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# IMPLICIT TAXATION IN LOTTERY FINANCE

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## ABSTRACT

State lotteries as they are operated in the United State today involve four distinct aspects: legalization of lottery games, monopolistic provision by the state, marketing of lottery products, and extraction of a portion of the surplus they derive from sales for state revenue. In this paper we use conventional tools of applied public finance to examine the implicit tax levied by lottery agencies through this fourth function . We examine the incidence of the implicit lottery tax, focusing on the dominant lottery games used in the 1980s. We find that the implicit tax is regressive in virtually all cases. We then consider whether the implicit tax rate on lotteries is too high, comparing that rate to excise tax rates on alcohol and tobacco.

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# IMPLICIT TAXATION IN LOTTERY FINANCE

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State lotteries have been the fastest-growing source of revenue to state governments in the U.S. since 1970. They are also the most lucrative type of state-owned enterprise in the 22 states that currently operate lotteries. Net revenues from these lotteries amounted to $30 per capita in 1985. Since this money was transferred to state treasuries to support other activities of these governments, it is appropriate to call this transfer an "implicit tax" on the operation of the lotteries. Previous studies have examined the incidence of this implicit tax and demonstrated that it was regressive during the 1970s.[1] Because the product line has changed dramatically during the last decade as the agencies have sought to broaden the appeal of their games, it is useful to take another look at the distributional patterns of lottery sales. In addition, the conceptual basis for conclusions reached in the earlier literature needs clarification. In particular, how can the lotteries be labelled "regressive" if the primary effect of the creation of a state lottery is to enhance consumer welfare?

In this paper we distinguish among four separate aspects of government-operated lotteries: legalization, monopolistic provision, marketing, and revenue extraction, or taxation. In doing so, we restrict ourselves to the revenue side of the budget and ignore the expenditure side. We then analyze

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the taxation aspect of current lotteries as operated in the U.S. and Canada. Section I of the paper describes the development of contemporary state lotteries. Section II discusses the four aspects of lotteries. Section III examines the implicit tax incidence of state lotteries using new data from several states. In addition to conventional measures of incidence, we focus on the variation in tax within income classes. Section IV examines the rate of taxation implicit in U.S. state lotteries and compares it to tax rates on several heavily-taxed commodities. These tax rates are discussed in relation to the theory of optimal taxation of commodities. Section V concludes the paper.

## I. Background

In 1964 New Hampshire introduced the first American government-operated lottery in the 20th century. Since then lotteries have grown to become fixtures in state government finance in half the states, and over 60 percent of the U.S. population now lives in a lottery state. In November 1986 five states voted to establish new state lotteries. The spread of lotteries in the U.S. since the introduction of New Hampshire's game has been nothing short of breathtaking. Not only have total sales increased as more states have adopted lotteries, per capita sales have grown as well. Measured in 1985 dollars, per capita sales in lottery states have increased from $23 in 1975 to an average of $88 in 1985 or 14 percent a year. Table 1 lists the currently operating American lotteries by age. The first great wave of lottery adoptions occurred between 1971 and 1974, when 10 northeastern states, comprising 28 percent of the nation's population, began operations. The nation now appears to be in the midst of a second wave, with five states having begun operations since 1985 and another five now set to begin in 1987 as a result of referenda in 1986.

In the jurisdictions operating lotteries in 1985, sales per capita ranged from a low of $10 in Vermont, to a high of $175 in Washington, D.C. As a rough correction for the opportunity to sell tickets to nonresidents, we calculated an adjusted per capita figure by including in the denominator the population of non-lottery states on each operating state's borders.[2] By this measure, Massachusetts has the highest level of per capita sales, at $173, although this is an imperfect measure as well since a state such as Massachusetts still has out-of-state sales despite being ringed with lottery states.[3] However, using this rough adjustment, aggregate per capita sales in lottery states was $82 in 1985.

Table 1 also gives information on the proportion of sales returned as prizes, used for operating expenses, and kept as net revenues for the state. The proportion of sales not returned as prizes, called the takeout rate, varies narrowly around 50 percent in U.S. state lotteries, although it is lower in some foreign lotteries. Due to the evident economies of scale in lottery operations and variations in prize payout ratios, the profitability per dollar varies considerably.[4] In 1985 net revenue varied from 28 percent of sales in New Hampshire and Maine to 47 percent in New York.

Accompanying the rapid growth in aggregate and per capita lottery sales has been a transformation in the product mix offered by lotteries. In the early years of modern lotteries, the mainstay of the product line was a draw game operated like a raffle with periodic, usually weekly, drawings. Next came "instant" games, requiring players only to scratch off a plastic covering to reveal -- instantly -- whether the ticket is a winning one. In the mid-1970s lotteries entered the computer age with a numbers game, based on the illegal version popular in many areas, featuring daily drawings and the opportunity for players to choose their own numbers.

Figure 1 illustrates the change in product mix brought about with the introduction of these successive types of games, using aggregate data for three states that began operations in 1972: Connecticut, Massachusetts, and Pennsylvania. Weekly draw games quickly lost their prominence to instant games and, to a greater extent, to daily numbers games. By 1981 numbers accounted for three-fourths of total sales in these states. But perhaps the most dramatic change of all has been the emergence of a fourth type of game, lotto, in which players attempt to pick the six winning numbers that are to be drawn from a larger set (anywhere between 36 to 49). The odds of winning are miniscule allowing extremely large jackpots for exact matches. In some cases these jackpots have exceeded $10 million. In a period of four years, lotto jumped from less than 1 percent of total sales in these states to over 40 percent in 1985. Significantly, the growth in lotto does not appear to have come at the expense of numbers games; nor has the growth of numbers appreciably diminished the size of instant game sales.

Despite their rapid growth in real terms, lotteries still account for only a small portion of revenues in states that have them. Table 2 compares lottery revenues to several other sources of state own-source revenues in 1984 for 18 lottery states. In those states, revenues from lotteries averaged 2.7 percent of total own-source revenues. In only two states, Pennsylvania and Maryland, did lotteries account for more than 4 percent of the total. But when viewed in comparison to excise taxes, lottery revenues look somewhat more substantial. For example, lotteries raised about the same amount of revenue as state alcohol and tobacco taxes combined.[5]

The importance of lotteries for state governments cannot be grasped by looking only at the revenue they raise, however. Not only are lotteries a source of revenue, they are also a product marketed and sold directly by state government. In fact, in states where they operate, lotteries constitute one of the biggest and most prominent goods or services provided directly to citizens and widely identified as a product of state government. Certainly lotteries are one of the most important products that is both advertised and sold. Table 3 provides some indication of this significance by comparing per capita direct expenditures by category with three items that are sold directly to households. Probably the most important product that state governments sell directly to the general public is higher education, and states are closely identified with this product. After higher education, one could argue that lotteries are the second most important product provided to the general public. If states' legalization, provision and advertising of lottery products have any effects on the attitudes and behavior of citizens, then, such effects may be substantial.

## II. Four Elements of Lottery Finance

Because the purchase of tickets is entirely voluntary, lottery proponents sometimes argue that it is inappropriate to apply conventional concepts of taxation, such as regressivity or "tax burden," to lotteries. By this argument, lotteries constitute a "painless tax" and should not be compared to excise or income taxes[6]. The apparent confusion here may result from the fact that the lotteries are in every case state-owned enterprises which are operated for "profit," with the state treasuries being the residual claimants. This is an unusual organizational form for the United States and Canada, although common in the rest of the world. The lottery states are in the business of selling a product at a price considerably above average cost for the primary purpose of financing other government activities. Not only is it appropriate to label the resulting net revenue an implicit tax, it is interesting to note that this implicit tax is closely analogous to a corporate tax on net income, but with a tax rate of 100 percent.

In order to clarify these and other issues related to the normative evaluation of lotteries, it is useful to identify four distinct aspects of lottery finance as currently practiced in the United States: legalization, provision, taxation, and promotion.

Legalization. Lotteries were outlawed in all states from the late 19th century until New Hampshire's adoption in 1964. While lottery games such as the numbers game certainly were played before the advent of the modern state-run versions, the state did not sanction them and often was vigorous in trying to discourage them. The act of legalizing lottery games then is a first and important aspect of lotteries as currently established. As similar as legal and illegal numbers games may seem, for example, the fact that the state-run game is legal and officially sanctioned does make it qualitatively a different product. Allowing lotteries to be provided legally confers consumer surplus. If consumers are well-informed and there are no important external costs, this increase in consumer surplus is a clear benefit of current lottery finance.

Provision. A second aspect of lotteries is provision. In all lotteries in the U.S. and in most lotteries elsewhere, the government has made itself the exclusive legal provider. If there were no economies of scale in the provision of lottery products, this monopolization itself would have no necessary normative implication. To the extent that economies of scale do exist, monopoly offers the potential of a lower average cost and consequently larger surplus to consumers or the state.

*Taxation.* Once a decision has been made to legalize the lottery and operate it as a state-owned monopoly enterprise, there remains a number of operational decisions concerning product line and pricing. The appropriate definition of "price" in this context is a bit ambiguous; one reasonable definition is "the cost of buying a probability distribution of prizes that has expected value of one dollar." A closely related measure that is simpler for our purposes, is the takeout rate, the fraction of the total bet retained by the state. (The takeout rate is identically equal to $(p-1)/p$, where p is the price defined as above.) Changes in the price have welfare significance, both in terms of aggregate consumer surplus and in terms of incidence of the implicit tax.

*Promotion.* The fourth aspect of lottery finance as currently practiced is promotion. State lottery agencies have adopted sophisticated marketing strategies to sell their products, including imaginative advertising that emphasizes such themes as the chance of winning big prizes, the fun of playing, and the benefit the state derives from lottery revenues. We do not deal with this aspect in the current paper.[7]

## Implications for Normative Analysis

The welfare implications of these aspects can be illustrated by considering an individual's compensated demand curve for a lottery product, such as that shown on the right side of Figure 2. Quantity is measured in dollar units, and price is stated in terms of takeout rate T. It is assumed that the individual is well-informed and that there are no externalities in consumption. On the left hand side, a hypothetical market demand curve (D) is shown along with an average cost curve (AC) reflecting administrative costs as a percent of sales, which are assumed to fall with sales. At rate $T_1$ total revenue to the state is $T_1 Q_1$, and the state's net revenue is $(T_1-T_a)Q_1$. This amount can also be thought of roughly as the "monopoly profits" accruing to the state by virtue of its self-granted monopoly over the provision of legal lottery products.[8]

In the context of this conventional framework, two implications are evident. First, the legalization and provision of lottery products create consumer surplus, even when the takeout rate exeeds the average cost of administration. For the individual shown in Figure 2, this is area abc. By this reasoning lotteries are welfare-enhancing.[9] The second implication of the analysis, however, is that this welfare gain due to the lottery's introduction would be greater if the takeout rate were lower. If the lottery were to produce at the minimum breakeven takeout rate ($T_2$), the consumer surplus would be as large as the triangle aef, although that would leave the state with no revenue and is therefore a highly unlikely alternative.

The intensity of the controversy that surrounds lotteries suggests, however, that any evaluation based on demand curves and conventional applied welfare concepts may be seriously incomplete. Lottery critics question two assumptions made in the conventional normative analysis: that individuals are best able to judge what is good for them and that there are no externalities in consumption or production. It is a familiar caveat in welfare economics that consumer surplus loses its usual significance in the case of "children and madmen" and where consumers are seriously misinformed about the good being consumed.[10] In the case of lotteries, individuals often have only the most rudimentary notion of the odds of winning or the amount taken out for state revenue.[11] Furthermore, it may be true that lotteries increase the prevalence of compulsive gambling. These concerns call into question the appropriateness of using observed demand to measure the benefit of consuming lottery products, especially given the use of advertising to stimulate play.

The presence of externalities may also complicate the simple analysis outlined above. The operation of the lottery itself, most especially the advertising, creates externalities, although arguably of a mild variety. Signs, commercials, and publicity make it evident to all that the state is in the lottery business. To the extent that provision and promotion of lotteries have harmful effects on attitudes toward work or illegal gambling, for example, such external costs would need to be taken into account. If lotteries reduce rather than increase illegal gambling, at least some of the externalities would be positive. This consideration of externalities is quite apart from the view that lotteries are a "merit bad" for those who object to gambling on moral grounds.

To what extent these considerations outweigh the conclusion of conventional applied welfare economics is uncertain. What is clear is that they must be assigned considerable importance in order to reverse the clear implications of the conventional analysis. Unless there are strong reasons to believe that people are participating in lotteries against their own interests or that lottery operation creates strong externalities, lowering the takeout rate would increase net welfare. If, on the other hand, lotteries are seen as a social evil — as they seem to have been in every state and province before 1964 -- then a higher rate may be justified as a sumptuary tax. A sumptuary tax policy is difficult to square with the practice of advertising lotteries as desirable consumer products, however.

## III. Implicit Tax Incidence

As in many other applications in public finance, there is great interest in the distributional effects of the lottery as a fiscal device. It might seem reasonable in this context to ask, "What is the incidence of lottery finance?" The distinctions made in the previous section must be kept in mind in answering this question. Lottery creation and taxation together produce net welfare gains (assuming full information and no externalities), so the incidence of lotteries as a whole is the story of the distribution of these benefits. But once it is decided to legalize and provide lotteries are made, it seems more appropriate to concentrate on the incidence of the implicit tax alone. At this point the relevant policy variable is the percentage of revenues kept by the state, not the existence of the lottery itself. We therefore focus in this section on the incidence of the implicit tax on lottery purchases.

Any household's contribution to revenues, corresponding to the quantity $(T_1-T_a)Q_1$ in Figure 2, is proportional to its expenditures on lottery products. In terms of average rate progression, implicit lottery taxation would be proportional if expenditures as a percentage of income were constant over the income scale. It would be regressive if the proportion falls as income increases. Not only does this conventional characterization of tax incidence describe the distribution of the total implicit tax burden of lotteries, it also indicates the distributional impact of marginal changes in the takeout rate. The reduction in consumer surplus caused by a one percent increase in the takeout rate, for example, will be exactly proportional to a household's expenditures on lottery products. Such incremental incidence is central to the policy question of whether takeout rates ought to be reduced. If the incidence of the implicit tax is regressive, reducing the takeout rate will benefit the poor more than proportionately with respect to income. In this section we examine available information on lottery expenditures by income in order to determine incremental incidence by income class. We then turn to variations in expenditures within income classes.

A. Average Expenditures by Income Class

Tables 4 through 8 present information on average household expenditures on lottery products by income class. The first two tables are based on previously published data. Using information from three northeastern states at a time when weekly draw games were the predominant lottery product, Table 4 shows absolute expenditures peaking in the $10,000 to $15,000 income class. Table 5 summarizes a survey taken about the same time and again indicates the lowest average expenditures at the highest and lowest income levels. Both of these tables imply that expenditures on weekly lottery games fall as a percentage of income as one goes up the income scale. The only previously published analysis focusing on lottery products other than weekly games is Clotfelter (1979), a study of Maryland games concluding that the implicit lottery tax on numbers games is significantly more regressive than that on weekly games. Because it employs data based on the location of the sale rather than the residence of the purchaser, however, that study is relevant to comparative incidence only and cannot be used to determine the incidence for any specific lottery product.[12]

To determine the implicit tax incidence of the lottery products now dominating the market, we collected data on personal expenditures by type of game from a variety of sources. Table 6 shows the distribution of weekly expenditures on instant game tickets in California based on a survey taken several months after the introduction of that state's lottery. This survey reveals some variation in average expenditures by income but again the income elasticity appears to be close to zero, implying regressivity. Table 7 presents information for two states based on the zip codes of winners. (Winners are a convenient random sample of players). Winners are arrayed according to the median income of their zip codes. In the case of a 4-digit numbers and instant games in Maryland, there is no discernible pattern in relative expenditures below $25,000. Relative expenditures in the top income group are quite low for both of these games. Again, these figures point to regressivity in terms of average rate progression. For lotto, the data for both Maryland and Massachusetts indicate some increases with income over some ranges, suggesting a pattern closer to proportionality. In this regard, it is interesting to note that the income distribution of lotto players apparently changes when jackpots become very large. The last line of Table 8 shows relative expenditures by income class for drawings when the jackpot exceeded $5 million. Except for the highest income class, expenditures rise proportiately faster than income, suggesting a progressive incidence over this range.

Table 8 gives information on participation and expenditures by game in Maryland. For each of these games, average expenditures are highest in the lowest income class. Absolute spending falls monotonically in the 4-digit daily numbers game, while it shows a nonmonotonic pattern in the other games. In contrast to previous tables, the distributions for the two numbers games in Maryland appear to indicate inferior goods, clearly implying regressivity for the implicit tax. In this regard, the findings are consistent with those based on sales data in Clotfelter (1979). Above $10,000 in income, expenditures on lotto are roughly flat, though this distribution would also imply regressivity. Participation in lottery games also tends to fall with incomes above $10,000.

To summarize: with the exception of lotto expenditures in the presence of very large jackpots (where expenditures rose with income at low and middle incomes) and numbers games in Maryland (where the lottery is an inferior good) the general finding here is that average lottery expenditures exhibit no consistent relationship to income. This result implies that as a percentage of income a proportional tax on lottery expenditures generally falls as income increases. For example, average yearly lottery expenditures in California fall monotonically from 1.4 percent of income in the lowest income class to 0.1 percent in the $50,000 to $60,000 class.[13] Overall, the incidence of implicit lottery taxation is decidely regressive.

B. Concentration

Incidence measures based on mean expenditures such as those discussed above obscure an important element in lottery incidence: participation is heavily concentrated within a small subgroup of the population. In order to examine concentration of play among individuals, we used a survey of California residents taken several months after the introduction of that state's lottery. At the time of the survey the only games offered were instant games. The survey asked for the number of tickets purchased in the previous two months, tickets being priced at $1 each. Table 9 summarizes the degree of concentration in lottery purchases implied by the California survey. During the period only about half of the sample bought any lottery tickets at all. Among players the amount bet varied greatly. The 8 percent of the adult population that played the most during the sample period accounted for 60 percent of all purchases. The most active 20 percent accounted for 80 percent of purchases. Another survey of California lottery expenditures based on purchases within the last week yields similar results, with the most active 10 percent of players accounting for 64 percent of all play.[14]

The implication of this extreme concentration of lottery play is that measures of incidence based upon mean values alone are likely to miss important distributional aspects of lottery finance. As a way of bringing evidence on dispersion into the more traditional portrayal of incidence, we follow an approach similar to that of King (1983). We used data from the Maryland survey to calculate mean purchases for quintiles within each income class. Figures refer to average weekly expenditures for those who played within the last month. Since fewer than 60 percent of every income class played the lottery in the sample month, the first and second quintile means are zero in every case. Figure 3 shows the class means for the third, fourth and fifth quintiles by income class. The decline in mean expenditures between the lowest and the middle income class is mirrored by wide variations within each class. While all of the class means are below $8 per week, the fifth quintile means exceed $11 in every class. Especially striking is the very heavy play among the most active players in the lowest income classes. For the most active 20 percent in the under-$10,000 class, average weekly spending on the lottery was an astounding $30. The dispersion in lottery expenditures within income classes shown here makes it clear that a relatively small proportion of households in each income class is contributing a disportionate share of the revenue from the lottery.

One might well expect such dispersion in tax burdens for other excise taxes, particularly alcohol and tobacco. For the sake of comparison to widely-used excise tax bases, Figure 4 shows the percentage of total expenditures accounted for by the top quintile for several goods and services. Expenditures for gasoline and telephone services are least concentrated, with the top quintile spending less than half of the total in most income classes. Expenditures for tobacco and liquor exhibit more concentration, particularly at lower incomes. Yet lottery expenditures using the Maryland survey results generally show still more concentration.[15]

C. Incidence by Other Characteristics

Although income is the natural focal point for the analysis of tax incidence, it is useful to determine in the present case whether lottery participation varies by other social or demographic characteristics. Most notably, it is important to examine variations in race due to the frequently-voiced charge that state lotteries cater to players from minority groups. It is also interesting to know how participation varies with education, since lottery critics have charged that, with their relatively high takeout rates, lotteries prey upon the ignorance of bettors. In order to examine the independent effects of race, education and other individual characteristics, we estimated equations explaining average weekly expenditures based on the survey of Maryland residents. Equation 10.1 in Table 10 presents the basic estimated equation.

Largest and most statistically significant among the explanatory variables is race, with blacks spending an average of about $4.50 more than whites, other characteristics the same[16]. Figure 5 illustrates the joint effect of race and income on the proportion of people betting more than $10 per week. This measure of heavy play also illuminates the degree of concentration of play. Plainly, heavy lottery play is much more prevalent among blacks than whites in Maryland, and this difference is most striking in the lowest income class. In that class, the proportion of blacks who report betting over $10 per week approaches 45 percent, compared to less than 10 percent for whites. These racial differences are so large and pervasive in this data set that we estimated separate equations for blacks and whites in addition to the basic equation in Table 10.

Lottery expenditures for whites and blacks alike tend to fall with education. This effect is significant only for whites, with the difference between college graduates and those who did not complete high school being almost $5 per week. A similar pattern with smaller differences is observed for blacks, but due to the small sample the coefficients are estimated very imprecisely. Regarding age, the estimates imply that expenditures on lottery products are lowest for the elderly and highest in the prime earning years of 25-54. Males spend more than females: the point estimates imply a difference of about $1 for whites and $4 for blacks. Surprisingly, expenditures do not vary significantly between urban and rural counties once income, race and the other characteristics are held constant.

The estimated effects by income class reflect the patterns previously discussed. Among those who report their income, expenditures are lowest in the (omitted) $15,000 to $25,000 income class. The highest expenditures are recorded in the under-$10,000 class, but the difference between the middle and the lowest class is statistically significant only for blacks, the point estimate being over $14. The conclusion implied by Table 8 that Maryland lottery products taken together constitute an inferior good, is supported for blacks. For whites, however, expenditure levels are not significantly different by income level.

## IV. Optimal Pricing of Lotteries

What should the takeout rate be on state lotteries? Having considered efficiency and equity questions related to the creation and taxation of lotteries, it is useful to conclude this analysis by asking whether the optimal tax literature in public finance can inform us about this basic policy question. Public finance theory offers several well-known rules for determining optimal public sector prices and excise taxes. In order to suggest the broad implications of this literature, we apply one of those rules, fully aware that this application necessarily will be incomplete. Feldstein (1972) incorporates distributional considerations in the determination of optimal public sector prices. One special case he obtains is a modification of the familiar Ramsey pricing rule for the special case in which cross-elasticities of demand are zero. Any externalities in production or consumption are ignored. Where the p's are gross prices and the m's are marginal costs, $E_{11}$ and $E_{22}$ are the own-price elasticities of demand for goods 1 and 2, and $D_{12}$ corresponds to the "distributional characteristic" of the two goods, the ratio of optimal markups on the goods is given by:

$$\frac{(p_1 - m_1)/p_1}{(p_2 - m_2)/p_2} = D_{12} \frac{E_{22}}{E_{11}} \qquad (1)$$

The distributional factor $D_{12}$ given here is a function of the pattern of consumption of both goods over the income distribution and the marginal social utilities assigned to income at different incomes. As the percentage of good 1 bought by the poor rises, $D_{12}$ falls. If both goods are purchased at the same relative magnitudes over the income distribution, $D_{12} = 1$ and the rule reduces to the simple inverse elasticity condition. As the relative concentration of good 1's purchases among lower income purchasers rises, however, the optimal markup for that good falls, reflecting distributional considerations.

In order to assess current policy in light of this rule, we compare the implicit tax rate for lottery products with the tax rates on alcohol and tobacco products. Based on an average distribution of 50 percent for prizes and 15 percent for operating costs, lottery products face a typical markup of 35 percent apart from federal taxes. We estimate that federal income taxes on prizes average roughly 5 percent of sales, for a total tax rate of some 40 percent, shown in Table 11. This compares with tax markups of about 30 percent on liquor, 13 percent on wine, 12 percent on beer, and 33 percent on tobacco products, aggregating federal and state taxes on those products. Regarding the "distributional characteristic," we have seen that lottery purchases exhibit either no relationship to income or are inferior goods. In contrast, consumer expenditure surveys show that liquor is normal throughout the income distribution and that the other commodities are normal overall (U.S. Bureau of Labor Statistics 1978, Table 1; Congressional Budget Office 1987, Table 1).

For current relative tax rates to satisfy the pricing rule, therefore, either lottery products would have to be appreciably less price-elastic than the other products or lotteries would have to present more substantial negative externalities. Neither possibility seems very strong. One is left with the strong suspicion, therefore, that the tax rates implicitly levied on lotteries are too high relative to those levied on alcohol and tobacco.

## V. Conclusion

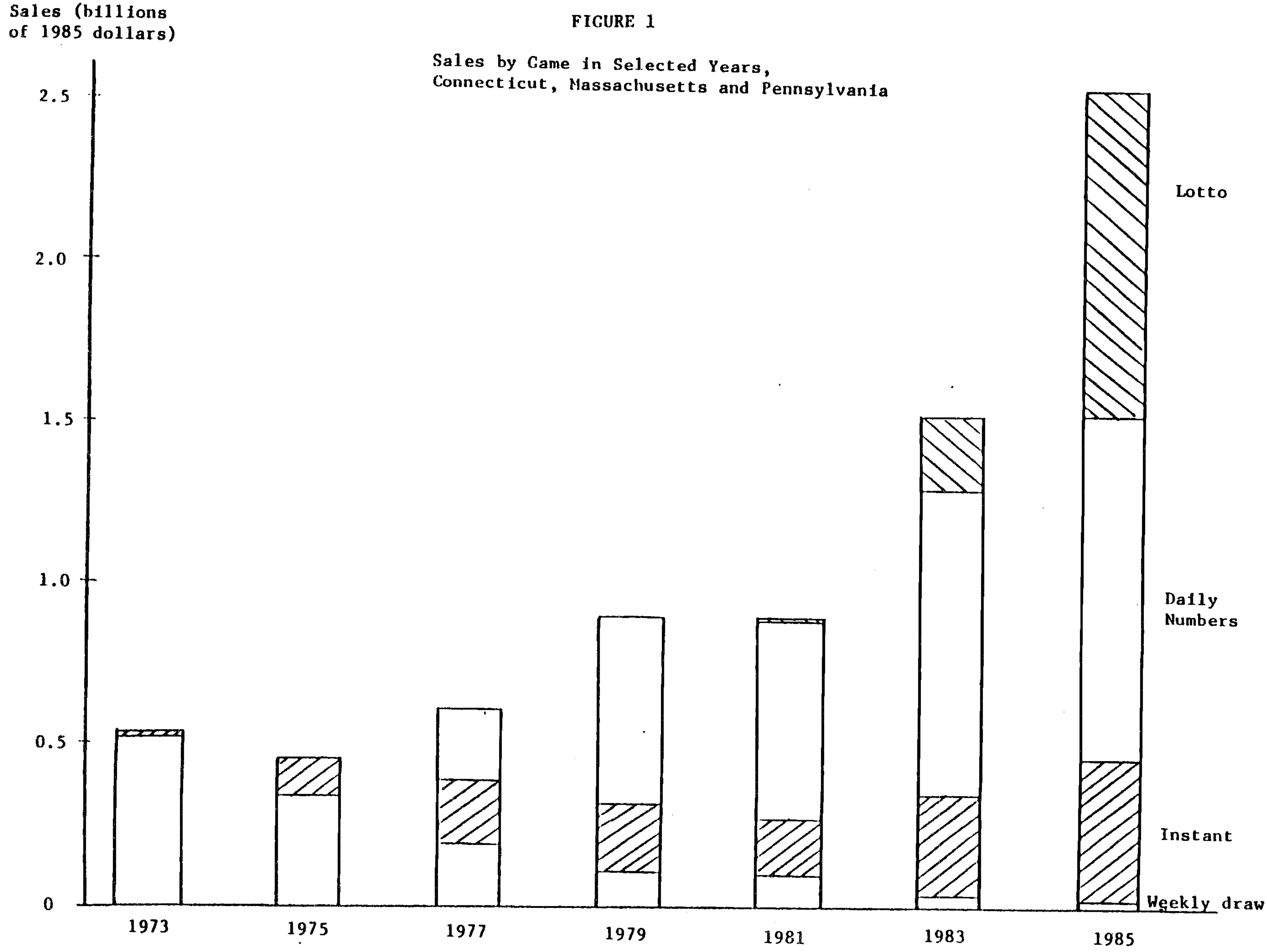
Once a state has decided to legalize and provide lottery games to its citizens, an important public finance question remains: what is the appropriate takeout rate? Without exception, the states and provinces in the United States that have instituted lotteries have a hign takeout rate for the purpose of securing large net revenues. Although lottery revenues do not approach the magnitude of the major broad-based taxes on income, property and sales, they are large relative to excise taxes and are certainly growing. In the United States the average rate of the implicit tax on gross lottery purchases, counting federal and state taxes, is about 40 percent, which exceeds the combined rate of tax on distilled spirits. It seems difficult to justify such a high rate of tax on sumptuary grounds, especially in light of the extensive marketing of lottery products conducted by states.

The evidence presented here demonstrates that the incidence of the implicit tax on lottery products in the 1980s is highly regressive, as it was in the 1970s. Equally important are the particular patterns of variation in tax rates within income classes. Because lottery expenditures are highly concentrated, the tax burden is also concentrated. The survey results we present suggest that, within income classes, blacks are more likely to bet, and bet heavily, than whites. Looking at the provision aspect of lotteries implies, of course, that these heavy players also benefit more from the existence of lotteries if their decisions are well-informed. But focusing on the tax aspect highlights the fact that tax rates need not be as high as state and provincial governments have set them. Any reduction in lottery tax rates would have distributional effects favoring those groups that play the most.

In conclusion, it is worth emphasizing two of the limitations of the current paper. First, the incidence analysis is couched in conventional differential incidence terms where the implicit point of reference is a proportional income tax. But since state tax structures on the whole tend to be regressive, objections to the dramatic regressivity of lottery finance on the basis of equity criteria may be mitigated somewhat. Second, the current paper does not consider the expenditure side of the budget in analyzing lottery finance. Where lottery revenues go to a state's general fund, this omission has little effect. But where lottery revenues are earmarked for specific purposes and where that earmarking has a discernible impact on a state's pattern of expenditures, focusing on the revenue side of the budget alone can miss important aspects of the distributional and allocative effects of lottery finance.[17]

FIGURE 1

Sales by Game in Selected Years, Connecticut, Massachusetts and Pennsylvania




Source: Annual reports

FIGURE 2

Market and Individual Demand for Lottery Tickets

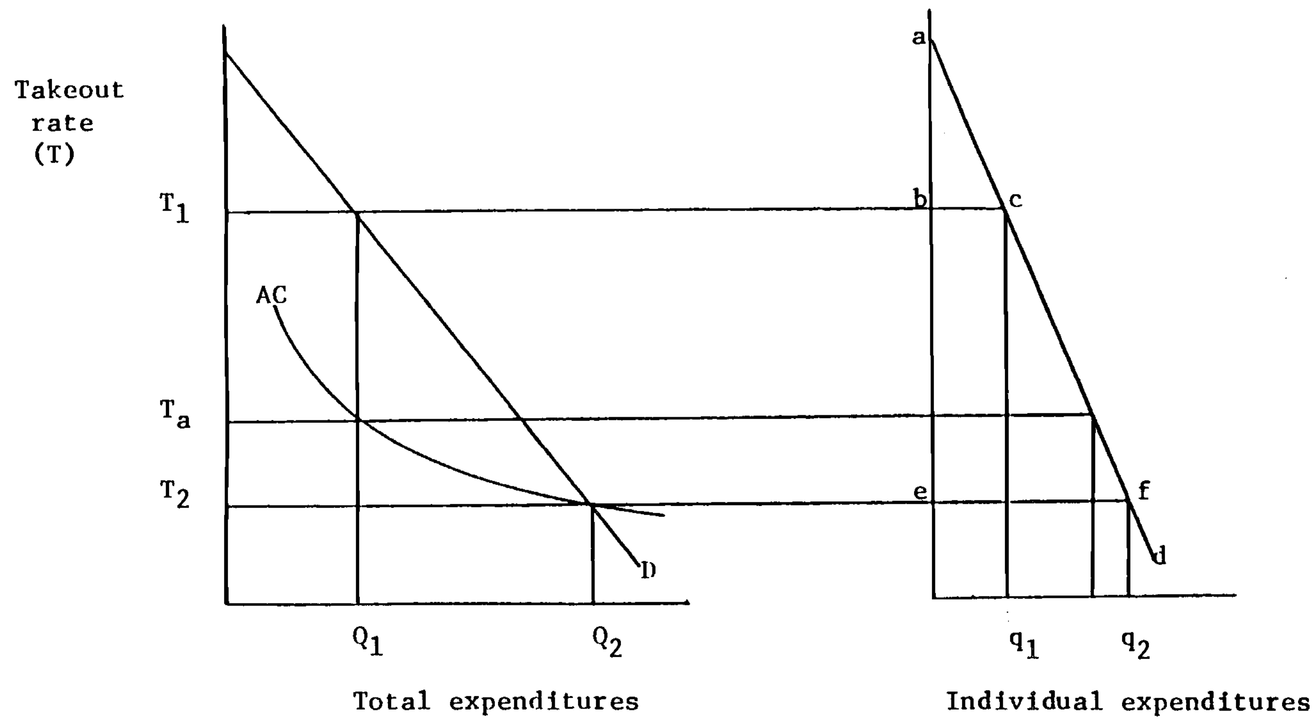
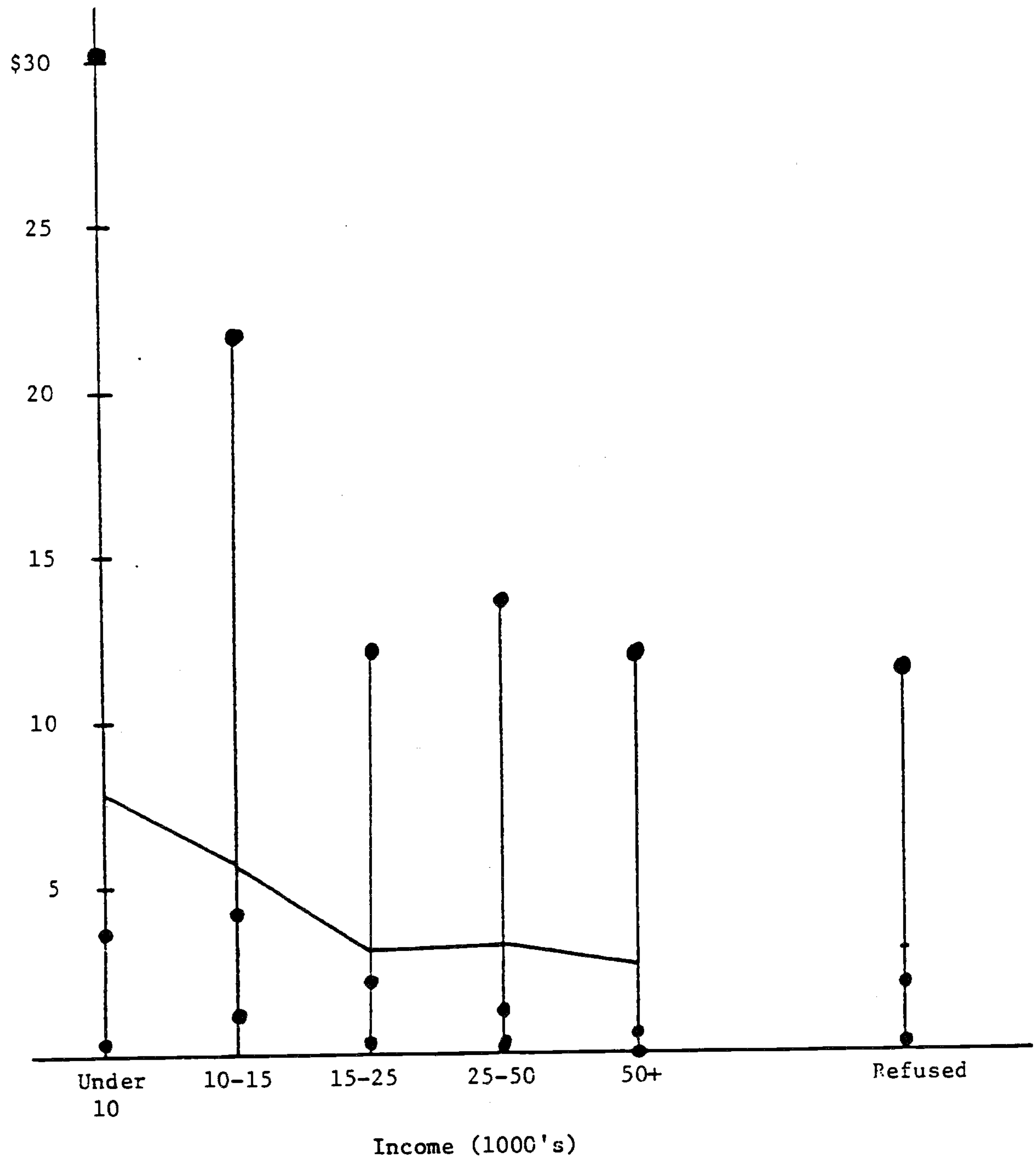


Figure 3

Average Weekly Expenditures in Maryland
by Income Class and Quintile within
Each Class

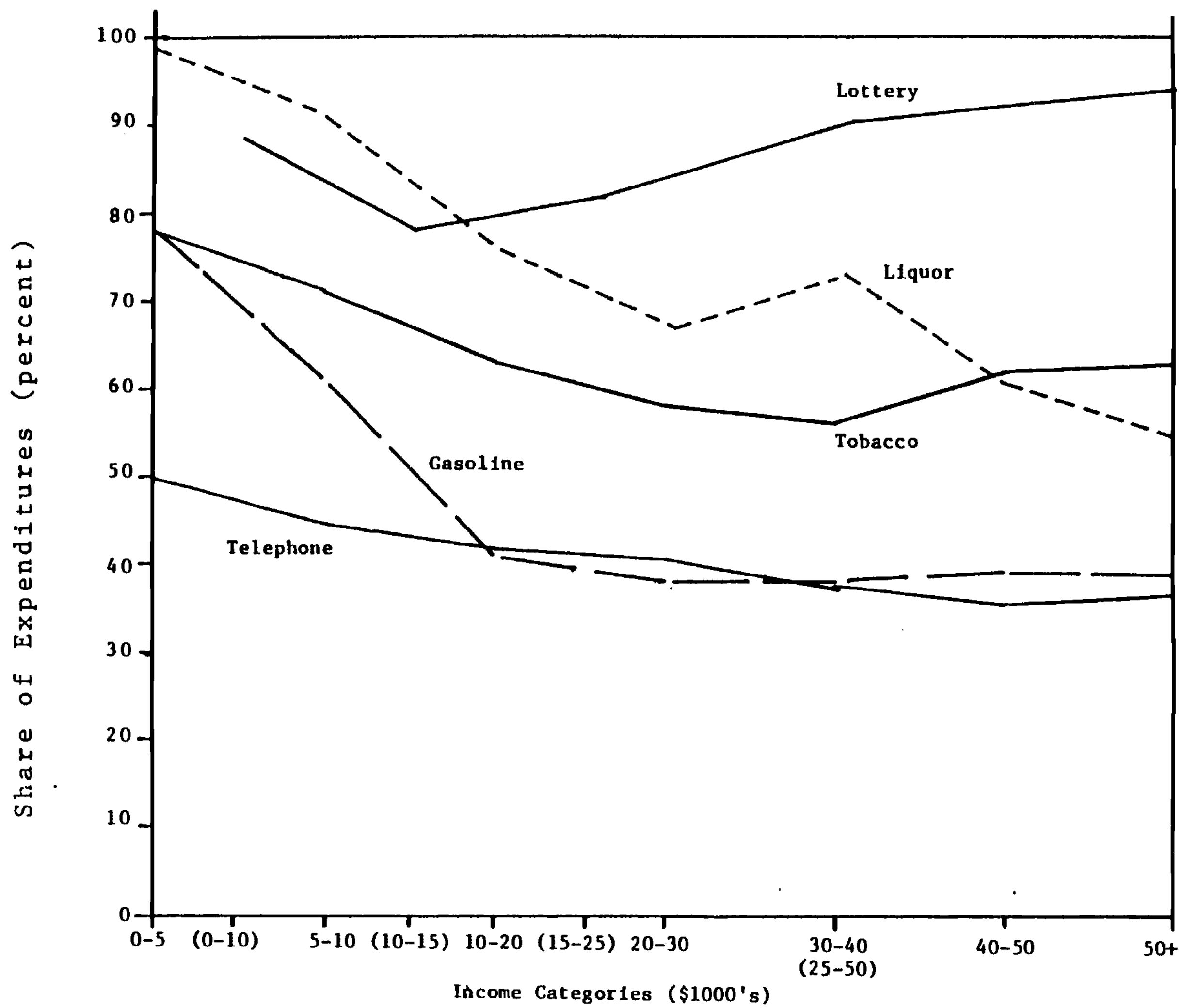



Note: solid line connects class means; heavy dots denote quintile means.

GALLUPT 3/12/87, 2341; Table 10.

Figure 4

Share of Expenditures by Top 20% within Income Classes



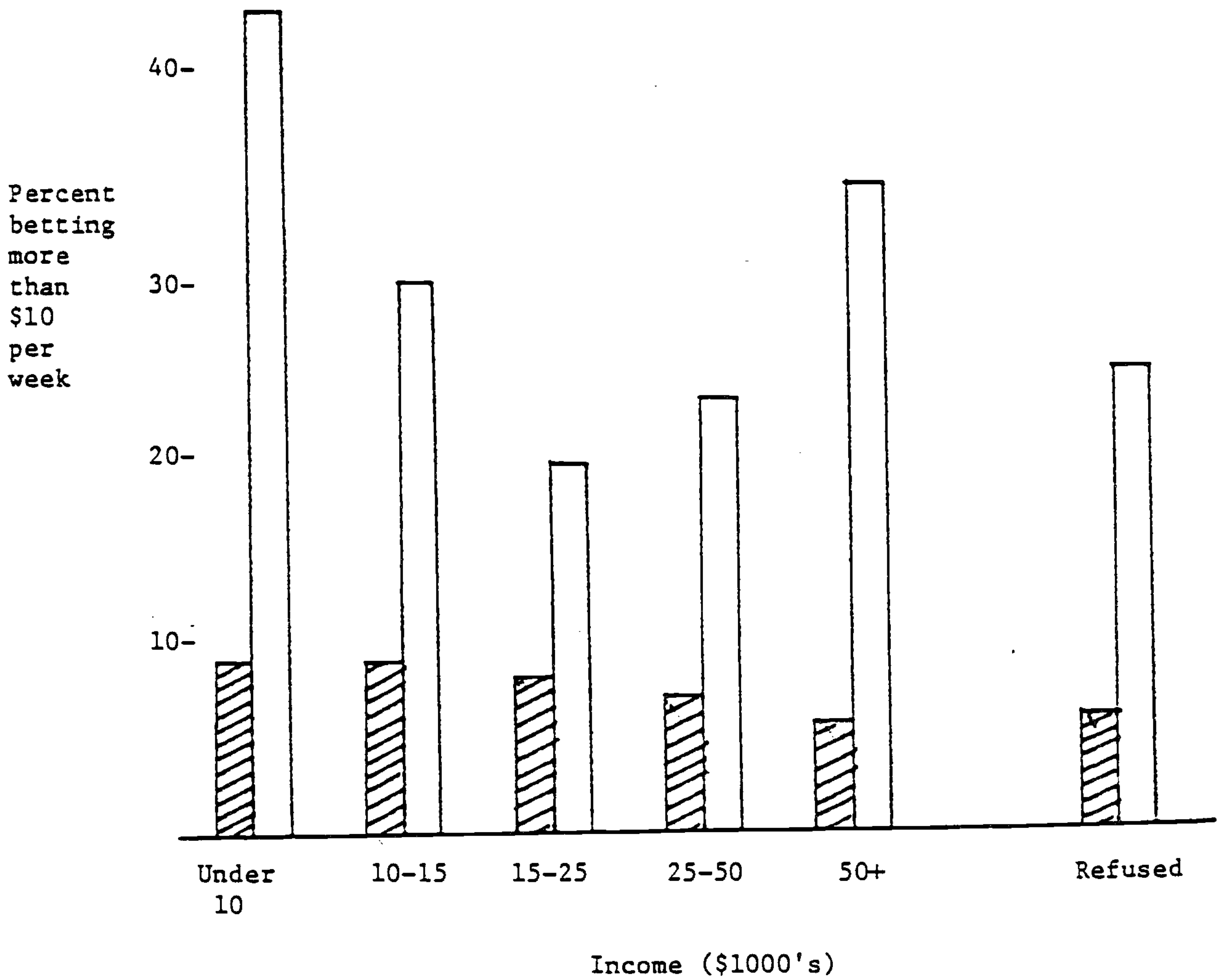

Note: Income categories in parenthesis refer to Gallup Survey; others refer to the Survey of Consumer Expenditures.

Source: CBO, "The Distributional Effects of an Increase in Selected Federal Excise Taxes," January 1987; Sammartino (1987); Gallup Survey, GALLUPT 3/12/87.

Figure 5

Heavy Play by Race and Income,
Maryland, 1984

White    Black




GALLUPT 3/14/87, 1633.

Table 1

U.S. State Lotteries by First Year of Operation: Sales and Distribution of Sales in Fiscal Year 1985

| Lottery | First year of operation | Sales, FY 1985: Total ($M) | Per Capita ($) | Adjusted per capita[b] ($) | As percent of sales[a]: Prizes (%) | Operating Expenses (%) | Net Revenues (%) |
|---|---|---|---|---|---|---|---|
| New Hampshire | 1964 | 15.2 | 16 | 16 | 48 | 24 | 28 |
| New York | 1967 | 1,271.2 | 73 | 73 | 44 | 11 | 47 |
| New Jersey | 1971 | 924.6 | 121 | 121 | 50 | 9 | 42 |
| Connecticut | 1972 | 344.5 | 107 | 107 | 52 | 5 | 43 |
| Massachusetts | 1972 | 1,004.1 | 173 | 173 | 55[c] | 11[c] | 35[c] |
| Pennsylvania | 1972 | 1,294.7 | 110 | 110 | 47 | 9 | 44 |
| Michigan[c] | 1972 | 604.7 | 67 | 63 | 49 | 12 | 40 |
| Maryland | 1973 | 681.1 | 161 | 129 | 54 | 8 | 38 |
| Rhode Island | 1974 | 52.3 | 55 | 55 | 49 | 17 | 36 |
| Maine | 1974 | 16.0 | 14 | 14 | 50 | 23 | 28 |
| Illinois | 1974 | 1,235.9 | 107 | 86 | 48 | 8 | 44 |
| Ohio[c] | 1974 | 623.1 | 58 | 50 | 48 | 11 | 41 |
| Delaware | 1975 | 38.5 | 63 | 63 | 50 | 11 | 39 |
| Vermont | 1978 | 5.2 | 10 | 10 | 50 | 27 | 24 |
| Arizona | 1981 | 72.9 | 26 | 25 | 46 | 23 | 31 |
| District of Columbia | 1982 | 112.0 | 175 | 90 | 52 | 17 | 31 |
| Washington | 1982 | 149.5 | 35 | 34 | 47 | 18 | 35 |
| Colorado | 1983 | 96.4 | 30 | 29 | 50 | 20 | 34 |
| Oregon[d] | 1985 | | | | | | |
| Iowa[d] | 1985 | | | | | | |
| California[d] | 1985 | | | | | | |
| West Virginia[d] | 1985 | | | | | | |
| Missouri[d] | 1986 | | | | | | |
| Florida[e] | | | | | | | |
| Idaho[e] | | | | | | | |
| Kansas[e] | | | | | | | |
| Montana[e] | | | | | | | |
| South Dakota[e] | | | | | | | |
| Total, 18 lotteries | | $8,541.9 | $88 | $82 | | | |

[a]Percentages may sum to more than 100 due to other revenues.
[b]Sales divided by state population plus estimated population in bordering non-lottery states who live within 20 miles of the border.
[c]Based on fiscal year 1984 sales in 1985 dollars.
[d]No complete FY 1985 data.
[e]Lottery approved by referendum, November 1986.

Sources: Annual reports; U.S. Statistical Abstract, various years; County and City Data Book.

Table 2

Per Capita State Revenues for Selected Revenue Sources, Lottery States, 1984

| | |
|---|---|
| Total own-source[a] | $1120 |
| General sales & gross receipts[b] | 261 |
| Excise Taxes[b] | |
| Motor fuels | 50 |
| Public utilities | 45 |
| Tobacco products | 21 |
| Insurance | 15 |
| Alcohol | 10 |
| Parimutuel | 4 |
| Other | 13 |
| Lottery net revenue[c] | 30 |

Note: 18 states included (Arizona, Connecticut, Delaware, Illinois, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Washington, District of Columbia, and Colorado).

[a]U.S. Department of Commerce, Bureau of the Census, Governmental Finances in 1983-84, pp. 6-14.

[b]1984 Government Finances, GF-3 Series, p. 10.

[c]ACIR, p. 126 (1984) and U.S. Department of Commerce, Bureau of the Census, Governmental Finances in 1983-84, p. 6-14.

Table 3

Direct Provision of Goods and Services by States, Fiscal Year 1983, Per Capita

| | |
|---|---|
| General direct expenditures (50 states + D.C.) | |
| Public welfare | $ 192 |
| Education | |
| Higher education | 156 |
| Other education | 35 |
| Highways | 90 |
| Health and hospitals | |
| Hopsitals | 63 |
| Other | 26 |
| Natural resources | 24 |
| Financial, administration and other general | 201 |
| TOTAL | 787 |
| Direct sales | |
| State lotteries (14 states)[a] | 56 |
| State liquor stores (17 states) | 45 |
| Motor vehicle and operators' licenses[b] | 30 |

Source: Tax Foundation, Facts and Figures on Government Finance, 1986, Tables E3, E9, E12, E33; Annual reports of state lotteries; U.S. Bureau of the Census, Statistical Abstract of the United States 1985, p. 11.

[a]Based on 14 states with lotteries operating for complete fiscal years in 1983. See TSCS 4409 11/5/86. AZ, CT, DC, DE, IL, MD, MA, MI, NH, NJ, NY, OH, PA, VT.

[b]Fiscal year 1984.

Table 4

Annual Lottery Expenditures per Family in 1973
for Connecticut, Massachusetts and Pennsylvania

| Income | Percentage of all families | Absolute Expenditures | | | Multiple of Average | | |
|---|---|---|---|---|---|---|---|
| | | Conn. | Mass. | Penn. | Conn. | Mass. | Penn. |
| $ 0-5,000 | 12.7 | $ 22 | $ 28 | $ 21 | .66 | .80 | .67 |
| 5,000-10,000 | 22.6 | 33 | 35 | 35 | .98 | 1.00 | 1.13 |
| 10,000-15,000 | 24.2 | 43 | 39 | 36 | 1.28 | 1.12 | 1.16 |
| 15,000-25,000 | 28.6 | 34 | 27 | 30 | 1.01 | .77 | .97 |
| 25,000 or more | 11.9 | 21 | 17 | 16 | .63 | .49 | .52 |
| Sample Average | | $ 34 | $ 35 | $ 31 | ---- | ---- | ---- |

Source: Brinner and Clotfelter (1975, p. 400) and U.S. Bureau of the Census, Statistical Abstract of the United States 1978, p. 452.

Table 5

Average Lottery Purchases in Lottery States, 1974

| Family Income | Average bet per person | Multiple of Average |
|---|---|---|
| Under $5,000 | $ 7.48 | .60 |
| 5,000-9,999 | 16.91 | 1.36 |
| 10,000-14,999 | 16.84 | 1.35 |
| 15,000-29,999 | 11.15 | .90 |
| 20,000-29,999 | 14.23 | 1.14 |
| 30,000 or more | 8.72 | .70 |
| Total | 12.43 | |

Source: Suits (1977, p. 23).

Table 6

Lottery Purchases by Income,
California, March 1986

| Family Income | N | Average number of tickets purchased in previous week | Multiple of population average |
|---|---|---|---|
| Less than $10,000 | 138 | 1.31 | .65 |
| 10,000 to 20,000 | 319 | 2.26 | 1.12 |
| 20,000 to 30,000 | 332 | 2.29 | 1.14 |
| 30,000 to 40,000 | 320 | 2.29 | 1.14 |
| 40,000 to 50,000 | 192 | 1.64 | .81 |
| 50,000 to 60,000 | 107 | 1.39 | .69 |
| More than 60,000 | 177 | 2.28 | 1.13 |
| Not sure or refused | 112 | 1.40 | .69 |
| TOTAL | 1697 | 2.02 | 1.00 |

Source: L.A. Times Survey, LAT 4718, 11/2/86.

Table 7

Relative Expenditures by Income, Selected Lottery Games

| State and data | | Number of Winners | Median household income for zip code, 1980: Under $10,000 | $10,000 under $15,000 | $15,000 under $20,000 | $20,000 under $25,000 | $25,000 and over |
|---|---|---|---|---|---|---|---|
| Maryland: Upper-tier winners, 1/86 to 8/86; Lotto jackpot winners, 1/84 to 8/86 | Number of zip codes | -- | 34 | 116 | 150 | 99 | 99 |
| | Ratio of share of sales in class to share of households, by game | | | | | | |
| | 4-digit numbers | 211 | 1.34 | 1.01 | .92 | 1.31 | .74 |
| | Instant | 66 | 1.85 | 1.48 | .90 | 1.20 | .48 |
| | Lotto | 581.5[a] | 1.00 | .72 | .89 | 1.12 | 1.20 |
| Massachusetts: Lotto jackpot winners, 12/82 to 3/86 | Number of zip codes | -- | 28 | 113 | 227 | 135 | 67 |
| | Ratio of share of sales in class to share of households | | | | | | |
| | All lotto | 425 | .47 | .90 | 1.01 | 1.24 | .89 |
| | Lotto when jackpot exceeded $5 million | 123 | .24 | .85 | .90 | 1.60 | .71 |

[a]Ticket shared with non-resident. All winners of shared tickets with only one zip code shown were assumed to reside in the same zip code. Otherwise, shared tickets were prorated among zip codes.

Source: MASS 4617 8/7/86; MDZIP 3252, 9/2/86

Table 8

Lottery Expenditures and Participation by Income, Maryland, 1984

| Income | N[a] | 3-digit numbers | 4-digit numbers | Lotto | Total | Ratio of total to sample average | Percent playing any game during month |
|---|---|---|---|---|---|---|---|
| Under $10,000 | 74 | 3.79 | 1.88 | 2.25 | 7.93 | 2.12 | 55 |
| $10,000 under 15,000 | 93 | 3.38 | 1.12 | 1.37 | 5.87 | 1.57 | 64 |
| $15,000 under 25,000 | 204 | 1.23 | .55 | 1.25 | 3.02 | .81 | 56 |
| $25,000 under 50,000 | 406 | 1.61 | .43 | 1.35 | 3.39 | .91 | 50 |
| $50,000 and over | 192 | 1.33 | .43 | 1.10 | 2.87 | .77 | 40 |
| Don't know; refused | 153 | 1.54 | .54 | .92 | 3.01 | .80 | 57 |
| All | 1122 | 1.80 | .63 | 1.30 | 3.74[b] | 1.00 | 52 |

[a]Number with known amount bet.

[b]Based on 1094 sample.

Source: Gallup Survey, November 1984.
GALLUPT 3/16/87, 924; GALUP 3/14/87, 1628, p. 34.

Note: Averages are not adjusted for nonrespondents and players who gave no estimate of how much they normally bet.

Table 9

Concentration of Lottery Expenditures, California, May 1986

| Expenditures in previous two months ($) | Number | Percentage of | | Cumulative percentage of | |
|---|---|---|---|---|---|
| | | Adult Population | Purchases | Adult Population | Purchases |
| 300 or more | 2 | 0.2 | 7.3 | 0.2 | 7.3 |
| 200 - 299 | 4 | 0.4 | 8.1 | 0.6 | 15.5 |
| 150 - 199 | 2 | 0.2 | 2.8 | 0.8 | 18.3 |
| 100 - 149 | 16 | 1.6 | 16.2 | 2.4 | 34.5 |
| 75 - 99 | 9 | 0.9 | 6.4 | 3.3 | 40.9 |
| 50 - 74 | 25 | 2.5 | 12.6 | 5.7 | 53.5 |
| 31 - 49 | 20 | 2.0 | 6.5 | 7.7 | 60.0 |
| 21 - 30 | 41 | 4.1 | 8.5 | 11.8 | 68.5 |
| 16 - 20 | 78 | 7.7 | 11.4 | 19.5 | 79.9 |
| 10 - 15 | 124 | 12.3 | 12.6 | 31.7 | 92.6 |
| 4 - 9 | 113 | 11.2 | 6.0 | 42.9 | 98.5 |
| 2 - 3 | 60 | 5.9 | 1.2 | 48.8 | 99.8 |
| 1 | 29 | 2.9 | 0.2 | 51.7 | 100.0 |
| 0 | 489 | 48.3 | 0 | 100.0 | 100.0 |
| Total | 1012 | 100.0 | 100.0 | | |

Source: The Field Institute, The California Poll, Early May 1986, Data File #86-02, p. 42. The sample size was 1013. One respondent who gave no answer for the number of tickets purchased was omitted. Mean values were assumed to be equal to midpoints for all bounded classes and to $450 for the top class.

Table 10

Average Weekly Expenditures on Lottery Products for Those Who Played in the Last Month, Maryland, 1984

| Equation | 10.1 Full Sample | 10.2 Whites | 10.3 Blacks |
|---|---|---|---|
| Education | | | |
| High school graduate only | - 2.79 (1.98) | - 4.93* (1.98) | 1.36 (5.19) |
| College graduate | - 8.34* (2.08) | -11.24* (2.08) | 0.62 (5.55) |
| Age | | | |
| 25–39 | 1.70 (1.68) | .51 (1.70) | 5.15 (4.39) |
| 40–54 | 3.81* (1.84) | 1.73 (1.83) | 11.61* (4.90) |
| 55–69 | 3.59 (2.10) | 3.44 (2.02) | 3.62 (6.67) |
| 70+ | - 2.43 (3.67) | - 2.25 (3.37) | - 8.61 (13.59) |
| Race | | | |
| Black | 10.20* (1.48) | ---- | ---- |
| Hispanic and other nonwhite | - 3.12 (4.34) | ---- | ---- |
| Income | | | |
| Under $10,000 | 4.50 (2.55) | 0.90 (2.60) | 25.02* (6.94) |
| $10,000–15,000 | 0.89 (2.33) | 1.14 (2.53) | 10.02 (5.50) |
| $25,000–50,000 | 0.85 (1.67) | 0.48 (1.60) | 5.55 (5.14) |
| $50,000 and over | - 1.25 (2.02) | 1.05 (1.92) | 4.48 (6.67) |
| Refused, don't know | - 1.59 (2.12) | - 2.02 (2.10) | 6.71 (5.86) |

Table 10 (Continued)

| Equation | 10.1 Full Sample | 10.2 Whites | 10.3 Blacks |
|---|---|---|---|
| Male | 3.14* (1.16) | 2.59* (1.12) | 7.45* (3.46) |
| Percent urban in county | .036 ( .023) | .020 ( .021) | .128 ( .084) |
| Intercept | 6.72 (3.18) | - 0.10 (3.05) | - 23.8* (10.4) |
| Log Likelihood | - 2485.8 | - 1797.1 | - 619.9 |
| Mean of dependent variable | 3.73 | 2.71 | 8.79 |
| Proportion non-zero | .500 | .455 | .725 |
| N | 1051 | 847 | 182 |
| F(z) | .444 | .420 | .548 |

Note: Method of estimation was Tobit. Standard errors are in parenthesis. Asterisks (*) denote t-statistics 2.0 or greater in absolute value. The derivative of the expected expenditure with respect to any right-hand variable is equal to the estimated Tobit coefficient multiplied by F(z)

GALLUP 3/27 6870, 6879, 6881.

Table 11

Tax Rates on Lotteries, Alcohol and Tobacco Products, 1985

| | Federal | State & Local | Total |
|---|---|---|---|
| Lotteries | 5[a] | 35 | 40 |
| Liquor | 15.8[b] | 13.8[c] | 29.6 |
| Wine | 4.2[b] | 8.9[c] | 13.1 |
| Beer | 4.4[b] | 7.3[c] | 11.7 |
| Tobacco products | 13.3[b] | 19.9[d] | 33.2 |

[a]Rough estimate of average marginal federal income tax rate. Approximate percentage of winnings subject to tax (followed by assumed marginal tax rates for winnings subject to tax in brackets) are: numbers (MD): 9% [.20]; lotto (MD): 22% (middle prizes) [.20], 50% (jackpot) [.30]; lotto (MA, 12/21/85 - 1/22/86): 68% (jackpot) [.30]; instant (MD, 1986): 4% (middle prizes) [.20], 3.5% (high) [.30]; instant (VT, 1986): 9% [.25]. Resulting weighted average marginal tax rates and proportion of sales for each type of game (taken from Table 2) are: numbers: .02 and .41; lotto: .20 and .41; and instant: .02 and .17. On average, 50 percent of sales are returned as prizes. Excluding passive games from the calculation, the weighted average marginal income tax on sales is: $.5[.02(.41)+.20(.41)+.02(.17)]/.99=.047$.

[b]From [C], based on the ratio of excise revenues to consumer expenditures for each product. Alternative estimates are given in [A], Table 5, p. 6 showing federal excise rates for spirits, wine and beer for 1984 to be: 25.5, 1.1, and 5.5, respectively.

[c]Calculated as the ratio of tax revenues for excise taxes, sales taxes, and profits in control states [A, Table 2, p.3] to total retail expenditures [B, Table 45, p. 48].

[d]State excise tax from [D] plus 4.8 percent, the average state and local sales tax rate for all alcoholic beverages.

Sources:

[A] Distilled Spirits Council of the United States, 1984/1985 Public Revenues from Alcohol Beverages.

[B] ____________, Annual Statistics Review 1984/85.

[C] Sammartino, Frank, unpublished estimates used in Congressional Budget Office (1987), dated March 27, 1987.

[D] Toder (1985).

## FOOTNOTES

[1]See, for example, Spiro (1974), Brinner and Clotfelter (1975), and Clotfelter (1979).

[2]The ratio of population in non-lottery states within 20 miles of a state's borders to the state's own population was approximated using all or half of county populations in bordering states.

[3]Data on sales to nonresidents is not normally available, but inferences can be drawn from the zip codes of winners. For Massachusetts, such information is available only for lotto. An analysis of 500 winners showed that 15 percent lived outside of the state. New Hampshire, which had much smaller lotto jackpots than Massachusetts, accounted for 7 percent, Rhode Island 4 percent, New York, none, and other states the remaining 4 percent. Maryland, with four lottery states and one non-lottery state on its border, had a similar 16 percent of lotto winners from out of state. However, the percentage of other games won by nonresidents was smaller: 13 percent in instant games and 9 percent in 4 digit numbers games. These figures suggest that the BORDER variable is at best an imperfect measure of the capacity for out-of-state sales.

[4]See DeBoer (1985) for a statistical test of economies of scale in lottery administration.

[5]Actual revenues from lotteries almost surely overstate their incremental contribution to state budgets due to declines in other revenue sources. For example, to the extent that purchases of lottery tickets take the place of taxable consumer expenditures, retail sales tax collection will decline. Where various bases other than lottery expenditures are denoted $B_i$, average tax rates on each of them $t_i$, and total state revenue. $R = \sum_i t_i B_i + t_L L$, the incremental effect of an increase in lottery expenditures $(L)$ is $dR/dL = t_L + \sum_i t_i (dB_i/dL)$. For illustration, suppose a dollar's worth of lottery tickets reduces taxable retail sales by 80 cents and there are no other effects on any other tax base. In this case a state whose average lottery contribution to net revenue is 35 cents per dollar of sales would enjoy a marginal contribution of only 29 cents per dollar if the state sales tax rate were t percent and lottery winnings were not taxable. For the case of California, a state that does not tax lottery winnings, Vasche (1986, p. 48) speculates that the lottery depresses revenues from sales, income and pari-mutuel taxes.

[6]See, for example, Dennis Farney, "More States Bet on Lotteries to Increase Revenue as Popularity of this 'Painless Taxation' Grows," Wall Street Journal, February 6, 1986, p. 42.

[7]For a discussion of lottery marketing, see Clotfelter and Cook (1987).

[8]If the opportunity costs of capital were added to administrative costs, the conceptual correspondence to monoply profits is exact. This distinction is ignored in the present discussion.

[9]The introduction of a new good (such as a legal lottery) will be expected to cause a shift in the demand curves for substitute goods (in this case, illegal lotteries). This shift does not imply an offsetting reduction in welfare, however, since the demand curve for legal lotteries already accounts for the presence of the substitute good. This is so for the same reason that the shift in the demand for a good creates no additional offsetting welfare gain when a tax is placed on a substitute good. See Harberger (1974, pp. 32 ff.), for example. For a similar application, see Sugden and Williams (1978, pp. 134-137).

[10]See for example, Stokey & Zeckhauser (1978, pp. 263-264).

[11]See, for example, Los Angeles Times Poll, March, 1986, referred to above.

[12]Clotfelter (1979) employs data on sales and average incomes by zip code. To the extent that individuals purchase tickets outside their zip code of residence and these zip codes have lower average income levels, the income elasticities using such data will be biased downward. For that reason the study makes conclusions based only on comparative incidence.

[13]Using midpoints of bounded income classes, implied lottery purchases as a percent of income in California for the classes shown in Table 8 are 1.36, 0.79, 0.48, 0.34, 0.19, and 0.13. If the mean of the over $60,000 class is $80,000, the ratio for that class is 0.15.

[14]In order to calculate concentration or sample means in this March survey, it was necessary to estimate the mean number for the highest category on the questionnaire, which was 9 or more tickets. One method was to fit a log-normal distribution, and the other was to use data on amount of winnings. The estimate using the first method, 16 tickets, was lower and was the one we use in this paper.

We assumed that the natural log of weekly expenditures was normally distributed over the population of those who purchased at least one ticket. A normal distribution with mean of 1.0 and standard deviation of 1.25 provided a good fit for the empirical distribution. The other method of calculating average play in the top group relies on answers to a question concerning the to a question concerning the amount won in the previous week. The average reported winnings generally rises with number of tickets purchased, but the average ratio of winnings to number of tickets ($1.04) is too high by a factor of 2, given a 50 percent payout rate. Whether this results from a tendency to overstate winnings or understate number of tickets purchased is unclear. But assuming the ratio of reported winnings to play is constant for all players, the average reported winnings for the top class, $20.75, implies an average purchase of 20 tickets in the top category.

[15]The figure is based on expenditures in Maryland, but similar results were obtained for California using the Los Angeles Times Poll.

[16]The derivative of expected expenditures with respect to race is F(z) multiplied by the coefficient 10.20.

[17]For a discussion of the earmarking of lottery revenues, see Mikesell and Zorn (1986).

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