HOPE eligibility requirements. In order to be as inclusive as possible, the academic progress of these students was followed for nearly two academic years (i.e., through the winter quarter of 1998). The final sample employed in this study is based on the 1,189 HOPE Scholars who had scheduled their 45th credit hour at Georgia Tech within the period of observation.[10]

Within only their putative freshman year, a surprisingly high number of these students lost their HOPE Scholarship. The means in Table 1 indicate that among this cohort, nearly 57% failed to achieve the 3.0 grade point average cutoff after scheduling their 45th credit hour. Table 1 also presents descriptive statistics by college. There were five colleges at Georgia Tech over

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[9] It is not unusual at Georgia Tech for true freshmen to matriculate in the summer and begin coursework. State-specific data sets such as these are increasingly providing novel opportunities for empirical research on the economics of education (Dee, Evans, and Murray 1999).

[10] This selection effectively implies that this study only examines those who persisted in college at least long enough to risk losing their HOPE Scholarship. The students who were omitted had, on average, levels of academic achievement well below the HOPE cutoff. Given that the focus of this study is on the retention of this merit-based scholarship, the selection of students with at least a modest level of college persistence is arguably appropriate.

Table 1. Descriptive Statistics

Variable	Full Sample	College				
		Ivan Allen	Architecture	Computing	Engineering	Sciences
Lost HOPE Scholarship	56.5%	53.2%	57.6%	64.8%	56.1%	54.9%
	(0.496)	(0.500)	(0.498)	(0.480)	(0.497)	(0.499)
Female	32.8%	56.2%	44.1%	17.2%	23.5%	56.5%
	(0.470)	(0.498)	(0.501)	(0.378)	(0.424)	(0.497)
Black	5.2%	4.4%	3.4%	5.4%	6.4%	1.6%
	(0.222)	(0.205)	(0.183)	(0.227)	(0.246)	(0.127)
Hispanic	2.2%	2.2%	3.4%	2.7%	2.1%	1.6%
	(0.146)	(0.147)	(0.183)	(0.163)	(0.145)	(0.127)
Asian	9.7%	2.9%	6.8%	10.8%	9.5%	15.8%
	(0.296)	(0.169)	(0.254)	(0.312)	(0.293)	(0.296)
Catholic	14.4%	21.9%	8.5%	12.6%	13.5%	15.8%
	(0.352)	(0.415)	(0.281)	(0.333)	(0.342)	(0.365)
Baptist	16.1%	10.9%	10.2%	9.9%	19.4%	13.0%
	(0.368)	(0.313)	(0.305)	(0.300)	(0.396)	(0.338)
Other Protestant	29.1%	36.5%	33.9%	28.8%	28.8%	23.4%
	(0.454)	(0.483)	(0.477)	(0.455)	(0.453)	(0.424)
Verbal SAT	611	595	588	644	609	619
	(76.6)	(80.4)	(61.2)	(76.6)	(76.7)	(74.1)
Math SAT	663	625	634	682	672	656
	(65.5)	(67.5)	(57.5)	(58.3)	(63.4)	(63.9)
High School GPA	3.7	3.6	3.6	3.6	3.7	3.7
	(0.289)	(0.280)	(0.222)	(0.281)	(0.288)	(0.275)
Number of Observations	1,189	137	59	111	698	184

Standard deviations are reported in parentheses.

this period (Architecture, Ivan Allen, Computing, Engineering and Sciences). The Ivan Allen College consists of social sciences and humanities, as well as some professional schools. Except for the College of Computing, the rates of attrition are fairly similar across colleges. However, the means in Table 1 also establish an important stylized fact: student profiles differ somewhat across these colleges. For example, the average math SAT scores are 7.5% higher in the College of Engineering than in the Ivan Allen College. Table 1 also presents means by college for the other available variables: gender, race, ethnicity, religious affiliation, math and verbal SAT scores, and high school grade point average. A variety of other student attributes that are simply unavailable in these administrative records (e.g., family and parental traits, elementary and secondary school quality) are undoubtedly important determinants of attrition from the HOPE Scholarship. Fortunately, the empirical relevance of such omitted socioeconomic variables can be addressed by exploiting information on the student's county of residence. In particular, as a check for the robustness of this study's key findings, some of the empirical models presented here will include fixed effects that capture the shared but unobserved attributes of these counties.[11]

[11] Because it is also likely that there is further heterogeneity within counties, some models included fixed effects specific to the student's demographic characteristics.

3. Empirical Specifications

The implicit theoretical model of the decisions that influence scholarship retention can be understood here as a somewhat modified version of a basic human capital model that focuses on formal schooling (Becker 1964). More specifically, observed scholarship attrition is understood as an outcome of a model in which students maximize discounted lifetime utility with their nested decisions regarding educational attainment, college curriculum, and subsequent academic effort. These decisions would plausibly reflect the explicit and opportunity costs of schooling, the heterogeneous rewards in the labor market to particular courses of study, the idiosyncratic personal costs of academic effort, and possibly, an understanding of the differential risk of scholarship attrition by chosen courses and major.[12] Given that the only available data, which includes the chosen fields of study, are for students who have already matriculated into Georgia Tech, our theoretical perspective raises some selection issues that inform and qualify the subsequent empirical results in important ways discussed below.

The basic specifications presented here assume that the educational choices made by student i are reflected in index function that measures the student's net cost of retaining a HOPE Scholarship, Y_i^*. This index function is assumed to be a linear function of its determinants, X_I and a mean-zero error term, ϵ_i:

$$Y_i^* = X_i\beta + \epsilon_i.$$

These net costs are, of course, not observed directly. However, whether a student actually loses the HOPE Scholarship is observed.[13] Attrition from the HOPE Scholarship is defined by the binary indicator, Y_i:

$$Y_i = 1 \quad \text{if } Y_i^* > 0$$

$$Y_i = 0 \quad \text{if } Y_i^* \leq 0.$$

The probability of losing the HOPE Scholarship is equal to Prob ($Y_i^* > 0$). This expression can be rewritten as

$$\text{Prob}(Y_i^* > 0) = \text{Prob}(\epsilon_i > -X_i\beta) = \text{Prob}(\epsilon_i < X_i\beta) = \Phi(X_i\beta),$$

where $\Phi(\cdot)$ is a symmetric cumulative density function. This probability forms the basis for conventional maximum likelihood estimations of this model. Most of the results presented here are probit models that assume that $\Phi(\cdot)$ is the cumulative normal. The marginal effects reported for these probit models are based on the mean value of the dependent variable.[14] However, models based on the logistic distribution generate results similar to those reported here.[15] Linear probability models ($\Phi(X_i\beta) = X_i\beta$) are also presented here. A central motivation for presenting

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[12] Interestingly, such a model offers at least two compelling explanations for why a student would knowingly select a course of study with a higher risk of scholarship loss: idiosyncratic preferences and/or higher expected rewards in the subsequent labor market.

[13] In practice, the student's observed grade point average might provide a plausible proxy for the net benefits of retaining a HOPE Scholarship. However, this binary formulation insures that the marginal effects are defined for the outcome of interest: the HOPE Scholarship's cutoff point.

[14] More specifically, the reported marginal effects are equal to the estimated β multiplied by $\phi(z)$ where $\phi(z)$ is the probability density function evaluated for the index implied by the mean value of the dependent variable (i.e., $z = \Phi^{-1}(0.565)$).

[15] This is not surprising since these distributions differ largely in their tails and the average probability of losing the HOPE Scholarship is close to 50%.

such least squares estimations is that they facilitate important robustness checks by allowing the inclusion of 99 county-fixed effects.[16]

The key regressors in these estimations include indicators for gender, race, and ethnicity; the available measures of observed, prior student ability; and indicators for the student's academic college. As mentioned above, because the evidence on scholarship attrition is based on data from students who chose both Georgia Tech as well as particular courses of study upon matriculation, there are some notable selection issues. In particular, it should be emphasized that these inferences are based only on students who chose to attend Georgia Tech after the introduction of the HOPE Scholarship program. Interestingly, the available stylized evidence suggests that by encouraging the best students to remain in-state, the introduction of the HOPE Scholarship increased the overall quality of students at selective in-state institutions like Georgia Tech.[17] The reported marginal effects with respect to demographic variables and measures of student ability are valid only for this observed sample of HOPE Scholars. For some policy inferences (e.g., predicting at-risk status among undergraduates), the inferences based on this sample are arguably relevant. However, the possibility that the sample selection supports alternative interpretations of certain results should be noted. For example, selection could conceivably exacerbate observed racial differences in scholarship attrition. The HOPE Scholarship program may have provided weaker incentives to appear in this sample (i.e., matriculate at an in-state institution) for disadvantaged students who already received federal college assistance. This implies that the composition of HOPE Scholars might reflect disproportionately more students from middle- and upper-class families. To the extent such students tend to be white and are more likely to retain their HOPE Scholarships, the racial differences observed in the probit and linear probability models reported here would increase. A similar interpretation of racial inequities might be appropriate if the HOPE Scholarship program disproportionately encouraged students who were both black and disadvantaged to enter the observed sample of HOPE Scholars.[18] However, as a practical matter, the possibility of such selection patterns does not appear to confound these results. In preferred specifications, the observed racial differences in scholarship attrition are actually relatively small and statistically insignificant. Nonetheless, the possible role of selection in interpreting the estimated marginal effects should be noted.

In particular, the arguably nonrandom selections into the five colleges by these HOPE Scholars are possibly more troubling for some of this study's key inferences. The subsequent estimation results indicate that, conditional on measures of student ability, students in the colleges of Engineering, Sciences and Computing are substantially more likely to lose their HOPE Scholarships. Do these large differential risks reflect the historically different grading standards across disciplines, or could these inferences somehow be confounded by self-selection into these colleges? The nature of the self-selection suggests that these results do reflect the effect of different grading conventions. More specifically, our expectation is that students who self-selected into the colleges of Engineering, Sciences, and Computing despite the high risk of schol-

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[16] A well-behaved convergence of the log-likelihood function is not achieved in models that exhaust so many degrees of freedom. Nonetheless, those results are still quite similar to those reported here. There are more than 99 counties in Georgia. However, not all are represented in this sample.

[17] Similarly, less able in-state students may have chosen to attend institutions with lower risks of scholarship attrition.

[18] Although the cash value of HOPE Scholarships was lower for disadvantaged students, its effect on the probability of matriculating in-state may have been larger (e.g., through creating new matriculants).

Table 2. Attrition from the HOPE Scholarship, Probit Estimations

	Model 1		Model 2		Model 3	
Variable	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Female	−0.253 (0.078)	−0.100	−0.475 (0.085)	−0.187	−0.258 (0.090)	−0.102
Black	0.269 (0.172)	0.106	−0.085 (0.182)	−0.033	−0.039 (0.187)	−0.015
Hispanic	−0.066 (0.252)	0.026	−0.207 (0.262)	−0.076	−0.160 (0.271)	−0.063
Asian	−0.234 (0.126)	−0.092	−0.194 (0.133)	−0.076	−0.081 (0.141)	−0.032
Catholic	0.033 (0.114)	0.013	0.041 (0.118)	0.016	−0.016 (0.125)	0.394
Baptist	0.259 (0.111)	0.102	0.176 (0.116)	0.069	0.318 (0.122)	0.125
Other Protestant	0.049 (0.090)	0.019	0.043 (0.094)	0.017	0.072 (0.098)	0.028
Verbal SAT	—	—	−0.00181 (0.00056)	−0.00071	−0.00074 (0.00059)	−0.00029
Math SAT	—	—	−0.00665 (0.00070)	−0.00262	−0.00560 (0.00074)	−0.00220
High School GPA	—	—	—	—	−1.88 (0.161)	−0.740
Log Likelihood	−802.0		−726.5		−650.2	

Standard errors are reported in parentheses.

arship attrition tended to be students with higher academic ability.[19] Therefore, the dramatically higher risks of scholarship loss observed in these colleges could reasonably be understood as conservative lower bounds on the actual differential risks of scholarship attrition by discipline. Given that observed risks are already quite large, such possible patterns of selection do not appear to constitute completely confounding specification issues. However, their implications for the reported results should, nonetheless, be understood.

4. Results

The key results of basic probit estimations that include gender, race, religious affiliation, and measures of student ability as regressors are reported in Table 2. Model 1 in Table 2 only includes the basic demographic covariates. Model 2 adds to model 1 the student's math and verbal SAT scores. Model 3 adds to model 2 the student's high school grade point average. These empirical models appear to fit the data well. For example, a naïve model that did not incorporate the information from these estimations would always predict that a student would lose the HOPE Scholarship. Those predictions would be correct 56.5% of the time. These models

[19] This understanding is supported by the descriptive statistics in Table 1 and by the downward bias in the fixed effects associated with these three colleges in models that exclude measures of student ability (e.g., model 1, Table 3).

perform considerably better. For example, model 3 in Table 2 generates accurate predictions 73.1% of the time.[20]

In Table 2, the sparse empirical models that do not condition on measures of student ability suggest there are statistically significant differences by gender, race, and ethnicity. For example, the results of model 1 imply that females are 10 percentage points less likely than males to lose their HOPE Scholarship.[21] Similarly, this model also suggests that black students are 10.6 percentage points (18.8%) more likely than white students to lose their HOPE Scholarship. However, none of the race or ethnicity differentials are robust to models that include measures of student ability (models 2 and 3). In contrast, the evidence that females are more likely than males to retain their scholarship support proves fairly robust.[22] Not surprisingly, models 2 and 3 indicate that students with higher levels of observed ability are more likely to retain their scholarship. For example, an increase of 100 points on the math SAT implies that a student is 22 percentage points (39%) less likely to lose the HOPE Scholarship (model 3). Similarly, students whose high school grade point averages were 0.5 points higher were 37 percentage points (65%) less likely to lose their HOPE Scholarship. Although these observed links between prior measures of student ability and scholarship attrition are consistent with prior expectations, the existence and size of these marginal effects are still noteworthy. For example, to the extent we view these prior measures of student ability as a reflection of unobserved socioeconomic priors, these results constitute another dimension along which the HOPE Scholarship is inequitable.

The probit results presented in Table 3 introduce fixed effects for the student's college. The reference is the Ivan Allen College. In model 1, which excludes measures of student ability, we again see some large and statistically significant differences by race and gender. However, as in Table 2, these results are not entirely robust to the inclusion of measures of student ability. Similarly, the results of model 1 also suggest that there are not large and statistically significant differences across students of different disciplines in terms of who loses the HOPE Scholarship. However, because these models omit measures of student ability and because these measures of student ability vary across disciplines, these results may reflect an omitted variable bias. The results of models 2 and 3 suggest that this is so. More specifically, models 2 and 3 demonstrate that, conditional on student ability, there are dramatic differentials across disciplines in attrition from the HOPE Scholarship program.[23] Students who study in the colleges of Computing, Engineering, or Sciences are 12 to 29 percentage points more likely than similarly qualified students in other disciplines to lose their HOPE Scholarships after just one academic year. These large and statistically significant marginal effects imply increases of 21 to 51% in scholarship attrition.

Conditional on measures of student ability, the results in Table 3 demonstrate that there are not statistically significant racial or ethnic differentials in attrition from the HOPE Schol-

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[20] Another goodness-of-fit measure is the likelihood ratio index. The value of the log-likelihood function when these estimations included only an intercept was −814.0. This implies that the likelihood ratio index for model 3 in Table 2 is 0.201 (1 − [650.2/814]). Similar calculations can be made for the other models.

[21] Given the mean likelihood of losing the HOPE Scholarship, this constitutes a reduction of nearly 18% (0.10/0.565). The other marginal effects reported here will also be scaled by the mean value of the dependent variable.

[22] The meaning of this relationship is open to some interpretation. For example, it could suggest that females discount the future less than males do.

[23] The direction of this omitted variable bias is consistent with the stylized view that students in the colleges of Engineering, Sciences, and Computing have higher prior measures of academic ability. As noted earlier, this observation is important because it suggests that self-selection into these three colleges does not confound these results.

Table 3. Attrition from the HOPE Scholarship, Probit Estimations with College Fixed Effects

	Model 1		Model 2		Model 3	
Variable	Coefficient	Marginal Effect	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Female	−0.260 (0.083)	−0.102	−0.430 (0.089)	−0.169	−0.197 (0.094)	−0.078
Black	0.283 (0.173)	0.111	−0.133 (0.185)	−0.052	−0.100 (0.190)	−0.039
Hispanic	−0.070 (0.253)	−0.028	−0.230 (0.265)	−0.091	−0.194 (0.273)	−0.076
Asian	−0.240 (0.126)	−0.094	−0.235 (0.134)	−0.092	−0.130 (0.142)	−0.051
Catholic	0.045 (0.114)	0.018	0.069 (0.119)	0.027	0.010 (0.126)	0.004
Baptist	0.279 (0.111)	0.110	0.179 (0.117)	0.070	0.304 (0.123)	0.120
Other Protestant	0.060 (0.091)	0.024	0.070 (0.095)	0.028	0.104 (0.099)	0.041
Verbal SAT	—	—	−0.00208 (0.00057)	−0.00082	−0.00096 (0.00060)	−0.00038
Math SAT	—	—	−0.00706 (0.00072)	−0.00278	−0.00618 (0.00076)	−0.00243
High School GPA	—	—	—	—	−1.92 (0.163)	−0.756
College of Architecture	0.100 (0.197)	0.039	0.123 (0.204)	0.048	0.121 (0.217)	0.048
College of Engineering	−0.017 (0.122)	−0.007	0.304 (0.130)	0.120	0.454 (0.137)	0.179
College of Sciences	0.084 (0.144)	0.033	0.342 (0.152)	0.135	0.480 (0.158)	0.189
College of Computing	0.226 (0.167)	0.089	0.700 (0.179)	0.276	0.736 (0.187)	0.290
Log Likelihood	−800.0		−718.2		−640.4	

Standard errors are reported in parentheses.

arship program. However, these results also indicate that there are dramatically different rates of scholarship attrition across academic disciplines. These striking results imply that the simple grade cutoff employed by Georgia's program financially punishes students who pursue more difficult courses of study relative to similarly qualified students in other fields. However, before discussing the implications of this result further, it is worth addressing whether it is empirically robust. As noted earlier, one possible concern is that the self-selection into particular colleges might make these results misleading. However, the probable pattern of any selection would only reinforce these results because the students who engaged a difficult course of study despite the differential risk of scholarship attrition are likely to be those with higher levels of prior academic ability. Instead, the observed patterns of scholarship attrition by college would be misleading if there were unobserved student characteristics that were associated with the choice to study the sciences, engineering, or computing and that also predisposed students to do poorly in college. The existence of omitted variables with that particular covariance seems unlikely. However, the sort of detailed data on the student's socioeconomic priors that could be used to check

Table 4. Linear Probability Models with College and County of Origin Fixed Effects

Variable	Model 1	Model 2	Model 3
Female	−0.097	−0.135	−0.038
	(0.034)	(0.032)	(0.030)
Black	0.119	−0.039	0.007
	(0.070)	(0.067)	(0.062)
Hispanic	−0.045	−0.095	−0.039
	(0.100)	(0.093)	(0.086)
Asian	−0.081	−0.079	−0.034
	(0.051)	(0.048)	(0.045)
Catholic	0.047	0.049	0.028
	(0.046)	(0.043)	(0.040)
Baptist	0.114	0.066	0.090
	(0.045)	(0.042)	(0.039)
Other Protestant	−0.029	0.024	0.022
	(0.036)	(0.034)	(0.031)
Verbal SAT	—	−0.00084	−0.00041
		(0.00020)	(0.00019)
Math SAT	—	−0.00229	−0.00166
		(0.00025)	(0.00024)
High School GPA	—	—	−0.684
			(0.050)
College of Architecture	0.077	0.081	0.042
	(0.081)	(0.076)	(0.070)
College of Engineering	0.004	0.115	0.140
	(0.049)	(0.047)	(0.043)
College of Sciences	0.054	0.140	0.164
	(0.058)	(0.054)	(0.050)
College of Computing	0.088	0.235	0.209
	(0.068)	(0.065)	(0.060)
R^2	0.118	0.225	0.342

Standard errors are reported in parentheses.

for any further bias are simply unavailable. Fortunately, as noted earlier, the administrative records do indicate the county of residence for these in-state students. The characteristics of students' counties of residence will reflect both the attributes of the community in which they were reared as well as the quality of the local schools. Therefore, this study presents some empirical models that include fixed effects that unambiguously purge the shared and unobserved attributes associated with a student's county of residence. Because this robustness check exhausts so many degrees of freedom, the convergence of the log-likelihood function for the probit model is not well behaved. Therefore, these models are estimated using a simple linear probability model. The results of these estimations are reported in Table 4. An F-test on the county fixed effects in the more fully specified model 3 suggests that they are jointly significant determinants of the probability of losing the HOPE Scholarship ($p = 0.0076$).

Similar to previous results, the estimates in Table 4 indicate some gender, race, and ethnic differentials that are not entirely robust to including the measures of student ability. These results also suggest that students with higher ability are less likely to lose the HOPE Scholarship.[24]

[24] The inclusion of these fixed effects reduces the marginal effects associated with the observed measures of student

Furthermore, in models that include those measures of ability, we again see sharp differences across disciplines in who loses the HOPE Scholarship. For example, the results in model 3 indicate that students in engineering, the sciences or computing are 14.0 to 20.9 percentage points more likely to lose the HOPE Scholarship (i.e., 25 to 37%). These effects are somewhat smaller than those based on maximum likelihood estimations. Nonetheless, the existence of these large and statistically significant differentials in models that include county fixed effects underscores the robustness of the results presented in Table 3. However, one possible limitation of the robustness checks presented in Table 4 is that those models assume that county-specific attributes are invariant with regard to the student's gender, race, and ethnicity. Because this assumption may not be tenable, these models were also estimated with county fixed effects that were specific to the student's basic demographics. In the interest of brevity, those results are not reported here.[25] However, the college fixed effects in those estimations are similar to those in Table 4 in magnitude and statistical significance despite the sharp increase in the number of regressors.

5. Conclusions

The widely popular HOPE Scholarship program in Georgia has inspired similar state and Federal proposals that seek to promote access to postsecondary education. Most criticisms of these initiatives have emphasized the inequities of this funding strategy relative to programs targeted more directly and generously at poorer families and students. Less attention has been paid to the implications of the striking stylized fact that roughly half of HOPE scholars lose their funding after only one academic year. This study has used unique student-level data from freshmen at Georgia Tech to address what observed characteristics systematically relate to attrition from the HOPE Scholarship program. These results indicated that there are not robust and dramatic differentials by the race or ethnicity of students. However, these results also suggest that, among HOPE Scholars, there may be important horizontal inequities associated with who retains the HOPE Scholarship. More specifically, these estimations indicate that there are large, robust, and statistically significant links between students' courses of study and their success at retaining HOPE Scholarships. In particular, students in the sciences, engineering, and computing are 21 to 51% more likely to lose their funding than similarly qualified students in other fields. This finding implies that the uniform grade cutoff, which characterizes the HOPE Scholarship program in Georgia, financially punishes students who choose more challenging courses of study. This horizontal inequity could have further important and unintended consequences because it might discourage students from choosing curricula that present such increased risks for scholarship attrition. Regardless, in response to these results, there are at least two general perspectives on redesigning the terms of such postsecondary aid. One class of solutions might involve substituting a uniform grade cutoff with standards that recognize the extensive cross-disciplinary heterogeneity in grading standards. Another class of solutions might simply involve the use of available funds to subsidize postsecondary tuition regardless of a student's ongoing

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ability. This also underscores the probable empirical relevance of unobserved socioeconomic priors in the determination of scholarship attrition.

[25] Such models include roughly 200 county fixed effects. The results suggest that much of the heterogeneity within counties is related to academic success in college.

academic performance. Of course, subsequent evaluations of these and other funding alternatives should be based on careful consideration of a variety of important normative, positive, and administrative issues beyond those addressed here. Nonetheless, the empirical results presented here provide novel evidence that should both motivate and inform those discussions.

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