# Examining the 'Halo Effect' in Lotto Games

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**Abstract**

The "Halo Effect" occurs when lotto ticket sales are unexpectedly high following a large jackpot. An examination of the Powerball lottery finds evidence that the halo effect exists and that it is the result of bettors exchanging prize winnings for new tickets.

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## I. INTRODUCTION

"Lotto" is among the most popular games offered by state lottery associations, accounting for roughly one-quarter of total revenues for state-run U.S. lotteries. Lotto games generally consist of an individual picking a set of five or six numbers from a group of approximately 35-55 choices. Winning numbers are then randomly selected at a weekly or bi-weekly drawing. A player whose ticket matches all of the winning numbers wins the jackpot prize, but if no player matches all of the correct numbers, the jackpot prize pool rolls over into the next drawing, increasing the jackpot in the subsequent period. For this reason, lotto jackpots can grow in an unlimited fashion, and, in part, lotto derives its popularity from the large jackpot prizes that can be won in this game.

Since the price of a lotto ticket and the odds of winning remain fixed regardless of the size of the jackpot, the expected return of purchasing a lotto ticket nearly always increases along with the size of the jackpot. Numerous authors including Scott and Gulley (1995), Farrell, *et al* (1999), Forrest, *et al* (2002), and Matheson and Grote (2005) have noted that lotto players generally behave in ways consistent with basic economic principles by responding to the higher expected return provided by larger jackpots with increasing ticket purchases while reducing ticket purchases when the expected return falls.

One notable exception to this behavior, as described by Farrell, *et al* (1999) and Matheson and Grote (2005), is the tendency for drawing right after a large jackpot has been won to experience unusually high ticket sales. This phenomenon is known as the "Halo Effect." In their examination of nearly 11,000 lotto drawings, Matheson and Grote (2005) find only 173 cases where ticket sales dropped despite an increase in the jackpot. Fully two-thirds of these cases (118 of 173) occur in the time period around a large jackpot being won demonstrating the

halo effect. They attribute the halo effect to "the publicity following the award of a large jackpot prize [which] apparently influences later consumers to make lottery ticket purchases despite the fact that the jackpot prize, and hence the expected value of the ticket, falls back to lower levels following the payoff of a large jackpot."

An alternative explanation to the halo effect is offered by scholars in the area of gambling addiction who would attribute the increased sales to gamblers who get "hooked" on playing the lottery during periods of high jackpots and then cannot "kick the habit" once the jackpot returns to a lower level. This brief paper examines the existence of the halo effect and offers an alternative explanation for its presence.

## II. TESTING FOR THE HALO EFFECT

Testing for the halo effect requires an estimate of ticket sales for a particular lotto drawing. Following the models developed by Farrell, *et al* (1999) and Forrest, *et al* (2002), the equation used to estimate the halo effect on lotto ticket sales is shown in equation (1)

$$(1) \qquad Sales_t = \beta_0 + \beta_1(Jackpot_t) + \beta_2(Jackpot_t^2) + \beta_3(Trend_t) + \beta_4(Halo_t) + \epsilon_t$$

where Sales is the number of tickets purchased in a particular drawing. Jackpot is the advertised jackpot for the particular drawing and is included to account for the increase in ticket sales that occurs with a rising jackpot. Jackpot-squared is included to account for the non-linear relationship between ticket sales and advertised jackpots that has been observed in previous research such as Farrell, *et al* (1999) and Forrest, *et al* (2002). Trend is a simple linear variable that is included to account for the declining popularity in lottery products after they are introduced to the market. Halo is the variable(s) of interest that is included to test for the halo effect and is explained further in the results section.

The data used to estimate equation (1) are drawing by drawing sales and jackpot information for the Powerball lotto from November 5, 1997 to October 5, 2002. Powerball, a multi-state game sold in twenty-seven states, is used because of its widespread popularity and because the long period of time during which the game structure remained relatively unchanged. Powerball has bi-weekly drawings, and since ticket buyers' behavior may differ between weekdays and the weekend, equation (1) is estimated separately for drawings on each of these days.

The results of regression analyses for equation (1) under a variety of "Halo" variables are provided in Table 1. All of the regressions showed significant evidence of positive first-order serial correlation so the variables used have been adjusted using the Cochrane-Orcutt process to diminish that effect. The Durbin-Watson statistics of the original regressions and the rho values used to adjust the variables are included at the bottom of the tables.

## III. RESULTS AND CONCLUSIONS

Several different variables could be included to test for the halo effect. If Matheson and Grote's assumption that the halo effect is caused by the publicity surrounding large jackpots or large jackpots being won is true, then the "Halo" variable should be the size of the jackpot in drawing t-1 (Model 1) or the size of the jackpot in drawing t-1 interacted with a dummy variable that takes a value of 1 when the jackpot is won and 0 otherwise (Model 2). If the halo effect is instead caused by gambling addiction, then the "Halo" variable should be ticket sales in time period t-1 or perhaps ticket sales in multiple past periods. Trial and error revealed that setting the "Halo" variable equal to the sum of ticket sales in periods t-1 and t-2 yielded the best model fit and is shown as Model 3. This allows for the consideration of ticket purchases over the previous

week of lottery drawings rather than just the previous drawing. Theoretically, it makes sense to include the entire week of past sales to capture both ticket purchases by individuals who buy tickets once a week and those who buy tickets for each drawing.

Considering the regression results in Table 1, it is apparent that all of the models do well overall in explaining the level of sales for the Powerball drawings. All of the models tested provide significant and expected signs for the Jackpot, Jackpot-squared and Time variables. (While the Jackpot variable is negative, when combined with the Jackpot-squared term, the advertised jackpot has a positive impact on sales over all observed jackpot levels.) Of primary importance for this analysis, however, is the significance of the variables used to detect the halo effect.

Model 1 suggests that the previous jackpot has no significant effect on current sales for either the Wednesday or Saturday drawing. Model 2 indicates that while the previous jackpot being won does positively affect ticket purchases for Saturday drawings, it does not affect ticket purchases for the Wednesday drawings. One possible explanation for this is the different buying habits of individuals who participate in weekend drawings as opposed to weekday drawings. It appears that individuals who buy tickets for weekend drawings increase their ticket purchases in response to a jackpot being won, indicating that they, at least, may experience the halo effect even if ticket buyers for weekday drawings do not. In Model 3, for both the Wednesday and Saturday drawings, lottery participants buy significantly more tickets for the current drawing when they have been purchasing tickets in the previous two drawings as well.

An examination of the individual coefficients on the “Halo” coefficients as well as of the overall model fit statistics modestly favors an explanation of addiction (i.e. Model 3) over that of publicity (Models 1 and 2). Further analysis of the data, however, showed that sales in periods

more than two drawings in the past had no demonstrable effect on current period sales. If the halo effect is a result of gambler addiction, the addiction is oddly short-lived suggesting that perhaps a third explanation is in order.

Lotto players matching some but not all of the winning numbers win smaller consolation prizes. In Powerball, 20.8% of ticket sales are returned to players in the form of consolation prizes of which 12.0% is used to pay out to prizes between $3 and $7 which are redeemed at lotto retailers.

The “Halo” coefficients in Model 3 indicate that Powerball players contribute between 2.6% and 3.4% of their previous spending on new ticket purchases in the subsequent two drawings. If, hypothetically, all Powerball players winning a small prize cashed in their tickets within one week of the drawing and each purchased one new ticket with a portion of their winnings, current sales would increase by 2.8% of past sales. Alternatively, if all small winners converted one-quarter of their prizes into new ticket purchases, current sales would increase by 3.0% of past sales. These fractions are both consistent with the observed halo effect from Model 3.

This “reinvestment” of small lottery winnings into the buying of new tickets could be considered as addiction in that a past gambling experience leads to future wagering; however, this is certainly not the type of pathological addiction described in the compulsive gambling literature as the addiction ends once the player stops winning. Indeed, the halo effect appears to be an “addiction of convenience,” for what is more natural than for a winning lotto player to spend a portion of his profits on further gambling when new tickets are readily available?

Lottery associations would also do well to remember this type of gambling behavior. Lotto games should be designed to offer some frequently won smaller prizes as lottery

associations are likely to immediately receive a portion of their payouts on these prizes in the form of new ticket sales.

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Table 1: Testing for the Halo Effect

| Variable | Model 1 Wed | Model 1 Sat | Model 2 Wed | Model 2 Sat | Model 3 Wed | Model 3 Sat |
|---|---|---|---|---|---|---|
| Constant | 8,969,658** | 8,179,354** | 8,889,452** | 7,811,268** | 8,623,655** | 7,870,380** |
| | (15.97) | (17.68) | (15.13) | (16.53) | (14.92) | (17.44) |
| Jackpot $_t$ | -126,534** | -21,157* | -116,735** | -12,319 | -117,472** | -20,999* |
| | (-8.26) | (-1.98) | (-7.35) | (-1.10) | (-7.92) | (-2.03) |
| Jackpot $_t^2$ | 3,757** | 2,662** | 3,747** | 2,639** | 3,718** | 2,647** |
| | (46.97) | (52.19) | (45.61) | (51.09) | (45.45) | (50.55) |
| Trend | -7,511* | -4,798 | -7,296* | -4,861* | -7,180* | -4,664* |
| | (-2.56) | (-1.95) | (-2.51) | (-2.02) | (-2.51) | (-2.07) |
| Jackpot $_{t-1}$ | 9,643.4 | -472.4 | | | | |
| | (1.18) | (-0.08) | | | | |
| Jackpot $_{t-1}$ x Jackpot won | | | 5,792 | 9,089* | | |
| | | | (1.01) | (2.13) | | |
| Sales $_{t-1}$ + Sales $_{t-2}$ | | | | | 0.017* | 0.013* |
| | | | | | (2.36) | (2.37) |
| N | 256 | 256 | 256 | 256 | 255 | 255 |
| Adjusted $R^2$ | 0.978 | 0.983 | 0.978 | 0.984 | 0.979 | 0.985 |
| F | 2,271.3** | 3,047.5** | 2,283.0** | 3,119.2** | 2,331.8** | 3,252.2** |
| DW | 1.718 | 1.538 | 1.735 | 1.556 | 1.744 | 1.687 |
| Rho | 0.139 | 0.229 | 0.130 | 0.221 | 0.126 | 0.155 |

The number in parentheses below each coefficient is the respective t-score for that coefficient.

**, * significant at 1% and 5% level, respectively.