

## THE RELATIVE REGRESSIVITY OF SEVEN MINNESOTA LOTTERY GAMES\*

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### INTRODUCTION

THE MINNESOTA LOTTERY'S CORE PURPOSE IS "TO raise money for the State of Minnesota."<sup>1</sup> A desire to increase state lottery sales and profits has led to a proliferation of types of lottery games, such as instant tickets, various number games, and the multi-state lottery game Powerball. Introducing new games helps state lottery agencies combat "lottery fatigue," where revenues tend to level off or decline at some point for mature lottery products. The Minnesota Lottery achieved record profits of \$100.7 million on total lottery sales of \$387 million in fiscal year 2004.<sup>2</sup>

A common criticism of state-run lotteries is that the implicit lottery tax is borne more heavily by lower-income individuals. The implicit lottery tax, as defined by Clotfelter and Cook (1987), is the total player losses from lottery purchases less administrative and transaction costs when the state grants itself the exclusive legal right to sell lottery games. The overall distributional effects of the implicit lottery tax across income groups can be measured using the Suits Index (Suits, 1977), which compares the cumulative distribution of income to the cumulative distribution of tax burden. A few studies have computed Suits Indices for different types of lottery products in various states. These studies find that the implicit tax on lottery products is regressive.

We use a new dataset on individual Minnesota lottery game sales by zip code for fiscal year 2004 to examine the relative distributional incidence of each Minnesota lottery product using Suits Indices. In addition, this paper is the first that we know of to analyze the regressivity of Hot Lotto and online instant state lottery games. Introduced in 2002, Hot Lotto has a unique structure of pick 5 plus a "hot" sixth number and is sold in states that are members of the Multi-State Lottery Association. Minnesota's new G3 games, the first online instant games, are important innovations in that they do not require

preprinted scratch-off tickets and thus offer identical odds to all players at the time of purchase. Our analysis suggests that Hot Lotto is less regressive than all but one other Minnesota lottery product, while the G3 games are more regressive than all other games.

### PREVIOUS LITERATURE

Most empirical studies find that the implicit tax on lottery games is regressive. Studies using the Suits Index approach include Price and Novak (1999, 2000), who find that scratch games and pick 3 number games are more regressive than the Texas Lotto game. Spry (2004) calculates Suits Indices for each of the several Hoosier Lottery products in Indiana, and reports Suits Indices in the regressive range for each game in each of the six years examined. He finds that Indiana's scratch and daily games are the most regressive and Powerball and the Hoosier Lotto are the least regressive. Clotfelter and Cook (1987) find that the scratch games offered by the California Lottery have a Suits Index in the regressive range. They also find that daily games, scratch games, and lotto in Maryland are all regressive. Pick 3 and pick 4 daily games are the most regressive lottery products in Maryland. Lotto is the least regressive lottery product offered by the Maryland Lottery.

Other studies analyze distributional effects of lotteries by estimating income elasticities of demand for lottery sales using regression. Some of these studies use geographic total lottery sales data and others use geographic sales data for individual lottery games. Most often lottery sales are collected for each county or zip code in a particular state. Papers finding income elasticities less than one using regression methods include Spiro (1974), Clotfelter (1979), Clotfelter and Cook (1987), Scott and Garen (1994), Hansen (1995), Price and Novak (1999, 2000), Cornwell and Mustard (2001), and Spry (2004). Oster (2004), and Tosun and Skidmore (2004). Interestingly, Oster (2004) shows that Connecticut Powerball income elasticities become closer to one as the jackpot grows, yet within the sample never exceed one. In contrast,

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Mikesell's (1994) panel study of total state lottery sales finds an income elasticity of 3.9. However, he also finds that higher unemployment greatly increases lottery sales. Including unemployment, which is correlated with income, may have affected the income elasticity coefficient.

The Minnesota lottery has been examined in two prior papers, both of which use county level data and restrict the analysis to total lottery sales. Hansen et al. (2000) estimate a negative income elasticity for overall Minnesota lottery sales. Their estimate of this income elasticity was significantly different from one at the 99 percent confidence level. Steinnes (1998) examines the change in lottery sales by county over time. He finds that Minnesota lottery sales fell less than 2 percent in counties with Native American casinos. He does not estimate the effect of income on the level of lottery sales.

As noted by Price and Novak (2000), a reliance on county level data is likely to miss important relationships between income and lottery sales because of aggregation problems. For this reason, we use zip codes, smaller geographical units, for making inferences about the distributional impacts of lotteries, especially in Minnesota, where the four largest

metropolitan counties in the St. Paul/Minneapolis area contain some 46 percent of the state population. Twenty-two percent of the state's population resides in one county alone, which displays tremendous socioeconomic differences. County level data would not account for the extremely large variation in income within each county and thus would not capture the underlying relationship between individual income and purchases of lottery tickets.

#### MINNESOTA LOTTERY GAMES

This paper examines each of the seven categories of games sold by the Minnesota Lottery. The seven Minnesota lottery products are pre-printed instant scratch-off games, G3 instant games, Daily 3, Gopher 5, Northstar Cash, Hot Lotto, and Powerball. Sales figures for each game for fiscal year 2004 are reported in Table 1.

Preprinted instant scratch-off games are the most popular lottery product in Minnesota, accounting for 55.75 percent of all lottery sales in fiscal year 2004. Preprinted instant scratch-off tickets allow players to remove a thin, opaque film to immediately realize the gambling outcome. Minnesota

Table 1  
Minnesota Lottery Sales by Game FY 2004

<i>Game</i>	<i>Total Sales (in millions)</i>	<i>Total Prize Payment (in millions)</i>	<i>Game Sales as Percent of Total Sales</i>	<i>Realized Ex Post Player Loss of an Average \$1 Bet</i>	<i>Realized Implicit Tax on an Average \$1 bet (Ex Post Player Loss per Dollar less \$0.16 Administrative Costs per Dollar)</i>
Scratch Games	\$215.7	\$143.9	55.75%	\$0.33	\$0.17
G3 Instant Games	\$5.4	\$3.2	1.40%	\$0.41	\$0.25
Daily 3 (pick 3)	\$13.2	\$7.0	3.42%	\$0.47	\$0.31
Gopher 5 (pick 5)	\$18.3	\$10.5	4.74%	\$0.43	\$0.27
Northstar Cash (pick 5)	\$6.3	\$3.1	1.62%	\$0.51	\$0.35
Hot Lotto	\$10.4	\$5.2	2.69%	\$0.50	\$0.34
Powerball	\$117.5	\$58.7	30.37%	\$0.50	\$0.34
<b>Totals</b>	<b>\$386.9</b>	<b>\$231.6</b>	<b>100.00%</b>		

Source: 2004 Annual Report of the Minnesota Lottery.

Available at <http://www.lottery.state.mn.us/ar04/index.html>



has a history of instant games of chance, such as pull-tab games sold in taverns and social gatherings, that predates the advent of legal gambling in the state.<sup>3</sup> From a marketing perspective, the appeal of instant gaming is the immediate realization of the gambling outcome. Players do not need to wait for a drawing, as in other games. Some particular Minnesota instant games such as "Viva Las Vegas," "Ruby Red 7s," "Poker Night," and "\$25,000 Table Stakes" feature strong references to casino games.<sup>4</sup> Preprinted instant scratch-off games are printed centrally in large batches. Therefore, the odds of purchasing a winning ticket at a moment in time are conditional on the number of large prizes remaining to be claimed. Lottery players may be sensitive to this information and the Minnesota Lottery posts updated information on claimed preprinted instant scratch-off prizes. Sometimes a particular preprinted instant scratch game will be pulled from retailers when the large prizes are claimed early.<sup>5</sup>

In an effort to increase lottery sales, in February 2004 the Minnesota lottery introduced G3 Instant Games, novel instant scratch-off games that are printed at the time and point of purchase. The marketing idea behind this lottery product is to use online terminal technology to print random tickets, so the problem of pulled instant games is avoided. These games feature themes such as bingo and crossword puzzles.

Daily 3, Gopher 5, and Northstar Cash are traditional online games where winners are determined by matching numbers selected in random Minnesota Lottery drawings. The Daily 3 game provides players with the opportunity to win up to \$1,000 by correctly picking three numbers from 1 through 10 in a daily drawing in the evening seven days a week. In Gopher 5, players pick five numbers from 1 through 42. The jackpot starts at \$100,000 and grows larger until the top prize is won. Gopher 5 drawings are held twice a week. In Northstar Cash, players pick five numbers from 1 through 31. Northstar Cash offers a starting \$25,000 jackpot that grows until won. Northstar Cash drawings are offered seven days per week. Intermediate prizes are also available in these games for players who match some of the numbers in a drawing.

Powerball<sup>6</sup> and Hot Lotto<sup>7</sup> online games are products of the Multi-State Lottery Association that are sold by the Minnesota Lottery. Powerball is a prominent multi-state jackpot game whose sales in Minnesota comprised 29.54 percent of total Min-

nesota lottery sales in fiscal year 2004. Correctly picking five numbers from 1 through 53 and the sixth "Powerball" number from 1 through 42 wins the jackpot, which starts at \$10 million and grows until won.<sup>8</sup> Hot Lotto offers a starting jackpot of \$1 million that grows until won. To win the Hot Lotto jackpot a player must correctly pick five numbers from 1 through 39 and a "HOT" number from 1 through 19. The pick-5-plus-1 structure is novel in state lottery games. Players can win smaller prizes in Hot Lotto and Powerball by matching some of the numbers in a drawing.

Each of these seven Minnesota lottery products has a large realized, ex post average expected loss for consumers of lottery tickets. This loss varies by lottery product as shown in Table 1. The state's profits are the total player losses from lottery purchases less administrative costs and payments to retailers. The administrative costs and payments to retailers in fiscal year 2004 average \$0.16 per prize dollar. The realized average player losses and the realized implicit lottery tax for one dollar bet by lottery game are shown in Table 1.

## DATA

Lottery sales data by zip code of purchase for each of these games were provided by the Minnesota State Lottery for fiscal year 2004.<sup>9</sup> Income and population data for residential zip codes were obtained from the 2003 *Sourcebook America*. Data from these two sources were combined for all 857 residential zip codes in Minnesota. We omit lottery sales data from 27 nonresidential zip codes with lottery sales, such as the Minneapolis-St. Paul airport and commercial rebate centers. We believe it would be problematic to attribute lottery sales in such nonresidential zip codes to nearby residential zip codes.

## SUITS INDICES FOR SEVEN LOTTERY GAMES

The Suits Index (Suits, 1977) is a summary measure of the distributional burden of a tax that compares the cumulative distribution of income to the cumulative distribution of the tax burden. The implicit lottery tax is proportional to lottery sales because the rules of each of these lottery games are the same regardless of the zip code of purchase. Therefore we compare per capita income to lottery sales in each zip code to compute Suits Indices.

Following Suits (1977), let  $K$  be the area under 45 degree line in Figure 1 and let  $L$  be the area

Figure 1: Calculation of Suits Index from Lorenz Curve

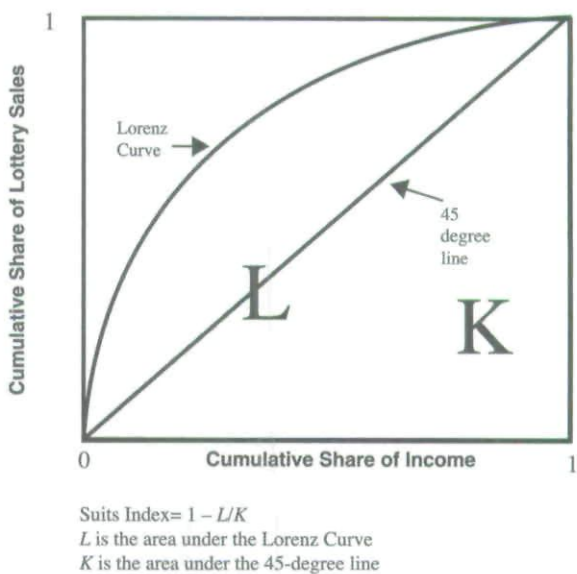


Figure 2: Lorenz Curves, Minnesota Lottery Games in Fiscal Year 2004

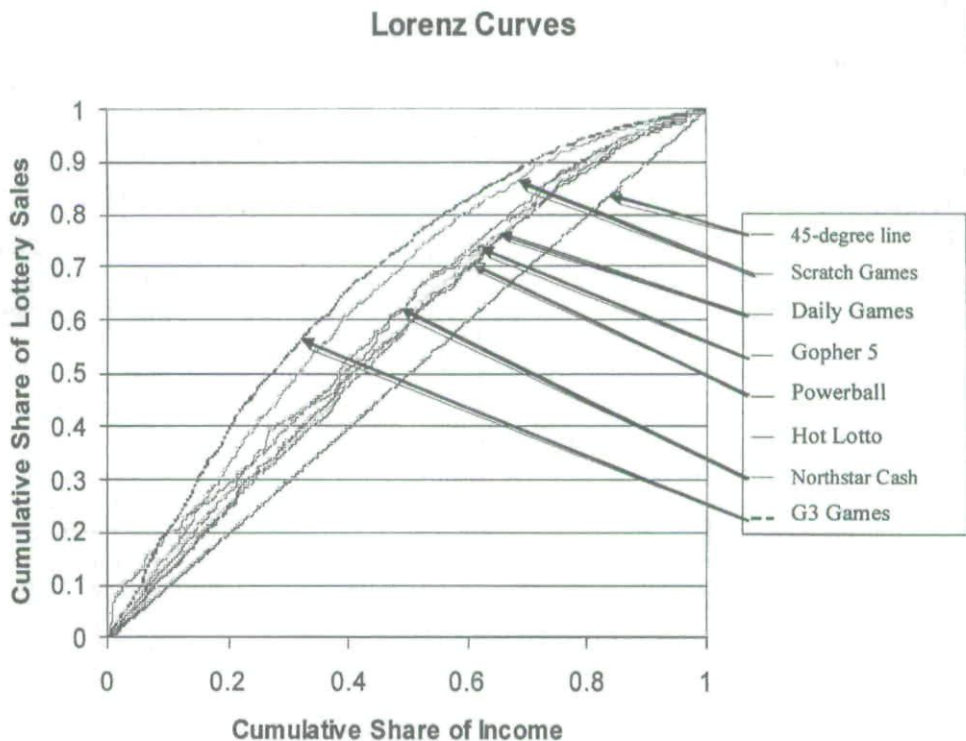


Table 2  
Suits Indices for Minnesota Lottery Games  
Fiscal Year 2004

<i>Lottery Game</i>	<i>Suits Index</i>
Hot Lotto	-0.13
Powerball	-0.14
Gopher 5 (pick 5)	-0.15
Total online (all non-scratch games)	-0.15
Northstar Cash (pick 5)	-0.19
Daily 3 (pick 3)	-0.20
Scratch Games	-0.28
G3 Instant Games	-0.34
<b>Total Sales</b>	<b>-0.23</b>

under the Lorenz Curve for a particular lottery product. The Suits Index is  $S = 1 - L/K$ . When the tax burden is perfectly proportional to income, areas  $L$  and  $K$  are equal and the Suits Index is zero. If the tax is progressive, area  $K$  exceeds area  $L$ , resulting in a positive Suits Index. If the tax is regressive, area  $L$  exceeds area  $K$ , resulting in a negative Suits Index. Lower Suits Indices indicate lower tax progressivity.

Figure 2 plots the cumulative distribution of per capita income versus the cumulative distribution of lottery sales by zip code for each of the seven Minnesota lottery games. For each of these lottery products, this curve is concave and lies above the 45-degree line. The Suits Index for each of these

games is negative because the Lorenz Curves are above the line of proportionality. These concave Lorenz Curves show that lottery sales are a larger share of income for lower income zip codes than for higher income zip codes.

Point estimates for Suits Indices for each lottery product sold by the Minnesota Lottery are shown in Table 2. (Table 3 compares our Suits Indices to other studies.) All of the point estimates of Suits Indices are negative, suggesting that the implicit tax on each lottery product is regressive.

There are interesting variations in the Suits Indices between Minnesota Lottery products. G3 games have the lowest Suits Index of -0.34, which suggests that this type of game is the most regressive Minnesota lottery product. The scratch games are the second most regressive category of games with a Suits Index of -0.28. Suits Indices of scratch games in Maryland, Texas, and California are of a similar regressive nature (Table 3). The Suits Index for the daily games is -0.20. This is a less negative Suits Index than found for pick 3 games in other states. Northstar Cash and Gopher 5 have Suits Indices of -0.19 and -0.15, respectively. The least negative Suits Indices are for Powerball (-0.14) and Hot Lotto (-0.13), suggesting they are the least regressive lottery products in Minnesota. However, the relative regressivity of lottery games is somewhat inconclusive based on the Suits Index point estimates alone. A statistically meaningful

Table 3  
Suits Indices for Various Lottery Games Using Zip Code Data

<i>Revenue Source</i>	<i>Suits Index</i>	<i>Source</i>
Lotto - Indiana Lottery	-0.10	Spry (2004)
<b>Hot Lotto (Pick 5) Minnesota Lottery</b>	<b>-0.13</b>	<b>Combs, Kim, and Spry (2006)</b>
<b>Powerball - Minnesota Lottery</b>	<b>-0.14</b>	<b>Combs, Kim, and Spry (2006)</b>
Powerball - Indiana Lottery	-0.14	Spry (2004)
<b>Gopher5 (Pick 5) Minnesota Lottery</b>	<b>-0.15</b>	<b>Combs, Kim, and Spry (2006)</b>
<b>Northstar Cash (Pick 5) Minnesota Lottery</b>	<b>-0.19</b>	<b>Combs, Kim, and Spry (2006)</b>
Scratch Games - Indiana Lottery	-0.19	Spry (2004)
<b>Daily 3 (Pick 3) Minnesota Lottery</b>	<b>-0.20</b>	<b>Combs, Kim, and Spry (2006)</b>
Lotto - Texas Lottery	-0.21	Price and Novak (1999)
<b>Scratch Games - Minnesota Lottery</b>	<b>-0.28</b>	<b>Combs, Kim, and Spry (2006)</b>
Scratch Games - California Lottery	-0.32	Clotfelter and Cook (1987)
Daily Games - Indiana Lottery	-0.34	Spry (2004)
<b>G3 Instant Games - Minnesota Lottery</b>	<b>-0.34</b>	<b>Combs, Kim, and Spry (2006)</b>
Pick 3 Daily Game - Texas Lottery	-0.34	Price and Novak (1999)
Lotto - Maryland Lottery	-0.36	Clotfelter and Cook (1987)
Scratch Games - Texas Lottery	-0.37	Price and Novak (1999)
Scratch Games - Maryland Lottery	-0.41	Clotfelter and Cook (1987)
Pick 3 Daily Game - Maryland Lottery	-0.42	Clotfelter and Cook (1987)
Pick 4 Daily Game - Maryland Lottery	-0.48	Clotfelter and Cook (1987)



comparison would require the knowledge of the properties of the sampling distribution of the Suits Index (Anderson et al., 2003).

### CONCLUSION

Recently a significant minority of Minnesota State Senators voted to abolish the Minnesota Lottery in part because they thought that the lottery was regressive (Sturdevant, 2004). Even though the Minnesota Lottery was retained, information on Suits Index values for individual games would help policy makers improve the lottery from a distributional perspective. This paper computes point estimates of Suits Indices of each of the seven Minnesota State Lottery games. The Suits Index values suggest that all Minnesota lottery games are regressive and that the degree of regressivity varies across games. Our results suggest that the newly introduced online instant G3 games are the most regressive lottery games. Similarly, scratch games, the best selling lottery product, appear to be more regressive than online lottery games, whereas Gopher 5, Powerball, and Hot Lotto appear to be the least regressive lottery products.

### NOTES

<sup>1</sup> According to its 2004 annual report, Minnesota State Lottery's long-term goal is to increase its contribution to state revenues from \$100.7 million in 2004 to \$250 million in 2024.

<sup>2</sup> Nationally, total ticket sales for state lottery games climbed from \$2.4 billion in 1980 to \$43.5 billion in 2003, yielding some \$14.0 billion in after-prize contributions to states' revenues in fiscal year 2003. (U.S. Census Bureau, *Statistical Abstract of the United States 2004-2005*, Table 448, 2004.)

<sup>3</sup> Don Feeney, Director of Research, Minnesota Lottery, personal interview December 10, 2004.

<sup>4</sup> <http://www.lottery.state.mn.us/instgame.html>

<sup>5</sup> <http://www.lottery.state.mn.us/unclaim.html>

<sup>6</sup> Powerball is offered by lottery agencies in Arizona, Colorado, Connecticut, Delaware, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Mexico, North Dakota, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Washington D.C., West Virginia, Wisconsin, and the U.S. Virgin Islands.

<sup>7</sup> Hot Lotto is offered by lottery agencies in the District of Columbia, Iowa, Minnesota, Montana, New Hampshire, North Dakota, South Dakota, and West Virginia.

<sup>8</sup> In 2005, Powerball odds were changed. A win now requires 5 out of 55 numbers and 1 of 42 for the jackpot.

<sup>9</sup> Fiscal year 2004 for the Minnesota Lottery ran from July 1, 2003 until June 30, 2004.

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