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Fungibility of Lottery Revenues and Support of Public Education

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Over the last thirty-five years, 37 states have adopted lotteries. In many instances, the state governments represented lotteries to voters as being a financial savior of public education, indicating that revenues generated by lotteries would allow public schools to progress with less dependency on local and state tax revenues.[1] Yet, despite the existence of lotteries for over thirty years, many school systems in states that have adopted lotteries are still faced with program cuts and frequent requests to voters for substantial levies. Newly introduced computer based lotteries have renewed the public's interest in lotteries as supplemental revenue sources. Such renewed interest highlights concerns about the relationship between lottery revenues and the support for public education.

Few studies have rigorously considered whether lottery revenues are substitutes for tax dollars that would have otherwise been spent on public education, otherwise known as these revenues being *fungible* sources of revenue for public education. While the current study of the fungibility of lottery revenues for the support of public education is not the first of its kind, it extends the literature in significant ways. The existing literature tends either to be limited to a subset of states (those with lotteries and/or those earmarking lottery revenues for education) or based upon simple an-

1. John L. Mikesell and C. Kurt Zorn, "State Lotteries as Fiscal Savior or Fiscal Fraud: A Look at the Evidence," *Public Administration Review* (July/August 1986): 311-320.

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ecdotal evidence or descriptive statistics. By contrast, this paper uses a comprehensive data set for all fifty states, over a five-year period. We believe it is important to consider comparative support for public education, not only for states with lotteries or for states with earmarked revenues, but for other states as well.

Lotteries as a Source of State Revenue

Lotteries are attractive to state officials because they generate revenues without increasing taxes or implementing new ones. They yield as much revenue in one year as increasing a state sales tax rate by 1 percentage point.[2] Another often cited advantage of lotteries over taxation is their voluntary nature.

Despite these attributes, lotteries tend to be inefficient sources of revenue in comparison to taxes, in that operating a lottery entails significant administrative costs. It is common for lottery costs to exceed 10 percent of net revenue, as compared to the 1 percent administrative costs associated with most broad-based taxes. And although the purchase of a lottery ticket is voluntary, lotteries are a regressive revenue source with a higher proportion of lower income voters, and thus as would be expected, with a higher proportion of less highly educated voters participating. In addition, Borg, Mason, and Shapiro found that low income lottery players in Florida actually spent more on lottery expenditures per month than high income players, and that low income lottery players had significant reductions in expenditures on utilities, groceries, personal grooming, and professional services after the lottery's introduction.[3]

The Fungibility Question: Lotteries and Enhancing Public School Finance

If lotteries are both inefficient and regressive as revenue sources, why have 37 states chosen to implement them? Several studies regarding which states adopt state lotteries provide evidence in this regard. The fiscal conditions of a state clearly affect the likely adoption of state lotteries, with the probability of adoption significantly higher where there are already heavy tax burdens. Similarly, states where the revenue potential (e.g., per capita income) of a lottery is high are more likely to adopt a lottery. But perhaps most telling for this analysis, one study suggests that when education expenditures fall below a critical level, legislators turn to lottery adoption as an

2. Mikesell and Zorn (1986).

3. Mary O. Borg, Paul M. Mason, and Stephen L. Shapiro, *The Economic Consequences of State Lotteries* (New York: Praeger, 1991).

additional revenue source.[4]

In fact, 14 states have earmarked lottery revenues specifically for the finance of public education. The fundamental question becomes whether lottery funds, earmarked or not, enhance the financial support for public education, or merely serve as a substitute for financing from the general fund, freeing these funds to be spent elsewhere. This latter phenomenon is defined as fungibility.

Several studies have provided preliminary evidence that fungibility of lottery revenues being diverted away from education does exist. Jones and Amalfitano compared educational funding across all fifty states to determine how much of the variation in state funding could be attributed to the lottery when other factors are controlled.[5] This study hypothesized that if lotteries benefit education, then states with lotteries should have higher financial support for education than states without lotteries. While the authors found no significant difference between per capita state aid to elementary and secondary education in lottery and non-lottery states, aid to education as a percentage of government expenditures was significantly lower in lottery states. Lottery states allocated approximately 15 percent of expenditures to education, while non-lottery states allocated over 23 percent.

Borg and Mason used a quadratic trend analysis of several state expenditure and revenue variables from 1974 to 1985 for five lottery states that earmarked revenues for education.[6] Trends were identified for total state expenditures on education, total state tax revenue, and total educational expenditure net of lottery funds for pre- and post-lottery periods. On a per student level, only three states saw increasingly positive trends in state educational allocations since the lottery. However, these were the same three states that also had experienced increasing trends in total state tax revenue. State expenditure on education net of lottery revenues, the best indicator of fungibility in their study, decreased or grew at a

4. O. Homer Erekson, Glenn Platt, Christopher Whistler, and Andrea L. Ziegert, "Factors Influencing the Adoption of State Lotteries," *Applied Economics* 31 (1999): 875-884; Ronnie Davis, John E. Filer, and Donald L. Moak, "The Lottery as an Alternative Source of State Revenue," *Atlantic Economic Journal* 20 (June 1992): 1-10. In the first paper, the authors examined the relationship between educational expenditures per pupil and the probability of lottery adoption and found that a $10 increase in expenditures per pupil from the prior period decreased the probability of lottery adoption by 0.0004.

5. Thomas H. Jones and John L. Amalfitano, *America's Gamble: Public School Finance and State Lotteries* (Lancaster, Pa.: Technomic Publishing Co., 1994).

6. Mary O. Borg and Paul M. Mason, "Earmarked Lottery Revenues: Positive Windfalls or Concealed Redistribution Mechanisms?" *Journal of Education Finance* 15 (1990): 289-301.

decreasing rate in every state. Moreover, in a cross-sectional data analysis for 1974-75, 1979-80, and 1984-85, they found that by 1984, lottery states were allocating 35 percent less per student than non-lottery states. These results were supported in later work by Garrett, who used ARIMA time-series modeling in a study of the effects of the lottery for Ohio from 1958 to 1996. His results suggested that education expenditures in Ohio have been completely fungible, with existing expenditures in an amount equal to lottery revenues diverted to other uses.[7]

It is reasonable to ask whether fungibility of lottery revenues for education is a result of the insignificance of these funds as a portion of all revenue sources or a result of actual substitution for other sources of state support. Stark, Wood, and Honeyman attempted to determine if lottery revenues actually were serving as substitutes for other state funds through a study of the Florida education lottery. They used a series of linear regressions covering the period from 1973 to 1990 to test whether lottery funds allocated to the Florida Education Finance Program (FEFP) substituted for other state funds allocated to education. This finding would be quite important, as in Florida it is constitutionally forbidden to use lottery proceeds "as a substitute for existing resources for education"; they must be used "to support improvement in public education."[8] The results of this study showed that by 1990 actual combined state and local funding per student was $161.99 lower than predicted by funding growth trends. In other words, since lottery funds amounted to $285.38 per student, only $123.39 of lottery proceeds was used to enhance current funding, with 56.8 percent of total lottery funds being used to substitute for funds from the FEFP. This result for Florida was reinforced in a later study that showed that lottery and general revenue allocations comprised a decreasing share of community college support.[9]

Thus, various studies to date have provided limited evidence of fungibility of lottery revenue. If lottery funds are giving voters a false sense of security regarding educational funding, voters may

7. Thomas A. Garrett, "Earmarked Lottery Revenues for Education: A New Test of Fungibility," *Journal of Education Finance* 26 (2001): 219-238.

8. Steven Stark, R. Craig Wood, and David Honeyman, "The Florida Education Lottery: Its Use as a Substitute for Existing Funds and Its Effect on the Equity of School Funding," *Journal of Education Finance* 18 (1993): 231-242.

9. Susan R. Summers, David S. Honeyman, James L. Wattenbarger, and M. David Miller, "An Examination of Supplantation and Redistribution Effects of Lottery Allocations to a Community College System," *Journal of Education Finance* 21 (1995): 236-253.

erroneously reduce property taxes and other forms of support for public education because they see lottery funds as being supplemental. The purpose of this paper is to provide a more thorough test of the fungibility hypothesis, investigating why fungibility occurs so often in many states, regardless of the original intention for adopting the lotteries.

The Political Economy of Lotteries

State-run lotteries are solely state owned and operated enterprises. While this allows for public scrutiny of operations, it allows for fungibility that would not be seen with private ventures. For this reason, the fungibility effects of lottery revenues must be examined in the context of a public choice framework.

In considering the political value of lotteries, it is useful to think in terms of a legislator-support model based on the Stigler-Peltzman framework of voter support maximization by legislators. In short, legislators recognize that increased spending on public programs such as education enhances the welfare of constituents, and thus their political support. However, if these increases are at the expense of the loss of support due to the increased tax burden placed upon constituents, there would be a decline in political support.[10] Thus, alternative revenue raising mechanisms, such as lotteries, are attractive in maintaining program objectives without increasing the tax burden on constituents.

These political advantages are heightened even further through earmarking if voters perceive these revenues as supplementing education while maintaining or, in some cases, decreasing tax burdens. This is a legislator's panacea: it satisfies those who value education, while also appeasing those who do not wish to pay for such quality through taxes. The preconditions for fungibility are established even more fully when considering that voters are generally quite removed from the state-level budgetary processes that determine the allocation of state funds. Thus, the level of spending on education determined at the state level is accomplished with a good deal of distance in terms of voter information. However, voters are keenly aware of their state income or other taxes. A legislator desiring election or reelection has a greater incentive to lower the tax burden by securing alternative revenue sources, such as the lottery, than to maintain a particular expenditure level for education.

10. See Erekson, Platt, Whistler, and Ziegert (1999) for a fuller specification of this model, and supporting empirical results.

A Fungibility Model and Empirical Results

The previous research, discussed above, has concentrated on the state's overall demand for education and how a lottery may alter that demand. In this study, we examined fungibility effects from a legislator perspective, enabling the effects of lottery revenues and fungibility on re-electability to become evident. Moreover, we tested the model developed here using data from all fifty states, over a five year period, whether the states have a lottery or not, and whether the states have earmarked the lottery for education. This cross-sectional, time series approach significantly broadens the analysis beyond existing fungibility research, and, we believe, provides a much richer framework in which to test for fungibility. Because nominal revenue and spending varies across time and among states, we adopted educational expenditure as a percentage of general revenue (EDPRCT) as the best measure of state support for public education. EDPRCT then served as the dependent variable in this analysis.

Before looking at the lottery variables included in the model, it is useful to consider the control variables used as independent variables. In Table 1, we have provided the definition of each variable and summary statistics for 1990, along with the sources of data. We included a control variable, general revenue per capita (REVC) in the model, expecting it to capture two offsetting effects. On one hand, an increase in revenue makes more funds available to support public programs, including education. However, one can also argue that as one looks across states, increases in general revenue per capita may be evidence of increasing relative needs for other public services such as prisons or transportation. The impact of REVC on EDPRCT then is theoretically ambiguous. We also included another control variable, intergovernmental transfers from the federal government as a percentage of total general expenditures (FEDPCT). We expected that as this percentage increased, it would negatively affect EDPRCT, as fewer state funds would be needed for public education. Another determinant of a state's fiscal health is its long-term debt. High debt states must divert funds for interest payments on the debt, reducing funds available for education. Thus, we included a debt to expenditure ratio (DEBTPCT) as an independent variable and expected it to have a negative effect on EDPRCT.

Finally, voters in states with extremely high tax rates may not accept further increases in taxes in support of public services. Since many states that institute lotteries do so to avoid higher taxes, this should not be a significant factor in the lottery's influence on educational expenditure. However, we included a national index of the overall level of taxes raised (TAXEFF) to control for the vari-

TABLE 1
VARIABLE DEFINITIONS, SOURCES, AND SUMMARY STATISTICS

Variable Name	Definition	1990 Mean Value
EDPRCT	State education expenditures for K-12 as a percentage of state general revenues	36.0 (6.4)
REVC	State general revenue per capita	2271 (1053)
FEDPCT	Intergovernmental transfers from the federal government as a percentage of state total general expenditures	24.0 (4.9)
DEBTPCT	State long term debt as a percentage of state total general expenditures	69.4 (39.2)
TAXEFF	State value of National Index of Tax Effort	96.2 (13.0)
POP517	Percentage of state population, age 5 to 17, relative to mean percentage of US population, age5 to 17	1.10 (0.11)
LOTC	State lottery revenue per capita	25.0 (25.0)

Data Sources:

EDPRCT, REVC, FEDPCT, DEBTPCT, and POP517 were obtained from US Department of Commerce, State Government Finances, select years

TAXEFF was constructed by and obtained from the Advisory Commission on Intergovernmental Relations, Washington, D.C.

LOTC Lottery revenue used in the construction of this variable was obtained from state mlottery commissions

The mean value (and standard deviation in parenthesis) for each variable for 1990 is provided.

ance in tax levels across states.[11]

To capture variations in the demand for education across states, we created a ratio (POP517) of the state's population of children aged 5-17 (as compared to the mean student-age population for all 50 states) to the general population (also as compared to the mean population of all 50 states). We expected POP517 to be positively related to EDPRCT. Earlier studies have normally found higher

11. The tax effort index was developed by the Advisory Commission on Intergovernmental Relations and is the ratio of actual tax revenue raised by a state as compared to potential tax revenue if an average tax rate for all 50 states was applied.

proportion of school-aged children to be one of the most important determinants of spending on education.[12]

Turning now to the impact of lotteries, we included two variables; lottery revenue per capita (LOTC) and a dummy variable (YES), which was used to indicate the presence of a lottery in a state. Ceteris paribus, if increasing lottery revenues have a negative effect on the percentage of state revenue that is allocated to public education, LOTC will be negatively related to EDPRCT. This is the direct test for fungibility.

We first estimated the following basic model:

$$EDPRCT = \beta_0 + \beta_1 REVC + \beta_2 POP517 + \beta_3 FEDPCT + \beta_4 DEBTPCT + \beta_5 TAXEFF + \beta_6 LOTC + \varepsilon,$$

where ε is a normally distributed error term.

Next, we estimated a second model to examine whether the lottery's effect was more pronounced when studying only states that operate lotteries rather than all 50 states. To capture this possibility, we included the dummy variable, YES. One previous study found that lottery states on average allocate more funds to education than do non-lottery states, although they attributed this to higher wealth in those states.[13] So we expected that the YES variable would have a positive effect on EDPRCT. We also expected that by including this variable, the effect of LOTC would be affected. Jones and Amalfitano found that non-lottery states devoted a larger *share* of their more limited income to support education. Without the mediating effect of non-lottery states on the LOTC coefficient, we expected the coefficient to increase in magnitude to provide a more accurate estimate of how lottery revenues actually affect educational expenditures in states that rely upon them.

The equation shown above, and then the equation with the YES variable included, were both estimated using ordinary least squares estimation for each of the years 1986 to 1990.[14] These empirical results are much more comprehensive than other cross-sectional studies that have focused on a subset of states, most typically just those states earmarking lottery revenues for education. However,

12. Raquel Fernandez and Richard Rogerson, "The Determinants of Public Education Expenditures: Longer-Run Evidence from the States," *Journal of Education Finance* 27 (2001): 567-584.

13. Jones and Amalfitano (1994).

14. Because this analysis examined the same 50 states over a 5 year period, any effects that were observed in an individual state in one year would possibly persist in subsequent years. Thus, a pooled time series/cross section estimation also was made using a Parks correction. These results were consistent with those reported in this paper and are available upon request.

we believe that whether lottery revenues are earmarked or not, the fungibility effect of lottery revenues on education may be present. Moreover, we believe it is appropriate to include all states in the analysis, rather than a small subset, as the impact of the lottery on state education funding has been shown to vary between states and over the years for each state. For instance, one study focusing on seven lottery states finds evidence of fungibility in each state; however, in only four states was the cumulative effect of the lottery negative.[15]

The empirical results are shown in Table 2, with statistical significance noted at the 1 percent, 5 percent, and 10 percent levels. The control variables (REVC, POP517, FEDPCT, DEBTPCT, and TAXEFF) had results consistent with the predicted effects discussed above. A full discussion for these variables is available from the authors.

The objective of this paper was to test for the existence of fungibility. In all five years, in both specifications of the model, there were overwhelming indications of the fungibility of lottery revenues. The coefficient of LOTC was negative and significant in each instance, with a decrease of approximately 1 percent to 1.5 percent in educational support for every per capita dollar of lottery revenue generated. Even more telling is that when controlling for the presence of a lottery in a state, the negative effect of the lottery on educational support increased. The coefficient on LOTC increased by almost 50 percent when the YES variable was included. Clearly, states where lotteries contribute to general revenue, whether they earmark revenue for education or not, are allowing lottery funds to substitute for general fund revenues that would have been used for education. This is even more pronounced by the fact that the coefficient of the YES variable is positive in all models (although statistically significant in only three years). Even though lottery states, on average, allocate around 0.2 percent more to education than non-lottery states, this differential appears to be easily dissipated by the negative fungibility effect of lottery revenues.

Finally, to place dollar values on the results of this analysis, a comparison was made of the mean values of educational expenditure and general expenditure with the LOTC coefficient. These results are summarized in Table 3. For our study period, a $1 increase in lottery revenues per capita reduced educational expenditures by $11,000-12,000. When extrapolated to the aggregate level for an individual state, this outcome becomes a significant detriment to financial support for public education.

15. Charles J. Spindler, "The Lottery and Education: Robbing Peter to Pay Paul?" *Public Budgeting and Finance* (Fall 1995): 54-62.

TABLE 2

LEAST SQUARES REGRESSIONS FOR EDUCATIONAL EXPENDITURES AS PROPORTION OF GENERAL FUND REVENUES

YEAR	1986a	1986b	1987a	1987b	1988a	1988b	1989a	1989b	1990a	1990b
INT	0.44***	0.42***	0.42***	0.39***	0.36***	0.33***	0.49***	0.48***	0.43***	0.43***
	(6.19)	(6.13)	(5.10)	(5.03)	(4.68)	(4.37)	(6.10)	(6.09)	(5.69)	(5.77)
REVC	-0.02***	-0.02***	-0.02**	-0.02**	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***
	(-2.60)	(-2.44)	(-2.20)	(-2.24)	(-2.84)	(2.70)	(-2.76)	(-2.51)	(-2.97)	(-2.63)
POP517	0.30***	0.33***	0.24***	0.27***	0.19***	0.23***	0.13*	0.14*	0.17***	0.17***
	(4.41)	(5.02)	(3.12)	(3.67)	(2.77)	(3.44)	(1.73)	(1.91)	(2.50)	(2.52)
FEDPCT	-0.74***	-0.76***	-0.46***	-0.52***	-0.34***	-0.41***	-0.29*	-0.31**	-0.25*	-0.25*
	(-5.26)	(-5.70)	(-2.81)	(-3.26)	(-2.50)	(-3.06)	(-1.92)	(-2.07)	(-1.84)	(-1.84)
DEBTPCT	-0.07***	-0.07***	-0.07***	-0.07***	-0.07***	-0.08***	-0.08***	-0.09***	-0.08***	-0.08***
	(-5.30)	(-5.96)	(-4.11)	(-4.55)	(-4.76)	(-5.26)	(-5.02)	(-5.20)	(-4.86)	(-5.01)
TAXEFF	-0.00***	-0.00***	-0.00	-0.00	0.00	0.00	-0.00	-0.00	-0.00	-0.00
	-2.33)	(2.67)	(-1.41)	(-1.62)	(0.34)	(0.19)	(-1.01)	(-1.23)	(-1.13)	(-1.41)
LOTC	-0.97***	-1.56***	-0.91***	-1.62***	-0.96***	-1.49***	-1.09***	-1.37***	-0.85***	-1.12***
	(-3.40)	(-4.27)	(-2.89)	(-3.83)	(-3.35)	(-4.15)	(-3.64)	(-3.67)	(-3.04)	(-3.23)
YES		0.04***		0.04**		0.04**		0.02		0.02
		(2.41)		(2.37)		(2.28)		(1.24)		(1.29)
R2	.80	.82	.72	.75	.73	.76	.73	.74	.73	.74

Dependent Variable: EDPRCT
n=50 (for each year)
t-statistics in parentheses

*significant at 10% level
**significant at 5% level
***significant at 1% level

TABLE 3
AVERAGE ESTIMATED FUNGIBILITY

	General Expenditures	Education Expenditures	Reduction Due to Lottery Revenues
1986	7,530,386	2,803,784	-11,295
1987	8,078,778	2,998,013	-12,926
1988	8,294,637	3,190,005	-12,276
1989	9,387,186	3,463,678	-12,860
1990	10,165,681	3,698,693	-11,182

CONCLUSION

This study has offered evidence that, regardless of a state's relative wealth, population, debt pressures, or tax burden, increases in lottery revenues negatively affect support for public education. Clearly, lottery revenues are fungible, and general fund revenues that otherwise would be devoted to education are diverted to other uses. This outcome is consistent with numerous other studies, but is much stronger as it considers the relationship between education expenditures, general fund revenues, and lottery revenues for all fifty states (those with and without lotteries), over a five year period.

Given that fungibility is clearly evident across all states, it must be concluded either that voters are not concerned with fungibility or that they are insufficiently aware of it. Since it takes a substantial analysis of data and statistics, much of which are removed from the voting public, it hardly seems likely that the average voter could devote sufficient time to fully appreciate the degree of fungibility. Before state legislators and state officials blame lack of funding for sub-optimal educational quality, they should more fully acknowledge the diversion of general fund revenue away from education.