Available online at www.sciencedirect.com
SCIENCE DIRECT®
ELSEVIER
Regional Science and Urban Economics 35 (2005) 795–807
regional SCIENCE & urban ECONOMICS
www.elsevier.com/locate/econbase

Copycat gaming: A spatial analysis of state lottery structure

Ryan P. Brown[a], Jonathan C. Rork[b,*]

[a]NERA Economic Consulting, 1166 Avenue of the Americas 34th floor, New York, NY 10036-2708, United States
[b]Department of Economics, Vassar College, Department of Economics, Box 229, 124 Raymond Avenue, Poughkeepsie, NY 12604, United States

Received in revised form 21 December 2004
Available online 29 August 2005

Abstract

In models of tax competition, tax instruments are explicit; all parties are aware of the tax and respond to incentives provided therein. In the case of state lotteries, the tax is the amount of sales collected but not redistributed as prizes. Using data from 1967 to 2000, we show that although such a tax is implicit, states still engage in tax competition; if neighboring states raise their prize payout by 10% (thereby lowering their lottery tax), the home state will respond with up to a 5% increase in their prize payout.

JEL classification: H2; H71; H77
Keywords: Tax competition; State lotteries

1. Introduction

> "The general impression is that we are under siege." (Greenwich CT Police Chief Peter Robbins[1]).

The quote above was in reference to the throng of New Yorkers who crossed the Connecticut border into Greenwich in July of 1998 searching for tickets for the $250

* Corresponding author. Fax: +1 845 437 7576.
E-mail address: rork@vassar.edu (J.C. Rork).
[1] CNN, July 29, 1998.

doi:10.1016/j.regsciurbeco.2005.03.001

million drawing of Powerball. There were similar stories of Californians crossing into Arizona and Utahans crossing into Idaho at this time. The end result was long lines for all those hoping to purchase tickets in states offering Powerball.[2]

This simple historical example shows that given proper incentives (in this case, a large jackpot), people are willing to travel long distances across state borders in order to participate in another state's lottery. Large jackpots are an infrequent occurrence and, for the most part, are dependent on forces outside a state's control.[3] The day-to-day operations of the lottery, however, are a different matter, as states have the ability to choose the prize payouts of individual games. Knowing that state fiscal policy is responsive to policies undertaken in neighboring states, we ask the question of whether or not the lottery is also susceptible to these competitive forces.

By focusing on the so-called lottery tax, which is the percentage of lottery sales not redistributed to lottery participants as prizes, we demonstrate that state lotteries are indeed subject to interstate competition. Using data from 1967 to 2000, we show that the payout rate of state lotteries, which is the percentage of lottery sales returned as prizes, responds positively to the payout rates of neighboring states. Higher payout rates correspond to lower lottery taxes, meaning that the lottery is yet another example of downward tax competition. Moreover, our estimates of competition become even stronger upon controlling for the issue of self-selection that occurs with adopting a lottery.

The remainder of the paper is organized as follows. We begin by discussing the literature on lotteries and tax competition in Section 2. Section 3 introduces a model highlighting how neighboring state lotteries can influence a home state's payout rate. After discussing the data and estimation technique in Section 4, we present the results in Section 5. Section 6 concludes.

2. Literature review

2.1. Lotteries

Existing research on state lotteries focuses on the two agents involved in participation: the player and the state. From the vantage point of the player, the lottery has been shown to be regressive in nature throughout North America (Livernois, 1987; Hansen, 1995; Stranahan and Borg, 1998a,b; Benzing et al., 2002).[4] Although players with higher incomes may consume nominally more lottery tickets than less affluent individuals, research has consistently illustrated that poor individuals will spend a higher percentage of their income on lottery products. The regressivity of the lottery raises concerns because the

[2] In the US, tickets for a particular state's lottery can only be purchased in that state.

[3] Today, the largest jackpots occur in multi-state games such as Powerball and The Big Game, which are managed by a consortium. Hence an individual state is unable to influence the structure of the lottery as much as if it were the only state offering that particular game.

[4] See Miyasaki et al. (1998) for a detailed survey on the various studies exploring the lottery's regressivity.

presence of a state lottery alters consumer spending patterns (Kearney, in press) as individuals substitute other purchases for lottery consumption.[5] This becomes an even greater worry in times of high unemployment, as it has been shown (Vasche, 1985; Mikesell, 1994) that lottery play increases with unemployment.

Although the lottery has a regressive feature, 39 states now operate some form of a lottery. Early adoptions were believed to be a result of fiscal pressure within a state (Alm et al., 1993; Erekson et al., 1999), as states could turn to the lottery as a means of increasing revenues without imposing additional taxation on the entire population. The net effect of lottery revenue on a state's aggregate revenue flows is likely to be smaller than forecast, however, for lottery revenue often decreases other forms of state taxation (Borg et al., 1993; Elliott and Navin, 2002; Fink and Rork, 2003; Fink et al., 2004).

Recent adoptions have been less a result of fiscal pressure within a state and more a response to the adoptions of neighboring states (Alm et al., 1993; Caudill et al., 1995). Under this scenario, states witness their residents cross borders to purchase lottery products and decide that it would be best to contain those sales within their own jurisdiction. Once the lottery is in place, sales are still influenced by lotteries across the border, as differences in the types of games offered influence aggregate sales levels (Garrett and Marsh, 2002; Tosun and Skidmore, 2004) as consumers shop for the best gaming option.

2.2. The lottery tax and potential tax competition

Clotfelter and Cook (1989) refer to the lottery as a painless tax. The lottery is a tax in the sense that only a fraction of the money paid into the lottery is redistributed to the players as prizes; the remainder flows into government coffers. Because participation in the lottery is voluntary, the tax is considered painless since the tax is easily avoided by not playing the lottery.

In thinking of the lottery tax, the tax base would consist of the individuals participating in the lottery. Given that lottery players have been shown to cross state borders to participate in various games, such mobility would indicate that the lottery tax would be a prime candidate for interstate tax competition. In models of interstate tax competition,[6] the mobility of the tax base plays a large role in that it allows capital to flow between jurisdictions in search of the highest after-tax rate of return. States attempt to encourage capital inflow by lowering their tax rates; if capital's response is elastic in nature, revenues will increase as a result. Ultimately, the degree of mobility influences the final level at which tax rates are set, with perfect mobility resulting in a zero rate.

Empirical work on tax competition has confirmed the importance of mobility, as taxes with mobile bases have been shown to exhibit downward competition. While often found within the realm of local property taxes (Heyndels and Vuchelen, 1998; Brueckner and Saavedra, 2001; Revelli, 2001), tax competition has also been discovered at the state level

[5] Kearney's (in press) work shows the substitution is highest among other vices such as cigarettes and alcohol, although the potential exists for other substitution patterns to emerge.

[6] See Wilson (1999) for a thorough survey of the tax competition literature.

with corporate taxation (Buettner, 2001) and specific excise taxation such as gasoline and tobacco (Rork, 2003).[7]

In all the examples listed above, the tax in question is explicit, meaning that the tax is easily understood by those impacted by its presence. The lottery tax, on the other hand, is an implicit tax. Participants are likely unaware of the taxation they are subjected to, as the face value of partaking in the lottery remains unchanged, even as the prize structure is altered.[8] By increasing its payout rate (and hence lowering its lottery tax) the state can increase a player's expected winnings, which, if sufficiently large, will entice neighboring residents to enter the state and play the lottery. Other states will raise their payouts in response as a means of maintaining their lottery base. While this is a classic example of downward tax competition, the implicit nature of the lottery tax means the competition will manifest itself in higher payout rates, which correspond to lower lottery taxes.

3. A model of lottery tax competition

To illustrate how neighboring lotteries may influence the prize payout of an individual state lottery, we model the simple case of two bordering states, each having a lottery. We assume residents have single peaked preferences so that we may invoke the median voter theorem. This assumption implies that the government will satisfy the preferences of the median voter.

There are three goods in the model: X, a private good, G, the per capita level of a public good provided by the state, and l, the amount of lottery tickets purchased by the individual. Assuming X, G and l are additively separable[9] yields utility in the form of:

$$U(X,G,l) = u(X) + v(G) + w(l). \tag{1}$$

Let y represent an individual's before tax income, and Y represent total private income in the state. The government of state A partially finances expenditures of the public good through a proportional income tax, t. In addition, the government will use all lottery revenue not returned as prizes to fund the public good. Thus:

$$X = (1-t)[y+\beta l] - l \tag{2}$$

$$G = t[Y+\beta L] + (1-\beta)L \tag{3}$$

where β represents the proportion of lottery revenue returned as (pre-tax) prizes and L represents aggregate purchases of lottery tickets in the state. For simplicity, we assume that all lottery winnings are taxed at the existing income tax rate.

[7] Moreover, local taxation appears to respond to tax changes at the national level in both the US (Besley and Rosen, 1998) and Europe (Goodspeed, 2000, 2002).

[8] Most state lottos, for example, have a jackpot that changes weekly, yet the price of a ticket remains unchanged.

[9] The assumption of additive separability is done for simplicity. We can generate the same conclusions, albeit in a more complex and less illustrative form, without this assumption.

Individuals are allowed to play the lottery in each state. Each player will compare the expected winnings in each state before deciding where to play. This mobility implies that the number of tickets an individual will purchase in state A depends on the prize payouts in both states. Therefore:

$$l = l(\beta, \beta^*) \tag{4}$$

where β^* represents the prize payout in state B. The problem for the government is to choose the prize payout that maximizes the utility of the median voter (1) subject to the budget constraint of the individual (2) and the government (3). Substituting the constraints into the utility function (1) and maximizing with respect to β yields a first-order condition of:

$$\frac{\partial l}{\partial \beta}[\gamma u_x + \psi v_G + w_l] + (1-t)[lu_x - Lv_G] = 0 \tag{5}$$

where for notational simplicity, $\gamma = (1-t)\beta - 1$ and $\psi = t\beta + (1-\beta)$.

As we are interested in the impact of a change in state B's payout on the optimal prize payout of state A, we differentiate Eq. (5) with respect to β^*

$$\frac{\partial^2 l}{\partial \beta \partial \beta^*}[\gamma u_x + \psi v_G + w_l] + \frac{\partial l}{\partial \beta^*}\frac{\partial l}{\partial \beta}\left(\gamma^2 u_{xx} + \psi^2 v_{GG} + w_{ll}\right) + (1-t) \times \frac{\partial l}{\partial \beta^*}(\gamma l u_{xx} + u_x - \psi L v_{GG} - v_G). \tag{6}$$

As in Besley and Rosen (1998), Goodspeed (2002) and Rork (2003), the slope of the reaction function with respect to β^* can be either positive, negative or zero. Note that if lottery players do not respond to neighboring payout rates, Eq. (6) simplifies to zero as $\partial l / \partial \beta^*$ and $\partial^2 l / \partial \beta \partial \beta^*$ are both zero. The remainder of the paper sets out to estimate the slope of the reaction function.

4. Econometric model and estimation concerns

4.1. Data

The data used in our analysis spans from 1967 to 2000. Fiscal information on state lotteries, including lottery sales, prizes and amounts, was collected from various editions of State Government Finances. For early years not covered by State Government Finances, we contacted individual state lottery commissions. We combined this lottery data with state demographic data complied from annual editions of The Statistical Abstract of the United States. The end result is a data set containing 34 years of information for each of the 48 mainland states.[10]

[10] We follow the practice of Case et al. (1993), Rork (2003) and others of limiting our analysis to the 48 contiguous states. Alaska and Hawaii are typically eliminated both because they have no geographic neighbors (and thus in typical tax competition research are assumed to have no 'competitors') and because their economies and fiscal policies are so different from the other 48 states.

4.2. Identifying the competition

In order to model state tax competition, one needs to determine which states are in competition with one another. Because the mobility of lottery players plays a large role in determining competitors, we limit our definition of competitor to geographically contiguous states.[11] Thus, if we were looking at New York's lottery, its competitors would be the existing lotteries in the neighboring states of Connecticut, Massachusetts, New Jersey, Pennsylvania and Vermont.

Once the competitors are identified, we next assign weights in order to capture the relative importance one state may wield over another. We employ four different weighting schemes. The first is *contiguity*, in which all neighboring states are considered to wield equal influence. For our New York example, observations from Connecticut, Massachusetts, New Jersey, Pennsylvania and Vermont would be given equal weights, whereas observations from California would be assigned a weight of zero. Because New Jersey has a larger population than Vermont, it may be the case that New York would be more concerned with what occurred in New Jersey than Vermont. To account for this, our second weight is *population-contiguity*, in which the weights are based on the populations of the bordering states. Thus, New Jersey would be given a higher weight than Vermont.

Our remaining measures, *center and city*, depend on the physical distances between states. Lottery players in Albany, New York, are unlikely to drive to New Jersey because of the distance, but they may be willing to drive to Massachusetts, which is considerably closer. Center measures the distance from the center of one state to the center of a neighboring state. It effectively measures the average distance a resident of the home state would need to travel to cross borders. Because population is not uniform, we also employ the weight city, which measures the distance between each state's largest city in terms of population.

It is common in the spatial literature to use row-standardized weights, meaning the sum of weights equals one. In the case of the contiguity weights for New York, each competitor would be given a weight of 1/5, since five states border New York. In creating population-contiguity weights, we take the bordering state's population and divide it by the population of all bordering states. For both center and city, we want to ensure that states closer together get a higher weight. We therefore assign the inverse of the distance as the weight for each state prior to row-standardization.[12]

[11] The definition of neighbors need not be limited to simple geography: Case et al. (1993) defined neighbors as those with similar racial compositions, whereas Conway and Rork (2004) argued states were neighbors on the basis of elderly migration patterns. We are unable to estimate who the true competition is when using a spatial approach, which forces the modeler to assign the structure of competition. Because geographic definitions of competition are parsimonious and are the standard approach used in most spatially based studies, we limit ourselves to these definitions rather than attempt to impose a structure that may or may not exist.

[12] Like Case et al. (1993), we estimated our models using various polynomial forms of distance, including the inverse of the square root of distance. Since our results remained essentially unchanged, we present the simplest version of our distance weights. Results using other weights are available upon request.

4.3. Econometric specification

We apply the specification used in Case et al. (1993) to the lottery by assuming that a state's lottery payout is a function of state characteristics (Z_{it}) and the lottery payout of its neighbor. Denoting P_{it} to be the lottery payout in state i at time t yields a linear specification of:

$$P_{it} = Z_{it}\beta + \theta P_{jt} + \xi_i + \rho_t + u_{it} \quad (7)$$

where ξ_i and ρ_t are state fixed effects and year effects, respectively, and u_{it} is a mean zero, normally distributed error term. As described above, states are going to have more than one neighbor, hence we replace P_{jt} with $\sum_j w_{ij} P_{jt}$, where w_{ij} refers to the weight assigned to state j. Since each state has a set of weights, we can rewrite out specification in Eq. (7) using matrix notation:

$$P_t = \theta W P_t + Z_t\beta + \xi + \rho_t + u_t \quad (8)$$

where W is a weighting matrix assigning neighbors to every state.

4.4. Discussion of state characteristics

In order to estimate the presence of state lottery competition, we need to control for other factors that may influence the amount of lottery revenue a state will return in prizes. These factors can be categorized as fiscal, political or demographic influences. We discuss each in turn.

Our fiscal controls are meant to control for what Alm et al. (1993) refer to as fiscal stress. When a state is under fiscal stress, it may feel pressure to raid lottery revenues to make up for unforecasted budget shortfalls. Thus, we include per capita levels of state debt and federal transfers. Higher debt levels may force the state to raise money through the lottery to satisfy its creditors. If federal transfers decrease, the state may use lottery revenue to help offset the loss in federal income.

Since Besley and Case (1995) argue that the political environment can influence state tax setting, we control for the political environmental with three variables in case this influence extends itself into the lottery arena. We include a dummy variable for whether or not the year of observation is a gubernatorial election year. Since lotteries are often subject to intense debate among a state's constituents, the governor may not want to alter the state's payout rate if re-election is tightly contested. We also include dummy variables indicating whether or not the governor and the majority of the state legislature are from the same political party while making the distinction between Republicans and Democrats. Since cooperation is more likely when all political bodies are from the same political party, we posit it may be easier to alter payouts when that occurs.

State descriptive variables are also included. We include the unemployment rate as it is correlated with the fiscal well-being of a state. Moreover, lottery play tends to increase in times of high unemployment, so a state may not need to alter its lottery payout to influence playing patterns. Per capita income is included to measure discretionary income, as lottery play is shown to nominally increase with income. The percent of a state's population that is elderly (over age 65) is included since they are often active participants in a state lottery. Because lottery play is often limited to ages 18 and above, we include the percent of a state's population that is school-aged (ages 5–17). States with large numbers of youth may feel pressure not to raise their payouts for fear it may make gambling more attractive to this segment of the population. We include the number of years the lottery has been in existence, as it has been argued that sales tend to plateau once a lottery has been present for a few years. Finally, we include a dummy variable indicating the presence of pari-mutuel gaming in the state. As pari-mutuel gaming is a direct competitor with the state lottery, we posit that the state may raise its payout rate in order to make the lottery more attractive to consumers.

As mentioned above, the final specification also includes state and year fixed effects. The state fixed effects control for unobserved state characteristics, as well as history. Year fixed effects control for variables that impact all states in a given year, such as national business cycle conditions and federal tax changes.

4.5. Measuring the payout

The dependent variable in the analysis is the state lottery payout rate. This measure is created by dividing the amount of prizes paid out by the state in a given year by total lottery sales in that same year. This measure accounts for all the games offered under the lottery umbrella, hence it should be thought of more as an average payout rate. The lottery tax, therefore, is $1-$the payout rate, which makes an increase in the payout rate equivalent to a lowering of the lottery tax. If our hypothesis of downward tax competition is correct, it should manifest itself in a positive coefficient on the payout rate of neighboring states.

4.6. Econometric concerns

The inclusion of the payout rate, P_t, on the right hand side of Eq. (8) means that estimation via OLS will be inconsistent, due to correlation with the error and/or simultaneity bias. If states are indeed competing with one another in setting their payout rates, then the lottery policy of one's neighbors will be simultaneously determined with one's own policy. Thus, New York's payout will be affected by what New Jersey has chosen and New Jersey will react, in turn, to what New York has decided to do. To deal with this endogeneity, we estimate Eq. (8) using the instrumental variables approach outlined in Kelejian and Prucha (1998) in which weighted values of the exogenous variables (WZ_t) are used as instruments of the spatial lag (WP_t).[13]

[13] Note that an alternative approach is to invert the system and estimate via maximum likelihood. However, should spatial error dependence also be present, maximum likelihood may provide false evidence of strategic interaction (see Brueckner, 2003 for a discussion.). We prefer the instrumental variable approach since it has been shown (Kelejian and Prucha, 1998) to yield consistent estimates, even in the presence of spatial error dependence.

We also face a self-selection issue, since not every state has chosen to implement a lottery. States may adopt lotteries when, for example, they are under financial stress. If this were the case, these states would also be most susceptible to interstate competition, which would have the effect of biasing our estimates. We address this concern by estimating a lottery adoption equation based on the specification of Alm et al. (1993) and performing a Heckman two-step selection correction based on the estimated probability to adopt a lottery. We use the adoption equation to calculate the inverse Mills ratio, which is included in the regression as an explanatory variable.

5. Results

Table 1 reports results of our estimation of Eq. (8) using our contiguity definition of neighbors. The first column indicates our baseline results, using OLS. We correct for the endogeneity issue via two-staged least squares in column 2. Column 3 accounts for the endogeneity and our concerns over sample selection. All specifications contain state and year fixed effects.

Across all three specifications, our variable of interest, the prize payout of neighboring states, is positive and significant. Most importantly, as we correct for both endogeneity and sample-selection, our estimated impact doubles from 0.20 to 0.41. Our final estimate of 0.41 suggests that a 10% increase in the payout rates of neighboring states will result in a 4% increase in the payout rate of the home state. Our estimate is consistent with those found in the literature for more traditional property and excise taxes.[14]

Among our other variables, the number of years the lottery has been in existence is estimated to have a positive impact, indicating that states feel the need to increase the prize payout to generate new demand for lottery play. The presence of pari-mutuel gaming is also positive and significant, which is consistent with the lottery needing to raise its prizes in order to compete for gaming dollars. State debt is found to have a significantly negative impact, as states with high debt will lower their prize payout in an attempt to use lottery revenues to offset their debt. States may be treating the elderly as a captive market, which would explain the negative impact of the elderly's presence. Finally, a strong Republican presence will lower the prize payout, reinforcing the regressivity of the lottery tax.

Table 2 reports the estimated impact of neighboring states' lottery payouts using our different definitions of neighbor. For brevity, we only report the results of our final specification, as we believe that controls for all our econometric concerns correctly. Column 1 repeats our contiguity estimates, column 2 contains estimates obtained from our population-contiguity weights, whereas estimates using our center and city measures are listed in columns 3 and 4, respectively.

Notice that our estimates are robust to our choice of weighting scheme. The impact of neighboring lottery payouts is positive and significant in all four measures, ranging from a

[14] As an example, Rork (2003) found a response rate of 4–6% for cigarette and gasoline taxation and Revelli (2001) found a response rate of 4–5% for property taxation in the UK.

Table 1
Estimation results of state lottery payout rates using contiguity neighbors

Method	[1]	[2]	[3]
	OLS	2SLS	2SLS
Independent variable			
Neighboring states' lottery payout rate	0.2029 [0.0445]***	0.3877 [0.1120]***	0.4136 [0.1203]***
Number of years state has had lottery	1.4464 [0.1027]***	1.3457 [0.1175]***	1.4163 [0.1297]***
State per capita debt	− 0.0013 [0.0004]***	− 0.0013 [0.0004]***	− 0.0012 [0.0004]***
State per capita federal transfers	− 0.0141 [0.0048]***	− 0.0147 [0.0048]***	− 0.0144 [0.0051]***
Percentage of population ages 5–17	0.5886 [0.5055]	0.2766 [0.5371]	0.4755 [0.5472]
Percentage of population 65 years or older	− 2.5702 [0.6259]***	− 2.7375 [0.6363]***	− 2.9993 [0.6737]***
State per capita income (in 1000's)	− 0.0425 [0.0531]	− 0.0364 [0.0536]	− 0.0379 [0.0540]
Election year (YES = 1)	0.0964 [0.9961]	0.0416 [1.0021]	0.1012 [1.0156]
Same party-democrat	0.7106 [1.0168]	0.2895 [1.0489]	0.2978 [1.0732]
Same party-republican	− 2.9612 [1.2074]**	− 2.7295 [1.2210]**	− 3.6180 [1.3816]***
Presence of para-mutuel gaming (YES = 1)	8.6527 [1.5489]***	8.0051 [1.5986]***	6.0715 [2.1933]***
State unemployment rate	0.1195 [0.3325]	0.2653 [0.3441]	0.0553 [0.3553]
Constant	59.5344 [15.9711]***	64.166 [16.2653]***	66.3912 [16.7654]***
Sample	Full	Full	Full with inverse Mills ratio

Standard errors in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%.
All regressions contain state and year fixed effects.

low of 0.21 with our city weights to a high of 0.50 with our population weights. Thus, we would expect that a 10% increase in the payout rate of neighboring states would be met with an increase between 2% and 5% in the home state. The estimates of our other variables are also consistent across weighting schemes. Moreover, these estimates are contained within a very small range across specifications.

As a final robustness check to ensure that our estimates are actually measuring state interdependence in lottery payout rates and are not a result of spurious correlation, we re-estimate our specification using the alphabetical weights outlined in Case et al. (1993). A state is deemed to be a neighbor if it comes before or after another state in the alphabet. Alabama, for example, would have Wyoming and Arizona as neighbors. Using such a weighting scheme should have nothing to do with competitive forces.

The results of this test are reported in column 5 of Table 2. Using these nonsensical weights completely eliminates any evidence of interstate competition, both in terms of significance and magnitude. Notice that the estimates of our remaining variables remain significant and are of the same magnitude as our estimates using the other weights. This finding confirms that our estimation is indeed providing evidence of interstate competition in the lottery and is not simply the result of spurious correlation.

Table 2
Estimated impact of neighboring states' lottery payout rates using differing definitions of neighbor

Method and weight	[1] 2SLS Contiguity	[2] 2SLS Population	[3] 2SLS Center	[4] 2SLS City	[5] 2SLS Alphabetical
Independent variable					
Neighboring states' lottery payout rate	0.4136 [0.1203]***	0.5035 [0.0886]***	0.3400 [0.1175]***	0.2091 [0.1025]***	0.0905 [0.0647]
Number of years state has had lottery	1.4163 [0.1297]***	1.6844 [0.1278]***	1.4211 [0.1308]***	1.4860 [0.1260]***	1.5286 [0.1245]***
State per capita debt	− 0.0012 [0.0004]***	− 0.0011 [0.0004]***	− 0.0013 [0.0004]***	− 0.0013 [0.0004]***	− 0.0014 [0.0004]***
State per capita federal transfers	− 0.0144 [0.0051]***	− 0.0139 [0.0051]***	− 0.0152 [0.0051]***	− 0.0146 [0.0051]***	− 0.0142 [0.0051]***
Percentage of population ages 5–17	0.4755 [0.5472]	− 0.1342 [0.5626]	0.5835 [0.5437]	0.7619 [0.5330]	1.0070 [0.5225]*
Percentage of population 65 years or older	− 2.9993 [0.6737]***	− 2.9169 [0.6640]***	− 3.0244 [0.6799]***	− 2.7642 [0.6628]***	− 2.5460 [0.6564]***
State per capita income (in 1000's)	− 0.0379 [0.0540]	− 0.0243 [0.0542]	− 0.0440 [0.0538]	− 0.0435 [0.0535]	− 0.0506 [0.0536]
Election year (YES = 1)	0.1012 [1.0156]	0.0584 [1.0164]	0.1281 [1.0131]	0.1142 [1.0051]	0.0998 [1.0110]
Same party-democrat	0.2978 [1.0732]	0.3519 [1.0541]	0.4898 [1.0664]	0.6958 [1.0572]	0.8822 [1.0562]
Same party-republican	− 3.618 [1.3816]***	− 4.2589 [1.3877]***	− 3.6030 [1.3783]***	− 3.4976 [1.3679]***	− 3.6677 [1.3750]***
Presence of para-mutuel gaming (YES = 1)	6.0715 [2.1933]***	5.8661 [2.1062]***	6.3775 [2.2070]***	7.5587 [2.1154]***	8.7730 [2.0270]***
State unemployment rate	0.0553 [0.3553]	0.0372 [0.3501]	0.0187 [0.3549]	− 0.1162 [0.3463]	− 0.1572 [0.3469]
Constant	66.3912 [16.7654]***	66.2033 [16.6757]***	67.5090 [16.8595]***	61.9071 [16.5194]***	54.0647 [16.8096]***
Sample	Full with inverse Mills ratio	Full with inverse Mills ratio	Full with inverse Mills ratio	Full with inverse Mills ratio	Full with inverse Mills ratio

Standard errors in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%.
All regressions contain state and year fixed effects.

6. Conclusion

States have been known to influence one another in the lottery arena, but so far our knowledge of that influence has been limited to lottery adoptions and lottery sales. This paper recognizes that the so-called lottery tax, the percentage of lottery sales that are not redistributed to players as prizes, is placed on a mobile base. Given that other taxes with mobile bases are found to exhibit strong interstate tax competition, we argue that the lottery tax appears to be yet another fiscal instrument that would be subject to competition. Moreover, unlike other taxes, the lottery tax makes for an interesting exercise in tax competition, as it is an implicit, rather than explicit, tax.

Upon controlling for the issue of self-selection, our results suggest that states do engage in interstate lottery tax competition. Our estimates indicate that a 10% increase in the payout rate of neighboring lotteries will result in up to a 5% increase in the payout rate of the home state's lottery. Such an increase in the payout rate implies that the lottery tax is being lowered, which has the additional impact of slowly whittling away at the inherent regressivity of the lottery. States who rely on their lottery to support certain expenditures should be sure to look over their borders to ensure that their forecasted stream of revenue will not be altered by actions beyond their control.

Acknowledgements

We would like to thank Gary Hoover, Stephen Ross and participants at the 2003 Meetings of the Southern Economics Association in San Antonio for their helpful comments and suggestions. We also thank the sponsors of the Ford Scholars Program at Vassar for funding of this project during the summer of 2003. Usual disclaimer applies.

References

Alm, J., McKee, M., Skidmore, M., 1993. Fiscal pressure, tax competition and the introduction of state lotteries. National Tax Journal, 46, 463–476.

Benzing, C., Andrews, T., Baker, J., 2002. The Tax Incidence and Determinants of the Pennsylvania Lottery. West Chester University.

Besley, T., Case, A., 1995. Incumbent behavior: vote-seeking, tax-setting and yardstick competition. American Economic Review, 85, 25–45.

Besley, T., Rosen, H., 1998. Vertical externalities in tax setting: evidence from gasoline and cigarettes. Journal of Public Economics, 70, 383–398.

Borg, M., Mason, P., Shapiro, S., 1993. The cross effects of lottery taxes on alternative state revenue. Public Finance Quarterly, 21, 123–140.

Brueckner, J., 2003. Strategic interaction among governments: an overview of empirical studies. International Regional Science Review, 26, 175–188.

Brueckner, J., Saavedra, L., 2001. Do local governments engage in strategic property-tax competition? National Tax Journal, 54, 203–229.

Buettner, T., 2001. Local business taxation and competition for capital: the choice of the tax rate. Regional Science and Urban Economics, 31, 215–245.

Case, A., Hines Jr., J., Rosen, H., 1993. Budget spillovers and fiscal policy interdependence. Journal of Public Economics, 52, 285–307.

Caudill, S., Ford, J., Mixon Jr., F., Peng, T., 1995. A discrete-time hazard model of lottery adoption. Applied Economics, 27, 555–561.

Clotfelter, C., Cook, P., 1989. Selling Hope: State Lotteries in America. Harvard University Press, Cambridge, MA.

Conway, K.S., Rork, J., 2004. Diagnosis murder—the death of state 'death' taxes. Economic Inquiry, 42, 537–559.

Elliott, D., Navin, J., 2002. Has riverboat gambling reduced state lottery revenue? Public Finance Review, 30, 235–247.

Erekson, O., Platt, G., Whistler, C., Ziegert, A., 1999. Factors influencing the adoption of state lotteries. Applied Economics, 31, 875–884.

Fink, S., Rork, J., 2003. The importance of self-selection in casino cannibalization of state lotteries. Economics Bulletin, 8, 1–8.

Fink, S., Marco, A., Rork, J., 2004. Lotto nothing? The budgetary impact of state lotteries. Applied Economics, 36, 2357–2367.

Garrett, T., Marsh, T., 2002. The revenue impacts of cross-border lottery shopping in the presence of spatial autocorrelation. Regional Science and Urban Economics, 32, 501–519.

Goodspeed, T., 2000. Tax structure in a federation. Journal of Public Economics, 75, 493–506.

Goodspeed, T., 2002. Tax competition and tax structure in open federal economies: evidence from OECD countries with implications for the European Union. European Economic Review, 46, 357–374.

Hansen, A., 1995. The tax incidence of the Colorado state lottery instant game. Public Finance Quarterly, 23, 385–398.

Heyndels, B., Vuchelen, J., 1998. Tax mimicking among Belgian municipalities. National Tax Journal, 51, 89–101.

Kearney, M., in press. State lotteries and consumer behavior. Journal of Public Economics.

Kelejian, H., Prucha, I., 1998. A generalized spatial two-stage least squares procedure for estimating a spatial autoregressive model with autoregressive disturbances. Journal of Real Estate Finance and Economics, 17, 99–121.

Livernois, J., 1987. The redistributive effects of lotteries: evidence from Canada. Public Finance Quarterly, 15, 339–351.

Mikesell, J., 1994. State lottery sales and economic activity. National Tax Journal, 47, 165–171.

Miyasaki, A., Hansen, A., Sprott, D., 1998. A longitudinal analysis of income-based tax regressivity of state-sponsored lotteries. Journal of Public Policy and Marketing, 17, 161–172.

Revelli, F., 2001. Spatial patterns in local taxation: tax mimicking or error mimicking? Applied Economics, 33, 1101–1107.

Rork, J., 2003. Coveting thy neighbors' taxation. National Tax Journal, 56, 775–787.

Stranahan, H., Borg, M., 1998a. Separating the decisions of lottery expenditures and participation: a truncated tobit approach. Public Finance Review, 26, 99–117.

Stranahan, H., Borg, M., 1998b. Horizontal equity implications of the lottery tax. National Tax Journal, 51, 71–88.

Tosun, M., Skidmore, M., 2004. Interstate competition and state lottery revenues. National Tax Journal, 57, 163–178.

Vasche, J., 1985. Are taxes on lotteries too high? Journal of Policy Analysis and Management, 4, 269–271.

Wilson, J., 1999. Theories of tax competition. National Tax Journal, 52, 269–304.