

The Tennessee Education Lottery Scholarship: A Reward for Past Achievement or Motivator for Future Performance?

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Abstract

The Tennessee lottery scholarship (TELS) program is intended to make college more affordable for young people in Tennessee, with the aim of increasing higher education enrollment and retention rates. One way to evaluate the effectiveness of TELS is to determine to what extent did the scholarship change student behavior? That is, does TELS induce desirable behavior that would not otherwise occur? Using a logit model to predict year-over-year college retention, we conclude that TELS has a positive, but small, effect on student behavior in Tennessee. The biggest impact of TELS occurs among continuing students, with no effect for first-time students.

Keywords: lottery, scholarship

JEL Categories: H75, H7, I21

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I. Introduction

Tennessee's program (Tennessee Education Lottery Scholarship, or TELS) is modeled after Georgia's Helping Outstanding Students Educationally (HOPE) scholarship program enacted in 1993. To be eligible for the Tennessee scholarship a student must be a recent high school graduate with a 3.0 GPA or a score of at least 19 on the ACT or 890 on the SAT.

The amount of the scholarship is determined each year by the Tennessee legislature in its annual budget appropriation. For the first year the Tennessee HOPE scholarship award was \$1,500 per semester or \$3,000 per year for a four-year institution and \$750 per semester or \$1,500 per year for a two-year institution. In addition, a need-based supplement was \$1,000 per year and the General Assembly Merit Scholarship was \$1,000. Thus, a high-achieving student or one from a family with income of less than \$36,000 per year could receive a maximum \$4,000 award. For fall 2006 the HOPE award increased to \$3,800 per year, and more increases are likely: proposed legislation would increase the award to \$4,000 per year for a full-time student for fall 2007. Other changes would accommodate part-time students by lowering the annual number of credit hours and increasing the time limit from four years to five. Through two full academic years of operation, \$2.3 billion in merit and need-based scholarships have been awarded to 96,253 students (Lawley, 2007).

Middle Tennessee State University (MTSU) is the largest of the six Board of Regents institutions and has the largest undergraduate enrollment among all public universities in the state. Since the mid-1980s MTSU has experienced the fastest enrollment growth of any four-year university in the state from 11,200 students in fall 1986 to 22,500 students in fall 2005. As a result, the limit of available resources was tested. For the fall 2004, the university administration anticipated a major increase in enrollment following the institution of the lottery scholarship and so proposed a significant increase in admission standards. Despite the higher standards MTSU enrolled 3,143 first-time freshmen in the fall 2004, up from 3,037 in fall 2003. Of those in the new freshman class 2,471 received lottery scholarships, as did 1,084 high school graduates from 2003.

Of the 2,471 new freshmen receiving the lottery scholarship at MTSU for fall 2004, 2,347 satisfied the 24 credit hour threshold during the academic year. Of these, 1,348 attained the required 2.75 or higher GPA needed to retain the scholarships for the coming academic year, a retention rate of 57.4 percent of those meeting the 24 credit hour threshold. While seemingly modest, this success rate compares favorably with other four-year institutions in the Tennessee Board of Regents system, with 54.1 percent of eligible students retaining their lottery scholarship.

II. Literature

Much has been written regarding various aspects of lottery scholarships, particularly concerning Georgia's HOPE scholarship.¹ The effects of the HOPE scholarship on overall college attendance rates are estimated in Dynarski (2000) and Cornwell, Lee, and Mustard (2006). Using nearby states as the control group, Dynarski estimates the HOPE scholarship increased college enrollment rates among young men and women, rising by 7.9 percentage points compared with the pre-HOPE period. Cornwell et al (2005) find that the HOPE program increased total freshman enrollment by 5.9 percent.

In a study more closely related to this paper, Cornwell, Lee, and Mustard (2005) find that HOPE students are less likely to enroll in a full courseload and tend to complete fewer credit hours compared with a control group. However, the study did not explicitly examine the issue of whether HOPE students are more likely to remain in college.

The effect of the HOPE scholarship on college retention is one of the issues dealt with by Henry, Rubenstein, and Bugler (2004), who compare persistence for HOPE recipients with other students, where persistence is defined as the probability of remaining in college the full four years. The authors find that HOPE increases the odds of persistence by a factor of 1.13, controlling for other variables, but the definition of persistence is unclear in the study and the model results do not correspond to the discussion in the text.²

¹ An overview is provided in Penn (2003).

² The logit coefficient for HOPE is 0.12 and the standard error is 0.10 in Table 4 of Henry et al. This result is flagged as statistically significant at the 0.05 level, which is quite puzzling, since the estimate 0.12 is clearly not twice as large as the standard error 0.10.

Other than Henry (2005), surprisingly little research has addressed the key question: do lottery scholarship students tend to remain in college more than non-lottery students? This paper deals primarily with this issue, using the Tennessee experience as a case study.

III. Outcomes from Two Years of TELS Experience

Outcomes from the first two years of TELS operation were recently released in a report by the Tennessee Higher Education Commission (THEC). The report offers details regarding TELS awards for fall 2005 and fall 2006. The results of the report are discouraging: 48 percent of freshmen entering the Tennessee higher education system in fall 2004 retained their TELS award in fall 2005. But by fall 2006, just 36 percent of fall 2004 freshmen retained their scholarship. Further, the loss of the award did not seem to have much effect on college retention, as many who lost awards remained in college. The report finds that retention of the TELS award is related to academic preparation, family income, race, and gender.

The THEC report offers considerable detail about the characteristics of lottery scholarship recipients, their retention rates in college, and the rate at which they return to college even without the award. However, it does not compare lottery recipients with other similar students who do not receive the scholarship. We argue that the impact of the lottery scholarship is best determined by examining outcomes of award recipients with those of similar non-recipient students, controlling for other relevant variables. While few would characterize a 64 percent scholarship loss rate a success, it may well be that these students who even briefly had the lottery scholarship demonstrate favorable outcomes compared with students who never benefited from the scholarship.

IV. Data

Data for this study were provided by MTSU's Information Technology Division and Financial Aid Office. Enrollment records were obtained for all undergraduate students for the academic years 2004 through 2006; items in the files include GPA (cumulative), hours attempted per semester, hours earned per semester, cumulative hours earned, major, high school GPA, high school graduation date, entry term, ACT score, race, sex, lottery scholarship status (Yes or No), residency, class level, and status (first

time student, continuing student, transfer, and so on). These enrollment records were matched with data from the FAFSA financial aid application using student ID numbers, linking parents' income and parents' educational attainment enrollment data. As discussed later, not all enrollment records can be matched with financial aid data, since not all students applied for financial aid.

V. Comparative Characteristics of Lottery Students

Students awarded the lottery scholarship differ somewhat from the overall student population. Compared with non-lottery students, lottery students tend to be female (almost nine percentage points more than non-lottery students) and white (+6.4 points), as shown in Table 1. Black students are under-represented among the lottery students by five percentage points. These findings correspond to the distributions documented for higher education institutions in Tennessee (THEC 2007). One typically thinks of the first lottery class as consisting of first-time freshmen; while most are, one-third are continuing and transfer students who graduated from high school as early as January 2003. We shall see that the status of the student (first-time student versus continuing student) matters substantially in terms of scholarship retention, enrollment retention, and the marginal effect of the lottery scholarship.

Differences in family income and educational background are summarized in Table 2, compiled from items provided on the students' FAFSA application form and linked to the enrollment data. Lottery families are better educated and enjoy higher incomes than non-lottery families. The probability that a parent has a college degree is five percentage points higher for lottery students compared with non-lottery students, and the probability of just a high school education is two to four percentage points lower.

Lottery student families also have higher incomes than do non-lottery students: median incomes are 24 percent higher (Table 2). Why the difference? The reason is not completely clear, but two explanations come to mind. First, it may be that the lottery scholarship attracts affluent students and academically gifted students who would have attended college out-of-state if not for the scholarship. Second, the difference simply might be an artifact of the data: family income data is missing for a substantial portion of the non-lottery students, but nearly completely reported for lottery students. This is true

because the federal financial aid form (FAFSA) must be completed and filed by all lottery scholarship students; parents' adjusted gross income (AGI) and parents' education are two items that must be reported on the form. Non-lottery students, by contrast, are not required to file the FAFSA form unless, of course, they wish to apply for a loan, grant, or scholarship.

In all, we have income data for 99 percent of the lottery students but just 55 percent of the non-lottery students. Clearly, better coverage of the non-lottery students would be helpful, but the issue is to what extent are the non-lottery students with reported income different from non-lottery students with unknown income? We do know that income and race are highly correlated; incomes of White students are 62 percent higher than incomes of Black students (Table 3). We also know that Black students are much less likely to apply for financial aid, as evidenced by the large share of Black students for which income is unknown. Consequently, the non-lottery students who apply for financial aid (and for whom income is known) very likely have *higher* incomes than the non-lottery students who do not apply for aid. Thus, if anything, the reported incomes of the non-lottery students are *positively* biased, and tend to be higher than incomes of *all* non-lottery students. Thus, students of privilege are either more able academically or more adept at securing lottery scholarships than are students from less privileged backgrounds.

We may speculate that students from more affluent and better educated families will likely perform better academically in terms of grade average and retention than will students from less affluent and less educated families. And the more affluent students tend to be over-represented among lottery students, thus further complicating the task of sorting out the marginal effect of the lottery scholarship on academic performance.

VI. College Retention and the Lottery Scholarship

The model of college retention detailed in this section estimates the marginal contribution of the lottery scholarship on year-to-year retention of MTSU freshmen and sophomores. Specifically, we use a logistic model to predict the probability of retention with and without the lottery scholarship, conditioning on other variables that affect retention.

Ideally, a researcher desires to randomly assign the sample to either a treatment group or a control group. Demographic, income, and other characteristics would be the same between the two groups; the only material difference would be the students in the treatment group receive a scholarship, and the students in the control group do not. The researcher would then measure outcomes such as retention and GPA for the two groups over time and determine whether a significant difference exists.

Unfortunately, as is nearly always the case in social science, the available data fall short of the ideal. Several problems are known to exist. For example, the treatment group, consisting of lottery scholarship recipients, differs in material ways from other students, thus potentially confounding any comparison. We know, for example, that lottery students are above average performers because they must have been good high school students to qualify for the scholarship. Thus, is the lottery scholarship simply an indicator that identifies the better students? Second, lottery students tend to come from families with higher incomes than other students, and educational performance is likely to be positively related with income. Thus, comparing lottery students with other students without controlling for income may bias the results. Fortunately, we have access to household income data for a large number of students.

Finally, the data are subject to the usual miscoding and data errors that typically crop up when dealing with individual-level micro data. As an example, approximately 14 upper-class students (juniors and seniors) are coded as lottery students in the fall of 2004; clearly, this is not possible, and these values are re-coded as non-lottery students.

VII. Outcomes for Lottery and Non-Lottery Students at MTSU

Comparing outcomes for lottery students with non-lottery students, two things are clear. First, lottery students generally perform better than non-lottery students, and second, continuing students perform better than first-time students. Details are offered in Table 4. As for the first point, lottery students are more likely to enroll full-time, as they must to remain eligible for the scholarship. And lottery students are much more likely to actually complete a full load of 12 credit hours than are non-lottery students. Year-over-year retention is better for lottery students, and GPA is somewhat better.

On the second point, continuing students perform better than do first-time students across the board. For example, 89 percent of continuing students with the lottery scholarship completed a full load in fall 2004, compared with 65 percent of first-time college students. Continuing lottery students are also much more likely to return to MTSU the next year (91.5 percent compared with 73.3 percent for first-time students) and to retain their scholarships (81.8 percent compared with 65.9 percent for first-time students). We may speculate that earning a few credit hours of college credit causes a substantial boost for student confidence, thereby increasing the probability of retention.

Spearman correlations are shown in Table 5. Grade point average (GPA) for fall 2004 is easily the most important predictor of year-over-year retention, and lottery scholarship is second most important. Other variables with a moderately strong association with retention are continuing student, father's education and mother's education. Income is strongly related to race and parents' educational level, and somewhat strongly associated with GPA and lottery status. The figures suggest that isolating the effect of the lottery scholarship requires us to hold constant the effects of GPA, income, and parents' educational levels.

VIII. A Model of Lottery Scholarship Effectiveness

Do lottery students tend to remain in college at a higher rate than other students, after controlling for contributing factors such as GPA, status, income, race, sex, and major? This section estimates a logit model that predicts the probability of year-over-year retention, given other contributing factors. The logit model is

$$\ln(y/1 - y) = \alpha + \beta \text{Lottery} + \delta X$$

with the dependent variable y set to unity if a student enrolled in fall 2004 returns to college the following year (fall 2005), zero if the student does not enroll. Lottery is a binary variable set to unity if the student received the lottery scholarship in fall 2004, and zero if not. All other variables are represented by the vector X including GPA, status, race, sex, and major. Under the hypothesis that the lottery is a significant factor for retention, the coefficient β will be positive and significantly greater than zero.

Our view is that the performance of lottery scholarship students should be compared with that of other *similar* students. It is not appropriate, for example, to

include all undergraduate students in the sample, since juniors and seniors were not eligible for the lottery scholarship in fall 2004. Defining what precisely is a *similar* student involves some judgment.

Several positive effects of the lottery scholarship may be imagined. First, the scholarship may allow a high school student to attend college who otherwise could not afford to attend. Second, the scholarship may act as an incentive for high school students to perform well academically. Third, the scholarship may act to boost high school graduation rates in a state with historically low achievement in this regard. Fourth, the scholarship may boost total higher education enrollment, hopefully resulting in more college-educated adults in a state that lags also by this measure. Last, the scholarship may improve year-to-year retention rates; this is the issue analyzed in the remainder of this study.

As suggested by the correlations, a critical issue is how to separately measure the effects of the lottery scholarship when we know it is closely related to GPA and student status. Simply including all the variables in an equation is not completely satisfactory, since the likely collinearity may cause estimates of β to be biased. As an alternative, we will estimate separate equations for various sub-sets of the data; within each data sub-set, variation for a critical variable such as GPA or status will be held constant.

In the first model, we include all freshmen and sophomores enrolled full-time (at least 12 hours) in fall 2004 and for whom income is known; with these qualifications, the sample consists of 3,538 lottery students and 2,791 non-lottery students. The identifying assumption is that the lottery students have an additional incentive to remain full-time students at MTSU that the other students do not have: a \$3,000 scholarship.

Summary statistics for variables used in Model 1 are presented in Table 6, while Model 1 results are presented in Table 7. The fit of the model is reasonable, with an R-square of 0.26 and a very low p-value for the Wald test, and 76.4 percent concordant predicted probabilities. Model 1 results show, not surprisingly, that year-to-year retention depends foremost on cumulative grade point average; the GPA estimate is very large and positive, with a p-value of virtually zero. Continuing student status is next most important; students with at least some college experience enjoy a higher probability of retention than do first-time students. Surprisingly, Black students show a higher

probability of retention after controlling for other factors. Although Blacks are under-represented in the MTSU population compared with Tennessee's adult population, the model suggests that they have a higher likelihood of remaining in college once admitted. Parents' income is a mildly important predictor of retention, with a p-value of less than 0.02. Nursing majors and undeclared majors are predicted to have over-the-year retention substantially lower than other students. Other majors, such as business and math, were tested in the model, but p-values were very high and the variables subsequently excluded. Surprisingly, sex and father's educational level are not significantly different from zero.

The lottery variable has the correct positive sign and is significant at the 0.02 level. However, the lottery scholarship is not the first or even second most important positive factor contributing to retention; rather the lottery ranks fourth, between race and income.

Model 2 uses the same variables as Model 1, but limits the sample to more closely correspond to students who could qualify for the lottery scholarship. Recall that a high school student may qualify for the lottery scholarship by earning a high school grade point average of at least 3.0 OR achieving a minimum score of 19 on the ACT. Since high school grades are notoriously unreliable in terms of a reliable measure of academic achievement, we pay attention to just the ACT score. Consequently, Model 2 begins with Model 1 students, with the qualification that the students achieve at least 19 on the ACT, resulting in 1,323 non-lottery students.

Model 2 results show the same order of most important positive contributors to retention: GPA, continuing status, race, and lottery scholarship, in descending order of importance. The value of the lottery estimate is not much different than in Model 1; however, statistical significance of the estimate has slipped substantially, from 0.02 in Model 1 to 0.06 in Model 2. We may conclude that when lottery students are compared with non-lottery students conditioning on high school academic achievement, the effect of the lottery scholarship is marginal.

In both Model 1 and Model 2, continuing student status is an important factor determining year-to-year retention. Model 3 begins with the Model 1, but limits the sample to continuing students only. The results are striking; the estimate for the lottery

variable is more than double that of Model 1 and significant at the 2 percent level. Thus, the lottery is much more of a factor for continuing students than for first-time students and transfer students. Also in Model 3, income is not as important, but major is more important.

The contrast between continuing students and first-time students is very clearly presented in the results for Model 4, which include all but continuing students (mostly first-time or transfer students). For this subset of the sample, the lottery scholarship is not at all an important predictor of retention: the estimate is the wrong sign and not significantly different from zero. Income is more important than for continuing students (Model 3), as is GPA.

To summarize this section, the lottery scholarship makes a substantial difference for continuing students but no difference at all for first-time and transfer students. This result corresponds closely with the tabulations in Table 4 that show that continuing students are much more likely to be successful in sticking with college than are first-time students, with or without the lottery scholarship. Second, among continuing students, the lottery scholarship is an important predictor of retention.

So, does the lottery scholarship matter in terms of student retention behavior? It depends. The scholarship has no effect on first-time and transfer students, but is relatively important for continuing students. Why the difference? We may speculate that the college experience gained among continuing students is valuable in a number of ways. First, continuing students are more adapted to the college environment; leaving home and entering a large university can be a daunting task for many first-time students. Continuing students have successfully crossed this bridge. Second, continuing students may be better able to tune out the many distractions of college life, and focus on the task at hand of maintaining grades, thereby retaining the lottery scholarship.

The marginal effects of the lottery on the predicted probability of retention are presented in Table 8 for each of the four models. The probabilities are calculated as $\exp(z)/(1 + \exp(z))$, where $z = \alpha + \beta \text{Lottery} + \delta X$; α is the intercept term; and X the other explanatory variables evaluated at their mean values. The predicted probability of retention for lottery students is determined by setting the coefficient β equal to one; correspondingly, the probability of retention for non-lottery students is found by setting β

equal to zero. As is apparent, the increase in the probability of retention is relatively modest for Models 1-3, only a few percentage points. Model 4 shows no effect at all on the probability of retention.

An increase of the retention rate of 2.6 percentage points is not large, but does imply that 91 more students will be enrolled than otherwise would occur. Actual enrollment gains at MTSU during the past two years have been modest, averaging just 271 additional students in fall 2005 and fall 2006. With tepid enrollment growth, 91 additional students is a substantial gain. Further, the higher retention rate could well carry over to juniors and seniors as the initial cohort of lottery scholarship students gets older. Thus, retention gains could propagate in coming years as the lottery students progress through their academic careers. The boost to enrollment will level off, however, when the initial fall 2004 cohort reaches graduation in four or five years, and lottery students are represented in all four years of classification.

IX. Conclusions

The lottery scholarship is thought to generate incentives for increased higher education enrollment and enhanced student performance. If performance is measured as the likelihood of year-to-year retention in college, the lottery scholarship matters for the average student, but only at the margin. Other variables including GPA, race, and major, matter more than the scholarship. The lottery scholarship matters most for continuing students, and not at all for first-time students.

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Table 1: Enrollment characteristics of lottery and non-lottery students, fall 2004

	Freshmen and Sophomores	
	Lottery	Non-lottery
Students	3,672	5,757
Male	44.0%	52.8%
Female	56.0%	47.2%
<i>Race / ethnicity</i>		
Native American	0.2%	0.5%
Asian	2.2%	3.0%
Black	9.8%	14.7%
Hispanic	1.7%	2.1%
White	85.7%	79.3%
Other	0.4%	0.4%
<i>Status</i>		
First time college	66.9%	11.0%
Continuing student	28.4%	64.4%
Transfer	4.5%	16.6%
Other	0.2%	8.0%
<i>Classification</i>		
Freshman	79.4%	45.8%
Sophomore	20.6%	54.2%

Table 2: Family characteristics of lottery and non-lottery students, fall 2004

	Freshmen and Sophomores	
	Lottery	Non-lottery
<i>Father's educational level</i>		
Middle school	3.2%	4.3%
High school	43.3%	45.7%
College	49.4%	43.9%
Other	4.2%	6.1%
<i>Mother's educational level</i>		
Middle school	2.0%	2.7%
High school	43.8%	47.7%
College	51.0%	46.2%
Other	3.2%	3.3%
Family adjusted gross income (AGI)		
Median	\$69,272	\$56,000
Standard deviation	\$62,118	\$49,256
Observations	3,550	3,016

Table 3: Cross-tabulation of non-lottery students by reported income and race

	White	Black	Other
Income known (%)	48.1%	29.4%	46.5%
Median AGI	\$62,499	\$38,382	\$48,188

Table 4: Outcomes for lottery and non-lottery students

Type of student*	Fall 2004				Fall 2005				
	Enrolled	Completed	Percent enrolled full-time	Earned 12 hours or more	GPA	Returned to MTSU from fall 2004	Retention Rate	Retained lottery scholarship	GPA
<i>Lottery students</i>									
1st time college	2,458	2,355	99%	65%	2.86	1,802	73.3%	65.9%	2.86
Continuing student	1,042	1,040	100%	89%	3.27	953	91.5%	81.8%	3.27
Other	172	169				145	84.3%		
Lottery total	3,672	3,564				2,900	79.0%		
<i>Non-lottery students</i>									
1st time college	633	553	91.5%	40.1%	2.84	419	66.2%		2.63
Continuing student	3,709	3,456	87.7%	49.9%	2.54	2,689	72.5%		2.64
Transfer student	956	884	88.5%	45.4%	2.62	607	63.5%		2.69
Readmitted and other	459	400	69.1%	30.1%	2.56	209	45.5%		2.62

*Freshmen and sophomores only

Table 6: Summary statistics for Model 1 variables

Variable	Lottery students		Non-lottery students	
	Mean	Std. Deviation	Mean	Std. Deviation
Return fall 2005	0.795	0.404	0.732	0.443
GPA fall 2004	2.911	0.906	2.386	0.998
Adjusted Gross Income	\$79,075	\$62,156	\$64,269	\$49,688
Continuing student	0.285	0.451	0.679	0.467
Father completed college	0.490	0.500	0.435	0.496
Female	0.556	0.497	0.458	0.498
Black	0.096	0.295	0.192	0.394
Undeclared major	0.177	0.382	0.116	0.321
Nursing major	0.072	0.259	0.054	0.226
Observations	3,538		2,791	

Table 7: Logit model results

Variable	Model 1			Model 2			Model 3			Model 4		
	Estimate	Std error	p-value	Estimate	Std error	p-value	Estimate	Std error	p-value	Estimate	Std error	p-value
Lottery	0.1644	0.0796	0.0388	0.1972	0.0993	0.047	0.3651	0.1455	0.0121	-0.0416	0.1592	0.7939
GPA	1.0394	0.0368	<.0001	1.1121	0.0457	<.0001	1.0276	0.0614	<.0001	1.1222	0.0554	<.0001
Income (log)	0.0984	0.0429	0.0219	0.1535	0.0528	0.0036	0.0686	0.0695	0.3231	0.159	0.0646	0.0139
Continuing student	0.6316	0.0781	<.0001	0.6975	0.0977	<.0001	-	-	-	-	-	-
Father has college degree	0.0148	0.0706	0.8344	-0.058	0.0844	0.4918	0.1498	0.113	0.1849	-0.1419	0.1056	0.1791
Female	0.0473	0.0699	0.4981	0.0847	0.0841	0.3139	0.041	0.1128	0.716	0.1101	0.103	0.2851
Black	0.4938	0.1009	<.0001	0.5072	0.1461	0.0005	0.3381	0.1455	0.0201	0.7276	0.1669	<.0001
Major not declared	-0.2934	0.0901	0.0011	-0.2837	0.1034	0.0061	-0.3785	0.1633	0.0204	-0.292	0.1201	0.0151
Nursing major	-0.7941	0.1311	<.0001	-0.8756	0.154	<.0001	-1.3105	0.1891	<.0001	-0.4249	0.2033	0.0366
Intercept	-2.8058	0.4706	<.0001	-3.6439	0.5823	<.0001	-1.8363	0.758	0.0154	-3.5359	0.7176	<.0001
AIC			5643.9			3976.0			2294.3			2513.0
R-squared			0.269			0.285			0.259			0.287
Wald			<.0001			<.0001			<.0001			<.0001
Percent concordant			76.5			77.1			77.3			76.3
Observations			6,329			4,657			2,902			2,669
Lottery			3,538			3,334			1,007			2,365
Nonlottery			2,791			1,323			1,895			304

Table 8: Predicted probability of year-over-year retention, lottery and non-lottery students
 Predicted probability of retention

Model	Lottery	Non-lottery	Difference	Sample characteristics
Model 1	0.819	0.794	0.026	All full-time freshmen and sophomores with known income.
Model 2	0.831	0.802	0.029	All full-time freshmen and sophomores with known income and ACT>18.
Model 3	0.886	0.844	0.042	All full-time freshmen and sophomores with known income who are continuing students.
Model 4	0.771	0.778	-0.007	All full-time freshmen and sophomores with known income who are 1st time or transfer students.