Lottery Revenue and Cross-Border Shopping: A Nation-Wide Analysis.

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Abstract

In this paper, we test the hypothesis that a state's lottery suffers loss of revenue if a neighboring state begins its own lottery. Our hypothesis was that; the introduction of a lottery in a joining state has no effect on the lottery revenues of a state. We used econometric techniques, including panel data statistical methods and regression, to test the hypothesis. Data collected from the lower 48 states included lottery revenues as well as other data we chose to control for in our study. Our research concluded that the institution of a lottery in a neighboring state did not adversely affect the lottery revenues of a state.

1. Introduction

Lottery revenues are a topic of particular concern for many states. All but 13 states have lotteries and in those states that do have lotteries, the revenue generated is considered important to policy makers and voters. This is because governments typically earmark lottery revenue for special programs, such as education, that have special interest to policymakers and voters. This makes lottery revenues a topic of great interest for the both the state government and the public. Because money made from the state lottery is earmarked for special programs of high social priority, both the government and the public are protective of lottery revenue.

This leads many politicians and the public in general to argue that their state should have a lottery if their neighbors do. The logic of this view is simple. If a neighboring state has a lottery while they do not then they are losing potential revenue to the neighboring state because these lottery players travel to another state to play the lottery. This has led several states to institute lotteries attempting to recapture the revenue believed lost to neighboring states with lotteries.

In this paper examines the effect of the addition of a lottery in a neighboring state on a state's lottery revenue. We use panel data from all lower 48 states that have lotteries to determine the impact on a state's lottery revenue from a neighboring state adding a lottery. The approach is to use regression analysis to estimate the relationship among bordering states' lottery revenues. This is naturally done by finding the impact on a state's lottery revenue from a neighboring state adding a lottery. The panel data and regression analysis to measures changes in lottery revenues due to lottery additions.

The approach is unique in its scope. The literature we have reviewed has performed similar studies but has limited the scope of their studies to single states or more specific cross-border shopping occurrences.

The remainder of the paper is organized as follows: Section 2 discusses the literature. Section 3 describes the data and the empirical techniques employed to address the problem interstate competition in lottery sales. Section 4 discusses the results and the implications of the results. Finally, Section 5 discusses some further avenues of research and sums up what was leaned in this research.

2. Literature Review and Theoretical Issues

There is an abundance of quality literature on substitution and lottery games. Several studies cover the substitution between lottery games and other forms of gambling. Clotfelter and Cook (1990) make the case that new lotteries in the 1980s did

not siphon off revenues from other lottery games. Alternatively, Gulley and Scott (1989) and Elliot and Navin (2002), who studied the substitution effects between lotteries and other forms of gambling, argued that there exists a strong substitution effect between the two. Specifically, Gulley and Scott's work addressed the substitution between lotteries and betting on thoroughbred horse racing. Their work is parallel that of Elliot and Navin who argue that there is a strong substitution between lotteries and other forms of gambling, such as pari-mutuel betting and casinos.

More specific to our discussion are studies such as the one by Alm, Mckee, and Skidmore (1993). Their study examined the reasons that states enact lotteries. They find that border competition has eclipsed fiscal stress as the most significant reason for lottery enactment. They showed that the presence or creation of a lottery in an adjacent state was a major factor in the decision to enact a lottery.

Stover (1990) set a particularly important foundation for our work. His study established that lotteries in neighboring states were substitutes rather than complements. Also important was the work of Garret and Marsh (2002) which analyzes cross-border shopping between Kansas and its neighbors. Their use of cross-sectional data from 105 Kansas counties allowed them to estimate the impact of cross-border shopping on lottery revenues. Their conclusion was that cross-border shopping accounted for substantial revenue losses.

The study most closely associated with ours is the work of Tosun and Skidmore (2004). Their study also used panel data to look at cross-border shopping. They look at West Virginia and its neighboring states. Their conclusion is that the implementation of lottery games in neighboring states, which they conclude results in cross-border shopping, makes West Virginia's lottery less lucrative.

Key to our research, as it is with Tosun and Skidmore (2004), is the use of panel data. It allows us to determine how states introducing a lottery effects a neighboring state's revenue. We aim to measure the impact on a state's lottery sales from the introduction of a lottery in a neighboring state.

Empirical Analysis

The data consists of lottery revenues from all of the lower 48 states. Data on net (of the prizes paid and administrative costs) lottery revenues were obtained from the U.S. Census. The time-period was 1977 to 2006, excluding 2001 and 2003, which were missing from the Census' web. Data on the proliferation of lotteries was also obtained from the Census' dataset. For the analysis, it was assumed that the first year a lottery had net revenues corresponded to the year the lottery started operating.

The U.S. Census also provided data on per capita personal income and population, two variables that are included in the model to control for factors, which should highly influence lottery sales.

In order to examine the impact of a neighboring state's lottery on a state's lottery, panel data was used, which allows estimate the effect that the introduction of a lottery in one state had on the lottery revenue of bordering states. It also allows for the control for other variables that might influence lottery revenue. We feel would influence lottery revenue.

An important backdrop to this research has been the proliferation of state lotteries over the last thirty years. Table 1 shows the growth of state lotteries in terms of bordering states with lotteries. The number of states with no bordering lottery states goes from a majority of states to zero. In addition, we see that the number of states with multiple bordering lottery states begins to outpace states with only one bordering lottery state around 1985.

(1)

Where:

- Y_{it} = Net Lottery Revenues;
- Neighboring Lottery_{it} = 1 if a state had at least one neighboring state with a lottery, 0 otherwise;
- Population_{it} = Population in thousands;
- $\text{Per Capita Personal Income}_{it}$ = Per Capita Personal Income;
- State_i = 48 State indicator variables;
- Year_t = Year indicator variables;
- ε_{it} serially correlated error term;
- i = 48 states excluding Alaska and Hawaii;
- t = 1977-2006 excluding 2002 and 2005.

Equation (1) is estimated using a least squared dummy variable model (LSDV) with fixed state and time effects. The estimation procedure used robust standard errors to correct for panel heterogeneity and serial correlation. The LSDV model is a way to control for unobserved characteristics that are unchanging and perhaps unique to each state and is a way to control for time trends.

The results from the estimation of equation (1) are presented in table 2. Table 2 shows that while a bordering lottery does have an effect on lottery revenues it is not a significant effect. Border lotteries have a negative impact, but it is not a significant one. The two variables we expected to influence lottery revenue, population and per capita income, do affect lottery revenues significantly. Lottery revenues increase with both population and per capita personal income.

The R-square indicator is 0.53, which, given the scope of the data, is acceptable.

Equation (1) is simple as it does not allow for the progressive proliferation of lotteries in the United States. Equation (2) expands equation one to allow for the estimation one the impact that different numbers of lotteries have on lottery revenue

Where:

- Y_{it} = Net Lottery Revenues;
- No Neighboring Lottery_{it} = 1 if a state had exactly zero neighboring states with a lottery, 0 otherwise;
- No Neighboring Lottery_{it} = 1 if a state had exactly one neighboring state with a lottery, 0 otherwise;
- No Neighboring Lottery_{it} = 1 if a state had exactly two neighboring states with a lottery, 0 otherwise;

- No Neighboring Lottery_{it} = 1 if a state had exactly three neighboring states with a lottery, 0 otherwise;
- No Neighboring Lottery_{it} = 1 if a state had exactly four neighboring states with a lottery, 0 otherwise;
- No Neighboring Lottery_{it} = 1 if a state had exactly five neighboring states with a lottery, 0 otherwise;
- Population_{it} = Population in thousands;
- $\text{Per Capita Personal Income}_{it}$ = Per Capita Personal Income;
- State_i = 48 State indicator variables;
- Year_t = Year indicator variables;
- ε_{it} serially correlated error term;
- i = 48 states excluding Alaska and Hawaii;
- t = 1977-2006 excluding 2002 and 2005.

Using the estimated coefficients from equation (2), a joint F test was performed with the hypothesis that all coefficients on the lottery variables were jointly zero. This hypothesis could not be rejected. Table three shows that none of new state border lottery variables were significant. In addition, population and per capita income were significant in their impact. They were also of the expected sign. Again, the R-square indicator is 0.53, which is acceptable.

The conclusion is that there is no relationship between a border lottery and decreased revenue. There are several possible reasons for this. It could very well be that there simply is no effect from the presence of a border lottery on a state's lottery revenues. Alternatively, it could be that the effect is small enough to be lost in the white noise of the error terms. This could explain how similar studies that focus on a single state and its neighbors could find some impact.

A more complex answer involves a complement effect between additional lotteries such as a Powerball and similar games. This effect increases revenue because as more people play the payoffs increase which draws more people to play. Therefore, as neighboring states add lotteries it increases the attractiveness of a state's lottery. Thus, perhaps the complement effect washes out the obvious border effect.

This research did not account for the population in bordering counties, as this would be beyond the scope of our research. It could be that in states that have highly

populated counties near the border that there is more cross-border shopping. Take, for example, the Fargo/Moorhead region of North Dakota and Minnesota. Minnesota had a lottery starting 1990 while North Dakota had not adopted a lottery until 2004. It is likely that these sister cities of Fargo and Moorhead experienced some cross-border shopping. However, on a national scale it is possible that there are not enough areas populous enough to create cross-border shopping that would be detectable in a study of this scope.

Conclusion

This research focused on the impact of a border lottery on a state's lottery. Regression analysis was used to determine the effect while controlling for other determinants of lottery revenue. The results suggest that while a border lottery did have a negative effect on the lottery revenue of a state it is an insignificant effect. This is particularly interesting because the literature suggests that there is a substitution effect between bordering lotteries.

Table 1 Proliferation of Border Lotteries							
Year	Number of Bordering Lotteries						
	Zero	**One**	**Two**	**Three**	**Four**	**Five**	**Six**
2006	0	3	6	12	10	13	4
2005	0	4	5	14	12	9	4
2004	0	4	5	14	12	9	4
2002	0	5	8	15	9	9	2
2000	0	6	8	14	9	9	2
1999	0	6	8	14	9	9	2
1998	0	6	8	14	9	9	2
1997	0	6	8	14	9	9	2
1996	0	6	8	14	9	9	2
1995	0	7	8	15	8	8	2
1994	0	7	8	15	8	8	2
1993	3	6	9	15	6	8	1
1992	3	6	10	15	5	8	1
1991	5	5	9	15	5	8	1
1990	5	5	9	15	5	8	1
1989	5	8	10	14	5	5	1
1988	6	9	12	15	3	2	1
1987	10	9	12	13	1	2	1
1986	10	9	12	13	1	2	1
1985	15	12	10	8	0	3	0
1984	16	14	7	8	0	3	0
1983	16	14	7	8	0	3	0
1982	21	11	5	8	0	3	0
1981	26	6	5	8	0	3	0
1980	27	5	5	8	0	3	0
1979	27	5	5	8	0	3	0
1978	27	5	5	8	0	3	0
1977	27	5	6	7	2	1	0

Table Two: Estimation Results from Equation (1)	
Independent Variable	
State has a bordering lottery	-4470. (-0.45) [0.65]
Population	

	86.9 (6.15) [0.00]
Per Capita Personal Income	6.2 3.48 [0.00]
Constant	-365390 -68.26 0.00
Estimated Rho	0.94
R-squared	0.53
Data Source: US Census T-statistics in parenthesis, P-values are in brackets	

Table Three: Estimation Results from Equation (2)	
Independent Variable	
State has no bordering lottery	15,331 (0.39) [0.70]
State has one bordering lottery	11,105 (0.29) [0.77]
State has two bordering lotteries	19,630 (0.54) [0.59]
State has three bordering lotteries	25,952 (0.74) [0.46]
State has four bordering lotteries	29,111

	(0.88) [0.38]
State has five bordering lotteries	22,239 (0.72) [0.47]
Population	85.6 (6.05) [0.00]
Per capita personal income	6.2 (3.45) [0.00]
Constant	-385558 (-68.38) [0.00]
Estimated Rho	0.94
R-squared	0.53
Data Source: US Census T-statistics in parenthesis, P-values are in brackets	

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