Instant Game Sales follow an Economic Predictive Model

it's good to play

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In Washington State, the Lottery has benefitted over the years from working with economists who forecast many of the state government's revenue streams. Economists know that they can predict some types of state revenue (sales taxes, for instance) if they have accurate accounts of factors like the population of the state and the rate of unemployment. That is, sales tax "follows a predictive model" based on population and unemployment. The predictive model is built by using the quarter-by-quarter development of population, unemployment, and sales tax in the past to determine a "best-fitting" equation. This equation is then used to project future sales tax based on future (projected) population and unemployment.

We have found that sales of instant games in Washington follow a predictive model based on population and unemployment. In fact, using quantitative methods, we have found that more than 70 percent of the quarter-to-quarter variation in sales of our instant games, over the past eleven years, can be accounted for by variation in just these two factors. Put another way: most of the variation in sales over this period of time can be understood without knowing anything about what the Lottery has been doing.

This sort of finding was somewhat troubling when it was first presented, in FY2008. Surely, our success in growing sales from FY2000 through FY2008 cannot have been merely driven by economic factors: it must also have been due to changes we made in the product line-up, and other efforts. With further quantitative study we have been able, in fact, to prove the effect of changes in the product line-up and to estimate its size.

To represent the change in the product line-up we can use, pretty much interchangeably, either the average price of a Scratch ticket sold, or the percentage of the value of the sale that went to pay prize expense. Both have increased over the past eleven years, though not uniformly or smoothly.

Adding a variable that describes the change in the product line-up to the predictive equation increases the proportion of the quarter-to-quarter variability accounted for in a significant way. By significant, I mean that the model with the new variable agrees more precisely with reality, and the improvement passes statistical tests of reliability. By including the average price of a ticket sold in the model, we account for 10 percent more of the variation in actual sales. This brings the total of variation accounted for to 83 percent.

Put another way: diversification of the instant game portfolio, and emphasis on higher-priced tickets with higher prize expense, has

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contributed to the development of instant sales in Washington, though most of the change has been driven by economic factors.

Having the economic model has helped us to understand the impact of the economic downturn on instant sales. In particular, instant consumption dropped in response to the worsening economy, as represented by the increased unemployment factor, in a way that was highly consistent with changes in earlier periods that were milder and less sustained. As forecasts of economic recovery have been updated over the past several quarters, we have been able to adjust our expectations of instant sales in future budget periods accordingly.

We have continued to refine the predictive power of our model by finding factors that affect instant consumption in a way independent of the other factors in the model. We can account for 89% of the quarter-to-quarter variation in instant ticket sales over an eleven-year period by adding factors to account for general price inflation, and seasonality. That is, as the buying power of the dollar has gone down, so has player's willingness

to spend more on instant tickets. Further in Washington, instant ticket play is reliably higher in the fall and winter quarter than in the spring and summer.

The graph below summarizes the fit of the complete model to 48 quarters of actual data, from Q3 1999 through Q2 2011. This graph was produced by the economic modeling software package E-Views, which does not lend itself to beautification, so I must explain it:

The horizontal axis represents calendar year quarters.
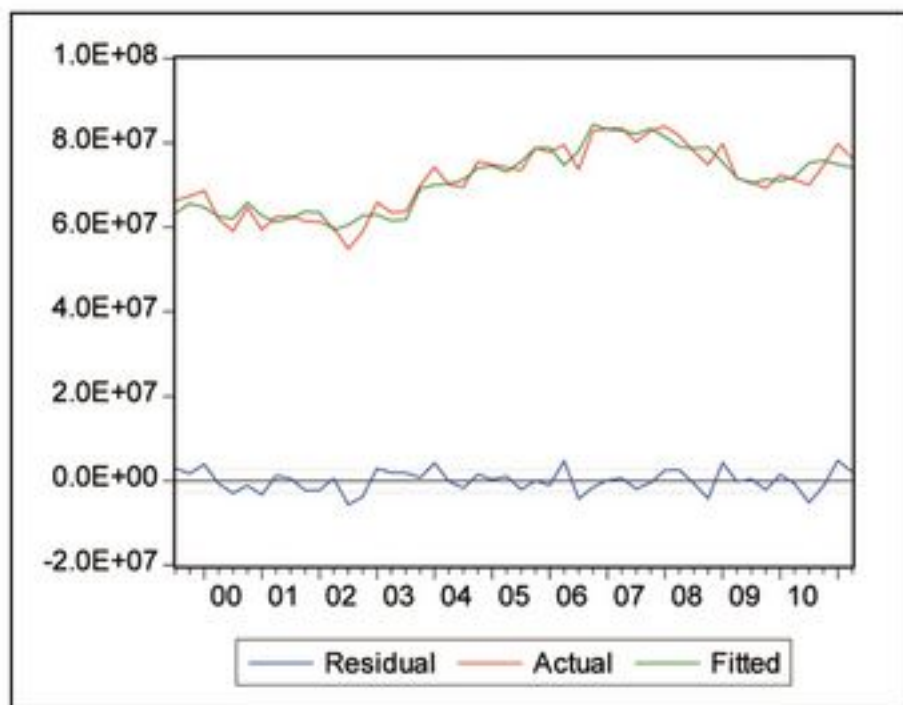
We hope to use this type of analysis to identify further success factors.

The vertical axis represents instant sales in dollars per quarter, expressed in scientific notation. Instant sales in Washington have generally varied between $60 and $80 million per quarter during this period.

The red line "actual" represents actual instant sales.

The green line "fitted" represents the model prediction given the state of the driving variables for that quarter.

The blue line "residual" shows the departure of the actual sales from the prediction. The residual line generally jitters around zero. Detailed analysis shows that most of the time, actual sales are within $3 million of the prediction. There are, however, periods in which actual sales exceed (or fall short of) the prediction by a larger margin. We study these departures closely in order to try to identify factors that can drive consistently higher performance.

We have applied similar modeling to Net Win (sales minus prize expense), with similar results.

Figure legend: Washington's instant sales over the past 11 years have followed a model based on population, economic health represented by unemployment and inflation, and seasonality. Changes to the product offering, represented by the average price of an instant ticket or by the prize expense of that average ticket, are also an important part of the model.

In summary: We have applied methods developed by economists to better understand the instant game business in Washington. We find instant sales highly predictable on a quarter-by-quarter basis, and largely driven by economic factors. Changes in the product line-up have also had a significant and measurable impact on consumption. We hope to use this type of analysis to identify further success factors.