The Tennessee Lottery Education Scholarship and its Effect on Income Distribution

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Introduction

In an era of expanding and ever more clamorous demands for government services, states are, out of necessity, finding increasingly more creative ways of generating the funds to support the prodigious list of programs required to keep citizens happy, healthy, and voting. State-run lotteries are becoming an increasingly popular method of filling out the scrawny budgets of public goods with high public demand. Typically, the government forms a corporation that provides an entertainment good, and redirects the profits from citizens back to citizens in the form of better parks, better mass transit services, better prescription drug benefits, and better public education. This last beneficiary is favored by lawmakers both for its inherent value to the lives of citizens, but also for its appeal to potential lottery participants who feel like they are donating to a good cause when they play. Investment in human capital is a sure-fire way to improve both individual standards of living and prospects for state-wide long-term economic growth, and increasing numbers of state governments are taking advantage of the profit-creating capabilities of lotteries instead of attempting to wring more money out of overtaxed treasuries. Tennessee recently jointed the ranks of states operating a lottery, and uses the proceeds to fund a merit-based college scholarship program.

At first glance, it looks like a win-win situation – people who desire gambling can indulge themselves while the state invests in its children, mankind's hope for the future. As is usually the case with systems of this size and scope, however, unexpected outcomes and unintended consequences abound. Lottery products are disproportionately consumed by low-income, undereducated citizens, while merit-based scholarships are disproportionately disbursed

to higher-income students from better schools. The group paying the costs of the program overlaps very little with the group enjoying the benefits. The Lottery Scholarship is causing a statewide redistribution of income from lower income levels to higher ones, and from the less educated to better educated populations. I plan to build a model that shows what factors make counties in Tennessee more or less likely to receive Lottery Scholarships. I can then combine that model with the assumption that Lottery sales are distributed in the same manner as in other states that have already been studied to determine how much redistribution of income occurs.

Background and Literature Review

State lotteries have been under scrutiny from economists almost since the moment they became a viable form of government revenue generation. A lottery is, in effect, a tax – a mechanism by which wealth is transferred from citizens to their government. It resembles a sales tax in that people surrender varying amounts of their income according to their tastes and consumption habits, but there the differences begin. Lotteries primarily provide what is considered entertainment, not a necessary good or service. Consumption of lottery tickets is entirely voluntary, and not a fundamental need like food or clothing. It can be entirely foregone with no impact to the well-being of the consumer.

People choose to sacrifice a portion of their income in order to play the lottery for a variety of reasons. A lottery ticket represents a kind of risky financial asset – with an investment of a dollar or two, the holder purchases a chance at a prize (Clotfelter and Cook 1990). In most states, lotteries are the only avenue in which citizens can legally indulge the thrill of gambling. When lottery proceeds fund public goods like education, buying a ticket becomes a way to justify gambling (traditionally perceived to be an immoral activity) and to contribute to a worthy

cause, which draws a different type of participant. But underlying all of these is the one fundamental of humankind: avarice. The prize accounts for the bulk of lottery sales (Clotfelter and Cook 1990).

Lotteries are a form of gambling, but the astronomically long odds, potentially large payouts, and wide availability of ticket vendors mean their effects differ significantly from traditional incarnations like casinos or racetracks. Normally, people judge odds based on knowledge gained from experiencing the event. For instance, when calling a coin toss, people know from observing past coin flips that if they choose heads, they have a 1 in 2 chance of being right. The chances of winning the highest paying multi-state lottery's are less than 1 in 176 million, and sometimes even more remote. In Powerball, a multi-state Lotto that in which Tennessee residents can participate, the players choose 5 of 55 numbers plus 1 additional "Powerball" between 1 and 42. The odds of picking all 6 numbers are 1 in 146 million. Other smaller games do have considerably better odds, but the expected return for each play is still negative. For example, the Tennessee Lotto 5 game requires the player to choose 5 of 39 numbers. The odds of picking all five are 1 in 575,757. Winning is an event that does not occur regularly enough for players to develop a true sense of how remote their chances are; instead, they rely on a rough assessment based on what Tversky and Kahneman called " 'availability,' defined as the ease with which instances of the event can be brought to mind" (cited in Clotfelter and Cook 1990). Players thus recall hearing about winners, but have no gauge of the vast pool from which those winners were selected. Most participants, therefore, have a skewed estimate of the likelihood that they might be struck by the jackpot lightening bolt.

The largest lottery prizes are enough to catapult anyone into the highest strata of society; the higher an unclaimed jackpot climbs, the more people from all income groups invest in

tickets. The smaller prizes of $250 or $500 on fewer matched numbers or instant games, however, may be enough to purchase a significant, if temporary, improvement in standard of living for a low-income player. Lottery games appeal particularly to players searching for their own Cinderella story, for whom the right sequence of numbers is as magical and transforming as a fairy godmother. Polling data suggests that more upper-income players take part in lotteries for fun rather than the prize, while more lower-income players cite the money as their primary motivation (Clotfelter and Cook 1990).

A clear pattern emerges: lottery participation falls as the level of formal education increases. The same is true of income, which tends to vary with education: the lower the income, the more likely regular lottery participation becomes (Clotfelter and Cook 1990). In addition, the lottery is highly regressive. A one dollar expenditure on a lottery ticket is a larger percentage of a small income than a large one, and thus represents a larger reduction in purchasing power. Not only are the poor more likely to purchase tickets, they are making a larger sacrifice when they do so. The effect that "state lottery products are disproportionately consumed by the poor" (Kearney 2005) has been observed in so many studies (most recently Worthington 2001, Hansen 1995, and Scott and Garen 1993, cited in Kearney 2005) that it has almost attained the status of economic fact. This is a tenuous position, certainly, but for now, nothing has been observed to the contrary. As education and income tend to correlate strongly to race, minorities also tend to purchase more lottery tickets than whites (Borg and Mason 1988).

Since winners are selected from the total number of participants, it follows that the winners are also predominantly poor. Despite this logic, Freund found that lotteries contribute significantly to the recent trend towards increasing inequality in income distribution due to the

regressivity of the lottery and its function as an income concentrator – many participants pay into one jackpot, from which only one person benefits (2005).

Opponents of state lotteries argue that they prey on the poor, who substitute lottery tickets for other consumption and savings. Detractors also worry that governments take advantage of consumers' misinformation and ignorance, and lure them into a "sucker's bet" that does them more harm than good. Supporters counter with the fact that all demographic groups play the lottery, and all participants are making voluntary purchases of entertainment goods. The lottery fills the demand for gambling in a constructive way that benefits citizens, as opposed to one in which illegal operations reap all the profit (Kearney 2005).

When placed in context as a government revenue generation tool, the potentially adverse effects of lotteries must be weighed against the societal benefits acquired with lottery profits. Education is a favorite recipient, with lottery money dedicated to school districts, pre-kindergarten, after-school programs, etc. It represents an attempt by government to transmute the potentially detrimental consequences of gambling into beneficial outcomes enjoyed by society as a whole.

Recent structural changes in the economy have made education a necessary element of success for individuals and communities. Without some form of study after high school, higher salaries and better standards of living fade further into the realm of the unattainable. Despite this reality, a college education remains an expensive commodity. With this (and their voters) in mind, state and federal governments provide aid in the form of loans, grants, and scholarships to students. An avowed goal of many of these programs is the lessening of racial and economic inequality among college students. Government officials are determined that financial obstacles should not be the only reason students are denied access to higher education. To that end, first

Georgia, and now Tennessee have established lottery-funded merit-based scholarship programs intended to remove the financial barriers to college.

In theory, abolishing financial considerations from the determination of who goes to college should negate discrepancies in the income levels of incoming college students. Predictably, however, scholars are proving that the effects of merit-based aid are far more complicated than they appear at first glance. When Dyarnarski studied the Georgia HOPE program, she found that, while HOPE had increased overall college attendance, those gains were concentrated in white upper- and middle-income students. This suggests that HOPE is actually widening racial and financial gaps in college attendance in Georgia. This may be due to the fact that upper- and middle- income students are closer to the margins of college consumption than lower-income students (2000). It takes more incentive to convince low income students to attend college. Policymakers have traditionally interpreted income gaps to be the result of a lack of monetary capability when students are deciding to attend college, and thus can be eliminated by offering programs that reduce those short-term hurdles. Seeing income as the only cause of inequality, however, masks the factors that put students on the margins of college attendance in the first place, before their ability to pay for it enters the picture. Family income has a much greater effect on the formation of academic abilities and college readiness of students, rather than their short-term ability to finance college (Cameron and Heckman 2001). If a student does not develop in secondary school the skills and motivation to succeed in higher education, no amount of financial aid will induce them to attempt it or to succeed in it. Scholarships enter the scene too late to change the fact that the stage is already set.

In 2004, Tennessee became the 39th state to operate a lottery (Kearney 2005). Revenue was to be generated for the avowed purpose of "maximiz[ing] revenues for education,"

according to Board Chairman Dennis Bottorff in the 2005 Tennessee Lottery Annual Report. In the same report, CEO Rebecca Paul lists beneficiaries made better off by the lottery – retailers with sales commissions in their profit columns, players who have been entertained by the games, players who have won prizes, employees of the Lottery, and students and families who have received the scholarships for which the Lottery exists.

Lottery revenue funds the Tennessee Education Lottery Scholarship (TELS) program, which administers HOPE scholarships that send qualified Tennessee residents to Tennessee institutions of higher education. Scholarship program architects were well aware of the pitfalls experienced by the Georgia Lottery scholarship on which TELS was modeled, and endeavored to structure the Tennessee program in such a way that they solved the distributional problems inherent in merit-based scholarship endeavors. All a student must do to receive a basic HOPE scholarship is: fill out a Free Application for Federal Student Aid (FAFSA), prove residency in the state of Tennessee, agree to attend a college or university within the state, and meet one of two academic eligibility criteria: either score a 19 on the ACT or attain a high school GPA of 3.0. For the 2004-2005 academic year, meeting these requirements entitled students to a $3,000 per year HOPE scholarship. If a student's family earned $36,000 or less per year, they were eligible for an extra supplement, called ASPIRE, of up to $1,000, for a total award of $4,000. In order to stem a "brain drain" of exceptional students to other prestigious universities across the country, TELS also offered the General Assembly Merit Scholarship (GAMS), which meant an extra $1,000 (for a total award of $4,000), to students who met higher GPA and ACT requirements. They also provided a one-year remedial ACCESS grant of $2,000 that required a lower GPA and ACT score, with the possibility of attaining a regular HOPE scholarship after the first year if the student met HOPE renewal requirements. The higher awards were sufficient to

cover most, if not all, of in-state tuition at a public Tennessee university. (All of these amounts have been raised for the coming 2006-2007 school year to keep pace with increases in average tuition.) To retain their scholarships throughout college, students must maintain a 3.0 cumulative GPA (TELS Annual Report 2005). With lottery revenues behind them, these scholarships are intended to make a college education available to every student who desires one, regardless of family income.

With the financial constraints eliminated in this way, the true population of consumers of higher education has begun to emerge in the demographic numbers gathered by the Tennessee Higher Education Commission (THEC). They indicate that, notwithstanding the best efforts of the framers of the program, participation of low income and minority students remains disproportionately low. (See Tables 1 and 2.) Once again, income and race tend to correlate strongly to one another.

Table 1 – 2004-05 Enrollment Profile: Race

(TELS Annual Report 2005)

	Asian	*African- Amer.*	*Caucasian*	*Hispanic*	*Unknown/Other*	TOTAL
HOPE	1.5%	7.1%	87.8%	1.0%	2.6%	20,750
GAMS	2.2%	0.8%	93.2%	0.6%	3.3%	1,957
ASPIRE	2.5%	20.1%	72.7%	1.5%	3.2%	7,725
Supplemental (GAMS & ASPIRE)	2.4%	16.2%	76.8%	1.3%	3.2%	9,682
Access	2.0%	38.0%	53.0%	2.0%	5.0%	100
TOTAL	***1.8%***	***10.1%***	***84.2%***	***1.1%***	***2.8%***	***30,532***

Table 2 – 2004-05 Enrollment Profile: Income

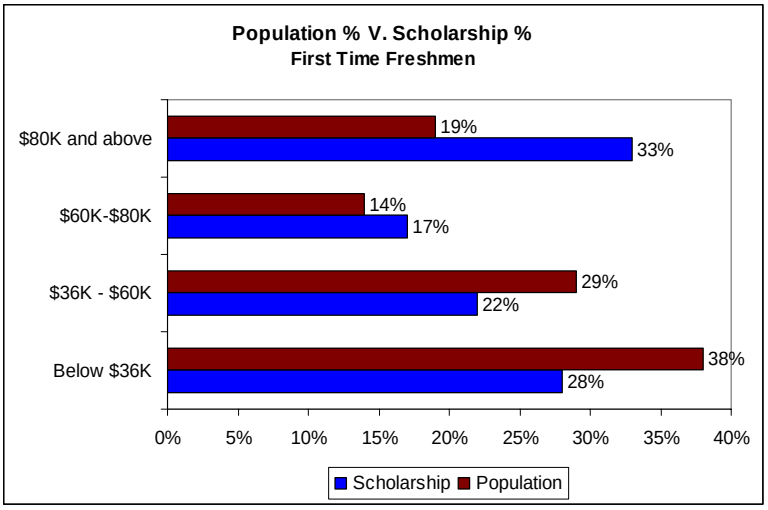
(TELS Annual Report 2005)

Income Level	*Total*	*HOPE*	*GAMS*	*ASPIRE*	*Access*
18,000 and under	10.0%		4.2%	39.8%	39.6%
18,001 – 24,000	5.1%		2.4%	20.1%	20.9%
24,0001 – 30,000	5.3%		3.5%	20.6%	20.9%
30,001 – 36,000	5.0%		3.8%	19.6%	18.7%
36,001 – 45,000	8.2%	11.3%	5.7%		
45,001 – 60,000	14.0%	19.2%	11.3%		
60,001 – 80,000	17.9%	24.2%	19.0%		
80,0001 – 100,000	13.8%	18.2%	18.6%		
100,001 and above	20.7%	27.1%	31.7%		
Total	29,644	20,669	1,942	6,942	91

TELS also reported that 19% of all Tennessee ACT test takers come from households with incomes greater than $80,000 per year, but 33% of all first-time freshmen HOPE recipients come from households in the same income group. (See Figure 1).

Figure 1 – Population Demographics vs. Scholarship Distribution

(TELS Annual Report 2005)



The numbers reveal a fundamental dilemma facing scholarship administrators: lower income students tend to come from lower quality schools. As the TELS Report puts it, "the group of students denied access [for academic reasons] to college scholarships (and those who have the greatest propensity not to retain them, even if received) are those for whom the financial aid is most needed" (2005).

Even though scholarship funds are widely available, students are not taking advantage of them in numbers proportionate to the demographics of the larger population. This suggests that Tennessee is not exempt from the effects already observed by scholars: short-term inability to pay tuition is not the primary reason students are choosing to forego college, but family income

still seems to influence that decision. The effect must therefore take place before scholarships are able to alter attendance rates, when academic ability, college preparedness, and desire for higher education are being formed rather than acted upon. Quality of secondary education tends to vary according to household income. Until this problem is solved, its effects will continue to carry over into the next level of education, regardless of the availability of aid.

The same types of distributional effects that accompany lottery sales also plague the merit-based scholarships they support, but they act in opposite directions – one is skewed toward the poor, the other toward the wealthy. Two phenomena, previously observed independently of each other, are occurring at the same time. The confluence of these two unique systems creates yet another unique interaction: while the state of Tennessee as a whole may be better off, the group that pays the costs of this program is statistically different from the group that reaps the benefits. As a result, income is being redistributed from the lower levels of in come to the upper, from the under educated to the educated, from those hoping for a miracle to rescue them to those able to set their own futures on the right path from the start.

Data and Methods

In order to determine whether this redistribution is occurring, I must show that the two groups of participants, lottery ticket purchasers and scholarship recipients, are demographically dissimilar. To accomplish this, I separated the two events into two independent models and set out to verify that the effects already observed in other states were, in fact, occurring in Tennessee. Unfortunately, data on lottery sales is not available to me at this time, so I am working under the assumption that the Tennessee Lottery operates similarly to other lotteries that have already been studied, and thus exhibits the same tendencies: lottery tickets are more likely

to be purchased by people with lower education and income. Given the fact that the Tennessee Lottery does not differ structurally in any significant way from most other lottery programs, this seems to be a reasonable assumption. The focus of this paper will be on the scholarship half of the equation, to determine whether the structural differences in the Tennessee Education Lottery Scholarship program have changed the distributional outcomes observed in other merit scholarship programs. If income and quality of high school education cause variation in the division of scholarship monies, then this fact, combined with the assumption that Lottery sales are similarly unequal, will indicate that a redistribution of income occurs due to combination of the Lottery and the TELS program.

To evaluate the distribution of HOPE scholarships, I created a model that explained scholarship dollars per capita as a function of race, income, education level of the college-age population, the opportunity cost of going to college, high school quality, gender, and household type (single parent or married couple).

Equation 1:

$$\frac{\$Scholarship}{population 18-24} = F(race,\ income,\ education,\ opp.\ cost,\ H.S.\ quality,\ gender,\ household\ type)$$

To measure the dependent variable, I acquired data from the Tennessee Higher Education Commission (THEC) which provided a count of the number of recipients of each scholarship in each county. Not all students receive the maximum amount possible, so to avoid overestimating the dollar value of the scholarship award, I used information found in the TELS Annual Report for the 2004-2005 academic year to determine the average allocation for each type of scholarship

(base HOPE, with Need, with GAMS, and ACCESS). I then multiplied the averages by the number of recipients of each scholarship in each county, and divided by the total population aged 18-24 to obtain scholarship dollars per capita in each county.

The THEC data included a number of scholarships of which the county was unknown. They account for about 15% of the total number of scholarships, which could lead to some distortion in the results. It is likely that they are more evenly distributed across a wide geographical area, and so should have a very small effect on the outcome of the analysis. As can be seen in Figure 2 below, scholarship dollars per capita are not equally distributed. In some counties, need-based scholarships account for more of the total; others have a larger proportion of GAMS.

Figure 2 – Scholarship Awards in Dollars Per 18-24-Year-Old

by Type of Scholarship

Counties are ranked from highest average income to lowest,
i.e., Williamson has the highest average income in the state, and so on.

Figure 2.1

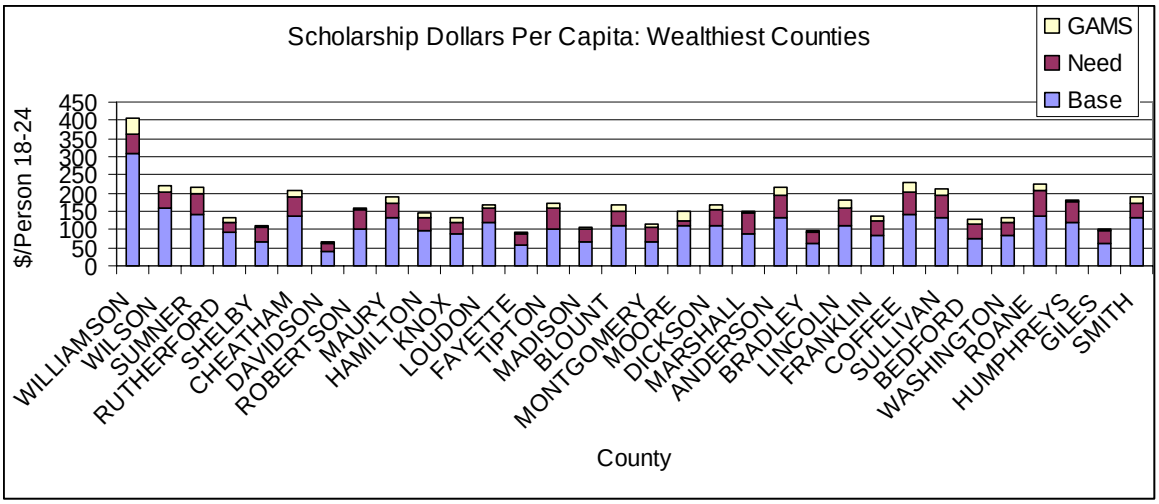


Figure 2.2

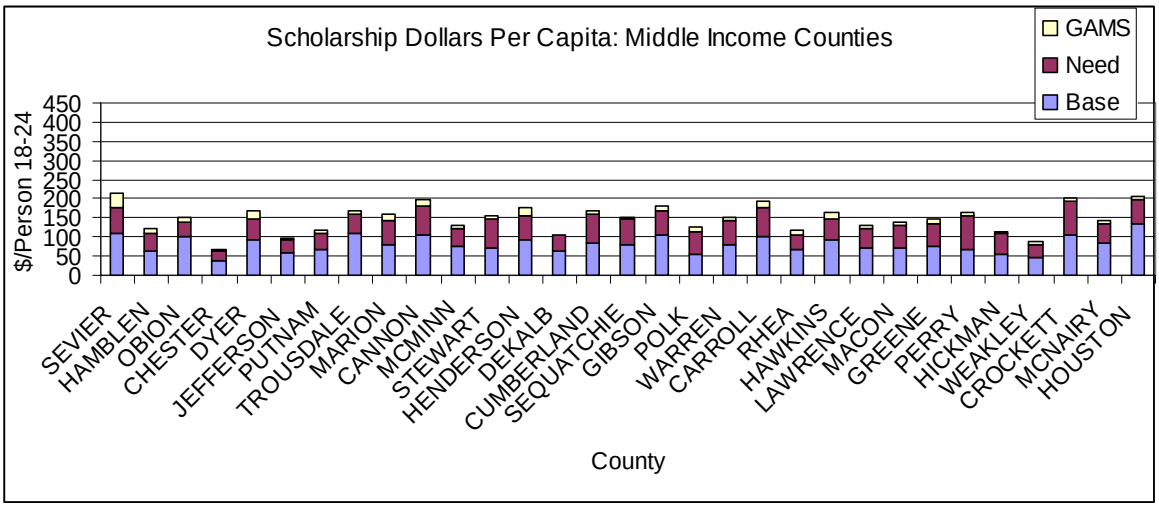
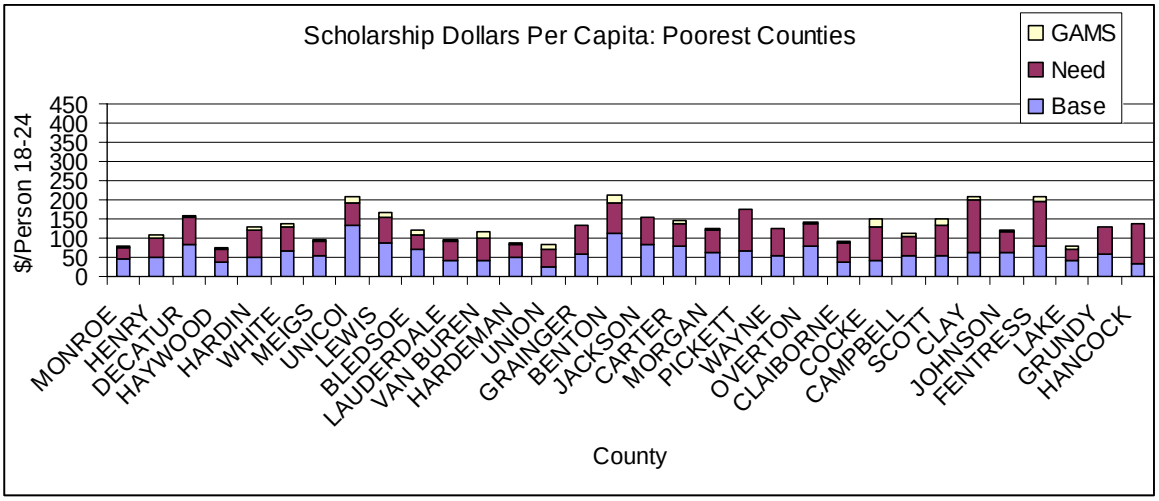


Figure 2.3

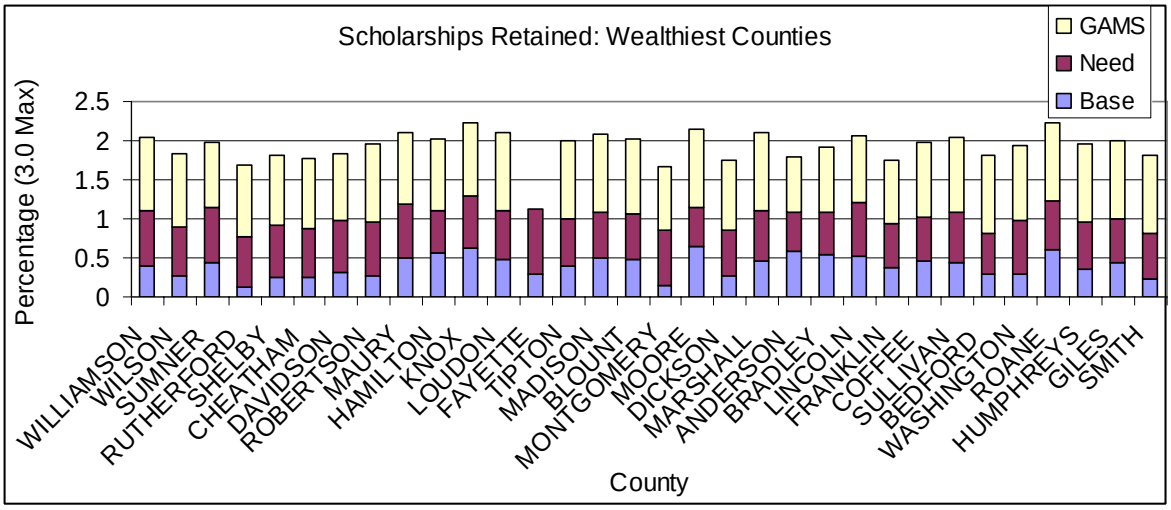


TELS also provided the number of those scholarships retained the next year in each county. These students met the academic standards required; students who lost their scholarships failed to maintain a 3.0 GPA during their first year. Retention is a reflection of the academic preparedness of the student, and thus is a revealing metric for evaluating the effectiveness of the Scholarship program. If students who receive scholarships are unable to cut it in college classes, then it is an indication that their high school may have prepared them inadequately. (See Figure 3. Each retention rate is measured as a percentage of the original type of scholarship, i.e., percentage of base retained, percentage of need retained, etc. A county that retained all the scholarships it originally received would read a "300%" on the graph.) No county achieves greater than 70% retention of the original scholarships awarded.

Figure 3 – Percent of Scholarships Retained

Counties are ranked from highest average income to lowest,
i.e., Williamson has the highest average income in the state, and so on.
Scholarships are measured as the percent of the original number of that type that were retained;
If all students had retained their scholarships, the county would show a 300% score on the y-axis.

Figure 3.1



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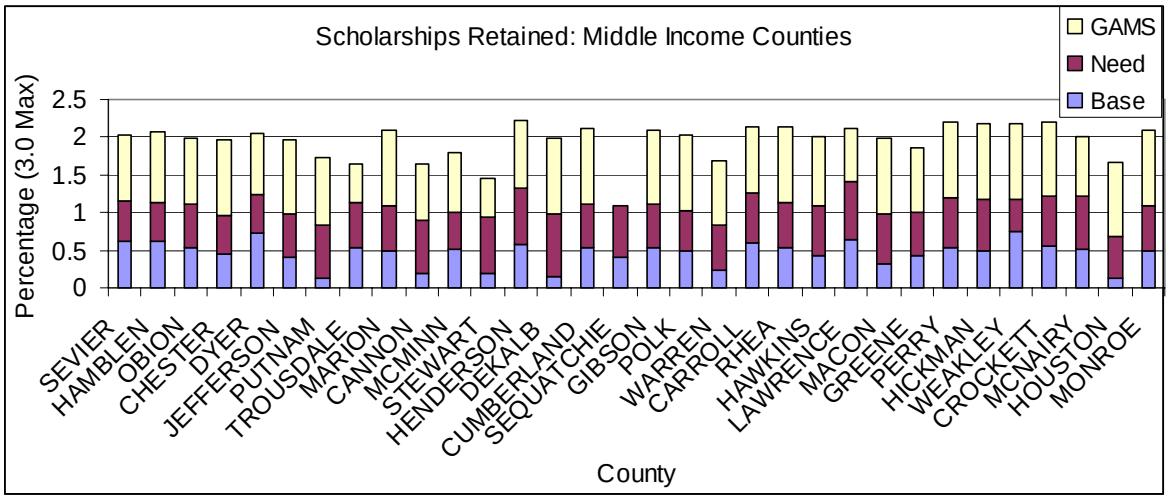
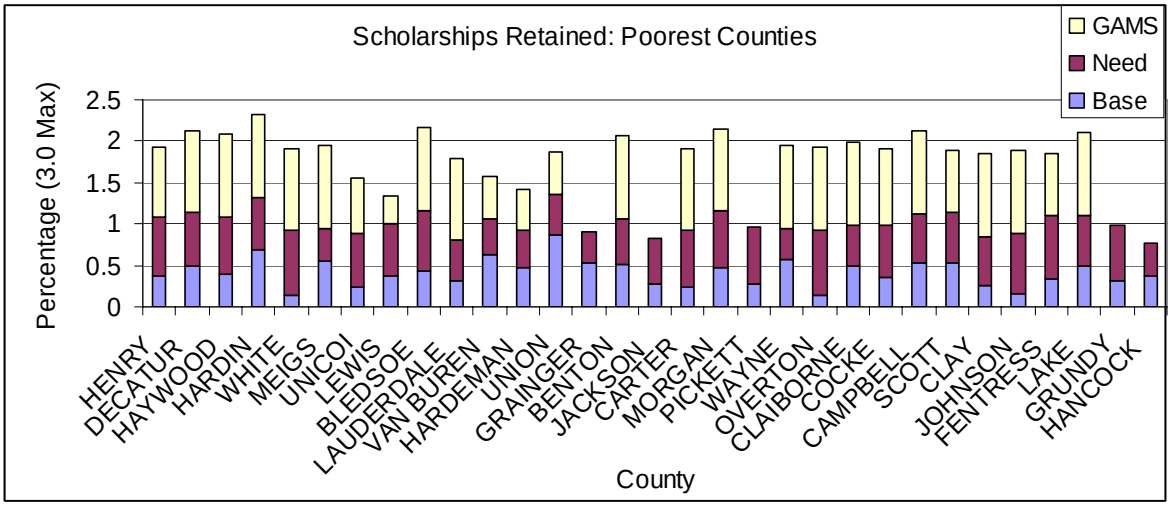


Figure 3.3



To measure high school quality, I obtained standardized test scores from the 2005 school system report cards published on the Tennessee Department of Education website. Both ACT scores and pass/fail rates of End of Course (EOC) exams were available. Not every student is required to take the ACT, so the End of Course exams were a better estimate of the overall quality of education available in the county. Some schools did not report their End of Course exam scores, or reported only certain subjects; but these were few and far between. In cases where a county contained more than one school district, I combined them with a weighted average. There is a great deal of variation in the scores, as can be seen in Figure 4. Gaps in the chart indicate where counties have not reported data for 2004-2005.

Figure 4 – English End of Course Exam Failure Rates

Counties are ranked from highest average income to lowest,
i.e., Williamson has the highest average income in the state, and so on.

Figure 4.1

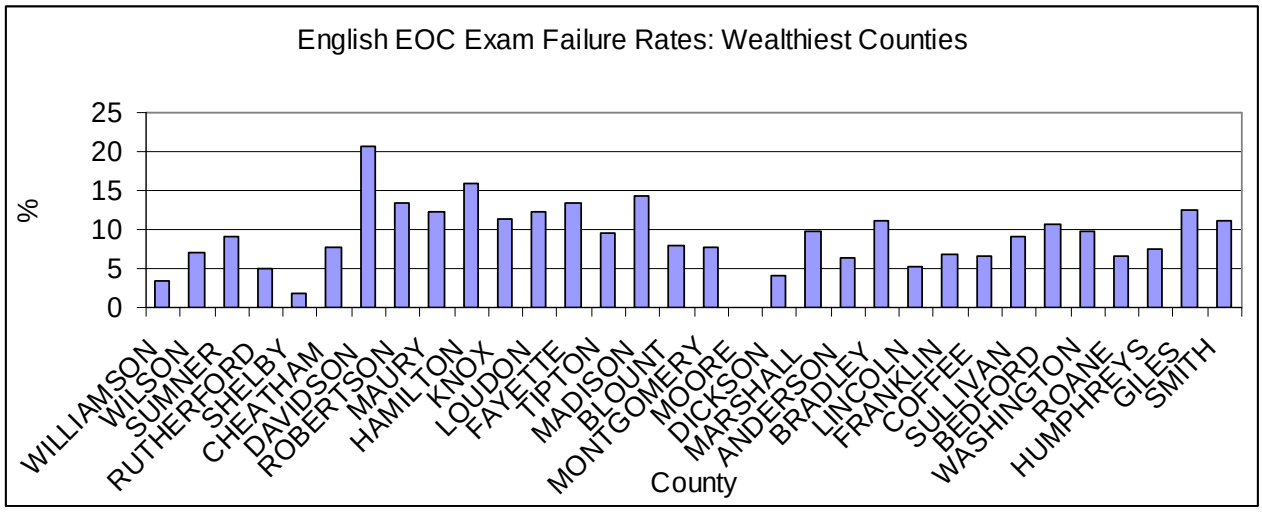


Figure 4.2

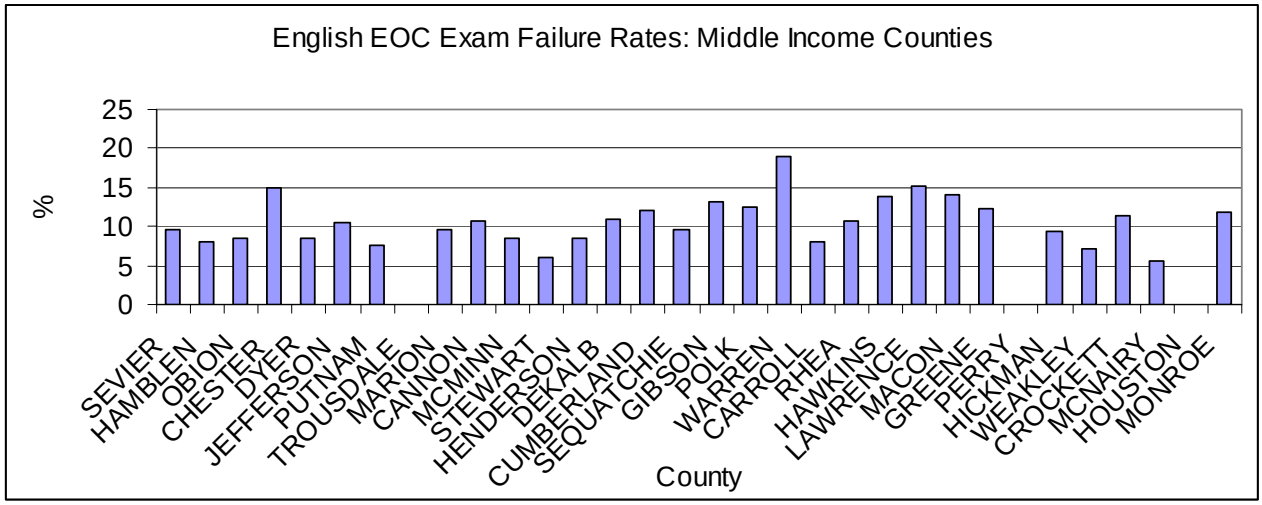
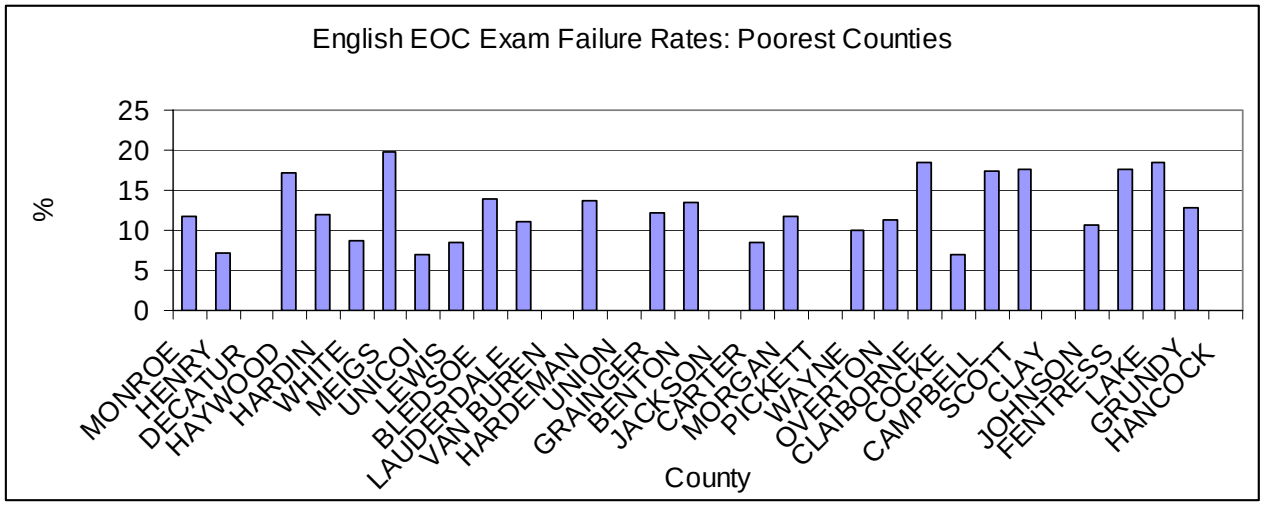


Figure 4.3



All other variables I obtained from the 2000 United States Census. Race, income, gender, and household type are all measured as a percentage in order to control for differences in total population across counties. I included race not as an explanatory variable but as an indicator of omitted variable bias. Minorities go to college less often than whites, but this is due to the fact that race and income vary strongly together, and is not attributable to any inherent racial characteristics. Ideally, when all relevant variables have been included properly, race should be statistically insignificant, and make no difference when dropped from the model. I include it as a signal that other factors have been accounted for.

Income is measured as the percentage of households that earn less than $35,000 a year. As the cutoff point for the need-based supplement is $36,000, this seemed to be the most useful measure. Since more girls attend college than boys, gender is included and measured as the percentage of the population who are female. Single parent households tend to have lower incomes, and thus lower college participation rates. They are measured as the percentage of single parent households in the total population of all households with children.

Level of education is measured as the percent of people aged 18-24 who are high school graduates. The opportunity cost of going to college is the income the student foregoes by spending time in class instead of on the job. In counties where low-skilled, well-paying jobs are readily available, students may be more likely to choose the short-term sure thing rather than the delayed gratification of a degree and a higher salary. I chose farming, mining, and manufacturing to represent the presence of those low-skilled careers, and measured them as a percent of the population employed in them. This variable also gives insight into the education level of previous generations, who did not require college degrees themselves to acquire these jobs.

Table 3 – Summary of Variables

Dependent Variable	Scholarship $ / population 18-24			
	Mean	*Std. Dev.*	*Minimum*	*Maximum*
	149.644	48.677	66.532	408.075
Independent Variables	Race: percent white			
	Mean	*Std. Dev.*	*Minimum*	*Maximum*
	0.904	0.110	0.467	0.996
	Income: percent < $35,000			
	Mean	*Std. Dev.*	*Minimum*	*Maximum*
	0.542	0.089	0.216	0.738
	Education level: percent of population 18-24 who are high school graduates			
	Mean	*Std. Dev.*	*Minimum*	*Maximum*
	0.409	0.077	0.228	0.555
	Opportunity cost: presence of careers available to high school graduates			
	Mean	*Std. Dev.*	*Minimum*	*Maximum*
	0.294	0.082	0.095	0.445
	High school quality: EOC failure rates			
	Mean	*Std. Dev.*	*Minimum*	*Maximum*
	9.506	5.031	0	20.600
	Gender: percent female			
	Mean	*Std. Dev.*	*Minimum*	*Maximum*
	0.514	0.022	0.378	0.550
	Household type: single parent families			
	Mean	*Std. Dev.*	*Minimum*	*Maximum*
	0.332	0.087	0.150	0.670

I used these variables in a series of linear regressions to explore the explanatory power of each variable and their interactions with each other.

Results

The first model I tested included all seven independent variables to explain the total scholarship award for each county. (See Table 4.)

Table 4 – Full Model Regression Results

$R^2 = 0.456$		$N = 95$	
Total Award	$\hat{\beta}$	*p*-value	Significance
percent white	99.603	0.131	Insignificant
percent low income	-184.691	0.004	Highly Significant
percent high school graduates	149.654	0.018	Significant
percent employed in low-skill jobs	-130.017	0.043	Significant
English EOC failure rate	-1.689	0.049	Significant
percent female	279.051	0.151	Insignificant
percent single parent household	-77.178	0.330	Insignificant
Constant	35.050	0.775	~

At a 95% confidence interval, race, gender, and household type are all statistically insignificant. As I had hoped, race and single parent households are highly correlated (rho = 0.7715) to each other, and were causing the regression to give a distorted image of events. When race was removed, every remaining variable except gender was statistically significant (see Table 5). Significant variables have predictive and explanatory power in the model.

Table 5 – Refined Model Regression Results

$R^2 = 0.405$			$N = 95$
Total Award	$\hat{\beta}$	*p*-value	Significant/Insignificant
percent low income	-147.241	0.012	Significant
percent high school graduates	153.374	0.016	Significant
percent employed in low-skill jobs	-132.910	0.040	Significant
English EOC failure rate	-1.844	0.032	Significant
percent female	335.276	0.082	Slightly Significant
percent single parent household	-172.154	0.001	Highly Significant
Constant	108.219	0.341	~

Interpreting results from a linear regression is far more simple that it at first appears. Holding all else constant, a one unit increase in any of the significant independent variables leads to a $\hat{\beta}$ unit increase in the dependent variable. For example, in this model, the $\hat{\beta}$ for percent low income is -147.241; so, for a one percent increase in low income people, the county can expect to receive about $147.24 fewer scholarship dollars per capita.

The coefficient of the income variable is negative and significant, meaning that as the percentage of low-income residents drops, scholarship dollars awarded to the county increase. The same is true of the presence of careers available to high school graduates – as the number of jobs decreases, the amount of scholarship awards go up. Single parent households show an even stronger negative connection to the total scholarship amount. For every one percent increase in single parent households, scholarship dollars per capita will decrease by $172.15. Because high school quality is measured as a rate of failure, its coefficient is negative as well; as the failure

rate decreases, scholarships increase. Gender is slightly significant, which is not surprising, given the small margins between male and female populations both in higher education and the world at large. It is also positive, indicating that the more girls outnumber boys, the more scholarship dollars per capita will be won by the county. This outcome is a reflection not only of the fact that girls tend to academically outperform boys and are more likely to go to college, but also may be affected by affirmative action programs that benefit women. The more high school graduates exist in the potential pool of scholarship recipients, the higher the scholarship allocation climbs. After race was dropped, the model behaves as I predicted it would.

Regression models can also be used for prediction as well as explanation. The results from Table 5 yield the estimated equation presented in Equation 2 below.

Equation 2

$$TotalAward = 108.2 - 147.2x_1 + 153.4x_2 - 132.9x_3 - 1.8x_4 + 335.3x_5 - 107.6x_6 + \varepsilon$$

Variables $x_1 - x_6$ represent the six variables (in order) from Table 5. Epsilon (ε) is the error term and is assumed to be "white noise" in the model. By replacing the *x*'s with the corresponding values from any county, the equation gives an estimate for the total award for that county.

With the model thus established and refined, I examined the individual types of scholarships that were created so that the scholarship program could be tailored to the needs of the state, and thus lessen the distributive effects of merit-based scholarships. Using the refined model, I regressed the amount of scholarship dollars of each type per capita as a function of the same independent variables. (See Table 6.)

Table 6 – Regression Results by Scholarship Type Compared to Total Award

Independent Variable	*Base HOPE*	*with Need*	*with GAMS*	*ACCESS*	*Total Award*
percent low income	* $\hat{\beta}_1$ = -252.901	* $\hat{\beta}_1$ = 136.472	* $\hat{\beta}_1$ = -29.766	$\hat{\beta}_1$ = -1.038	* $\hat{\beta}_1$ = -147.241
percent high school graduates	** $\hat{\beta}_2$ = 76.419	* $\hat{\beta}_2$ = 71.281	$\hat{\beta}_2$ = 4.191	$\hat{\beta}_2$ = 1.484	* $\hat{\beta}_2$ = 153.374
percent employed in low-skill jobs	$\hat{\beta}_3$ = -61.208	* $\hat{\beta}_3$ = -59.942	$\hat{\beta}_3$ = -12.672	$\hat{\beta}_3$ = 0.912	* $\hat{\beta}_3$ = 132.910
English EOC failure rate	$\hat{\beta}_4$ = -0.937	* $\hat{\beta}_4$ = -0.736	$\hat{\beta}_4$ = -0.162	$\hat{\beta}_4$ = -0.001	* $\hat{\beta}_4$ = -1.844
percent female	$\hat{\beta}_5$ = 122.763	* $\hat{\beta}_5$ = 169.490	$\hat{\beta}_5$ = 37.333	** $\hat{\beta}_5$ = 5.690	$\hat{\beta}_5$ = 335.276
percent single parent household	* $\hat{\beta}_6$ = -107.597	* $\hat{\beta}_6$ = -53.328	$\hat{\beta}_6$ = -12.940	* $\hat{\beta}_6$ = 1.710	* $\hat{\beta}_6$ = -172.154

* = variable is significant at 95% confidence
** = variable is significant at 90% confidence

In the ACCESS remedial scholarship model, single parent households were significant and gender was weakly significant. Despite their need-based component, ACCESS grants do not show a strong link to low-income students; instead, remedial students are more likely to come from households with only one parent. Only 100 ACCESS grants are given each year, so this effect warrants further scrutiny with a more precise dependent variable.

Income was significant across the board in the other types of scholarships, but it is positive when predicting the allocation of scholarships with need-based supplements and negative in all other models. Since these scholarships are given to families with incomes under $36,000, as the percentage of households under this income level increase, the number of need-based scholarships also increase. This was the intent of the TELS program architects, but the negative coefficient on the total scholarship allocation indicates that it is not enough to overcome the overall bias toward high income students.

Quality of education remains a factor in determining scholarship payouts, but has less of an effect on need-based allocations than the base HOPE scholarship, which points to a possible link between income and high school quality. Low income applicants can perform poorly and still have a chance at scholarship funds, even though they are likely to be less prepared to succeed in college. In Tennessee, then, the conundrum does exist: students in the most financial need who stand to gain the most from scholarships tend to be the least academically ready for college, and furthest from the margin of choosing to attend higher education at all.

Conclusions

Systems often have unexpected effects on their surroundings. I hypothesized that the system created by the Tennessee Education Lottery was resulting in a redistribution of income from the undereducated poor to the well-educated wealthy. The results of my analysis confirm this hypothesis. Combined with the assumption that those who pay the costs of the system tend to be lower-income and have fewer years of formal schooling, my models show that those reaping the benefits of the system are disproportionately wealthy and better educated. The result is a flow of income from those who pay the costs to those who reap the benefits. In the long run, the entire state of Tennessee will benefit from the additional investment in education; but in the meantime, some individuals benefit more than others.

Tennessee policymakers are attempting to use the Lottery as a revenue-generating tool while toning down the distributive inequities in the allocation of scholarship money by offering various supplements to the base amount. Their efforts have, to a limited extent, paid off. But the fact is, inequalities in education begin far earlier than college. Elementary and secondary schools in tax-starved districts are not able to provide the same level of service as well-funded

schools in other areas; that is where the inequalities begin. Since race and income tend to vary together, racial inequalities can also be traced to this stage. By the time a student reaches high school graduation, short term financial concerns are secondary to the fact that, despite potential, native intelligence or drive, they are hampered by a lack of effective preparation for the rigorous demands of college. When students are not prepared to continue their education, it is likely they will not be encouraged to do so. For many students, the fact that they might have trouble paying for it is not what makes a degree an unattainable commodity.

The Tennessee Education Lottery Scholarship has the potential to accomplish its goal of making higher education an option for every student, no matter their family's financial status. But if state officials desire to eliminate racial and income inequities in college attendance, they must move beyond creating equal opportunity to the formation of equally qualified students who can take advantage of those opportunities. Only then will the redistribution of income observed in this study be diminished.

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