

**Are Voting and Buying Behavior Consistent? An Examination of the South Carolina
Education Lottery**

Linda S. Ghent
Eastern Illinois University
lsghent@eiu.edu

Alan P. Grant
Eastern Illinois University
apgrant@eiu.edu

May 2006

I. Introduction.

The past twenty years have witnessed the proliferation of state-operated lotteries. Typically, though not always, the establishment of a licit market for lottery tickets is preceded by a popular vote on the issue. This naturally begs the question whether the same characteristics that determine persons' voting behavior are reflected *ex post* in their lottery ticket purchasing behavior.

This paper examines voting and sales data from the South Carolina Education Lottery which was established in 2000. Using county-level demographic and economic information, the study looks for similarities between voting and buying behavior. While some aspects of behavior in both political and economic markets display consistency, there exist many clear distinctions between the two.

II. Background.

The South Carolina Education Lottery was established by voter referendum in the Fall of 2000. At the time of the lottery vote, gambling was not new to South Carolina. From the late 1980s through the end of the 1990s, video poker thrived in the state. However, responding to pressure from anti-gambling groups, the state legislature scheduled a November 1999 referendum on eliminating video poker. The referendum never took place; instead, a decision by the South Carolina Supreme Court effectively banned video poker beginning in July 2000. Thus, at the time of the lottery referendum, the only form of legalized gambling in the state had been shut down. The lottery referendum passed, with 56 percent of voters choosing in favor of the state lottery.

III. Review of the Literature.

Early research on the economic effects of lotteries concentrated on the regressive nature of the lottery tax (Clotfelter, 1979; Clotfelter and Cook, 1987). More current research can be divided into two issues: those examining a state's adoption of a lottery and those interested in determining the factors that determine the demand for or expenditures on lottery products.

Lottery Adoption

Much of the analysis concerning lottery adoption focuses on the factors that affect legislator incentives. These include economic variables such as the fiscal health of the state government, along with general characteristics that reflect the preferences of their constituents, such as religious beliefs. For example, in an early study by Filer et al. (1988), the authors use a model of rational legislator behavior to examine the pattern of lottery adoption across the United States. Specifically, the authors estimate a probit model of lottery adoption and a tobit model to analyze the timing of lottery adoption. They find that states with a heavy tax burden are more likely to adopt lotteries and adopt them earlier than states with relatively lower tax burdens. In addition, they find that states with a lower percentage of households in poverty are more likely to adopt a lottery. Factors such as the education levels or religious beliefs of the population were not found to significantly alter the likelihood or timing of lottery adoption. Last, unlike later studies, Filer et al. do not find a relationship between one state's decision to adopt a lottery and the presence of a lottery in a bordering state.

In another early study by Martin and Yandle (1990), the authors estimate state adoption of a lottery as a function of per capita income, state debt per capita, tax burden, police costs per capita, and religious beliefs. They find a positive relationship between per capita income and

lottery adoption, which they interpret as a desire of those with higher income to redistribute income in their favor. Fiscal health (as measured by the amount of debt in a state) is shown to be inversely related to the adoption of lotteries; however, it also appears that legislators adopt lotteries in order to keep tax rates low. Finally, the proportion of the state's population with conservative religious beliefs reduces the likelihood of lottery adoption.

Alm et al. (1993) use a discrete-time hazard model to examine the timing of lottery adoption. They also determine that a state's fiscal health, namely its short-term debt per capita, is an important factor that influences the introduction of a state lottery. However, Alm et al. find no indication that state taxes affect this decision. Neighboring state lottery competition appears to play a significant role in lottery adoption. This is not surprising as Stover (1990) finds that contiguous state lotteries are in fact substitutes.

Two studies by the same set of authors [Caudill et al. (1995) and Mixon et al. (1997)] use a pooled yearly time-series of state-level cross sections for 1964 to 1989 to also estimate a discrete-time hazard model of lottery adoption. Their results are similar to those from previous studies, with per capita income and the presence of a lottery in a neighboring state having positive effects on the likelihood of lottery adoption. The proportion of the population that is Baptist is negatively related to the probability a state has a lottery. In addition, the authors find in both studies that the probability of lottery adoption is greater in states where gambling is legal.

Erekson et al. (1999) also focus on the fiscal health of a state in their analysis of lottery adoption. Two separate indicators of fiscal health are used – a one-year lagged variable equal to state revenues minus expenditures divided by expenditures and several gauges of adjustments in the state's tax base as measured by changes in manufacturing, service, and government services earnings per capita. As expected, the authors find that lottery adoption is inversely related to a

state's fiscal health. Other independent variables, such as income per capita, religion, and an indicator variable that a neighboring state has a lottery all have the predicted signs and are statistically significant.

Lottery Demand

As mentioned above, another focus of the lottery literature has been the factors that influence lottery play. Scott and Garen (1994) examine both the probability that an individual plays the lottery along with the level of lottery expenditures using a sample of Kentucky households. Using a maximum likelihood estimation two-step procedure developed by Heckman (1979), they find that prior gambling experience, unemployment, and being Catholic all raise the probability of playing the lottery. In general, higher education, being married, or being a Neofundamentalist Protestant reduce the likelihood that an individual is a lottery player. Both age and income have positive, but declining effects on the probability of lottery play, reaching maximums at age 25 and an income of \$30,000.

Interestingly, Scott and Garen find little impact of these same independent variables on an individual's level of lottery play. Previous gambling experience, marital status, age, income, education, and religion all have statistically insignificant effects on the amount an individual spends on the lottery, controlling for the probability that he or she plays the lottery at all. While race had no impact on the probability of play, the authors also find that nonwhites have higher lottery expenditures than whites. Thus, according to the results in this study, the factors that determine the demand for lottery play depend upon how "demand" is defined. The variables that impact whether an individual is a lottery player are not the same as those that determine how many lottery tickets he or she purchases in a given period of time.

Jackson (1994) estimates a demand function for the Massachusetts lottery by examining lottery sales per capita for 104 cities and towns in 1983 and 1990. His results indicate that per capita income is positively related to lottery sales, while the proportion of the population with a college degree reduces sales. The estimated impacts of two demographic groups provided mixed results. The proportion of the population that was African-American positively increased lottery sales, but this effect was only statistically significant for 1983. The proportion of the population ages 65 and older had a deterrent effect on lottery sales in 1983; by 1990, the proportion of senior citizens was positively related to lottery sales.¹

Using data from Texas, Price and Novak (1999, 2000) estimate the demand for three lottery games in 1994 (Lotto, Pick 3, and instant). In these analyses, the authors find that key economic and demographic variables have differing effects on the demands for these three products.² For example, per capita income and the proportion of the population with a college degree both have a positive and significant impact on per capita sales of Lotto tickets, but a negative and significant effect on sales of instant tickets. A higher median age raises instant ticket sales, but lowers the sales of Lotto and Pick 3 games. As the male-female ratio rises, sales of Lotto tickets rise, while purchases of Pick 3 games fall. There is no effect of gender on the sales of instant games.

Race also appears to have interesting effects. As the proportion of the population that is African-American rises, sales of Pick 3 and instant games rise, while the sales of Lotto tickets fall. A larger Hispanic population increases purchases of instant tickets, but has no impact on sales of the other two games.

Rubenstein and Scafidi (2002) are also concerned with the distributional effects of the lottery. However, to examine these effects, they consider both household purchases of lottery

tickets along with the receipt of educational benefits (in the form of scholarships, pre-kindergarten, and education infrastructure) from lottery revenues. Like Garen and Scott, Rubenstein and Scafidi use the Heckman two-step approach to estimate household lottery expenditures. They find that income is positively related to the likelihood of playing the lottery, but has no statistically significant impact on lottery expenditures. Accordingly, higher education and regular church attendance lower the probability that an individual plays the lottery, but also have no effect on lottery spending. Their results on race match those of Garen and Scott – nonwhites had significantly larger expenditures on the lottery, but race had no significant effect on the probability of play.

Lottery Adoption and Demand

To our knowledge, Hersch and McDougall (1989) provide the only study which examines the adoption of a state lottery along with the determinants of lottery demand. The goal of their study of the Kansas lottery is to measure the extent to which voter preferences for a lottery (through a referendum) are related to the desire to purchase lottery tickets. Using county-wide voting and sales data, the authors conclude that the several of the determinants of voting and buying are not the same. Counties with large conservative religious adherents were less likely to vote in favor of the lottery. While per capita income seemingly had no effect on lottery voting behavior, income distribution did. In fact, Hersch and McDougall conclude, “that, relative to ‘lower middle income’ households, the other income classes favored the passage of the lottery (p. 34).” On the other hand, in the estimated sales equations, religion appears to have no influence and the income distribution variables provide mixed results.

Our study takes a similar approach to examine voting behavior and lottery purchases in South Carolina. However, we attempt to improve on the Hersch and McDougall study in two ways. First, since the dependent variable is the percentage of votes in a county in favor of the lottery (which can only vary from zero to 100), we use two-stage weighted least squares rather than OLS. Second, because there may be unobserved factors that systematically influence behavior of individuals who reside in the same region of the state, we test and control for spatial correlation.

IV. Empirical Estimation.

The Lottery Vote

As mentioned above, the South Carolina Education Lottery was approved by constitutional referendum in 2000, and implemented shortly thereafter. In contrast to other education lotteries, the legislation establishing the lottery contains substantive measures to ensure that lottery revenues supplement, rather than replace, general fund tax revenues earmarked for education.³ While the overall lottery vote leaned substantially in favor of passage (56 percent), South Carolina's 46 counties differed markedly in their support for the measure, with the vote ranging from 88 percent in favor at the upper limit to only 41 percent in favor at the lower bound. Despite the substantial overall margin in the South Carolina referendum and the general spread of state lotteries nationwide, popular approval of a lottery initiative is never certain: Alabama voters rejected a lottery shortly after the South Carolina vote, and North Carolina failed to establish a referendum on the same question.⁴

Differences in voter preference for the lottery may reflect both social and economic considerations. At first glance, the decision to vote for a lottery can most easily be attributed to a latent demand to play the lottery; the stronger the aggregate desire to play, the greater the popular approval should be. Others with no interest in playing the lottery may vote in favor of its establishment in order to free-ride on the play of others. Philosophical considerations may also play a role in voter behavior. For example, voters may believe that gambling is inherently sinful, or they may object to the empirically regressive nature of the lottery as a means of raising revenue. These voters may vote “no” in order to prevent others from playing.

Following Hersch and McDougall and other studies of lottery demand, a cross-sectional voter approval regression is specified with both demographic and economic measures used as explanatory variables. Demographic variables include AGE65 (the proportion of county population over the age of 65), RELIGION (the percentage of the county population regularly attending an evangelical protestant or traditional black church), BLACK (the proportion of the county’s residents who are African-American), and EDUCHS (the percentage of the county population over the age of 25 with at least a high school diploma).⁵ Prior studies [see Caudill, et al. (1995) and Ellison and Nybrotten (1999), who assert that religious beliefs are perhaps the most important predictor of lottery opposition] suggest a negative coefficient for RELIGION, which reflects moral opposition to gambling. Other studies indicate a negative coefficient for EDUCHS (Rubenstein and Scafidi, 2002), and a negative coefficient for AGE65.⁶

Economic variables in the VOTE regression account for both the level and distribution of income. The level variable, PCI, is per capita county personal income.⁷ As in Hersch and McDougall, the distribution of income, holding mean income constant, is modeled by the inclusion of LOWINC (the proportion of county households earning less than \$15,000 per year),

UMINC (upper-middle income households earning between \$35,000 and \$50,000 per year), and HINC (high-income households earning over \$50,000 per year).⁸

Inclusion of the income-level variable reflects in part the latent demand for lottery tickets. A positive coefficient would be an imperfect indicator that lottery play is a normal good, with a negative coefficient revealing lottery play as inferior.⁹ Inclusion of the distribution variables captures the empirically regressive nature of lottery sales. More significantly, inclusion of the income level and distribution variables may reflect public finance considerations. For example, various income groups may vote for the lottery in an effort to shift the financial burden of state programs from taxpayers to lottery players, or because they believe they will benefit from the programs the lottery revenue finances. This hypothesis is at the core of Hersch and McDougall's analysis, and has also been suggested by Mixon et al. (1997), and by Martin and Yandle (1990). Because upper-middle and high income households often bear a disproportionate burden of taxes, it is likely that UMINC and HINC will be positive if these public finance considerations are important.

In addition to income, other economic considerations may affect the lottery vote. One such factor is the stated intent of the lottery to provide funding for public education. Persons living in underperforming school districts may feel compelled to vote for the lottery in hopes of improving the performance of their schools. G6TEST measures the performance of a county's 6th graders on a statewide, standardized exam assessing performance in language arts and mathematics, and has an expected negative coefficient.

Finally, we include several variables to account for the distribution of South Carolina's counties along the state borders. Martin and Yandle (1990) argue that states adopt lotteries to compete with other licit and illicit gambling activities, and suggest that a state's adoption of a

lottery is more likely if that state abuts another that has already established a lottery. While Martin and Yandle do not explicitly test this hypothesis, Alm et al. (1993) find that preventing outflows of lottery dollars has become an increasingly important factor in lottery adoption, a result confirmed by Stover (1990), and Caudill et al. (1995). Most recently, Garrett and Marsh (2002) find that cross-border lottery shopping is significant, and that the amount of cross-border shopping depends on the size of the retail sector in the relevant border county.

South Carolina abuts North Carolina to the north and Georgia to the southwest. At the time of the South Carolina referendum, Georgia had a state lottery; North Carolina did not. We hypothesize that people in the Northern border counties (indicated by BORDER1) may display increased desire to establish a lottery in hope of attracting players from North Carolina. Similarly, southwest counties (indicated by BORDER2) may vote defensively in favor of the lottery to keep South Carolina residents from playing the Georgia Lottery. As suggested by Garrett and Marsh (2002), we suspect that border counties with strong retail sectors may be particularly interested in establishing a state lottery. Specifically, they stand to benefit through retail sales to persons who cross borders to play the lottery. Thus, we construct both BORDER1 and BORDER2 as indicator variables, weighted by the percent of the county population employed in retail. We expect coefficients for both of these variables to be positive and of approximately the same magnitude.

The dependent variable in the VOTE regression reflects voter approval. Individual South Carolina voters faced a binary choice of either voting for or voting against establishment of the lottery. These votes were aggregated into grouped data by county, with n_i denoting the number of votes cast and P_i denoting the proportion of votes cast in favor of the lottery. Because proportions data such as P_i is bounded above and below, we follow econometric procedures

outlined in Greene (2000). Grouped data are transformed into logit form, where Y_i is the measure of voter approval, expressed as a function of the independent variables, X_i ,

$$(1) \quad Y_i = \ln[P_i / (1 - P_i)] = X_i\beta + \varepsilon_i.$$

Estimation of (1) using OLS produces heteroscedastic errors. Greene suggests using a two-stage weighted least squares algorithm in which (1) is estimated by OLS in the first stage, and the fitted values of Y , denoted y_i , are used to generate estimates of P , denoted \hat{p}_i .

Specifically,

$$(2) \quad \hat{y}_i = X_i\hat{\beta} \text{ and}$$

$$(3) \quad \hat{p}_i = e^{\hat{y}_i} / (1 + e^{\hat{y}_i}).$$

Values from equation (3) are then used to generate appropriate weights, w_i , for re-estimation of (1). Specifically,

$$(4) \quad w_i = n_i\hat{p}_i(1 - \hat{p}_i).$$

The two-stage procedure is completed with estimation of (1), incorporating the weights generated in (4). Following Garrett and Marsh, we modify (1) to test for spatially correlated errors. Specifically, we estimate

$$(5) \quad Y_i = X_i\beta + \rho MY_i + \varepsilon_i,$$

where M is a $(N \times N)$ spatial weights matrix and other variables are as defined above.¹⁰ Rho, the spatial autoregressive coefficient, reflects positive spatial correlation if $\rho > 0$, negative spatial correlation if $\rho < 0$, and no spatial correlation if $\rho = 0$. Results are presented in Table I.

Demographic variables have a mixed influence on the lottery vote. Religious adherence, as suggested by the bulk of the existing literature, plays a substantial role in determining voting behavior; the RELIGION variable is negative and significant at the 1 percent confidence level.

Race has been ignored by most previous studies of lottery adoption (see, for example Hersch and McDougall, 1988) and in others has been shown irrelevant with respect to approval or disapproval (see Ellison and Nybrotten, 1999). Our study, however, finds a strong positive coefficient for BLACK, indicating a significant difference in voting behavior between African-Americans and whites in South Carolina.

Education turns out to have little influence over the lottery vote, with less-educated counties voting only slightly (and insignificantly) more in favor than their more-educated counterparts. Finally, despite prior expectations, the age distribution appears to have little impact on individual's willingness to vote for the lottery.

Income variables have mixed influence over the lottery vote. The negative and significant PCI coefficient indicates that at the margin, an extra dollar of average income reduces one's desire to vote for the lottery. This suggests the economic inferiority of lottery play; in the next section of this paper, we examine whether this latent-demand coefficient is consistent with the income-level coefficient in a displayed-demand regression. In contrast to the Hersch-McDougall study, which finds that the shape of the income distribution matters, income distribution appears to have little influence over the lottery vote in South Carolina - counties with equal, but differently distributed, average income levels do not significantly differ in their voting behavior.

We find that G6TEST is negative and significant, indicating that people in underperforming school districts are more likely to vote in favor of the lottery.¹¹ This is consistent with prior expectations. Given the nature of the lottery constitution, voters can expect establishment of the lottery to increase education budgets; voters in underperforming districts are more likely to see this additional funding as an important priority. Furthermore, our border

variables are each consistently signed and highly significant, indicating that residents of border counties are substantially more likely to vote in favor of the lottery. As suggested in Garrett and Marsh (2002), we suspect that the promise of drawing cross-border shoppers from North Carolina underlies the BORDER1 coefficient. Similarly, the chance to defend against an existing outflow of lottery dollars and associated retail expenditures results in a highly significant statistic in the counties that border Georgia. Finally, we find evidence of, and correct for, strong positive spatial correlation in our regression specification.

Lottery Sales

The essence of this study is to determine whether agents exhibit consistent behaviors in their voting and buying behaviors. To that end, we assess whether the factors that determine voter approval also determine sales. County sales data from the first two years of operation of the South Carolina Education Lottery are normalized by county population to generate a SALES variable. As was the case with the lottery vote, we express SALES as a function of demographic, income, and other economic variables.¹² In addition, we include the predicted p_i (\hat{p}_i) as an additional explanatory variable to examine consistency in voting and buying behavior.¹³

Expressing SALES as a function of demographic, income, and other economic variables, as well as the predicted proportion of voters in favor of the lottery, we obtain

$$(7) \quad SALES_i = X_i\alpha + \delta\hat{p}_i + \eta_i. \quad ^{14}$$

Estimation of (7) was performed using OLS; results are presented in the first column of Table II. Inspection of δ , the coefficient for predicted p_i , allows us to compare voting and buying behavior. It appears that there is little additional information in estimated voting preferences on

lottery purchases that is not already captured by the regressors included in the SALES estimation.

Given the insignificant coefficient on \hat{p}_i and the potential for collinearity that inclusion of voter behavior presents, dropping predicted p_i as an explanatory variable allows us to firm up estimates of the other coefficients. Re-estimation of (5) with \hat{p}_i excluded yields the results presented in the second column of Table II. We can now conclude with authority that there is little information in voter behavior relevant to buying behavior that is not already captured in the demographic and economic regressors. The exclusion of voter behavior as an explanatory variable does little alter the explanatory power of the regression, nor does the exclusion of voter behavior cause substantial change in the sign, magnitude, or significance of the other regressors; coefficients are quite robust whether it is included or not.

The results of the SALES regression are quite striking, especially when contrasted to the VOTE regression discussed above. While religion was arguably the strongest determinant of voter behavior, it appears to play little role in shaping buyer behavior - once a lottery is established, even those who violently opposed the lottery on moral grounds appear no less willing to play that lottery than their less-fundamentalist peers. These results confirm to some extent what is suggested in both Garen and Scott (1990) and Rubenstein and Scafidi (2002), both of whom separate the decision to participate from the *level* of participation. In each of these studies of lottery demand, fundamentalism does not significantly affect either the decision to participate or the level of play; our results suggest that fundamentalists might exhibit *ex ante* opposition to the lottery, coupled with an *ex post* desire to play the very lottery they oppose. We find similar inconsistency in the behavior of the aged. While having a more aged population

makes little difference in the lottery vote, it appears to have a strong sales impact, with older voters spending significantly more on the lottery.

Finally, we find that African-Americans, who voted significantly more in favor of the lottery than their non-black peers, appear also to exhibit a higher level of lottery play. Here, voting and buying behavior are consistent; African-Americans appear to be voting for the lottery, at least in part, in order to play.

The VOTE regression suggested the economic inferiority of lottery play. These results are confirmed when the income variable is included in the displayed-demand regression above. Here, as above, the coefficient on income is negative and significant at the 10 percent level. This offers the loose suggestion that residents of wealthier counties are less likely to play the lottery, *ceteris paribus*. Perhaps more interesting are the income distribution variables; holding income constant, counties with a higher proportion of wealthier residents display a significantly greater propensity to play the lottery than counties with a more uniform distribution of income.

We conclude our study of lottery sales by inspecting the BORDER variables. BORDER1 is positive and significant, and indicates that counties along the northern border of the state experience greater-than-average sales than other counties. We hypothesize that this is due to cross-border shopping by North Carolina residents. Just as interesting is the insignificant BORDER2 coefficient - counties that border Georgia (which already has a lottery) appear to have sales equivalent to non-border counties. From this, we conclude that the South Carolina lottery has successfully stemmed a pre-existing outflow of lottery dollars into Georgia. Unlike northern border counties, southern counties did not experience an abnormally large volume of sales. We hypothesize that this reflects the fact that Georgians already have lottery shopping opportunities at home, and thus have little need to cross-border shop.

V. Conclusions.

This paper seeks to establish a relationship between political and economic markets. Using county-level voting and sales data from the recently established South Carolina Education Lottery, we are able to conclude that there is little link between a voter's willingness to vote for a lottery and that same voter's willingness to play the lottery once established. We find that including both the predicted and residual components of the lottery vote adds no explanatory power to a SALES regression. We conclude that there is little relevant information contained in the vote that was not already captured by the other regressors. This result differs from that of Hersch and McDougall, who ultimately conclude that to some degree, voters were expressing a latent demand for lottery play.

Second, an inspection of other explanatory variables illuminates several interesting distinctions between voting and buying behavior. For example, moral considerations play a larger role in voter behavior than in buyer behavior; the devout appear to be far more willing to play a lottery once established than they are to vote for its approval in the first place. Similarly, the aged appear to be no more likely to vote for the lottery, but exhibit substantially more play. We conclude that, at least in these cases, voting and buying behavior are not strongly linked. The interpretation of other regressors does allow us to posit some degree of interconnectedness. Both the income and race controls displayed consistent signs and significance across regressions. This allows us to assert that at least some voters voted in favor of the lottery in order to gain the chance to play.

Finally, a third motive for establishing the state lottery centered on the lottery status in neighboring states. In addition to providing additional funding for education (as indicated in the VOTE regression), the state government must have also been anxious to stem the flow of dollars

being spent on the neighboring Georgia Lottery and equally desirous of drawing in lottery dollars from North Carolina. By all accounts, these desires have been satisfied. Counties bordering Georgia display no less tendency to play the lottery than their inland neighbors, but counties on the northern border have significantly stronger sales that, we hypothesize, result from the play of North Carolina residents. These points, combined with our general test for a voter/buyer link, strongly suggest that public finance considerations may be an important determinant of one's willingness to vote in favor of a lottery's establishment.

References.

- Alm, J., M. McKee, and M. Skidmore. 1993. Fiscal Pressure, Tax Competition, and the Introduction of State Lotteries. *National Tax Journal* 46(4): 463-76.
- Borg, M. O. and P. M. Mason. 1988. The Budgetary Incidence of a Lottery to Support Education. *National Tax Journal* 41(1): 75-85.
- Brinner, R. E. and C. T. Clotfelter. 1975. An Economic Appraisal of State Lotteries. *National Tax Journal* 28(4): 394-404.
- Caudill, S. B., J. M. Ford, F. G. Mixon, Jr., and T. C. Peng. 1995. A Discrete-Time Hazard Model of Lottery Adoption. *Applied Economics* 27: 555-561.
- Clotfelter, C. T. 1979. On the Regressivity of State-Operated Numbers Games. *National Tax Journal* 32(4): 543-547.
- Clotfelter, C. T. and P. J. Cook. 1987. Implicit Taxation in Lottery Finance. *National Tax Journal* 40(4): 533-546.
- Ellison, C. G. and K. A. Nybrotten. 1999. Conservative Protestantism and Opposition to State-Sponsored Lotteries: Evidence from the 1997 Texas Poll. *Social Science Quarterly* 80(2): 356-369.
- Erekson, O. H., G. Platt, C. Whistler, and A. L. Ziegert. 1999. Factors Influencing the Adoption of State Lotteries. *Applied Economics* 31(7): 875-84.
- Filer, J. E., D. L. Moak, and B. Uze. 1988. Why Some States Adopt Lotteries and Others Don't. *Public Finance Quarterly* 16(3): 259-83.
- Garrett, T. A. and T. L. Marsh. 2002. The Revenue Impacts of Cross-Border Lottery Shopping in the Presence of Spatial Autocorrelation. *Regional Science and Urban Economics* 32(4): 501-19.
- Garrett, T. A. and R. S. Sobel. 2002. State Lottery Revenue: The Importance of game Characteristics. The Federal Reserve Bank of St. Louis, Working Paper 2002-011A.
- Greene, W. 2000. *Econometric Analysis, Fourth Edition*. Upper Saddle River, New Jersey: Prentice Hall, Inc.
- Heavey, J. F. 1978. The Incidence of State Lottery Taxes. *Public Finance Quarterly* 6(4): 415-426.
- Heckman, J. J. 1979. Sample Selection Bias as a Specification Error. *Econometrica* 47(1): 153-61.

- Hersch, P. L. and G. S. McDougall. 1989. Do People Put Their Money Where Their Votes Are? The Case of Lottery Tickets. *Southern Economic Journal* 56(1): 32-38.
- Jackson, R. 1994. Demand for Lottery Products in Massachusetts. *Journal of Consumer Affairs* 28(2): 313-25.
- Martin, R. and B. Yandle. 1990. State Lotteries as Duopoly Transfer Mechanisms. *Public Choice* 64(3): 253-64.
- Mixon, F. G. Jr., S. B. Caudill, J. M. Ford, and T. C. Peng. 1997. The Rise (or Fall) of Lottery Adoption Within the Logic of Collective Action: Some Empirical Evidence. *Journal of Economics and Finance* 21(1): 43-49.
- Moffitt, R. 1983. An Economic Model of Welfare Stigma. *American Economic Review* 73(5) 1023-35.
- Price, D. I. and S. E. Novak. 2000. The Income Redistribution Effects of Texas State Lottery Games. *Public Finance Review* 28(1): 82-92.
- Price, D.I. and S. E. Novak. 1999. The Tax Incidence of Three Texas Lottery Games: Regressivity, Race, and Education. *National Tax Journal* 52(4): 741-51.
- Rubenstein, R. and B. Scafidi. 2002. Who Pays and Who Benefits? Examining the Distributional Consequences of the Georgia Lottery for Education. *National Tax Journal* 55(2): 223-38.
- Scott, F. and J. Garen. 1994. Probability of Purchase, Amount of Purchase, and the Demographic Incidence of the Lottery Tax. *Journal of Public Economics* 54(1): 121-43.
- Stover, M. E. 1990. Contiguous State Lotteries: Substitutes or Complements? *Journal of Policy Analysis and Management* 9(4): 565-68.

Table I: Voter Behavior
Dependent Variable = VOTER APPROVAL

Variable	Coefficient (T-statistic)
<u>Demographic Characteristics:</u>	
AGE65	0.0121 (0.69)
RELIGION	-1.288*** (-3.42)
BLACK	0.007* (1.74)
EDUCHS	-0.018 (-1.44)
<u>Income Measures:</u>	
PCI	-0.0001*** (-2.96)
LOWINC	-0.033 (-1.18)
UMINC	-0.069 (-1.46)
HINC	-0.003 (-0.16)
<u>Other Variables:</u>	
G6TEST	-0.011* (-1.97)
BORDER1	1.955*** (3.34)
BORDER2	4.044 (4.56)
ρ	0.520*** (4.92)
CONSTANT	17.0900** (2.26)
N	46
Adjusted R²	0.8235
* $\alpha < 0.10$ ** $\alpha < 0.05$ *** $\alpha < 0.01$	

Table II: Purchasing Behavior
Dependent Variable = SALES PER CAPITA

Variable	(1) Coefficient (T-statistic)	(2) Coefficient (T-statistic)
<u>Demographic Characteristics:</u>		
AGE65	39.29* (1.68)	36.96* (1.77)
RELIGION	410.44 (0.71)	346.62 (0.81)
BLACK	11.35* (1.87)	11.88** (2.34)
EDUCHS	-19.10 (-1.32)	-19.62 (-1.41)
<u>Income Measures:</u>		
PCI	-0.03 (-1.37)	-0.03* (-1.68)
LOWINC	51.75 (1.51)	50.26 (1.55)
UMINC	116.53 (2.10)	112.84** (2.25)
HINC	56.57** (2.30)	56.36** (2.33)
<u>Other Variables:</u>		
BORDER1	2437.31** (2.39)	2488.59** (2.60)
BORDER2	124.72 (0.07)	301.34 (0.24)
CONSTANT	-4465.03 (-1.56)	-4225.58* (-1.74)
Predicted p_i	149.56 (0.16)	----
N	46	46
Adjusted R²	0.2176	0.2394
* $\alpha < 0.10$ ** $\alpha < 0.05$ *** $\alpha < 0.01$		

Notes:

¹ However, Jackson also finds that the proportion of elderly do not impact the sales of Megabucks tickets, only number games and instant tickets.

² Garrett and Sobel (2002) argue that the demand for various lottery games should be estimated separately as game characteristics are also important determinants.

³Specifically, the legislation mandates that education receive at least the same share of the general fund post-lottery as it did pre-lottery. While this protection is not perfect, it does ensure that tax dollars are not simply replaced with lottery dollars as a source of school funding.

⁴ A more recent vote by the North Carolina legislature established a state lottery that began in April 2006.

⁵Data on religion is obtained from the 2000 Religious Congregations and Membership data collected by the Association of Statisticians of American Religious Bodies (ASARB) and published by the Glenmary Research Center. Education data are obtained from the Bureau of the Census.

⁶ Not all studies are in agreement as to the signs of these demographic variables. For example, Filer et al. (1988) find, in the context of a hazard model of lottery adoption, that both religion and education play no significant role.

⁷County per-capita personal income figures are obtained from the Bureau of Economic Analysis. Data on total population are obtained from the Bureau of the Census.

⁸These income distribution variables omit the percentage of lower-middle income households earning between \$15,000 and \$35,000 per year. Inclusion of this category would result in perfectly collinear matrix of explanatory variables. Thus, the LOWINC, UMINC, and HINC coefficients are interpreted as incremental propensities to approve the lottery relative to the baseline lower-middle income household.

⁹In a perfectly specified vote regression, the income-level variable would reflect only the latent demand for lottery tickets. Thus, we would expect to find coefficients of the same sign as would be found in a well-specified lottery *sales* regression. It is possible that the income variable captures the effects of other unincluded variables which may affect persons' voting and buying behavior in different ways. Thus, inferences about the normality or inferiority of lottery play from the VOTE regression must be drawn with caution.

¹⁰ The elements of the spatial weights matrix, M_{ij} , initially assume a value of 1 if county i and county j abut. Elsewhere, the elements are assigned a value of zero. Once constructed, the rows of the matrix are normalized such that the entries sum to one.

¹¹Interestingly, alternative specifications using dollars per pupil and teachers per pupil produced insignificant coefficients. We hypothesize that the average voter is generally unaware of the magnitude of these variables and how they compare relative to other counties. Educational attainment figures such as our G6TEST variable, in contrast, are highly publicized in both absolute and relative form.

¹²These variables are identical to the variables in the voter approval equation, with one exception. Educational performance in one's home school district might well influence one's desire to vote for the lottery, but is likely to make little difference in one's lottery *play*. Thus, this variable was dropped in the SALES equation..

¹³In an alternative specification, the actual proportion of votes was included in place of the predicted proportion. The results are remarkably similar to those in column (1) of Table III and are not presented here. Finally, the sales regression was run using the residuals from the vote regression, resulting in no alteration of the sign, magnitude, or significance of any of the regressors. We also re-ran the VOTE regression using actual, predicted and residual sales as explanatory variables; in no form did sales significantly explain the vote.

¹⁴As was the case with the VOTE regression, the SALES regression originally included a term to test for spatial correlation. We failed to reject a null hypothesis of no spatial correlation and the term was dropped.