Gambling at Lucky Stores: Empirical Evidence from State Lottery Sales

by Jonathan Guryan and Melissa S. Kearney*

In this paper we show that the week following the sale of a large-prize winning ticket, the winning store experiences a 12 to 38 percent relative sales increase for the winning lotto game. We find that the effect dissipates over time but that sales at stores that sell winning tickets remain elevated for up to 40 weeks, conditional on contemporaneous sales. The sales response is increasing in the size of the jackpot, and is larger in areas with more economically disadvantaged populations.

We consider two explanations for this behavioral response: one a response to advertising, and the other a belief in what we call the *lucky store effect*, whereby consumers erroneously increase their estimate of the probability a ticket bought from the winning store will itself be a winner. If the sale of a winning ticket serves merely to advertise the lottery in the local market, sales at nearby stores should increase similarly. As the sales response is significantly larger at the winning store, as compared to stores within the zip code or to stores within a mile, we can rule out all but highly localized advertising stories - i.e. a "We Sold a Winning Ticket" sign in the window. We suspect such advertising is successful precisely because consumers are inclined to believe in the existence of a lucky store.

The lucky store effect explanation could be driven by either of two related cognitive biases. Consumers might appeal to the "hot hand" fallacy and expect positive serial correlation

* Guryan: University of Chicago GSB and NBER, 5807 S. Woodlawn Avenue, Chicago, IL 60637, (email: jonathan.guryan@chicagoGSB.edu); Kearney: University of Maryland Department of Economics and NBER, College Park, MD 20742, (email: kearney@econ.umd.edu). The authors are indebted to two anonymous referees and an editor of this journal for helping us to substantially improve the paper. We also thank Josh Angrist, David Autor, Marianne Bertrand, Bill Dickens, Mark Duggan, Amy Finkelstein, Larry Katz, Phil Levine, Toby Moskowitz, Kevin Murphy, Richard Thaler, Ping Zhang, and seminar participants at the NBER Summer Institute Labor Studies, University of Chicago GSB, University of Maryland, Federal Reserve Board of Governors, Heinz School of Public Policy at Carnegie Mellon, University of Illinois Urbana-Champaign, and Federal Reserve Bank of Chicago for helpful comments. We also thank Dwyer Gunn, Jillian Popadak, Andriy Protsyk, Eric Sun, and Daniel Theisen for valuable research assistance. Guryan received funding from the University of Chicago GSB to support this research. We are very grateful to the employees of the Texas Lottery Commission for their prompt response to our initial data request and for graciously answering our follow-up requests and questions.

or they might believe in non-existent variation in luck across stores and infer from the signal of a win which store is lucky. Our empirical finding is an interesting juxtaposition to work by Charles Clotfelter and Philip Cook (1993) and Dek Terrell (1994) documenting that the amount of money bet on a particular number in a pick-3 or pick-4 game falls sharply after the number is drawn and that it only gradually returns to its former level after several months.

Our empirical results thus highlight the need for a model of *when* we should expect to observe either of two well-documented but seemingly contradictory misperceptions of randomness: the hot hand and gambler's fallacies—one an expectation of positive and the other of negative serial correlation.[1] The existence of both cognitive biases has frequently been explained by a belief in "representativeness," also referred to in this context as the "law of small numbers."[2] In a common formulation of this explanation, individuals expect random series to demonstrate self-correction, or negative serial correlation, per the gambler's fallacy. The explanation posits that individuals reject randomness in a particular way: they rationalize the streaks they observe by inferring heterogeneity in the underlying rate of success (e.g. the probability that a basketball player successfully makes a shot).[3]

We observe a change in lottery gambling behavior consistent with a belief in a lucky store after a store has sold a single winning ticket. There is no streak to move someone from the gambler's fallacy to a belief in a lucky store.[4] We offer a speculative alternative explanation: that the perception of heterogeneity (e.g. among lottery retailers, basketball players, or mutual fund managers) necessary for a belief in the hot hand comes not from the signals produced by the data generating process—as the representative explanation would require—but rather from the

[1] The former misperception derives its name from the belief among basketball fans and players, first documented by Thomas D. Gilovich, Robert Vallone, and Amos Tversky (1985), that a player's chance of hitting a shot are greater following a hit than following a miss on the previous shot; the latter derives its name from the observation that gamblers frequently expect a certain slot machine or a number that has not won in a while to be "due" to win.
[2] See Tversky and Daniel Kahneman (1971) and Tversky and Kahneman (1974) for discussions of representativeness and the law of small numbers.
[3] This inferred heterogeneity could be either cross-sectional (certain players are better shooters) or across time (certain players are temporarily "hot").
[4] The representativeness explanation suffers from the additional problem that it cannot reconcile the results presented in this paper with those of Clotfelter and Cook (1993) and Terrell (1994), described above.

characteristics of the data generating process itself, namely whether the data generating process is perceived as having an animate or an intentional element. This claim is consistent with recent psychological evidence reviewed below.

Empirical evidence of misperceptions of randomness has frequently been drawn from laboratory settings.[5] Gilovich, Vallone, and Tversky's (1985) study of the belief in streakiness, or a "hot hand", among basketball players and fans is among the first to document evidence of such misperceptions outside the psychological laboratory. A set of papers in the finance literature show that mutual fund flows chase high returns (e.g. Mark M. Carhart (1997), Judith Chevalier and Glenn Ellison (1997), Terrance Odean (1998), Mark Grinblatt and Matti Keloharju (2001)). This evidence may be suggestive of a belief in non-existent streakiness, or it may be that high returns are correlated with signs of future returns, such as fund manager skill (Chevalier and Ellison, 1999). Our empirical strategy draws on the strengths of each of these empirical literatures. Like the finance literature on investors, we examine consumers making real-world choices that potentially have costly consequences.[6] Like the laboratory, our research design makes use of random assignment which ensures that the probability of buying a winning ticket is independent of the location of its purchase.

An additional important empirical finding is that the lucky store effect is larger in areas with more high school dropouts, more people living in poverty, and more elderly. To the extent we show that cognitive biases are more prevalent among these populations, our results have important policy implications in light of the fact that lotteries are state-run. Though not direct evidence, our results are also consistent with recent laboratory evidence that cognitive biases are

[5] William Wagenaar (1972) and Ruma Falk (1981) demonstrate that people in laboratory settings tend to reject the randomness of sequences that contain naturally-occurring streaks because they expect a random sequence to have negative serial correlation. Maya Bar-Hillel and Wagenaar (1991) provide a more recent review of similar laboratory evidence documenting that people expect a random series to have a "self-correcting" pattern.

[6] Using data from the BLS Consumer Expenditure Survey, Kearney (2005a) provides evidence that lottery gambling displaces household expenditures on non-gambling items.

mitigated by cognitive resources and cognitive ability. We view our results as complementary to the laboratory evidence in this area.

I. Data and Background on the Texas State Lottery

We compile a dataset that includes weekly store-level sales of lottery tickets by game, the location and jackpot size of winning tickets in three lotto games, and zip-code-level demographics for each lottery retailer. The data span the period from January 2000 to June 2002 and cover every lottery retailer active in the state of Texas during the period under study. During the sample period, there are 24,400 active lottery retailers in Texas spread across 1,386 cities and 3,660 nine-digit zip codes.

We analyze the effects of the sale of winning tickets in the three large lotto games in the Texas Lottery system: Lotto Texas, Texas Two Step, and Cash Five, though we report the results only for Lotto Texas here.[7] As can be seen in Table 1, these games typically offer very different prizes. Lotto Texas jackpots range from $1.03 million to $51.2 million; Texas Two Step jackpots range from $200,000 to $1.6 million; and Cash Five jackpots range from $8,888 to $93,201. Our sample period includes 68 winning jackpots from Lotto Texas, 55 from Texas Two Step, and 571 from Cash Five. These winners are spread across 669 retailers and 480 zip codes. During the sample period, the average lottery retailer in Texas sold $2,576 worth of lottery tickets per week: $733 of Lotto Texas, $110 of Texas Two Step, and $170 of Cash Five. More details on each game are available in Appendix 1.[8]

II. Empirical Specification

To uncover the effect on sales at the winning store one week after the winning ticket is sold we estimate the following specification separately for each game *j*={1,2,3}:

(1) $$g_{it} = \alpha_k + \gamma_k w_{i(t-k)} + \phi_k g_{i(t-k)} + \mu_{k,t} + \varepsilon_{k,it}$$

[7] The full set of results for all three games can be found in Guryan and Kearney (2005).
[8] We focus on the sale of winning tickets from *lotto* games as opposed to other types of state lottery games, such as scratch-off tickets, because lotto games tend to have larger top prizes and fewer winners.

where i indexes stores, t indexes weeks, k indexes weeks since the drawing, g is the log of the number of tickets sold, w is a dummy variable indicating that store i sold a winning lotto ticket for game j in week t-k, α, γ and ϕ are parameters to be estimated, ε is an error term and μ is a fixed week effect. The estimated effect of selling a winner is thus the effect relative to other stores that week; the inclusion of week fixed effects, among other things, controls for the fact that all stores will sell more tickets when the jackpot is very high and fewer tickets when the jackpot is very low. This specification is estimated once for each value of k. γ_k is then the estimated effect of selling a winner k weeks ago.

The more tickets a store sells, the more likely it is to sell a winning ticket. Since sales are serially correlated, it follows that $E[\varepsilon_{1,it} \mid w_{i(t-1)} = 1] \neq E[\varepsilon_{1,it} \mid w_{i(t-1)} = 0]$. Therefore, a simple comparison of average sales at stores that sold and did not sell winners one week ago does not recover the causal effect of the winning ticket sale. Fortunately, since each lottery ticket has the same chance of winning, the probability of a store selling a winning lottery ticket is a linear function of the number of tickets it sells in a week.[9] Thus, conditional on the number of tickets sold in week t, each store has the same chance of selling a winning lottery ticket. Therefore, $E[\varepsilon_{1,it} \mid w_{i(t-1)} = 1, g_{i(t-1)}] = E[\varepsilon_{1,it} \mid w_{i(t-1)} = 0, g_{i(t-1)}]$.[10]

III. Winning Tickets and Subsequent Sales Responses

[9] More precisely, the probability of selling a winning ticket is a linear function of the number of unique number combinations sold. If store A sells X tickets, representing λ X unique combinations, and store B sells X tickets, representing λ'X unique combinations, where $\lambda' > \lambda$ then store B has a higher probability of selling a winning ticket. We have no way of knowing in the data how many unique number combinations were sold, only how many tickets. Furthermore, there is no reason to suspect that the proportion of tickets that reflect unique combinations varies systematically across stores. We thus make the simplifying assumption that the number of unique number combinations a store sells is a fixed proportion of the number of tickets the store sells.

[10] Serial correlation is not a problem for the estimation of γ_k because any two stores with the same sales in week t-k have the same chance of selling a winning ticket in week t-k, regardless of whether sales have been high for a large number of weeks or if sales are only high for one week as a result of a temporary shock. Therefore, conditional on sales in week t-k (g_{it-k}), w_{it-k} is randomly assigned, and a simple Ordinary Least Squares (OLS) estimate of γ_k is unbiased. Some readers may be troubled by the inclusion of a serially correlated lagged dependent variable as a regressor. While it is true that the resulting estimate of ϕ is not the causal effect of lagged sales on current sales, the logic above still ensures that the estimate of γ_k is unbiased.

A. Same-game sales at the winning retailer

The top panel of Figure 1 presents the results from OLS estimation of equation (1) for Lotto Texas. Each point in the figure is the estimated effect of selling a winning ticket from a separate lag or lead regression. Weeks are measured relative to the date of the winning ticket. We estimate the dynamics of the sales effects up to 40 weeks after and 40 weeks before the sale of the winning ticket, estimating 80 different regressions. All regressions control for log sales measured the same week the winning ticket was sold and week effects. The dependent variable is the log of store-level Lotto Texas sales.

Within-game estimates suggest that same-store sales increase significantly the week after a store sells a winning ticket. The estimated sales increases are 32.0 log points (37.7 percent). Estimates are smaller but significant for the smaller-jackpot games: 11.7 log points (12.4 percent) for Cash Five, the game with the smallest jackpot, and 19.5 log points (21.5 percent) for Texas Two Step. All three estimates are precise enough to rule out a zero effect. For Lotto Texas, the size of the response is also increasing in the size of the jackpot.[11] Estimates from the lagged specifications (i.e., weeks 2 through 40) reveal that the initial increase in sales diminishes somewhat in the first ten weeks for Lotto Texas, but persists for up to 40 weeks for all three games.

Initial same-store sales responses to the sale of a winning ticket are large in both economic and statistical terms. The increase of 276 Lotto Texas tickets the week after selling a winning Lotto Texas ticket is about 11 percent of the week-to-week standard deviation in total retail-level lottery ticket sales; about 38 percent of the week-to-week standard deviation in retail-level Lotto Texas ticket sales; and 50.2 percent of the week-to-week standard deviation in the change in retail-level Lotto Texas ticket sales.

B. Testing the identifying assumption

[11] The details of these results can be seen in Guryan and Kearney (2005).

If the identifying assumptions are satisfied, sales in week t should not predict whether a store sells a winner at a future week $t+k$, controlling for sales in week $t+k$. A direct test of this prediction is to estimate equation (1) defining the winning indicator over future weeks. These are the *lead* versions of the *lags* specifications, and the results are presented to the left of the origin in Figure 1. Consistent with the prediction of the identifying assumption, none of the lead estimates are significantly different from zero. The point estimates vary in sign and hover around zero. There is no clear trend leading up to the week in which the winner is sold, and there is a sharp break in the series one week immediately following the sale of the winner.

C. Substitution Patterns: Within-retailer substitution across games

To determine whether the increase in sales at the winning retailer reflects an aggregate increase in sales, we estimate equation (1) at the retailer level defining the dependent variable as sales of all other lottery games minus sales in game j. The regressor of interest is a dummy for whether the store sold a winning ticket in game j. The results, presented in the leftmost column of Table 2, indicate that the sale of a winning Lotto Texas ticket initially has a net *positive* spillover on other games. The one-week estimate shows a 17.8 log point (19.5 percent) increase in sales of other lottery games at that retailer. This estimate is marginally significant with a standard error of 8.9 log points. Thus, there is no evidence that the initial increase in Lotto Texas sales shown in Figure 1 can be fully accounted for by substitution away from sales of other lottery games. Testing the identifying assumption, lead effects are all insignificant and are close to zero in the weeks leading up to the winner.

IV. Interpretation

A. Advertising v. Lucky Store

The one-week results demonstrate that consumer demand for lottery tickets responds positively to the sale of a winning ticket. We discuss two classes of explanations for this phenomenon. The first class of theories concerns the advertising associated with a winning ticket, both explicit and word-of-mouth.[12] This advertising may lead to increased sales because it brings lottery tickets to the forefront of consumers' minds, it leads consumers to update their subjective estimate of the probability of winning, or consumers consider advertising and lottery tickets to be complementary goods.[13] Crucially, the only reason the advertising effect would not apply uniformly to all lottery retailers in the state is that information about the win flows more easily to those closer to the winning consumer and retail outlet.

The second explanation for the increase in same-retailer ticket sales is that consumers think the store that has sold a winning ticket is at least temporarily "lucky". We call this explanation the *lucky store effect*. A distinguishing feature of this effect is that consumers attach the change in probability to the retailer rather than generally to the game. This distinction allows us to distinguish between the lucky store effect and the advertising effect based on patterns in the data.

B. Testing the Advertising story using substitution patterns: Geographic substitution across retailers

In this section we show that there is a net positive spillover to nearby stores, but that the sales response is significantly larger at the winning store itself. In this analysis we use the 9-digit zip code as a measure (albeit an imperfect one) of the local market. In results shown in the bottom panel of Figure 1, it appears the sale of a winning ticket within a zip code initially leads to increased sales of 13.2 log points (14.1 percent) for Lotto Texas.[14] The estimated increase is statistically significant, and indicates that substitution away from nearby stores cannot account for all of the increase in sales at the winning store.

---

[12] Our notion of "advertising" is quite general. We mean it to encompass all forms of explicit advertising as well as media coverage and general discussion that is spurred among local residents.

[13] See e.g. Gary S. Becker and Kevin M. Murphy (1993) for a model in which advertising and advertised goods are complements.

[14] The corresponding effects are 16.0 log points (17.4 percent) for Texas Two-Step, and 8.3 log points (8.7 percent) for Cash Five. As discussed in Guryan and Kearney (2005), the lead estimates for Lotto Texas and Texas Two-Step are all insignificant, though for Texas Two-Step they are fairly large. A conservative estimate, subtracting off the lead estimates leaves an aggregate effect on zip-code-level Texas Two-Step sales of 10.7 log points. The Cash Five lead effects are significantly positive, though the lag effects are about 4 to 5 log points higher than the lead effects.

To pinpoint the spillover effect on other stores in the zip code, we estimate own-store sales as a function of whether there was a winner in the zip code in week *t-k* and whether the particular store sold a winner in week *t-k*:

(2) $$g_{it} = \alpha_k^z + \gamma_k^{z1} w_{i(t-k)} + \gamma_k^{z2} w_{z(t-k)} + \phi_k^{z1} g_{i(t-k)} + \phi_k^{z2} g_{z(t-k)} + \mu_{k,t}^z + \varepsilon_{k,izt}^z .$$

The coefficient γ_k^{z2} captures the effect of the sale of a winning ticket in the zip code; the sum of $\gamma_k^{z1} + \gamma_k^{z2}$ captures the effect of the sale of a winning ticket at the winning store.

The center panel of Table 2 reports the results. The estimated effects reveal that the sale of a Lotto Texas ticket has a positive effect on other stores' sales; in the week following the sale of a winner, stores in the winning zip code experience an average increase in sales of 4.9 log points (5.0 percent) with a standard error of 0.9. However, the winning store experiences an additional 25.8 log point (29.4 percent) increase in sales with a standard error of 4.1.[15] The net positive spillover suggests there is some role for general advertising. The local chatter and hoopla surrounding the sale of the winning ticket appears to lead to increased sales in the area. Importantly though, the fact that the estimate of γ^{z1} is significantly positive and much larger than the estimate of γ^{z2} confirms that most of the effect is particular to the winning store. This pattern is inconsistent with all but the most localized (i.e. store-specific) advertising stories, and is consistent with the lucky store effect.

One weakness of the zip-code level regressions is that there is a great deal of heterogeneity in the size of these "local markets". To address this concern, we estimate a specification very similar to (2) that defines a local market as a one-mile radius around a retailer.[16] The results are reported in the right panel of Table 2. Just as the previous estimates

[15] The lead effects are close to zero and insignificant.

[16] The regression includes one observation per week for each retailer. The dependent variable is the log of game-specific sales in the store in week *t*, and the regressors of interest are indicators for whether a winning ticket was sold in the store and whether a winning ticket was sold within one mile of the store in week *t-k*. Regressions control for log game-specific sales in week *t-k* at both the store and one-mile group level. Stores are dropped if there are no other retailers within one mile. One-mile groups are defined around an individual retailer and therefore, unlike zip

showed, the one-mile estimates clearly indicate that the effect of a winning ticket is much larger at the winning store than at nearby stores. In contrast, while there appears to be a positive spillover to non-winning stores in the same zip code, there is no evidence of a similar spillover to stores within one mile. The one-mile results suggest that there is indeed more substitution away from nearby stores than from less nearby stores in the zip code. Again, these estimates are inconsistent with a general advertising story. Whatever advertising is produced by the sale of the winning ticket would have to accrue to consumers who frequent the winning store and not to consumers who shop at stores within one mile of that store.

Long-run substitution patterns strengthen the case for the lucky store effect. Table 3 presents estimates of equation (2) for lags of up to ten months. The estimates are pooled by month to increase precision. The estimates suggest that non-winning stores within one mile of the winner experience statistically significant decreases in sales of Lotto Texas 6-10 months later. These long-run estimates suggest that the persistent increase in game-specific sales at the winning store is potentially accounted for by permanent shifts in the location of consumers' purchases.[17]

The only viable advertising-based explanation is that the winning store changed its advertising within one week of selling the winning ticket. To investigate this possibility, we conducted a 5-minute phone and mail survey of the 67 retailers that sold the 68 winning Lotto Texas jackpot tickets during the period under study. (Details in Appendix 2.) The survey was conducted during the summer of 2004, approximately 2 to 4 years following the sale. Due to the time that had passed and the high turnover rate of employees at the retailers, the response rate was low: 18 of 67. There were, however, a number of remarkably consistent responses. Fifteen

---

codes, they are not mutually exclusive. As an individual retail outlet can belong to more than one group, spatial correlation among retail observations is potentially an issue. To account for this, we tried adjusting the standard errors for clustering at the nine-digit zip code level; the standard errors were virtually unchanged.

[17] The dissipation of the sales increase at the winning store seen both in this table and in Figure 1 is consistent with both a fading consumer belief that the store is always luckier than most (driven by mistaken inference of time-invariant cross-sectional heterogeneity in luck across vendors) and a belief that the store is currently enjoying a bit of luck that will eventually run out (the "hot hand").

of the eighteen respondent stores posted the “We Sold a Winning Lotto Texas Jackpot Ticket” (WSW) sign that was provided by the Texas Lottery Commission (TLC). All fifteen posted the sign immediately upon receipt in a prominent place, such as on the front door or near the road in front of the store. Eight of the stores continued to display the sign multiple years later; the remaining seven displayed the sign for anywhere between one week and six months. In a telephone conversation a TLC product manager explained to us that the sign typically arrives a day or two after the winning ticket is sold, but might take as much as a week or two to arrive at the winning store. The sign is 32 inches wide by 64 inches tall; it has a yellow background and in black block letters announces “We Sold a Winning Lotto Texas Jackpot Ticket!” The Texas Lottery logo is in the center of the sign. Remarkably, every respondent reported that the WSW sign was the *only* change in advertising practices following the sale of the winning ticket. Thus, if advertising was the cause of the sales increases, it was the WSW sign that was effective.

It is informative to ask why such advertising is effective. One possibility is that consumers learn that the lottery exists. However, all lottery retailers reported posting signs advertising the sale of lottery tickets prior to selling the winner. Posting these materials is, in fact, required under the vendor contract with the TLC. Furthermore, as shown in Figure 1, while the store-specific increase in sales following the sale of a winner persists out to 40 weeks, the magnitude of the one-week increase dissipates substantially within the first 10 weeks. We might expect that a belief in a store’s luck would wane over time, but we would not expect the informational content of a sign that primarily served to advertise the sale of lottery tickets would diminish over time. This provides further support to the claim that the sign is effective through its advertisement of a lucky store, not just a lottery retailer more generally. Alternatively, uninformed consumers might learn that the probability of winning is greater than zero. If that were true, one would expect a WSW sign to contain less marginal information when the jackpot is larger because of the general advertising associated with very large jackpots. However, we find that the response is increasing in the size of the Lotto Texas jackpot that was won.[18] This leaves the possibility that the WSW sign is effective precisely because consumers believe in the lucky store effect.

V. Interaction with population demographics

We next investigate whether certain demographic populations appear more likely than others to subscribe to a lucky store belief. We ask whether the observed one week lagged response to the sale of a winning lottery ticket is more pronounced for retail outlets located in zip codes with greater proportions of economically disadvantaged populations, as measured in the 2000 United States Census. In various specifications, we interact the winning ticket effect with the following: percent of the population 25 and over with less than a high school degree; percent of the population 16 and over who are age 65 or above; and percent of the population in poverty.

These results, shown in Table 4, show that the response to the sale of a winning ticket is more pronounced in zip codes with larger proportions of economically-disadvantaged groups, as measured by each of the three demographic characteristics.[19] Corroborative results shown in Guryan and Kearney (2005) reveal that the sales response decreases in the proportion of the population both with a college degree and above 200 percent of the poverty line.

Our findings are consistent with, though not direct evidence of, claims that cognitive biases are mitigated by cognitive resources. Shane Frederick (2005) finds that people who score

[18] Note that the jackpot always resets to the minimum after a win, so the response is a positive function of the size of the jackpot previously won, not the jackpot that is currently in play.

[19] There have been a number of previous studies investigating the demographic predictors of lottery gambling. These studies have tended to find that, on average, state lottery products are disproportionately consumed by low-income and minority households. Recent examples include Frank Scott and John Garen (1994), Ann Hansen (1995), Andrew C. Worthington (2001), and Kearney (2005a). In a cross-sectional analysis of zip code lottery sales and demographics, we find that a greater share of high school dropouts, nonwhites, and households on public assistance are associated with higher levels of sales, conditional on total population and median household income. If we consider the estimated coefficient on ln(median household income) as a measure of income elasticity indicating how total zip code lottery sales move with a proportional increase in median household income, we estimate an elasticity of -0.17, which implies a high degree of regressivity. When only sales on Texas Lotto are included in the dependent variable, we estimate an income elasticity of 0.36. This comparison suggests that overall sales are more regressive than TX Lotto sales. This is consistent with the observation in Kearney (2005b) that higher-educated lottery players prefer big-jackpot games while lower-educated lottery players prefer instant games and Emily Oster's (2004) finding that sales increase relatively more in high income zip codes when pari-mutuel jackpots grow excessively large.

low on a test designed to measure cognitive reflection are more likely to exhibit excessive impatience and risk aversion over small gambles.[20] Daniel J. Benjamin, Sebastian A. Brown and Jesse M. Shapiro (2006) show that similar biases are negatively related to more standard measures of cognitive ability.[21] Drawing on psychological and neuro-cognitive research, a number of behavioral economists have theorized that many economic decisions are governed by two distinct cognitive mechanisms, one that is automatic, emotional and unconscious, and a second that is deliberate, reflective and analytical.[22] Others argue that the latter mechanism requires greater cognitive resources,[23] the implication being that self-control and rational thinking are mediated at least in part by cognitive ability. To the extent that zip codes with lower education levels have on average lower cognitive ability, our results are consistent with the lucky store effect being mediated by cognitive resources. Though we think this is important to note as a finding from the field that is complementary to those from the lab, the reader should be careful not to conclude too much from our findings on this point. There are many differences between high and low education lottery players, and these rather than cognitive differences may explain differential responses to winning ticket sales. Irrespective of the structural mechanism, however, the fact that economically-disadvantaged populations are more likely to exhibit irrational

---

[20] The cognitive reflection test (CRT) is a form of IQ test with questions designed to have wrong answers that appear correct at first. Correct answers are obtained typically after some reflective thought. The test is positively correlated with more typical IQ tests, but Frederick argues that it is more predictive of the cognitive biases considered.

[21] Benjamin, Brown and Shapiro (2006) find, however, that expressed risk and time preferences are not affected by experimental manipulation of cognitive resources—for example, by having subjects pay attention to sequences of tones while making choices—which suggests the relationship might not be causal. The authors conclude that more intelligent people avoid cognitive biases not by devoting contemporaneous cognitive resources to problem solving, but by developing better heuristics over long periods. In contrast, Baba Shiv and Alexander Fedorikhin (1999) and John M. Hinson, Tina L. Jameson and Paul Whitney (2003) find that similar manipulations lead to increases in impulsivity.

[22] See e.g. Hersh M. Shefrin and Richard H. Thaler (1988), Samuel M. McClure, David I. Laibson, George Loewenstein, and Jonathan D. Cohen (2004), Drew Fudenberg and David K. Levine (2005), and Loewenstein and Ted O'Donoghue (2005). A similar idea was raised by Adam Smith (1759 [2002]) in *The Theory of Moral Sentiments.*

[23] See e.g. Arthur S. Reber, Faye F. Walkenfeld, and Ruth Hernstadt (1991), Reber (1993), Peter McGeorge, J.R. Crawford and S.W. Kelly (1997), Keith E. Stanovich and Richard F. West (2000), Kahneman and Frederick (2002) and Frederick (2005).

behavior in the purchase of lottery tickets has important policy implications, especially in light of the fact that lotteries are state-run enterprises.

VI. Final Discussion

We have used detailed sales data from the Texas Lottery to demonstrate that the sale of a winning jackpot ticket leads to an increase in ticket sales at the winning retailer. In particular, the sale of a winning Lotto Texas ticket leads to a 38 percent increase in game-specific sales the following week, controlling for contemporaneous sales and week fixed effects. The increase in sales is highly localized, with the increase at the winning store substantially greater than at other stores within the zip code or within one mile. The magnitude of the increase grows with the size of the jackpot and is most pronounced for retail outlets located in zip codes with high proportions of economically-disadvantaged populations.

We interpret the whole of our empirical evidence as being consistent with a belief in a lucky store. Juxtaposing our evidence on lottery vendors with the evidence on lottery numbers in Clotfelter and Cook (1993) and Terrell (1994), we must ask why lottery players believe that "lightning will strike twice" in the case of lottery vendors, but not in the case of numbers. This raises a fundamental question that is not easily explained with existing behavioral theories: When do individuals subscribe to the hot hand fallacy versus the gambler's fallacy?

As noted in the introduction, many have speculated that both tendencies stem from a belief in representativeness [e.g. Gilovich, Vallone, and Tversky (1985), Colin Camerer (1989), Matthew Rabin (2002)]. The intuition is that if an individual expects a small sample to closely resemble the underlying population from which it is drawn, he will expect negative auto-correlation among binary outcomes and will thus be surprised by randomly-occurring streaks. The gambler's fallacy thus leads the individual to mistakenly infer unobserved heterogeneity from the observation of a streak, and this inference might in turn lead directly to a perceived hot hand. Importantly, this explanation implies that the movement from the gambler's fallacy to the hot hand results directly from the sequence of signals and requires a streak.

The behavior we document makes this particular representativeness-based explanation unlikely. Lottery players appear to infer the luck of a store after a single win; they do not require a surprising streak of wins before they move away from an expectation of negative serial correlation. In fact, our finding of a response after a single win is consistent with Gilovich et al.'s (1985) original documentation of the hot hand belief among basketball fans.[24] Murray E. Jarvik (1951) also documents an expectation of positive serial correlation after only one realization of an event; he actually finds that after two such events, people predict that the opposite event will occur next.[25]

A proponent of the representativeness explanation might counter that the behavior we document is a response to a long string of signals observed by customers: a string of losses followed by a win for the winning store as compared with a string of losses for the non-winning store. Since the probability of selling a winning ticket is so low, arguably the only representative finite string of outcomes observed by a single consumer is all losses. Observing even one win could cause a customer to increase his estimate of the subjective probability at a particular store, but importantly only if he *ex-ante* believed in the existence of lucky stores. The representativeness story is vague about this initial source of erroneous perceived heterogeneity across stores. Stores are of course not lucky, and a subscriber to representativeness with this understanding should expect negative not positive serial correlation after observing a single win.

[24] Basketball fans were asked to consider a hypothetical player who shoots 50 percent from the field. Their average estimate of his field goal percentage was 61 percent "after having just made a shot," and 42 percent "after having just missed a shot."

[25] It is possible to tell a story consistent with the representativeness-based explanation in which lottery players fail to condition on sales when observing that some stores have more total lottery winners. They might therefore mistakenly infer heterogeneity in luck from this observation of clustered wins. As only one retailer in our data has more than one Texas Lotto winner, this story requires that winners be observed for a large set of games, perhaps including the daily Pick 3 and Pick 4 games and instant scratch-off tickets. We think it is unlikely that lottery gamblers keep track of the full set of smaller-prize winners across vendors in the state – as these wins are less conspicuous than a recent win on a big jackpot game – but it is surely not impossible. Furthermore, our estimates condition on lagged sales, which should account for most of the variation in past winning tickets sold.

Therefore, without an explicit theory about *ex-ante* perceived heterogeneity, the argument sketched above cannot explain both the results presented in this paper and those of Clotfelter and Cook (1993) and Terrell (1994).

We offer a speculative alternative: that a belief in non-existent variation across retailers – i.e. a belief in lucky stores – stems from characteristics of the data generating process, as opposed to the signals generated. This hypothesis finds support in recent psychology research.[26] Peter Ayton and Ilan Fischer (2004) demonstrate that processes generated by inanimate objects (e.g. a roulette wheel) are expected to show negative serial correlation, but that human performance (e.g. a bettor's success) is expected to show positive autocorrelation. Eugene M. Caruso and Nicholas Epley (2007) show that perceived intention predicts which fallacy an individual subscribes to in a given context. In one of their experiments, subjects who are told a man is trying to get heads on a coin flip predict he has the hot hand, while subjects who are not told of his intentions predict the gambler's fallacy.

The context of lucky lottery stores does not fit squarely into the animate/inanimate or intended/non-intended distinction, but we speculate that something along these lines is at play. Perhaps lottery players view the winning number as being chosen (without intention) by the machine that sorts the ping pong balls in the televised drawing, while the location of the winning vendor is chosen deliberately by the person buying the winning ticket. Alternatively, the location of the winning ticket could be attributable to a corrupt lottery commissioner[27] or a store clerk with good karma. There are more human actors involved with the selection of a particular vendor than with a particular number and therefore more scope for intention.[28] We merely speculate

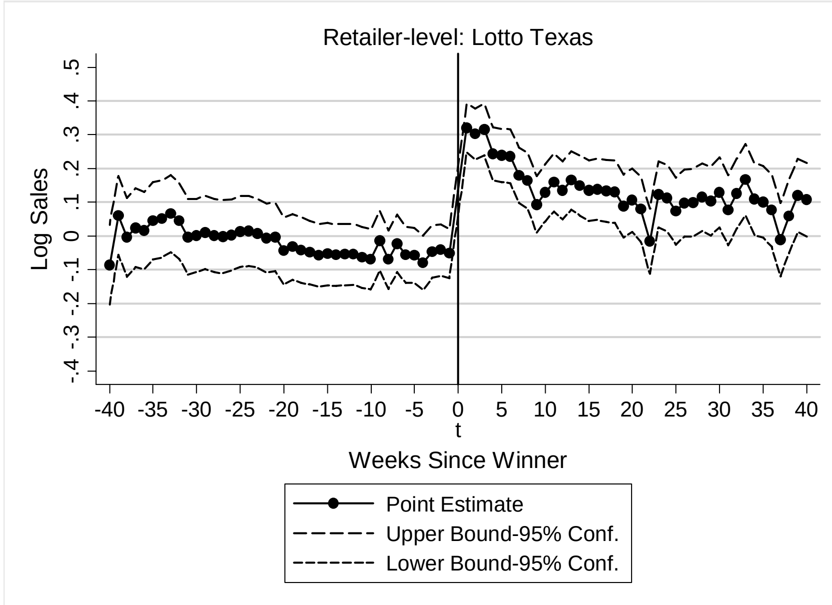
[26] We are indebted to a very helpful referee for pointing us to this literature.

[27] The perception of corruption might be encouraged by the fact that the winning store owner receives one percent of the prize. Consumers might infer from the sale of a winning ticket who is likely to be friends with the state lottery commissioner.

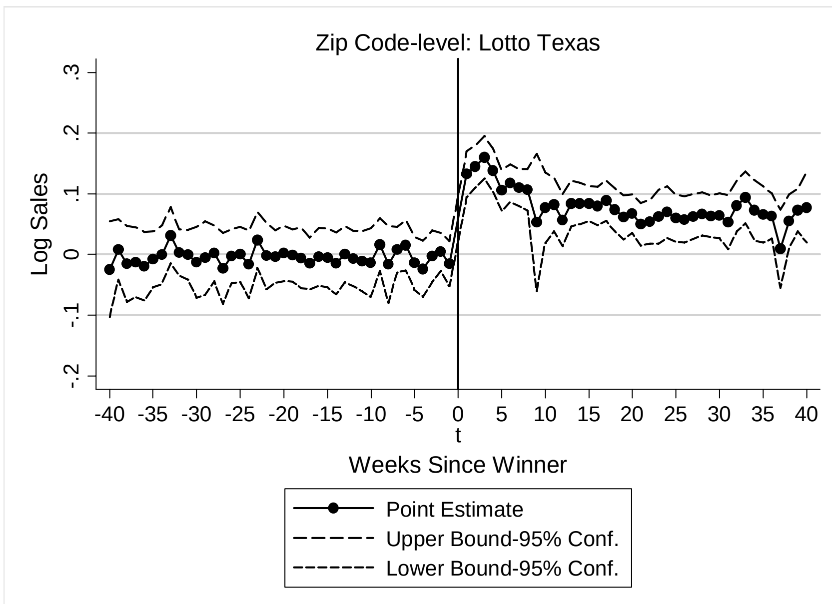
[28] The Texas Lottery website (www.txlottery.org) has one section that lists the name and location of stores that have sold winning tickets, and another that shows pictures of the machines that physically randomize the numbered ping-pong balls for each game. It is striking that when it comes to the location of the store, the website promotes the idea that some stores may be lucky, but when it comes to numbers, the website argues strongly that every number has the same chance of being chosen.

with regard to this explanation and hope that behavioral theorists and experimental economists will more fully explore the apparent contradictions between the behavior we document and behaviors documented and described elsewhere.

One final observation that we have not noted elsewhere has to do with the costs associated with acting on a mistaken belief in a lucky store. If the increase in store-specific sales is the result of consumers changing *where* they buy lottery tickets, then the only real costs borne by consumers are the transportation or hassle costs associated with changing retailers. If instead the increase is driven by a change in *whether* individuals buy lottery tickets, or *how many* lottery tickets they buy, then consumers are substituting away from the consumption of non-lottery goods to respond to a misperceived increase in the expected return on a lottery ticket. Given our finding that the initial response reflects an aggregate increase in sales, it appears to be the case that at least initially, consumers substitute other forms of consumption or saving for lottery ticket purchases. (Unfortunately our store-level data do not permit us to determine whether this is driven by new consumers entering the market or existing consumers increasing their purchases.) In the longer-term, we find that the increase in sales at the lucky store appears to be driven by the relocation of ticket purchases from other vendors; this implies that the long-term costs associated with a belief in a lucky store are potential transportation or hassle costs, rather than foregone consumption.



(a)



(b)

Figure 1:
Effect of the Sale of a Winning Lotto Texas Ticket on
(a) Lotto Texas Same-Store Sales and (b) Lotto Texas Total Zip-code Sales

Table 1: Texas Lottery Descriptive Statistics

Average Total Weekly Retailer Lottery Sales	$2,576
Lotto Texas	$733
Texas Two Step	$110
Cash Five	$170
Number of Winners	694
Lotto Texas	68
Texas Two Step	55
Cash Five	571
Prize Amounts	
Lotto Texas:	
Mean	$9,448,752
Min	$1,032,666
Max	$51,200,200
Texas Two Step:	
Mean	$590,455
Min	$200,000
Max	$1,600,000
Cash Five:	

Mean	$41,855
Min	$8,888
Max	$93,201

Notes: Average total weekly sales are per retailer and include both lotto and non-lotto lottery tickets. Number of winners counts the number of times a winning jackpot ticket was sold for a particular game during our sample period. Mean prize amounts are the average jackpot prize for a winning jackpot on that game.

Table 2: Estimates of Substitution Effects

	Effect on sales of other games within store [a]	Effect on total sales at other stores within local market: *Local Market: Zip-Code* [b]		*Local Market: 1-Mile Radius* [c]	
		winner at store	winner in zip code	winner at store	winner within 1-mile
5 week lead	.033	-.032	.019	-.113	.004
	(.093)	(.047)	(.010)	(.076)	(.085)
4 week lead	-.087	-.059	.024	-.119	-.109
	(.092)	(.046)	(.010)	(.075)	(.084)
3 week lead	.006	-.021	.033	-.090	-.140
	(.090)	(.044)	(.009)	(.074)	(.084)
2 week lead	-.137	-.031	.007	-.068	.036
	(.089)	(.043)	(.009)	(.071)	(.078)
1 week lead	-.004	-.021	-.015	-.113	-.175
	(.091)	(.040)	(.009)	(.067)	(.077)
1 week lag	.178	.258	.049	.333	.041
	(.089)	(.041)	(.009)	(.068)	(.080)
2 week lag	.085	.228	.067	.348	-.035
	(.087)	(.042)	(.009)	(.070)	(.080)
3 week lag	.144	.220	.082	.332	.049
	(.087)	(.043)	(.010)	(.071)	(.084)

4 week lag	.074	.157	.075	.206	.052
	(.088)	(.044)	(.010)	(.072)	(.085)
5 week lag	.116	.177	.059	.223	.146
	(.088)	(.044)	(.010)	(.072)	(.086)

[a] Each cell of the leftmost column corresponds to a unique regression of $\ln(\text{sales})_{i(-j)t}$ as a function of $\ln(\text{sales})_{ij(t-k)}$, $\ln(\text{sales})_{i(-j)(t-k)}$, and $\text{win}_{ij(t-k)}$, where *j* indexes lotto games, -*j* refers to all games other than *j*, *i* indexes retailers, *t* indexes weeks, and *k* indexes the number of weeks lead or lag. Each row reports the results for a different *k*. All regressions control for week fixed effects. The initial sample is 2,026,059 observations.

[b] Each row in the center panel reports results from a separate regression of $\ln(\text{sales})_{ijt}$ as a function of $\ln(\text{sales})_{ij(t-k)}$, $\ln(\text{sales})_{zj(t-k)}$, $\text{win}_{ij(t-k)}$, and $\text{win}_{zj(t-k)}$ where *j* indexes lotto games, *i* indexes retailers, *z* indexes 9-digit zip codes, *t* indexes weeks, and *k* indexes the number of weeks lead or lag. All regressions control for week fixed effects. The sample is limited to stores located in a zip code with at least one other retailer. The initial sample is 1,825,308 observations.

[c] Each row in the right panel reports results from a separate regression of $\ln(\text{sales})_{ijt}$ as a function of $\ln(\text{sales})_{ij(t-k)}$, $\ln(\text{sales})_{gj(t-k)}$, $\text{win}_{ij(t-k)}$, and $\text{win}_{gj(t-k)}$ where *j* indexes lotto games, *i* indexes retailers, *g* indexes “1 mile group”, *t* indexes weeks, and *k* indexes the number of weeks lead or lag. All regressions control for week fixed effects. The sample is limited to stores that have at least one other retailer within 1-mile. The initial sample is 823,412 observations.

Table 3: Long-run Geographic Substitution Patterns

	Local Market: 1-Mile Radius	
	winner at store	winner within 1-mile
1 month lag	.215	.072
	(.065)	(.091)
2 months lag	.043	-.001
	(.069)	(.096)
3 months lag	.065	-.043
	(.075)	(.096)
4 months lag	.127	-.030
	(.079)	(.102)
5 months lag	.082	-.038
	(.080)	(.106)
6 months lag	.104	-.110
	(.079)	(.106)
7 months lag	.079	-.198
	(.083)	(.108)
8 months lag	.061	-.200
	(.087)	(.120)
9 months lag	.036	-.051
	(.090)	(.134)

10 months lag	.033	-.138
	(.090)	(.143)

Notes: Results are from regressing $\ln(sales)_{ijt}$ as a function of $\ln(sales)_{ij(t-k)}$, $\ln(sales)_{gj(t-k)}$, $win_{ij(t-k)}$, and $win_{gj(t-k)}$ where *j* indexes lotto games, *i* indexes retailers, *g* indexes "1 mile group", *t* indexes weeks, and *k* indexes the number of weeks lead or lag. Regressions control for month fixed effects. The sample is limited to stores that have at least one other retailer within 1-mile. The initial sample has 245,300 observations.

Table 4: The Initial Effect of a Winning Lotto Texas Ticket on Retailer-Game Sales by Zip Code Demographics

	(1)	(3)	(4)
1 week lag	.083	.108	.094
	(.071)	(.093)	(.070)
*(percent HS dropout)	1.014		
	(.260)		
*(percent over 65)		1.47	
		(.598)	
*(percent poverty)			1.632
			(.428)
Adj. R^2	.890	.890	.890

Notes: Each column reports coefficients from a separate regression estimating $\ln(\text{sales})_{it}$ as a function of $\ln(\text{sales})_{i(t-k)}$, $\text{win}_{i(t-k)}$, $\text{win}_{i(t-k)}*(\textit{percentX})_z$, and $\textit{percentX}_z$, where *i* indexes retailers, *t* indexes weeks, *k* indexes the number of weeks lead or lag, and *X* refers to the particular demographic characteristic. All regressions control for week fixed effects. Population demographics at the five-digit zip code level are obtained from the 2000 U.S. census. The mean value of the percent of adults in a zipcode (weighted by the number of retailers in a zip code) with less than a high school degree is 26.2; adults over age 65 is 18.0; and population in poverty is 15.1.

References

Ayton, Peter and Ilan Fischer. 2004. "The hot hand fallacy and the gambler's fallacy: Two faces of subjective randomness?" *Memory & Cognition* 32(8): 1369-1378.

Bar-Hillel, Maya, and William Wagenaar. 1991. "Perceptions of Randomness." *Advances in Applied Mathematics*, 12(4): 428-454.

Becker, Gary S. and Kevin M. Murphy. 1993. "A Simple Theory of Advertising as a Good or Bad." *Quarterly Journal of Economics*, 108(4): 941-964.

Benjamin, Daniel J., Sebastian A. Brown, and Jesse M. Shapiro. 2006. "Who is 'Behavioral'? Cognitive Ability and Anomalous Preferences." http://home.uchicago.edu/~jmshapir/papers.html.

Camerer, Colin. 1989. "Does the Basketball Market Believe in the 'Hot Hand'?" *The American Economic Review*, 79(5): 1257-1261.

Carhart, Mark M. 1997. "On Persistence in Mutual Fund Performance." *Journal of Finance*, 52(1): 57-82.

Caruso, Eugene M. and Nicholas Epley. 2007. "The Road to Streaks is Paved with Intentions: Perceived Intentionality in the Prediction of Repeated Events." Unpublished Manuscript, University of Chicago.

Chevalier, Judith and Glenn Ellison. 1997. "Risk-Taking by Mutual Funds as a Response to Incentives." *Journal of Political Economy*, 105(6): 1167-1200.

Chevalier, Judith and Glenn Ellison. 1999. "Are Some Mutual Fund Managers Better Than Others? Cross-Sectional Patterns in Behavior and Performance." *Journal of Finance*, 54(3): 875-899.

Clotfelter, Charles, and Philip Cook. 1993. “The ‘Gambler’s Fallacy’ in Lottery Play.” *Management Science*, 39(12): 1521-1525.

Falk, Ruma. 1981. “The Perception of Randomness.” in *Proceedings of the Fifth International Conference for the Psychology of Mathematics Education*, 1:222-229.

Frederick, Shane. 2005. “Cognitive Reflection and Decision Making.” *Journal of Economic Perspectives*, 19(4): 25-42.

Fudenberg, Drew and David K. Levine. 2005. “A Dual Self Model of Impulse Control.” http://www.dklevine.com/papers.htm.

Gilovich, T., R.Vallone, and Amos Tversky. 1985. “The Hot Hand in Basketball: On the Misperception of Random Sequences.” *Cognitive Psychology*, 17: 295-314.

Grinblatt, Mark and Matti Keloharju. 2001. “What Makes Investors Trade?” *Journal of Finance*, 61(2): 589-616.

Guryan, Jonathan and Melissa S. Kearney. 2005. “Lucky Stores, Gambling and Addiction: Empirical Evidence from State Lottery Sales” *NBER Working Paper No. 11287*.

Hansen, Ann. 1995. “The Tax Incidence of the Colorado State Lottery Instant Game”. *Public Finance Quarterly*, 23(3): 385-99.

Hinson, John M., Tina L. Jameson and Paul Whitney. 2003. “Impulsive Decision Making and Working Memory.” *Journal of Experimental Psychology: Learning, Memory and Cognition* , 29(2): pp. 298-306.

Jarvik, Murray E. 1951. “Probability learning and negative recency effect in the serial anticipation of alternative symbols.” *Journal of Experimental Psychology*, 41(4): 291-297.

Kahneman, Daniel and Shane Frederick. 2002. “Representativeness Revisited: Attribute Substitution in Intuitive Judgment.” In *Heuristics and Biases: the psychology of Intuitive Judgment*, ed. Thomas Gilovich, Dale Griffin, and Daniel Kahneman, 49-81. New York: Cambridge University Press.

Kearney, Melissa S. (2005a) “State Lotteries and Consumer Behavior.” *Journal of Public Economics*, 89(11-12): 2269-2299.

Kearney, Melissa S. (2005b). “The Economic Winners and Losers of Legalized Gambling.” *National Tax Journal*, 58: 281-302.

Loewenstein, George and Ted O’Donoghue. 2005. “Animal Spirits: Affective and Deliberative Processes in Economic Behavior.” http://people.cornell.edu/pages/edo1/papers.html.

McClure, Samuel M., David I. Laibson, George Loewenstein and Jonathan D. Cohen. 2004. “Separate Neural Systems Value Immediate and Delayed Monetary Rewards.” *Science,* 306: 503-507.

McGeorge, Peter, J.R. Crawford and S.W. Kelly. 1997. “The Relationships Between Psychometric Intelligence and Learning in an Explicit and an Implicit Task.” *Journal of Experimental Psychology: Learning, Memory and Cognition*, 23(1): 239-245.

Odean, Terrance. 1998. “Are Investors Reluctant to Realize Their Losses?” *Journal of Finance,* 53(5): 1775-1798.

Oster, Emily. 2004. “Are All Lotteries Regressive? Evidence from the Powerball.” *National Tax Journal* 57: 179-87.

Rabin, Matthew. 2002. “Inference by Believers in the Law of Small Numbers.” *Quarterly Journal of Economics* 117(3): 775-816.

Reber, Arthur S. 1993. *Implicit Learning and Tacit Knowledge: An Essay on the Cognitive Unconscious*. New York: Oxford University Press.

Reber, Arthur S., Faye F. Walkenfeld and Ruth Hernstadt. 1991. "Implicit and Explicit Learning: Individual Differences in IQ." *Journal of Experimental Psychology: Learning, Memory and Cognition* 17(5): 888-896.

Scott, Frank and John Garen. 1994. "Probability of Purchase, Amount of Purchase, and the Demographic Incidence of the Lottery Tax." *Journal of Public Economics*, 54(1): 121-143.

Shefrin, Hersh M. and Richard H. Thaler. 1988. "The Behavioral Life-Cycle Hypothesis." *Economic Inquiry*, 26(4): 609-643.

Shiv, Baba and Alexander Fedorikhin. 1999. "The Heart and Mind in Conflict: The Interplay of Affect and Cognition in Consumer Decision Making." *The Journal of Consumer Research* , 26(3): pp. 278-292.

Smith, Adam. 1759. *The Theory of Moral Sentiments*, K. Haakonssen, ed. Repr. New York: Cambridge University Press, 2002.

Stanovich, Keith E., and Richard F. West. 2000. "Individual Differences in Reasoning: Implications for the Rationality Debate?" *Behavioral and Brain Sciences*, 23: 645-426.

Tversky, Amos and Daniel Kahneman. 1971. "Belief in the Law of Small Numbers." *Psychological Bulletin*, 76(2): 105-110.

Tversky, Amos and Daniel Kahneman. 1974. "Judgement Under Uncertainty: Heuristics and Biases." *Science*, 185(September 27, 1974): 1124-1131.

Terrell, Dek. 1994. "A Test of the Gambler's Fallacy – Evidence from Pari-Mutuel Games." *Journal of Risk and Uncertainty*, 8(3): 309-317.

Wagenaar, William. 1972. "Generation of random sequences by human subjects: A Critical survey of the literature." *Psychological Bulletin*, 77(1): 65-72.

Worthington, Andrew C. 2001. "Implicit Finance in Gambling Expenditures: Australian Evidence on Socioeconomic and Demographic Tax Incidence." *Public Finance Review*, 29(4): 326-342.

Appendix 1: The Lotto Games

Lotto Texas

Lotto Texas offers multi-million dollar jackpots, which winners can choose to receive either as 25 annual payments or as one (present-discounted) cash payment. From its inception in 1992 until it was changed in mid-July 2000, Lotto Texas was played by choosing six numbers out of a field of 50, yielding odds of 15,890,700 to one of matching all six numbers. The field was later expanded to 54, yielding odds of 25,827,165 to one. The prize pool for each Lotto Texas drawing is comprised of 55 percent of sales for that drawing. Of this amount, 68 percent is allocated to the jackpot prize, plus any amount carried over from previous drawings. If no ticket bet matches the winning six numbers in a given week, the amount allocated for a top-prize winner is rolled over to the next draw. Portions of the prize pool are reserved each week to pay pari-mutuel prizes for five-of-six and four-of-six winners. A fixed prize of five dollars is paid to players who match three of the six numbers. Lotto Texas drawings occur twice a week. Players can purchase bets up to 10 drawings in advance, paying one dollar per drawing.

Texas Two Step

Texas Two Step offers jackpots that start at $200,000 and accumulate until someone wins the top prize, which is paid in a single lump-sum payment. The jackpot is won by correctly choosing four numbers from 35 and one Bonus Ball number from one to 35; the probability of doing so is 1 in 1,832,600. Similarly to Lotto Texas, the game includes lower prize tiers. The total prize pool comprises 50 percent of sales. Texas Two Step drawings occur twice per week. Players can play their numbers for up to ten drawings by marking their play slip accordingly; each play costs $1.

Cash Five

Cash Five pays a pari-mutuel lump-sum top prize to players who correctly pick five numbers out of 39, with odds of 575,757 to one. (The playing field was changed to 37 numbers after our sample period.) If no one correctly matches all five numbers, the money set aside to pay the top prize rolls down to the four-of-five prize. A pari-mutuel prize is also awarded for matching three-of-five numbers and a fixed prize of two dollars is paid for matching two-of-five. The Cash Five prize pool equals 50 percent of sales. Drawings are held six evenings a week. Players can play their Cash Five numbers for up to 12 drawings by marking their play slip accordingly. They can also choose their numbers in advance and indicate what day they want to start playing. Each play costs $1.

Appendix 2: Survey of Retailers that Sold a Winning Lotto Texas Ticket

Methodology

We conducted a five-minute telephone survey of the retail outlets that sold winning Lotto Texas tickets during the time period we observe. The survey asked various questions about the store's advertising practices before and after the sale of a winning ticket. We attempted to contact the full sample of 67 stores that sold the 68 winning Lotto Texas tickets in our data. The surveyor initially asked to speak to the manager at each store. In the event that the manager was not available, the surveyor offered to call back at a time when the manager might be available. In the event that the manager had not been working at the store at the time of the winning ticket sale, the surveyor asked to speak to a store employee who had been there at the time. Of the 67 winning stores, the contact information for 8 was not current, 14 refused to take the survey, and 14 were unable to complete the survey because none of the current employees had worked at the store at the time of the winning ticket sale. Of the remaining 30 stores, 17 completed the phone survey. The surveyor recorded responses directly onto the paper copy of the survey. The survey was mailed to the remaining 13 stores with an addressed, stamped return envelope; three completed surveys were returned.

Results

Of the 18 winning stores that completed the survey -

- 15 report having received some type of media attention for having sold a winning lottery ticket, with local newspapers and television stations being the most common.

- 15 report hanging the "Winning Ticket Sold Here" sign provided by the Texas Lottery Commission (TLC); all 15 report displaying the sign immediately following the sale of the ticket or as soon as the sign arrived.

- 8 report that the "Winning Ticket Sold Here" sign still hangs in their window, multiple years later; 5 report displaying the sign for between 1- 6 months; 1 took the sign down after 6 weeks; one does not know for how long the sign was displayed.

- 18 report displaying the point of sale materials provided by the TLC, such as game decals, game posters and display tickets prior to the sale of the winning ticket.

- 0 report changing their general advertising strategies after the sale of a winning ticket.

- 15 report a perceived increase in lottery ticket sales following the winning ticket sale.

- 9 report a perceived increase in sales of other products following the winning ticket sale.