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The Distributional Burden of Instant Lottery Ticket Expenditures: An Analysis by Price Point

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Abstract

This article examines the distributional burden of different price-point instant lottery games. Theoretical reasons exist for expecting higher-priced instant lottery games to be less regressive than lower-priced instant games. Using county-level data on sales by price point for six states, the empirical results show that higher-priced instant games are less regressive than lower-priced games. In addition, regressivity is rejected in favor of proportionality for some instant lottery games. The analysis also reveals that counties having a higher-percentage of low-income households have higher sales of lower-priced instant games, but differences in the distribution of household income have no significant impact on higher-priced instant sales. Taken together, the findings suggest that large differences in the distributional burden of individual instant games are masked if aggregated instant-lottery sales data are used.

Keywords: state lotteries, instant games, burden, regressivity
JEL Codes: H7, H22, L3

The views expressed here are those of the author and not necessarily those of the Federal Reserve Bank of St. Louis or the Federal Reserve System.

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Introduction

Beginning with New Hampshire's introduction of the first modern-day state lottery in 1964, forty-three states and the District of Columbia now operate state-owned lotteries. Average annual growth in lottery sales topped 5 percent in the 2000s and surpassed 10 percent during the 1980s and the 1990s. Lottery sales in the United States totaled $58 billion in fiscal year 2010, of which state governments retained (after prize payouts and administrative expenses) nearly $18 billion (roughly 2 percent of total state tax revenue) for spending on education, infrastructure, and various social programs.[1] The growth of the lottery industry over the past several decades is not only a result of more states offering lotteries, but also ever-evolving and expanding product lines designed to attract and retain customers through higher jackpots.

The growth of the lottery industry has sparked much academic research on various aspects of the industry. The issue garnering the most attention is the distribution of lottery ticket expenditures across different income groups; that is, which income groups spend a greater percentage of their income on lottery tickets. This is commonly referred to as the distributional burden of lottery ticket expenditures (see, e.g., Clotfelter and Cook 1987, 1989; Scott and Garen, 1994; Farrell et al., 1999; Price and Novak, 1999; Forrest et al., 2000; Garrett and Coughlin, 2009).[2] Determining the distributional burden of state lotteries is most commonly done by estimating the income elasticity of demand for lottery tickets. The majority of research has shown that state lotteries have an income elasticity of demand less than one, thus defining

[1] Data are from the North American Association of State and Provincial Lotteries (www.naslp.org). The numbers for 2010 suggest an average tax rate of 31 percent. The average tax rate for lotteries has historically been much higher than that of other state excise taxes (Clotfelter and Cook, 1987). Whether a lottery ticket constitutes a tax is a point of debate since lottery participation is strictly voluntary.
[2] This is only a small listing of the dozens of studies on the subject.

expenditures on state lotteries as regressive. Research has also shown that instant lottery games (also called "scratch-offs") tend to be more regressive than online lottery games such as Lotto or Powerball (Mikesell, 1989; Oster, 2004), and that online games may be progressive.[3]

Speculative reasons for the difference in the distributional burden of instant and online games stem from research on why people play lotteries and the fact that online games tend to have higher jackpots than instant games. Caplin and Leahy (1998) suggest people play the lottery for fun, and that the level of fun is dependent on the size of the jackpot relative to a player's current wealth. Thus, wealthier individuals are more likely to play online games. Kahneman and Tversky (1979) argue that players have a poor understanding of the odds of winning. If true, then individuals with more income (and thus with more education) have a better understanding of the expected return of lottery games and will play online games with larger jackpots, as increasing jackpots due to rollovers raise the expected return to the player.[4]

Although the evidence suggests that instant lottery games are more regressive than online lottery games, studies on the distributional burden of instant lottery games have treated all instant lottery games within a state as identical. Before the the mid-1990s, all instant lottery games in a state (and across states as well) were very similar as they all cost $1 and had similar jackpot sizes. Since then, however, states have offered higher-priced instant lottery games in additional to the traditional $1 instant lottery game. It is now commonplace for states to simultaneously offer for sale $2, $5, $10, $20 and even $30 or $50 instant lottery tickets that have jackpots of several million dollars. These ticket prices are often referred to as price points by the lottery

[3] Instant lottery games require a player to scratch a latex covering on the ticket to immediately find out if a prize is won. Online lottery games require the player to select various combinations of numbers (say, 5 out of 49), or allow the lottery computer to select random numbers, at an authorized lottery retailer (gas station, convenience store, etc.). Drawings for online games are held several times a week and are aired on television, and the player wins if some or all of his or her numbers match those drawn.

[4] A rollover occurs when jackpots accumulate over several drawings because each previous drawing had no winner.

industry since the price for each instant game does not change. Although the jackpots available from instant games are lower than those from most online games, the potential jackpots available with higher-priced instant lottery games are significantly greater than the jackpots available with $1 instant lottery games.

Given that jackpot size is a reason cited for the different distributional burdens of instant games and online games, it is reasonable to hypothesize that the distributional burden of instant games varies by price point since the instant-game jackpot size is positively correlated with the ticket price. Thus, higher-priced instant lottery games should be less regressive than lower-priced instant lottery games, just as online games are less regressive than instant games. The difference in regressivity between lower-priced and higher-priced instant lottery games may also be compounded by the large price differences in instant lottery tickets, as higher-priced instant games are more likely to attract wealthier players.

This paper provides estimates of the distributional burden of instant lottery games by price point, with the purpose of testing the hypothesis that the distributional burden of all instant lottery games are not the same – specifically, that higher-priced instant games are less regressive than lower-priced instant games. In addition, this paper also explores the how the distribution of household income influences instant lottery sales. Recent research by Ghent and Grant (2010) shows that regions which have a larger percentage of lower-income households have higher lottery sales. The income elasticity analysis and the household-income distribution analysis each provides different insights into the distribution of lottery expenditures. The analysis is conducted using county-level data on instant lottery game sales by price point for several U.S. states.

Understanding the distributional burden of different instant lottery games is important for several reasons. First, the distributional burden of state lotteries has been the predominant area of academic research on the lottery industry for the past several decades, but no research to date has examined the distributional burden of different instant lottery games. Second, online ticket sales have historically been a greater percentage of total lottery ticket sales (e.g., 71 percent in 1992), but in recent years instant ticket sales have represented the majority of lottery tickets sold (51 percent in 2008).[5] The growth in instant ticket sales relative to online sales in the mid-1990s corresponds to the introduction of higher-priced instant lottery games. Finally, the distributional burden of state lotteries has received critical attention given the revenue maximization objective of state lottery agencies and the moral opposition of some groups toward state-sponsored gambling. As more states continue to adopt lotteries and other states expand lottery operations, the distributional burden of state lotteries will likely remain at the forefront of the policy debate over state lottery adoption and expansion.

II. An Overview of Instant Games by Price Point

In the mid-1990s states began to offer higher-priced instant lottery tickets in addition to the traditional $1 instant lottery game. The most common price points for these higher-priced instant games are $2, $5, $10, $15, $20, and $30. Of the states with lotteries in 2008, all offered $2 and $5 instant tickets, 35 offered $10 tickets, and 29 offered $20 tickets. The Texas Lottery currently offers the most expensive instant lottery ticket at a price of $50. Higher-priced instant games contribute to the majority of instant-lottery game revenue. For example, across all lottery states in 2008, revenue from $2 tickets was 22 percent ($6.6 billion) of total instant-ticket revenue; $10 and $15 tickets contributed 18 percent ($5.4 billion) of total instant-ticket revenue;

[5] Ticket sales data are from Lafluer's (2009).

and $5 tickets accounted for 25 percent ($7.3 billion) of total instant-ticket revenue.[6] In comparison, revenues from the traditional $1 instant lottery game accounted for only 11 percent ($3.1 billion) of total instant-lottery ticket revenue.

The sales of higher-priced instant tickets relative to $1 instant tickets are attributed to the higher jackpots and greater expected return available from these higher-priced games, as revealed in a legislative report written by the Wisconsin Lottery:

> *"The Lottery has been able to generate increases in instant scratch sales in recent years by responding to consumer demands for higher price point tickets with higher top prizes, better overall odds of winning, and a higher payout."* [7]

A search of state lottery websites reveals that $1 instant lottery games have top jackpots averaging from $50,000 to $100,000, whereas higher-priced instant games have jackpots of several million dollars. At the time of this writing, for example, the Florida Lottery offers a $20 instant game with a jackpot of $3 million; the Texas Lottery offers a $50 instant game with a top prize of $7.5 million; and the New York Lottery offers a $30 instant game with a jackpot of $1 million a year for life.[8] Higher-priced instant lottery games also tend to have a greater expected return to the player (corresponding to a lower return to the state). On average, $1 instant lottery games have an expected return to the player of about 50 to 55 percent, whereas higher-priced instant games have a return of about 60 to 70 percent. Although state lottery agencies receive a

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[6] See Lafleur's (2009, page 377).

[7] Wisconsin Department of Revenue, Lottery Division. "Lottery Sales and Prize Payout." A Report to the Joint Committee on Finance, 2011, page 6. Available at http://legis.wisconsin.gov/lfb/jfc/passive_review/Documents/2011_02_28_DOR%20PR%20to%20JFC%20on%20Lottery%20ticket%20sales(2.28.2011).pdf. Garrett and Sobel (2004) show that lottery sales are higher for games having greater jackpots, higher expected returns, and lower odds of winning.

[8] The instant games are: Florida – $3 Million Monopoly; Texas – Ultimate Casino Jackpot; New York – Win $1,000,000 a Year for Life. The games listed here were available as of January 20, 2011. Most instant games are on the market for several months.

lower percentage return from each higher-priced instant game on average, the absolute dollar amount the lottery receives from a higher-priced instant game is greater than that from each $1 game.[9]

The primary objective of state lottery agencies is to generate profits from the sale of lottery tickets to fund various public social programs.[10] As such, the introduction and current availability of higher-priced instant games appears commensurate with this objective as state lottery agencies are generating greater revenues from higher-priced instant lottery tickets. It is straightforward to demonstrate that lottery profits are higher when the state lottery offers instant lottery tickets with different price-points.

Consider a monopoly state lottery agency that sells only instant tickets at a single price point, say $1. The lottery has revenue of $P_1(Q_1)\cdot Q_1$ and costs of $C(Q_1)$, where P_1 = the price point of the lottery ticket and Q_1 = the quantity of tickets sold.[11] The lottery will maximize profits of $\pi = P_1(Q_1)\cdot Q_1 - C(Q_1)$. Differentiating profits with respect to Q and rearranging terms yields $P_1\left(1+\frac{1}{\varepsilon}\right) = MC,$ which is the usual profit-maximizing condition for a monopolist. With positive MC and P_1, it must be the case that the price elasticity of demand, ε, is less than -1. Thus, the demand for $1 tickets is price elastic at the profit maximizing level of P_1 and Q_1.

Because the demand for $1 instant tickets is price elastic at the profit-maximizing price and level of output, a profit-maximizing state lottery cannot generate additional revenue by

[9] For example, for each ticket sold, a $1 ticket with an expected return to the player of 50 percent yields 50 cents to the state, whereas a $2 ticket with an expected return to the player of 60 percent yields 80 cents to the state.

[10] The profit (or revenue) maximization objective of state lotteries is clearly stated in the annual reports of state lottery agencies and their web pages. For example, the mission of the Florida Lottery is "…to maximize revenues in a manner consistent with the dignity of the state and the welfare of its citizens" (http://www.flalottery.com/inet/aboutus-factsMain.do). The objective of the Kansas lottery is "… to produce the maximum amount of revenue possible for the State of Kansas while insuring the integrity of all games" (http://www.kslottery.com/LotteryInfo/AboutUs.htm).

[11] Here the analysis uses the dollar price of a lottery ticket rather than the expected price. Under the latter framework, the expected price of a ticket to the player would be the expected return of the ticket and marginal costs would be net of prize payouts. The conclusions are the same regardless of which measure of price is used.

increasing the price of $1 instant tickets. Profits may be increased through more advertising (to increase *Q*), but this would be only a short-run solution since sales eventually plateau over time as games age (Mikesell, 1994). To generate greater profits over the longer-run, the state lottery can segment the market for lottery tickets based on consumer income – high (low) income consumers are more (less) likely to buy higher-priced tickets – by introducing higher-priced instant lottery tickets in addition to still offering $1 tickets. If the state lottery now offers *N* higher-priced instant lottery games in addition to $1 instant games, the lottery will maximize profits (Π) of

$$\Pi = P_1(Q_1) \cdot Q_1 - C(Q_1) + \sum_{n}^{N} [Pn(Qn) \cdot Qn - C(Qn)] .$$

Clearly, Π > π if the revenue from each game exceeds the cost of providing each game. This condition makes intuitive sense, as it is unlikely that state lotteries would, at least in the long run, operate an individual lottery game at a loss.[12] Lottery profits will therefore be greater if the lottery offers multiple instant games at various price points than if it offered only $1 instant games.

In order to generate sales from higher-priced instant games, higher-priced instant tickets must have higher jackpots and expected returns since there would be no incentive for players to buy higher-priced tickets if these tickets have the same sized jackpots and expected returns as $1 tickets. Not only are higher-priced tickets simply more affordable to higher-income players, research by Caplin and Leahy (1998) and Kahneman and Tversky (1979) suggests that higher-income individuals are more likely to play lottery games with larger jackpots, such as those

[12] In the short run it is possible for revenue from any game *n* to be less than the costs of producing game *n* (i.e., in the short run an instant lottery game may still be produced as long as price exceeds average variable costs). Losses on any game could be a result of substitution between games (Clotfelter and Cook, 1989) or a mistaken estimation of consumer demand by the state lottery agency.

offered by higher-priced instant games. Thus, the greater affordability of higher-priced tickets by higher-income individuals and the preference of these individuals for larger jackpots suggest that higher-priced instant tickets may be less regressive than lower-priced instant tickets.

III. The Distributional Burden of Instant Lottery Expenditures

To determine the distributional burden of state lotteries, the majority of research on the subject has estimated the income elasticity of demand for lottery tickets by regressing lottery sales on income and a set of economic and demographic characteristics.[13] Although individual-level data is preferred, there are few available surveys of lottery players. Surveys that have been used in previous studies do not include player expenditures on individual lottery games and/or continuous measures of player income (i.e., only income ranges), both of which are required here. As a result, the unit of observation in most studies has typically been a zip code, a county, or a state.[14] Due to the use of aggregated data, any income elasticity estimated from aggregate data cannot be interpreted the same as an individual's income elasticity of demand unless all agents are homogeneous. Therefore, the estimated income elasticities here (as in previous studies using aggregated data) are interpreted as a measure of the responsiveness of regional per capita sales with respect to changes in regional per capita income, and thus provide a picture of the distributional burden across county income rather than across individual income.

Studies on the distributional burden of instant games (in aggregate) have generally found income elasticities less than one, although estimates do vary. In an analysis of Illinois counties

[13] Although parametric estimation has been used most commonly to determine the distributional burden of lotteries, several studies have used the Suits Index (Suits, 1977), which measures the relative sizes of cumulative tax burdens and cumulative incomes (see Clotfelter and Cook, 1989; Price and Novak, 1999; Combs, Kim, and Spry, 2008; and Ghent and Grant, 2010).
[14] Clotfelter and Cook (1987), Scott and Garen (1994), and Perez and Humphreys (2011) use household survey data on lottery expenditures.

for several years in the 1980s, Mikesell (1989) finds an income elasticity of demand for instant tickets of about 0.95. Garrett and Coughlin (2009) use county-level data for several states and obtain income elasticity estimates for instant games that range from 0.20 to 0.70. Other studies obtain much smaller income elasticity estimates. For example, Price and Novak (1999, 2000) find income elasticities of -0.20 to -0.45 for instant lottery tickets in Texas, thus suggesting instant tickets are inferior goods. A similar result was found by Hansen (1995) in a county-level analysis of Colorado instant games. Despite the wide range of estimates across studies, each has found that instant lottery games are regressive. These studies, however, used aggregate instant-lottery ticket sales in their analysis, thus ignoring potential differences in the distributional burden of instant lottery tickets with different price points.

To test the hypothesis that the regressivity of higher-priced instant games is less than that of lower-priced instant games, the analysis here uses county-level data for the states of Florida, Iowa, Missouri, New York, Texas, and West Virginia for 2009.[15] Instant lottery sales by price point at the county-level were obtained by contacting each state lottery agency. In 2009, the six states offered $1, $2, $5, and $10 instant lottery games. In addition, $3 tickets were available in four states (not New York and Texas), $20 tickets were available in five states (not West Virginia), and $30 tickets were available in two states (Florida and New York).[16] Descriptive statistics for instant lottery price-point sales are shown in Table 1. As seen in this table, sales of $1 instant tickets accounted for 7 percent to 24 percent of total instant sales (depending on the state) in 2009, whereas sales of $2, $3, $5, and $10 tickets each contributed a larger share of total

[15] Several factors simultaneously determined the level of data aggregation and the states used in the analysis. First, county-level data were the smallest unit of aggregation for which instant-ticket price point sales were available for several states. Second, all states that had a lottery in 2009 and a minimum of 50 counties (to ensure an adequate number of cross-sectional units) were contacted, but many states did not have instant-ticket price-point data readily available at the county level. Finally, it was desired to have states from different regions of the country to ensure that the results were representative of all states as closely as possible.

[16] In 2009, the Texas Lottery also offered $7, $25, and $50 tickets. However, these price points were excluded from the analysis because county-level sales data for these price points were incomplete.

instant-game sales. Not surprisingly, per capita sales for these price points were generally higher than sales for \$1 instant games.

[Table 1]

The correlation analysis in Table 2 provides preliminary insight into the relationship between per capita instant lottery sales by price point and per capita county income. The correlation between county income and \$1 instant ticket sales is shown in column (1), and the correlation between county income and sales for the highest-priced instant game in the state is shown in column (2). As seen in the table, the correlation between per capita income and per capita sales differs significantly by instant-game price point. For each of the six states, the correlation between income and \$1 ticket sales is less than the correlation between income and higher-priced instant ticket sales. In many instances, the correlation between \$1 ticket sales and income is negative, whereas the correlation between higher-priced sales and income is positive. The difference between these correlations is statistically significant for all states except Missouri and West Virginia (column 3). The correlations shown in Table 2 generally reveal a larger positive (or less negative) correlation between higher-priced instant ticket sales and income.

[Table 2]

Since the primary objective here is to explore the distributional burden of different instant lottery games, it is necessary to estimate income elasticities of lottery demand. To do so, the following lottery demand equation is estimated for each instant lottery game in each state:

$$\ln(Sales_i) = \beta \cdot \ln(Income_i) + \mathbf{X}_i + \varepsilon_i , \qquad (1)$$

where $Sales_i$ is per capita instant lottery sales (by price point) in county i and $Income_i$ is per capita personal income in county i. Both $Sales_i$ and $Income_i$ are transformed into natural logarithms. An instant lottery game is regressive (progressive) if the estimated income elasticity (β) from equation (1) is less (greater) than one. The lottery is considered proportional if the income elasticity is equal to one.

The matrix **X** contains demographic variables that previous studies have identified as significant determinants of lottery sales. Specifically, the instant-lottery demand model includes population density, the percentage of the population with a bachelor's degree or higher, the percentage of the population 65 years of age or older, and a binary indicator variable for whether the county borders another state.[17] Past research has shown that lottery sales are (1) higher in more densely populated areas, (2) inversely related to education levels, and (3) different across age groups.[18] The effect of cross-border lottery shopping has been shown to influence lottery sales in border counties (Garrett and Marsh, 2002; Tosun and Skidmore, 2004).[19]

The income elasticity in equation (1) is based on a measure of average (per capita) income in each county and thus does not capture the distribution of income within each county, which has also been found to be an important determinant of lottery sales (Rubenstein and Scafidi, 2002; Ghent and Grant, 2010). Matrix **X** therefore also includes variables to capture the distribution of household income in each county. These variables include: the percentage of county households having income less than \$15,000 (lower income); the percentage of county households having income between \$15,000 and \$35,000 (lower-middle income); and the percentage of county households having income between \$35,000 and \$50,000 (upper-middle

[17] All data were obtained from the U.S. Census.
[18] Studies have considered other economic and demographic variables as well, including the unemployment rate and the percent of the population living below the poverty level. A confounding issue in modeling lottery demand is that many of these variables tend to be highly correlated with each other as well as income and education. We include only income and education since these two variables have tended to be the strongest predictors of lottery sales in the literature.
[19] The expected return of lottery games has also been shown to be a determinant of lottery sales (Garrett and Sobel, 2004; Brown and Rork, 2005). Because separate regressions for each state are estimated here, there is no variation in the expected return as the expected return faced by all counties in a state is the same.

income).[20] The omitted category is the percentage of county households having income greater than $50,000 (upper income).

The income elasticity generated from per capita income and the household-income distribution variables each provides different insights into the distribution of lottery expenditures. The household-income distribution variables capture different levels of instant-lottery ticket expenditures by households having different incomes, but they say nothing about spending as a percentage of income. The income elasticity, on the other hand, reflects how instant-ticket sales respond to changes in income. Put another way, the income elasticity reflects how instant-ticket sales change with respect to a change income holding the distribution of income in each county constant. Ghent and Grant (2010) find that counties in South Carolina having a larger percentage of lower-middle income households have lower lottery sales per capita, and counties having a larger percentage of upper-middle income households have higher sales per capita. Rubenstein and Scafidi (2002) find no significant difference in ticket sales across household income in Georgia. Based on the earlier discussion, a reasonable hypothesis is that counties having a greater percentage of high-income households may have higher sales of higher-priced instant tickets.

IV. Empirical Results

Equation (1) is estimated for each instant-ticket price point in each state (see Table 1) to obtain game-specific income elasticities of demand. Equation (1) is also estimated using pooled data for the six states. The income elasticity of demand for all instant games (the sum of game-specific sales) in each state is obtained to highlight differences in the game-specific income elasticities and the overall instant-game income elasticity. In addition to presenting the estimated

[20] From the U.S. Census.

income elasticities, the coefficients on the income distribution variables are also presented since these variables provide information on how lottery expenditures vary by the distribution of household income within counties.

Results – The Distribution of Household Income

The coefficients for each of the three household income variables for each instant-game price point in each state are shown in Table 3. For brevity, the coefficient estimates for the other independent variables included in **X** are provided in the Appendix.

[Table 3]

The results in Table 3 suggest no clear pattern of how the distribution of household income impacts lottery sales. This is true within states and across instant games, as well as across states. In Florida, for example, instant ticket sales are higher in counties having a higher percentage of low-income and lower-middle income households (relative to upper-income households), but in New York a greater percentage of low-income households is associated with less sales relative to upper-income households. In three states (Iowa, Missouri, and West Virginia), the results generally suggest no significant differences in instant lottery sales across the income distribution.

Given the heterogeneous results from the state-specific regressions, the results from the pooled-state regressions can provide a somewhat clearer picture of the impact of the income distribution on instant ticket sales.[21] For lower-priced instant tickets (≤ $5), per capita sales of these tickets are higher in counties having a greater percentage of low-income and lower-middle income households. On the other hand, for higher-priced instant tickets (> $5), lottery sales are generally not statistically different for both lower-income and lower-middle income households

[21] The pooled regressions include state dummy variables.

relative to upper-income households. In the case of $20 instant tickets, a greater percentage of lower-income households is associated with lower $20 lottery sales relative to upper-income households. Thus, although a clear relationship between the distribution of household income and instant lottery sales has not been found, there is evidence that the impact of the income distribution on instant lottery sales does vary by instant price point, a fact that is missed when only aggregate instant lottery sales is examined.

Results – Income Elasticities of Demand by Price Point

The income elasticity of demand for each instant game price point in each state is shown in Table 4. The full regression results are shown in the Appendix.

[Table 4]

The empirical results in Table 4 support the hypothesis that higher-priced instant games have larger income elasticities than lower-priced instant games and thus are less regressive than lower-priced games. For each state, the estimated income elasticities of demand generally increase in magnitude with instant game price point, although most income elasticity estimates are not significantly different than zero for the states of Iowa, Missouri and West Virginia (but still indicate regressivity since $\beta < 1$). For the other states, the income elasticities for higher-priced instant games are, with a few exceptions, statistically larger than the income elasticity estimates for the lower-priced instant games. Similar results are found from the pooled regressions.[22] Although it is not possible to test the equality of income elasticity estimates across instant games (since they are each from a different regression), there is evidence that higher-priced instant games are less regressive than lower- priced games since the former are statistically greater than zero and have larger income elasticity estimates. The estimated income

[22] The pooled regressions include state dummy variables.

elasticities from Table 4 are shown in Figure 1 to illustrate that the regressivity of instant lottery tickets generally decreases as the ticket price increases.

[Figure 1]

One interesting finding is that the income elasticities of demand for \$10 and \$20 instant tickets in Texas and \$5 and \$10 tickets in West Virginia are considerably larger than the income elasticities for all other instant games. For these games, *t*-tests indicate that the null hypothesis that each income elasticity is equal to one cannot be rejected. Thus, the distributional burden of these higher-priced instant games (shown in italics in Table 4) may be proportional. Although online games have been shown to be proportional or progressive in some instances (Mikesell, 1989; Oster, 2004; Garrett and Coughlin, 2009; Perez and Humphreys, 2011), the results presented here reveal that higher-priced instant games may, to some degree, mimic online games in terms of their income elasticity of demand. This seems reasonable, as higher-priced instant games have jackpots and odds of winning that are more similar to online games than are the jackpots and odds of winning from lower-priced instant games. The important conclusion is that not all instant lottery games may be regressive.

The results shown in the last column of Table 4 and the far-right bar in each graph in Figure 1 reveal that the income elasticities for all instant games combined (which are similar to those found in previous studies) are quite different than the income elasticities from individual instant games. For example, the income elasticity for all instant games in Texas is 0.471, but individual instant-game elasticities range from 0.249 to 0.801. A similar result is found for New York and Florida. In addition, while the income elasticities for all instant games in both Iowa and Missouri are both not significantly different than zero, the income elasticity for \$2 tickets in Iowa and the income elasticity for \$3 tickets in Missouri are much larger and statistically different than zero. Thus, while regressivity is found for most instant games and for all instant games combined, the degree of regressivity varies across instant games, and in some cases, the income elasticity for aggregated instant games masks the proportional distributional burden of some higher-priced instant games.[23]

Results – A Comparison with Online Games

It is worthwhile to now briefly explore how the income elasticities of demand for higher-priced instant games compare with the income elasticity of demand for online games (in aggregate). Since online lottery games have much higher jackpots than the highest-priced instant lottery games, it is expected that the income elasticity of demand for online tickets is greater than that for instant games.

Equation (1) was re-estimated for each state and the pooled sample of states using per capita online lottery sales as the dependent variable. The estimated income elasticities for online games are shown in the last column of Table 5. To provide a comparison with the instant game elasticities, the largest instant price point income elasticity and the aggregate instant game elasticity (both from Table 3) are shown in the first two columns of Table 5.

[Table 5]

The results in Table 5 show that the income elasticity for online games is generally higher than that of each instant game price point, but there are some exceptions. For example, in Texas the income elasticity of demand for $20 instant tickets is greater than that for online

[23] An alternative method of examining the distributional burden of lotteries is the Suits Index (Suits, 1977). The Index, which ranges from -1 to +1, measures the relative sizes of cumulative lottery expenditures and cumulative incomes. A values less than (greater than) zero indicates regressivity (progressivity). Calculated indexes for each instant lottery game suggest regressivity, and in some states higher-priced instant games are less regressive than lower-priced instant games. The Suits Indexes are available upon request. The main reason regression is the preferred method of analysis over the Suits Index is that regression analysis controls for other factors that influence lottery sales (included in matrix **X** in equation 1) in addition to income, whereas the Suits Index only makes use of lottery sales and income.

games. The same is true for $3 tickets in Missouri. Also, $10 and $20 instant games from the pooled sample of states have income elasticities (0.687 and 0.694, respectively) greater than the income elasticity for online lottery games (0.578). Generally, the results show that online games are less regressive than instant lottery games, a finding supported by earlier literature. But the analysis by instant game price point done here suggests the possibility that some higher-priced instant games may be less regressive than online games.

V. Conclusion

The distributional burden of state lotteries has been, and most likely will continue to be, the most important issue in the policy discussion of state lottery adoption and expansion. To date, studies on the distributional burden of lotteries have examined the two broad categories of lottery games – instant games and online games. Research has generally found that instant lottery games are more regressive than online games, with the common explanation that higher-income players are more attracted to online games' higher jackpots. Following similar logic, it was argued here that the distributional burden of individual instant lottery games should differ for a similar reason – namely, higher-income players are more likely to play higher-priced instant lottery games with larger jackpots. Thus, the regressivity of higher-priced instant games should be less than that of lower-priced instant games.

The results revealed that the income elasticities of demand for higher-priced instant tickets are generally greater than those of lower-priced instant tickets, thus supporting the hypothesis that higher-priced tickets are less regressive than lower-priced tickets. Most higher-priced instant tickets, despite being less regressive than lower-priced instant tickets, are more regressive than online games. Evidence was also provided that the distributional burden for several higher-priced instant games was not significantly different than proportionality. This finding suggests that not all instant lottery games may be regressive. In addition, the distribution of household income provided mixed results across instant games and states, but the pooled analysis suggested that counties having a higher percentage of lower-income households have greater sales of lower-priced instant games, whereas the level of higher-priced instant game sales was not significantly different for lower-income households relative to upper-income households.

The income elasticity estimates for each instant game price point were also found to be quite different than the income elasticity of aggregated instant sales. The difference between aggregate instant game elasticities and those for individual games further reveals that using aggregated instant game sales may mask large differences in the distributional burden of individual instant games. Any policy discussion on the distributional burden of instant lotteries games therefore benefits from a game-level analysis rather than a more aggregate analysis since the latter, as shown here, can mask large differences in the distributional burden of instant games. Future research would benefit from the use of individual-level data on instant game expenditures by price point to explore whether individuals' income elasticities are similar to the more aggregate income elasticities used here.

APPENDIX TABLES

Table A1: Florida – Full Regression Results

Variable	Dependent Variable – Per Capita Sales (ln) of:							
	$1 Tickets	$2 Tickets	$3 Tickets	$5 Tickets	$10 Tickets	$20 Tickets	$30 Tickets	All Instant Tickets
Constant	-2.287 (0.36)	-1.268 (0.59)	-4.240 (1.38)	-2.165 (0.81)	-3.241 (1.10)	-1.275 (0.41)	-2.985 (0.99)	-0.231 (0.092)
Per Capita Income (ln)	0.357* (1.94)	0.344* (1.93)	0.383 (1.44)	0.488** (2.23)	0.590** (2.37)	0.494* (1.89)	0.522** (2.02)	0.469** (2.22)
% Low Income	0.029** (3.15)	0.029** (2.85)	0.023* (1.95)	0.034** (3.06)	0.033** (3.20)	0.023* (1.96)	0.022 (1.59)	0.028** (2.88)
% Low-Middle Income	0.033** (4.42)	0.026** (3.45)	0.033** (4.56)	0.017** (2.13)	0.012 (1.44)	0.016 (1.52)	0.005 (0.36)	0.018** (2.16)
% Middle Income	-0.009 (0.28)	-0.012 (0.30)	0.020 (0.71)	-0.009 (0.20)	-0.010 (0.25)	-0.029 (0.62)	-0.020 (0.40)	-0.016 (0.39)
Area	-7.26e-5 (0.98)	-9.20e-5 (1.25)	-0.000* (1.77)	-0.000* (1.87)	-0.000** (2.57)	-0.000** (2.28)	-0.000** (2.27)	-0.000** (2.15)
Border Dummy	0.440** (5.26)	0.282** (4.28)	0.176** (2.94)	0.269** (4.09)	0.233** (3.25)	0.192** (2.34)	0.302** (3.10)	0.254** (3.74)
% Bachelor's Degree	-0.008 (1.37)	-0.009* (1.95)	-9.40e-6 (0.00)	-0.014** (3.38)	-0.017** (4.01)	-0.011** (2.06)	-0.012* (1.83)	-0.012** (2.70)
% Pop > 65	-0.009 (1.49)	-0.000 (0.03)	0.004 (0.68)	-0.002 (0.33)	-0.007 (1.11)	-0.002 (0.31)	-0.001 (0.07)	-0.003 (0.43)
% Black Pop	0.002 (0.74)	0.006* (1.77)	-0.001 (0.19)	0.002 (0.67)	0.003 (0.68)	-0.001 (0.28)	-0.007 (1.39)	0.001 (0.43)
Adjusted R^2	0.652	0.572	0.353	0.476	0.450	0.245	0.171	0.439

Notes: Absolute t-statistics in parentheses based on White's heteroskedasticity-consistent standard errors. * denotes significance at 10%, ** at 5% or better. N = 67 counties.

Table A2: Iowa – Full Regression Results

Variable	Dependent Variable – Per Capita Sales (ln) of:							
	$1 Tickets	$2 Tickets	$3 Tickets	$5 Tickets	$10 Tickets	$20 Tickets	$30 Tickets	All Instant Tickets
Constant	-0.058 (0.02)	-5.237 (1.38)	-1.082 (0.23)	-3.783 (0.71)	-3.632 (0.61)	-5.824 (0.72)	-------	-1.190 (0.28)
Per Capita Income (ln)	0.197 (0.61)	0.729** (2.00)	0.378 (0.84)	0.626 (1.21)	0.660 (1.16)	0.666 (0.87)	-------	0.529 (1.32)
% Low Income	0.024 (1.55)	0.029* (1.94)	0.027 (1.43)	0.017 (0.92)	0.010 (0.48)	0.018 (0.58)	-------	0.022 (1.34)
% Low-Middle Income	0.019 (1.30)	0.035** (2.32)	0.011 (0.58)	0.023 (1.21)	0.018 (0.74)	0.032 (1.07)	-------	0.023 (1.45)
% Middle Income	-0.024 (1.33)	-0.021 (1.13)	-0.012 (0.48)	-0.040** (2.02)	-0.081** (3.34)	-0.092** (2.46)	-------	-0.036* (1.85)
Area	-0.000* (1.68)	-0.000 (1.52)	-0.000 (1.63)	-0.000** (2.73)	-0.000 (0.80)	-0.000 (0.29)	-------	-0.000* (1.86)
Border Dummy	-0.144* (1.98)	-0.204** (2.93)	-0.270** (3.11)	-0.243** (3.06)	-0.382** (3.92)	-0.294** (2.19)	-------	-0.244** (3.38)
% Bachelor's Degree	-0.023** (3.58)	-0.030** (4.79)	-0.030** (3.84)	-0.027** (3.32)	-0.024** (2.58)	-0.015 (1.26)	-------	-0.027** (4.06)
% Pop > 65	0.005 (0.35)	-0.018 (1.17)	-0.010 (0.50)	-0.004 (0.14)	0.006 (0.23)	0.018 (0.67)	-------	-0.005 (0.29)
% Black Pop	0.052** (2.53)	0.064** (2.99)	0.085** (3.39)	0.059** (2.16)	0.082** (2.19)	0.042 (0.83)	-------	0.067** (2.73)
Adjusted R^2	0.239	0.291	0.192	0.232	0.222	0.084	-------	0.246

Notes: Absolute t-statistics in parentheses based on White's heteroskedasticity-consistent standard errors. * denotes significance at 10%, ** at 5% or better. N = 99 counties.

Table A3: Missouri – Full Regression Results

Variable	Dependent Variable – Per Capita Sales (ln) of:							
	$1 Tickets	$2 Tickets	$3 Tickets	$5 Tickets	$10 Tickets	$20 Tickets	$30 Tickets	All Instant Tickets
Constant	-1.098 (0.26)	-2.638 (0.67)	-4.610 (1.26)	-2.310 (0.53)	-2.632 (0.50)	-0.934 (0.16)	-------	-0.604 (0.14)
Per Capita Income (ln)	0.258 (0.66)	0.479 (1.31)	0.608* (1.78)	0.462 (1.13)	0.408 (0.83)	0.276 (0.49)	-------	0.422 (1.07)
% Low Income	0.016 (1.08)	0.012 (0.96)	0.013 (1.20)	0.008 (0.65)	-0.001 (0.09)	-0.007 (0.34)	-------	0.008 (0.60)
% Low-Middle Income	0.032** (2.37)	0.027** (2.38)	0.009 (0.83)	0.020 (1.61)	0.025* (1.84)	0.029* (1.80)	-------	0.024** (2.00)
% Middle Income	0.018 (1.04)	0.020 (1.19)	0.030* (1.74)	0.008 (0.44)	0.009 (0.42)	-0.016 (0.60)	-------	0.012 (0.70)
Area	0.000 (1.56)	0.000* (1.74)	0.000* (1.78)	0.000** (2.54)	0.001** (3.87)	0.001** (3.24)	-------	0.001** (2.61)
Border Dummy	0.211** (3.05)	0.134** (1.99)	-0.000 (0.01)	0.093 (1.39)	0.132* (1.67)	0.086 (0.92)	-------	0.118* (1.76)
% Bachelor's Degree	-0.019** (2.91)	-0.020** (2.91)	-0.022** (3.66)	-0.018** (2.69)	-0.015** (1.98)	-0.009 (0.95)	-------	-0.017** (2.56)
% Pop > 65	-0.023 (1.59)	-0.013 (0.94)	-0.009 (0.68)	-0.008 (0.53)	-0.001 (0.05)	-0.004 (0.20)	-------	-0.009 (0.62)
% Black Pop	0.017* (1.71)	0.008 (0.93)	0.009 (1.50)	0.007 (0.53)	0.010 (1.03)	0.009 (0.79)	-------	0.010 (1.10)
Adjusted R^2	0.343	0.239	0.158	0.158	0.157	0.088	-------	0.199

Notes: Absolute t-statistics in parentheses based on White's heteroskedasticity-consistent standard errors. * denotes significance at 10%, ** at 5% or better. N = 115 counties.

Table A4: New York – Full Regression Results

Variable	Dependent Variable – Per Capita Sales (ln) of:							
	$1 Tickets	$2 Tickets	$3 Tickets	$5 Tickets	$10 Tickets	$20 Tickets	$30 Tickets	All Instant Tickets
Constant	-2.797* (2.00)	-1.991 (1.46)	-------	-0.450 (0.26)	-1.120 (0.49)	-1.101 (0.38)	-2.418 (1.07)	0.415 (0.26)
Per Capita Income (ln)	0.504** (3.79)	0.527** (4.11)	-------	0.438** (2.65)	0.487** (2.26)	0.403 (1.46)	0.494** (2.29)	0.466** (3.15)
% Low Income	0.008 (0.84)	0.014 (1.45)	-------	-0.028** (2.26)	-0.053** (3.67)	-0.044** (2.23)	-0.035** (2.23)	-0.015 (1.39)
% Low-Middle Income	0.047** (3.85)	0.045** (4.12)	-------	0.044** (3.57)	0.049** (3.56)	0.020 (0.98)	0.011 (0.72)	0.040** (3.66)
% Middle Income	-0.035* (1.97)	-0.047** (2.51)	-------	-0.053** (2.46)	-0.079** (3.28)	-0.072** (2.31)	-0.078** (3.16)	-0.059** (3.17)
Area	4.06e-5 (0.94)	7.49e-5 (1.59)	-------	4.82e-5 (0.86)	0.000* (1.84)	0.000 (1.43)	0.000** (2.51)	7.90e-5 (1.55)
Border Dummy	-0.025 (0.71)	-0.025 (0.63)	-------	0.017 (0.36)	0.038 (0.65)	0.089 (1.23)	0.011 (0.18)	0.010 (0.24)
% Bachelor's Degree	-0.011** (3.00)	-0.013** (3.89)	-------	-0.008** (2.28)	-0.004 (0.68)	-0.001 (0.17)	-0.001 (1.02)	-0.010** (2.77)
% Pop > 65	0.012 (1.01)	0.019* (1.74)	-------	0.007 (0.50)	0.006 (0.38)	0.020 (0.87)	0.023 (1.35)	0.013 (1.16)
% Black Pop	0.005 (1.28)	-0.001 (0.23)	-------	-0.004 (0.81)	0.009 (1.49)	0.007 (0.89)	0.008 (1.30)	0.002 (0.38)
Adjusted R^2	0.535	0.511	-------	0.284	0.461	0.445	0.560	0.288

Notes: Absolute t-statistics in parentheses based on White's heteroskedasticity-consistent standard errors. * denotes significance at 10%, ** at 5% or better. N = 62 counties.

Table A5: Texas – Full Regression Results

Variable	Dependent Variable – Per Capita Sales (ln) of:							
	$1 Tickets	$2 Tickets	$3 Tickets	$5 Tickets	$10 Tickets	$20 Tickets	$30 Tickets	All Instant Tickets
Constant	-0.559 (0.42)	0.037 (0.03)	-1.755 (0.91)	-0.854 (0.52)	-4.614** (2.35)	-5.753** (2.46)	-------	-0.227 (0.15)
Per Capita Income (ln)	0.250** (1.99)	0.265** (2.13)	0.386** (2.10)	0.428** (2.75)	0.717** (3.81)	0.801** (3.62)	-------	0.471** (3.23)
% Low Income	0.022** (4.39)	0.017** (3.09)	0.021** (3.40)	0.001 (0.17)	-0.003 (0.38)	-0.028** (2.56)	-------	0.007 (1.07)
% Low-Middle Income	0.005 (0.92)	0.004 (0.78)	0.013* (1.90)	0.001 (0.18)	-0.002 (0.30)	0.006 (0.66)	-------	0.003 (0.53)
% Middle Income	0.012 (1.32)	0.010 (1.07)	0.015 (1.35)	0.024** (2.54)	0.030** (2.71)	0.032** (2.12)	-------	0.022** (2.41)
Area	7.45e-5** (2.15)	7.40e-5** (2.06)	0.000** (2.32)	2.95e-5 (0.54)	7.81e-5 (1.37)	2.01e-5 (0.21)	-------	6.36e-5 (1.50)
Border Dummy	-0.169** (4.03)	-0.194** (4.54)	-0.213** (2.96)	-0.276** (4.76)	-0.306** (4.36)	-0.288** (2.86)	-------	-0.246** (4.63)
% Bachelor’s Degree	-0.025** (6.80)	-0.025** (6.59)	-0.025** (5.15)	-0.030** (6.31)	-0.031** (5.57)	-0.029** (4.24)	-------	-0.028** (6.57)
% Pop > 65	0.007 (1.29)	0.010* (1.95)	0.006 (0.73)	0.020** (3.18)	0.022** (3.01)	0.029** (2.88)	-------	0.016** (2.64)
% Black Pop	0.004 (1.56)	0.003 (0.99)	-0.019** (4.69)	0.007** (2.13)	0.007* (1.85)	0.011** (2.47)	-------	0.002 (0.57)
Adjusted R^2	0.379	0.347	0.325	0.316	0.282	0.272	-------	0.310

Notes: Absolute t-statistics in parentheses based on White’s heteroskedasticity-consistent standard errors. * denotes significance at 10%, ** at 5% or better. N = 249 counties.

Table A6: West Virginia – Full Regression Results

Variable	$1 Tickets	$2 Tickets	$3 Tickets	$5 Tickets	$10 Tickets	$20 Tickets	$30 Tickets	All Instant Tickets
	Dependent Variable – Per Capita Sales (ln) of:							
Constant	-1.135 (0.31)	-0.946 (0.15)	-------	-6.958 (1.29)	-11.556 (1.33)	-------	-------	-1.408 (0.27)
Per Capita Income (ln)	0.308 (0.88)	0.382 (0.64)	-------	0.865 (1.64)	1.270 (1.52)	-------	-------	0.492 (0.99)
% Low Income	0.009 (1.15)	0.015 (1.09)	-------	0.019 (1.50)	0.019 (0.95)	-------	-------	0.014 (1.24)
% Low-Middle Income	-0.009 (0.68)	-0.013 (0.93)	-------	-0.014 (0.76)	-0.010 (0.62)	-------	-------	-0.012 (0.93)
% Middle Income	-0.006 (0.36)	-0.013 (0.71)	-------	0.016 (0.50)	0.016 (0.50)	-------	-------	-0.005 (0.28)
Area	0.001** (2.59)	0.001** (5.85)	-------	0.001** (3.08)	0.001** (3.35)	-------	-------	0.001** (4.58)
Border Dummy	-0.212** (2.99)	-0.171* (1.97)	-------	-0.243** (2.46)	-0.364** (3.48)	-------	-------	-0.218** (2.79)
% Bachelor's Degree	-0.004 (0.36)	-0.011 (0.91)	-------	-0.015 (1.16)	-0.017 (1.05)	-------	-------	-0.010 (0.89)
% Pop > 65	0.040 (1.61)	0.024 (1.06)	-------	0.003 (0.07)	0.006 (0.16)	-------	-------	0.026 (1.06)
% Black Pop	0.031** (3.04)	0.013 (1.15)	-------	0.023 (1.47)	-0.002 (0.15)	-------	-------	0.017 (1.59)
Adjusted R^2	0.277	0.422	-------	0.257	0.293	-------	-------	0.391

Notes: Absolute t-statistics in parentheses based on White's heteroskedasticity-consistent standard errors. * denotes significance at 10%, ** at 5% or better. N = 55 counties.

Table A7: Pooled States – Full Regression Results

Variable	Dependent Variable – Per Capita Sales (ln) of: $1 Tickets	$2 Tickets	$3 Tickets	$5 Tickets	$10 Tickets	$20 Tickets	$30 Tickets	All Instant Tickets
Constant	-2.064** (2.10)	-2.259** (2.17)	-2.457* (1.66)	-3.420** (2.80)	-5.225** (3.55)	-6.767** (3.83)	1.089 (0.64)	-1.907* (1.71)
Per Capita Income (ln)	0.340** (3.67)	0.400** (4.08)	0.412** (2.96)	0.497** (4.31)	0.688** (4.97)	0.694** (4.21)	0.189 (1.19)	0.521** (4.94)
% Low Income	0.025** (6.50)	0.021** (5.19)	0.025** (5.37)	0.009* (1.77)	0.006 (0.92)	-0.015* (1.81)	-0.001 (0.06)	0.014** (3.04)
% Low-Middle Income	0.011** (2.40)	0.010** (2.32)	0.011* (1.95)	0.006 (1.09)	0.004 (0.62)	0.014* (1.77)	-0.000 (0.03)	0.007 (1.57)
% Middle Income	0.003 (0.46)	0.004 (0.56)	0.011 (1.34)	0.007 (0.96)	0.006 (0.65)	0.000 (0.03)	-0.080** (3.45)	0.006 (0.78)
Area	4.00e-5 (1.23)	5.77e-5* (1.68)	7.59e-5* (1.70)	-7.10e-6 (0.15)	2.77e-5 (0.54)	-4.66e-5 (0.56)	-7.88e-5 (0.93)	2.79e-5 (0.70)
Border Dummy	-0.010 (0.34)	-0.063** (2.24)	-0.096** (2.31)	-0.118** (3.51)	-0.158** (4.02)	-0.120** (2.26)	0.141** (2.24)	-0.091** (3.00)
% Bachelor's Degree	-0.018** (7.50)	-0.019** (7.85)	-0.017** (5.32)	-0.020** (7.24)	-0.020** (6.13)	-0.016** (4.04)	-0.010** (2.16)	-0.019** (7.36)
% Pop > 65	0.000 (0.03)	0.002 (0.59)	-0.000 (0.02)	0.007 (1.50)	0.006 (1.18)	0.013* (1.84)	0.010 (1.26)	0.005 (1.13)
% Black Pop	0.009** (4.38)	0.007** (3.02)	-0.007** (2.28)	0.008** (2.85)	0.009** (2.77)	0.011** (2.84)	-0.001 (0.34)	0.006** (2.49)
Adjusted R^2	0.614	0.715	0.665	0.815	0.612	0.764	0.323	0.687

Notes: Absolute t-statistics in parentheses based on White's heteroskedasticity-consistent standard errors. * denotes significance at 10%, ** at 5% or better. N = 647 counties. Regressions also include state dummy variables, coefficients not shown.

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Table 1: Descriptive Statistics – Instant Lottery Games by Price Point

State		$1 Tickets	$2 Tickets	$3 Tickets	$5 Tickets	$10 Tickets	$20 Tickets	$30 Tickets	All Instant Tickets
Florida (n=67)	Mean - Sales Per Capita	$10.48	$23.02	$3.39	$29.74	$21.09	$44.66	$8.64	$141.04
	Percent of Total Sales	7.4	16.7	2.5	20.7	14.4	32.2	6.2	-----
	Number of Games	23	30	3	19	10	5	1	91
Iowa (n=99)	Mean - Sales Per Capita	$6.88	$10.63	$11.46	$7.49	$8.31	$2.15	N/A	$46.65
	Percent of Total Sales	14.2	22.2	25.3	15.5	18.5	4.2		-----
	Number of Games	24	17	9	10	6	1		67
Missouri (n=115)	Mean - Sales Per Capita	$17.14	$32.93	$12.11	$29.38	$17.60	$17.70		$126.87
	Percent of Total Sales	13.9	25.0	9.9	23.0	14.0	14.2	N/A	-----
	Number of Games	23	37	7	22	3	1		93
New York (n=62)	Mean - Sales Per Capita	$23.16	$58.59		$52.24	$32.39	$11.81	$6.51	$184.71
	Percent of Total Sales	12.6	29.8	N/A	26.7	19.5	7.3	4.1	-----
	Number of Games	15	37		34	8	2	1	97
Texas (n=249)	Mean - Sales Per Capita	$12.97	$24.73	$18.65	$50.95	$24.00	$18.62		$149.57
	Percent of Total Sales	9.4	17.8	11.6	33.5	15.2	12.4	N/A	-----
	Number of Games	32	33	14	39	17	8		143
West Virginia (n=55)	Mean - Sales Per Capita	$14.56	$30.01		$10.14	$6.58			$61.29
	Percent of Total Sales	24.0	48.3	N/A	16.6	11.2	N/A	N/A	-----
	Number of Games	28	26		8	2			64

Notes: The mean is the county average for each state. Totals may not sum to 100 due to rounding. All data are for 2009. See text for further data description. N/A = no tickets sold at the respective price point. "Number of Games" is the number of instant-games at each price point that were available for sale during 2009.

Table 2: Correlations Between County Income and County Instant Lottery Sales

	ρ_1 (Income, \$1 Sales)	ρ_2 (Income, Top Sales)	*T*-test on H_o: $\rho_1 = \rho_2$
Florida	-0.373**	-0.090	3.07
Iowa	-0.123	0.093	2.12
Missouri	-0.237**	-0.155*	1.22
New York	-0.116	0.575**	4.49
Texas	-0.234**	0.207**	8.25
West Virginia	0.097	0.134	0.35

Notes: * denotes significance at 10 percent, ** at 5 percent or better from testing H_o: $\rho_i = 0$. 'Top Sales' is sales for the highest-priced instant lottery game in the state (see Table 1).

Table 3: The Distribution of Household Income and Instant Lottery Sales, by Price Point

State	Household Income Variable	Coefficient Estimates $1 Tickets	$2 Tickets	$3 Tickets	$5 Tickets	$10 Tickets	$20 Tickets	$30 Tickets	All Instant Tickets
Florida	Lower Income	0.029**	0.029**	0.023*	0.034**	0.033**	0.023*	0.022	0.028**
	Lower-Middle Income	0.032**	0.026**	0.033**	0.017**	0.012	0.017	0.005	0.018**
	Upper-Middle income	-0.010	-0.011	0.020	-0.010	-0.010	-0.029	-0.020	-0.017
Iowa	Lower Income	0.024	0.029*	0.028	0.017	0.010	0.018	-------	0.022
	Lower-Middle Income	0.019	0.035**	0.011	0.023	0.018	0.032		0.023
	Upper-Middle income	-0.025	-0.021	-0.012	-0.040**	-0.081**	-0.092**		-0.036*
Missouri	Lower Income	0.016	0.012	0.013	0.008	-0.001	-0.007	-------	0.008
	Lower-Middle Income	0.032**	0.027**	0.009	0.020	0.025*	0.029*		0.024**
	Upper-Middle income	0.018	0.020	0.030*	0.008	0.009	-0.016		0.012
New York	Lower Income	0.008	0.014	-------	-0.028**	-0.052**	-0.044**	-0.035**	-0.015
	Lower-Middle Income	0.047**	0.045**		0.044**	0.049**	0.020	0.011	0.040**
	Upper-Middle income	-0.036*	-0.047**		-0.053**	-0.079**	-0.072**	-0.078**	-0.059**
Texas	Lower Income	0.022**	0.017**	0.021**	0.001	-0.003	-0.028**	-------	0.007
	Lower-Middle Income	0.005	0.004	0.013*	0.001	-0.002	0.006		0.003
	Upper-Middle income	0.012	0.010	0.015	0.024**	0.030**	0.032**		0.022**
West Virginia	Lower Income	0.009	0.015	-------	0.019	0.019	-------	-------	0.014
	Lower-Middle Income	-0.009	-0.013		-0.014	-0.010			-0.012
	Upper-Middle income	-0.006	-0.013		0.016	0.016			-0.005
Pooled States	Lower Income	0.025**	0.021**	0.025**	0.009*	0.006	-0.015*	-0.007	0.014**
	Lower-Middle Income	0.010**	0.010**	0.011*	0.006	0.004	0.014*	-0.002	0.007
	Upper-Middle income	0.003	0.004	0.011	0.007	0.006	0.004	-0.080**	0.006

Notes: The dependent variable is the natural log of per capita instant-lottery ticket sales. The coefficients reflect the percentage change in per capita sales from a percentage point change in the respective income distribution. Variable definitions – Lower Income: percent of county households with income < $15,000; Lower Middle Income: percent of county households with income between $15,000 and $35,000; Upper Middle Income: percent of county households with income between $35,000 and $50,000. Omitted category is percent of county households with income > $50,000. * denotes significance at 10%, ** at 5% or better. Full regression results are shown in the Appendix tables.

Table 4: Instant-Lottery Income Elasticities by Price Point

State	Dependent Variable – Log Per Capita Sales of: $1 Tickets	$2 Tickets	$3 Tickets	$5 Tickets	$10 Tickets	$20 Tickets	$30 Tickets	All Instant Tickets
Florida	0.357* (1.94)	0.344* (1.93)	0.383 (1.44)	0.489** (2.22)	0.590** (2.37)	0.494* (1.89)	0.522** (2.02)	0.469** (2.22)
Iowa	0.197 (0.61)	0.729* (2.00)	0.378 (0.83)	0.626 (1.21)	0.660 (1.16)	0.666 (0.87)	-------	0.529 (1.32)
Missouri	0.258 (0.66)	0.479 (1.31)	0.607* (1.78)	0.462 (1.13)	0.409 (0.83)	0.276 (0.50)	-------	0.422 (1.07)
New York	0.504** (3.79)	0.527** (4.11)	-------	0.438** (2.65)	0.487** (2.26)	0.402 (1.46)	0.493** (2.30)	0.466** (3.15)
Texas	0.249** (1.99)	0.264** (2.13)	0.386** (2.10)	0.427** (2.75)	*0.717*** *(3.81)*	*0.801*** *(3.62)*	-------	0.471** (3.22)
West Virginia	0.301 (0.87)	0.382 (0.63)	-------	*0.864* *(1.64)*	*1.269* *(1.51)*	-------	-------	0.492 (0.99)
Pooled States	0.340** (3.67)	0.400** (4.08)	0.411** (2.96)	0.497** (4.31)	0.687** (4.97)	0.694** (4.21)	0.189 (1.19)	0.521** (4.93)

Notes: Each income elasticity estimate is obtained by estimating equation (1) for each instant game in each state. * denotes significance at 10 percent, ** at 5 percent or better. Absolute t-statistics for H_o: $\beta=0$ are in parentheses and are based on White's heteroskedasticity-consistent standard errors. Coefficients in italics are not significantly different than one based on a t-test for H_o: $\beta=1$. Full regression results are shown in the Appendix tables. The pooled regressions also include state dummy variables.

Table 5: Instant and Online Lottery Games - Income Elasticities

State	Highest Instant Price Point Income Elasticity (Table 4)	All Instant Games Income Elasticity (Table 4)	All Online Games: Income Elasticity
Florida	0.590* (2.37)	0.469** (2.22)	0.887** (2.56)
Iowa	0.729** (2.00)	0.529 (1.32)	0.902** (3.11)
Missouri	0.607* (1.78)	0.422 (1.07)	0.087 (0.16)
New York	0.527** (4.11)	0.466** (3.15)	1.031** (4.46)
Texas	0.801** (3.62)	0.471** (3.22)	0.314* (1.94)
West Virginia	1.269 (1.51)	0.492 (0.99)	1.967** (2.68)
Pooled States	0.694** (4.21)	0.521** (4.93)	0.578** (4.95)

Notes: Data in the first two columns are from Table 4. * denotes significance at 10 percent, ** at 5 percent or better. Absolute t-statistics are in parentheses and are based on White's heteroskedasticity-consistent standard errors. All regressions also include a constant term and demographic variables, and the pooled regression also includes state dummy variables.

Figure 1 – Instant Ticket Income Elasticities by Price Point