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The Impact of the Ohio Lottery on Public Primary and Secondary Schools in Montgomery County

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THE IMPACT OF THE OHIO LOTTERY ON PUBLIC PRIMARY AND SECONDARY SCHOOLS IN MONTGOMERY COUNTY

A masters internship report in partial fulfillment
of the requirements for the degree of
Master of Science

By

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I HEREBY RECOMMEND THAT THE MASTER'S RESEARCH REPORT PREPARED UNDER MY SUPERVISION BY Delores Davis ENTITLED The Impact of The Ohio Lottery on Public Primary and Secondary Schools BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF Master of Science.

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ABSTRACT

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In 1974, voters in the state of Ohio approved the institution of a lottery as a means to raise funds for their public primary and secondary schools. According to the legislative history of the Ohio Lottery, the purpose for the lottery is to provide a means for relatively poor school districts to enhance their own local tax base such that more public school funds could be produced locally to meet the special needs of their primary and secondary schools. Lottery operations have been conducted in most school districts for more than a quarter of a century. For a number of relatively poor school districts in Montgomery County, the amount of local school funding derived from local lottery operations within the district is significantly less than the entitlement expressed in the legislative history of the Ohio Lottery.

Under the present formula used to allocate lottery profits, there is no correspondence between lottery revenue and profit generated within a

district. The resultant pricing policy, which involves the bundling of a game of chance for players to win money and provisions for additions to players' local tax bases, has caused an increase in the unit cost of public primary and secondary education in poorer school districts in Montgomery County. Additionally, the formula has precipitated a broadening of the disparity between educational opportunities for youth in poor districts and youth in relatively affluent districts.

The focus of this research report is on Ohio Lottery operations for the year of 1997. A primary inquiry is whether the lottery is a regressive tax in Montgomery County. My approach will involve an examination of the effects the redistribution policy had on the sixteen school districts in Montgomery County. I will also address the trade-off involved in subsidizing some of the sixteen school districts in Montgomery County while attempting to motivate low-income households to increase their lottery expenditures.

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I. INTRODUCTION

Purpose of Study

For more than a quarter of a century, the state of Ohio has operated a state lottery as a source of additional support for primary and secondary public schools. Since its inception, the Ohio Lottery Commission has produced approximately $9 billion dollars in net proceeds for public education. This represents an average of approximately 33% of lottery revenue over the lottery's existence. Statutory mandates require that a minimum of 50 percent of ticket revenue be paid out to players in the form of prizes, and that at least 30 percent be allocated to the Lottery Education Fund. The remainder is used to cover administrative cost, operating expenses, and commissions to lottery agents. (Agents receive a commission of 5.5% of sales and 1.5% for cashing winning tickets; their initial outlay is $25.00 for a license). In addition to the $9 billion put into the Lottery Education Fund, since its inception, the lottery has created more than 700 millionaires, and has paid out more than $15 billion to players in the form of prizes. The prize pay-outs represent approximately 50 percent of sales. As lottery operations have

expanded over the years, both positive and negative externalities associated with the lottery have emerged. The central focus of this research will be to study the impact of lottery operations, as a source of public school funding, on Montgomery County's schools.

Initially, in August 1974, Ohio lottery operations involved one game. Today, operations involve 40 instant games, 5 online games, a weekly 30-minute televised game, and two daily televised numbers drawings. Lottery operations are conducted in 94% of the school districts in Montgomery County. And the various lottery products are consumed, to some degree, in every district within which lottery operations are conducted. According to reports of results from research conducted in various parts of the country, there is correlation between the games a district's players prefer most and the districts' demographic profile. Results of studies also indicate that there is an inverse relationship between per capita lottery expenditures and per capita income. This has raised the issue of whether the lottery is an efficient and equitable means to raise support for a public good. Central to much of the debate surrounding this issue is the notion that the lottery is a regressive tax.

In this thesis I will analyze the effects of state lottery operations on the various school districts in Montgomery County. One of my

primary inquiries will be whether the lottery is a regressive tax in Montgomery County. In resolving this issue, a determination will be made as to whether there is an inverse relationship between the amount of lottery revenue generated in a district and the district's receipts from the Ohio Lottery Education Fund. In this thesis, I will examine the social costs and benefits associated with the present allocation policies and the trade-off involved in subsidizing some of the 16 school districts in Montgomery County while attempting to motivate low-income households to increase their lottery expenditures via biased advertising.

Funding Public Education

Traditionally, public education has been financed primarily by local governments with real property tax revenues generated within a district. Increasingly, local funding is becoming secondary to state government funding in school districts with relatively low income and property values. In 1977, local, state, and federal government funding, as relative components of total funding, are 54 percent, 40 percent, and 6 percent, respectively, in Montgomery County. Federal and state funding, as a percentage of total funding, has increased due to court decisions made in cases that involved resolving equity issues. These cases were brought because differences in local tax bases resulted in disparate tax burdens or unequal educational

opportunities for youth across districts. Without state and federal aid dependent children domiciled in poor school districts would necessarily be deprived of an education equal to that of their counterparts domiciled in relatively affluent districts, with income and property values being the primary measures of affluence.

Among the 16 school districts across Montgomery County, annual revenue from all sources of school funding for fiscal year 1997 ranged from $5,108.57 per pupil to $9,275.03 per pupil. Table 1 below shows the per pupil revenues from all of the various sources, and the portion of total per pupil revenue each source provided. Column 7 shows aggregate receipts. State funding as a percentage of districts' total revenue ranges from a low of 19.74% in the Kettering School District to a high of 59.65% in the New Lebanon School District.

In 1997, funds from the Lottery Profits for Education fund represented 24.3% of state basic aid and categorical expenditures combined (1997 SF-12, ODE). The support from the Ohio Lottery is included in each districts' aggregate receipts figures listed in column 7. According to the figures, the amount of lottery funding a school district received from the Lottery Profits for Education Fund is a constant function of the amount each district received from the General Revenue Fund for basic aid and categorical programs. According to the Ohio Department of Education (ODE) SF12 reports,

TABLE 1

PER PUPIL REVENUE FROM ALL SOURCES

MONTGOMERY COUNTY SCHOO DISTRICTS	1 PER PUPIL LOCAL GOVT (% OF TOTAL)	2 PER PUPIL STATE GOVT (% OF TOTAL)	3 PER PUPIL FEDERAL GOVT (% OF TOTAL)	4 PER PUPIL ADJUSTMENTS (% OF TOTAL)	5 PER PUPIL CAPITAL PRJCT (% OF TOTAL)	6 TR PER PUPIL (ENROLLMENT)	7 DISTRICT AGGREGATE RECEIPTS
BROOKVILLE LSD	3092.12 54.63%	2567.7 45.37%	0 0.00%	0 0.00%	0 0.00%	5659.81 1485	8,404,824.32
CENTERVILLE CSD	4946.69 71.75%	1726.51 25.04%	109.35 1.59%	82.2 1.19%	29.65 0.43%	6894.4 7075	48,784,740.98
DAYTON CSD	3174.09 38.79%	3698.29 45.19%	1177.09 14.38%	0.33 0.00%	133.62 1.63%	8183.41 25972	212,539,556.40
HUBER HEIGHTS CSD	2255.13 40.30%	2683.1 47.95%	179.13 3.20%	307.75 5.50%	170.57 3.05%	5595.68 7063	39,522,347.90
JEFFERSON TWNSHP LSD	3420.69 36.88%	4100.27 44.21%	1230.16 13.26%	339.13 3.66%	184.78 1.99%	9275.03 755	7,002,789.53
KETTERING CSD	4794.21 74.63%	1268.34 19.74%	181.28 2.82%	89.44 1.39%	90.82 1.41%	6424.08 7636	49,054,367.97
MAD RIVER LSD	2003.93 31.17%	3320.87 51.66%	680.4 10.58%	111.52 1.73%	311.78 4.85%	6428.5 3717	23,894,729.70
MIAMISBURG CSD	4103.09 63.34%	1352.74 20.88%	205.77 3.18%	251.67 3.89%	564.26 8.71%	6477.53 4490	29,084,209.92
NEW LEBANON LSD	1511.42 27.09%	3328.59 59.65%	268.56 4.81%	392.24 7.03%	79.42 1.42%	5580.23 1397	7,795,615.23
NORTHMONT CSD	2671.21 45.75%	2593.28 44.42%	123.28 2.11%	332.91 5.70%	117.45 2.01%	5838.13 5673	33,119,719.93
NORTHRIDGE LSD	4848.08 57.57%	2310.13 27.43%	869.11 10.32%	354.17 4.21%	40.09 0.48%	8421.58 2026	17,062,182.90
OAKWOOD CSD	5108.16 70.24%	1808.02 24.86%	69.45 0.95%	74.71 1.03%	212.62 2.92%	7272.95 1703	12,385,861.42
TROTWOOD-MADISON CSD	2474.36 35.02%	3392.59 48.02%	503.3 7.12%	492.15 6.97%	202.57 2.87%	7064.97 4026	28,443,466.85
VALLEY VIEW LSD	2679.88 44.67%	2616.3 43.61%	111.94 1.87%	413.16 6.89%	178.16 2.97%	5999.44 1888	11,326,920.50
VANDALIA-BUTLER CSD	5170.03 73.39%	1445.41 20.52%	77.44 1.10%	314.33 4.46%	37.11 0.53%	7044.33 3428	24,147,834.36
WEST CARROLLTON	3344.85 53.78%	2082.69 33.48%	157.43 2.53%	188.01 3.02%	447.09 7.19%	6220.07 4084	25,402,683.21

for the past 3 years districts' funding derived from the Lottery Profits for Education Fund (LPEF) has varied between 19.6% to 24.3% of state aid.

Problem Statement and Objective

According to the legislative history of the lottery, the purpose of the lottery is to provide districts that have low tax bases a means to supplement their local tax bases and lessen the local school funding disparities that exists among the various districts. As a result of the present redistribution policy inherent in the formula used to allocate lottery profits, efforts to mitigate inequities have been frustrated. The result has been a divergence from a traditional progressive taxing system. More importantly, lottery revenue raised in most districts with below average property values or income is used to subsidize districts with above average per capita income and property values. Reports issued by the National Gambling Commission, Clotfelter (Cambridge), Morgan (Princeton), Stranahan, et. al. are in agreement that the revenues generated by state lotteries are implicit tax revenues. According to these reports, if lottery expenditures of the poor are relatively high as a percentage of income, the tax scheme is regressive.

The objective of this thesis will be to discuss the net impact Ohio Lottery Operations have had on the 16 school districts in Montgomery

County individually and collectively. My approach will be to first address the issue of the appropriateness of categorizing lottery revenue as tax revenue. I will concentrate on the cost and benefits of the lottery to the various school districts, from the perspective of both normative and positive economics.

II. THE WORKINGS OF THE LOTTERY MARKET

Categorizing The Ohio Lottery

A taxing system is a mechanism that is used to redistribute income and to pool funds in order to provide goods and services. Though public goods and services can be funded with either voluntary contributions or contributions made through the tax system, when the government takes charge of the assessment, collection, and allocation of contributions, the contributions can rightfully be categorized as taxes. In Ohio, governing statutes require that at least 30 percent of each dollar contribution go into the Lottery Profits For Education Fund and that at least 50 percent be returned to players in the form of prizes. The remainder is used to cover administrative cost, operating expenses, and commissions to agents. Thus, from the perspective of an individual player, the expected return, E(R), to a lottery player for each dollar contribution is described by:

$$E(R) = (P)(R_m) + R_e \quad (2.1)$$

Where P is the probability that the number selected is the number that will be drawn, R_m is the potential monetary return, and R_e is the benefit a player receives from the portion of the take-out that goes to

the lottery profit fund. Since governing statutes require that only a fraction of ticket revenues be returned to players in the form of prizes, and that the remainder be taken out to cover costs and provide funding for public education, it is appropriate to categorize Ohio lottery revenues as state tax revenues.

Having established that lottery revenues are tax revenues, to ensure that appropriate results are derived in subsequent sections, it would be helpful to classify lottery tax revenues.

Classifying the Lottery Tax

In Table 2 A, three sources of school support and the corresponding tax liabilities for the 16 school districts in Montgomery County in 1997 are listed. Below the tax liability figures in columns 5,7, and 11 are the school districts' corresponding tax rates expressed as a percentage of the relevant tax base. Traditionally, both property taxes and income taxes have been progressive and consistent with the concepts of horizontal equity and vertical equity. According to the horizontal equity principle, similarly situated individuals should be treated similarly, so that individuals with the same income levels or property values bear the same tax burden. Vertical equity requires that dissimilar individuals be treated appropriately, so that individuals with a greater ability to pay bear a heavier tax burden.

TABLE 2A

DISTRICT TAX BASES AND TAX RATES

FY 1997

SCHOOL DISTRICT (SD)	1 AVERAGE INDIVIDUAL INCOME	2 PER CAPITA DISPOSABLE INCOME	3 POPULATION/ PER CAPITA INCOME	4 LOTTERY SALES/ AS PERCENT OF DISPOSABLE INCOME	5 LOTTERY TAX LIABILITY/AS % OF DISPOS Y	6 TOTAL INCOME/ DISPOSABLE Y
BROOKVILLE LSD	$37,039.00	$17,377.02	8586 20444	$1,399,782.00 0.94%	601,906.26 0.40%	175,528,390.00 149,199,131.50
CENTERVILLE CSD	$63,093.00	$30,945.98	46609 36407	$4,987,431.00 0.35%	2,144,595.33 0.15%	1,696,895,656.00 1,442,361,307.60
DAYTON CSD	$27,432.00	$8,721.29	200160 10260	$62,520,945.00 3.58%	26,884,006.35 1.54%	2,053,710,904.00 1,745,654,268.40
HUBER HEIGHTS CSD	$37,661.00	$14,880.84	40918 17507	$40,386,739.00 6.63%	17,366,297.77 2.85%	716,346,054.00 608,894,145.90
JEFFERSON TWNSHP LSD	$31,349.00	$7,943.07	8038 9345	$1,179,356.00 1.85%	507,123.08 0.79%	75,113,385.00 63,846,377.25
KETTERING CSD	$47,953.00	$19,920.32	61624 23436	$33,106,468.00 2.70%	14,235,781.24 1.16%	1,444,199,494.00 1,227,569,569.90
MAD RIVER LSD	$30,921.00	$9,344.03	25999 10993	$4,357,368.00 1.79%	1,873,668.24 0.77%	285,806,270.00 242,935,329.50
MIAMISBURG CSD	$38,613.00	$16,454.57	30504 19358	$4,307,644.00 0.86%	1,852,286.92 0.37%	590,505,949.00 501,930,056.65
NEW LEBANON LSD	$32,112.00	$12,106.80	7485 14243	$931,486.00 1.03%	400,538.98 0.44%	106,611,048.00 90,619,390.80
NORTHMONT CSD	$42,323.00	$17,405.83	32240 20477	$11,868,916.00 2.12%	5,103,633.88 0.91%	660,192,865.00 561,163,935.25
NORTHRIDGE LSD	$28,218.00	$8,503.31	12535 10004	$11,595,244.00 10.88%	4,985,954.92 4.68%	125,398,860.00 106,589,031.00
OAKWOOD CSD	$90,240.00	$39,392.57	8957 46344	$0.00 0.00%	0.00 0.00%	415,105,035.00 352,839,279.75
TROTWOOD-MADISON CSD	$31,603.00	$10,371.97	24234 12202	$16,521,216.00 6.57%	7,104,122.88 2.83%	295,710,875.00 251,354,243.75
VALLEY VIEW LSD	$36,819.00	$15,345.04	10022 18053	$1,021,925.00 0.66%	439,427.75 0.29%	180,927,064.00 153,788,004.40
VANDALIA-BUTLER CSD	$44,240.00	$19,320.28	23179 22730	$4,969,565.00 1.11%	2,136,912.95 0.48%	526,852,753.00 447,824,840.05
WEST CARROLLTON	$34,298.00	$14,121.98	27729 16614	$18,594,850.00 4.75%	7,995,785.50 2.04%	460,692,159.00 391,588,335.15
TOTALS:	$653,914.00	$14,659.23	568799 17246	$217,748,935.41 2.61%	93,632,042.23 1.23%	9,809,596,761.00 8,338,157,246.85

TABLE 2 (CONT)

FY 1997

		.895*.164*TAX= AMT OF INCOME PAID TO ED VIA STATE TAX	if I1>I2, then regr *(HL+KL+PL)/IL % OF INCOME ALLOCATED TO EDUCATION			
	7	**8**	**9**	**10**	**11**	**12**
SCHOOL DISTRICT (SD)	**STATE INCOME TAX LIABILITY AS % OF Y**	**AMT OF INCOM PAID TO EDUCAT ON/% OF INCOMI VIA INCOME TAX**	***% INCOME PD TO ED. BETWEEN LOCAL AND STATE % Y PD VIA LOT & REAL PROP**	**REAL PROPERTY TAXABLE AMT TO ED**	**REAL PROPERTY TAXES CHARGED**	**MILAGE AS % TO ED**
BROOKVILLE LSD	5,102,303.00 2.91%	749,018.08 0.43%	2.31% 1.89%	109,754,290 2,709,228	3870326 3.53%	35.26 2.47%
CENTERVILLE CSD	67,073,572.00 3.95%	9,846,400.37 0.58%	1.97% 1.39%	1,053,794,680 21,381,773	30545390 2.90%	28.99 2.03%
DAYTON CSD	51,753,787.00 2.52%	7,597,455.93 0.37%	3.57% 3.20%	1,303,641,910 38,735,828	55336897 4.24%	42.45 2.97%
HUBER HEIGHTS CSD	20,847,173.00 2.91%	3,060,365.00 0.43%	4.37% 3.94%	469,810,330 10,871,762	15531089 3.31%	33.06 2.31%
JEFFERSON TWNSHP LSD	1,974,518.00 2.63%	289,859.24 0.39%	4.26% 2.59%	52,465,450 1,439,750	2056786 3.92%	39.20 2.74%
KETTERING CSD	51,595,149.00 3.57%	7,574,167.87 0.52%	2.85% 2.32%	962,071,210 19,322,938	27604197 2.87%	28.69 2.01%
MAD RIVER LSD	7,033,812.00 2.46%	1,032,563.60 0.36%	2.31% 1.95%	182,572,780 3,688,176	5268823 2.89%	28.86 2.02%
MIAMISBURG CSD	17,694,336.00 3.00%	2,597,528.52 0.44%	2.46% 2.02%	522,227,230 10,062,735	14375336 2.75%	27.53 1.93%
NEW LEBANON LSD	2,798,775.00 2.63%	410,860.17 0.39%	2.03% 1.65%	70,123,060 1,355,860	1936943 2.76%	27.62 1.93%
NORTHMONT CSD	21,239,202.00 3.22%	3,117,914.85 0.47%	2.83% 2.36%	422,684,400 10,473,269	14961813 3.54%	35.40 2.48%
NORTHRIDGE LSD	3,106,112.00 2.48%	455,977.24 0.36%	7.22% 6.86%	136,624,750 3,616,544	5166491 3.78%	37.82 2.65%
OAKWOOD CSD	19,262,961.00 4.64%	2,827,802.67 0.68%	2.15% 1.47%	220,458,690 6,103,981	8719973 3.96%	39.55 2.77%
TROTWOOD-MADISON CSI	7,746,980.00 2.62%	1,137,256.66 0.38%	4.76% 4.38%	205,800,690 5,843,847	8348353 4.06%	40.57 2.84%
VALLEY VIEW LSD	5,188,357.00 2.87%	761,650.81 0.42%	1.68% 1.25%	116,079,660 1,830,780	2615400 2.25%	22.53 1.58%
VANDALIA-BUTLER CSD	17,514,155.00 3.32%	2,571,077.95 0.49%	2.63% 2.15%	421,402,830 9,166,210	13094585 3.11%	31.07 2.18%
WEST CARROLLTON	12,743,244.00 2.77%	1,870,708.22 0.41%	3.65% 3.24%	319,553,040 6,927,009	9895727 3.10%	30.97 2.17%
TOTALS:	############ 3.00%	45,900,607.27 0.47%	2.99% 2.52%	6,715,667,681 153,529,691	219328129.5 3.27%	 2.29%

Lottery tax revenue, which is derived from discretionary income, is not a traditional source of public school support in Ohio. The lottery was established so that districts would have a means of augmenting their local tax bases and produce a larger portion of total school funding at the local level. However, unlike real property tax revenue, the primary traditional source of local funding, poor districts are prevented from using lottery revenue generated in their district exclusively for funding their own local schools. This is due primarily to the present allocation formula used. Below, Table 2B shows the per capita property values for each district and the level of return on lottery sales and the lottery tax take-out produced in their district.

TABLE 2B

PROPERTY VALUES AND RETURN ON SALES AND TAKEOUT

SCHOOL DISTRICT	PER CAP PROPERY VALUE	RETURN AS % OF SALE	RETURN AS OF TAKE-
OUT TAKEOUT			
BROOKVILLE	12,783	42.82	99.57
CENTERVILLE	22,609	28.84	67.07
DAYTON	6,513	23.94	55.67
HUBER HEIGHTS	11,482	7.63	17.75
JEFFERSON TWP	6,527	42.93	99.83
KETTERING	15,612	2.61	6.06
MAD RIVER	7,022	43.64	101.48
MIAMISBURG	17,120	17.22	40.04
NEW LEBANON	9,368	76.12	177.01
NORTHMONT	13,111	19.05	44.31
NORTHRIDGE	10,899	5.95	13.83
OAKWOOD	24,613	*	*
TROTWOOD	8,492	12.26	28.50
VALLEY VIEW	11,582	79.66	185.25
VANDALIA BUTLER	18,180	12.08	28.10
WEST CARR	11,550	15.01	34.90

*** UNDEFINED**

****average per cap property value: 11,550**

The take-out rate, which is limited by statute to 50% in Ohio, is an ad valorem tax. The takeout is determined by the following equation:

$$TK = \frac{NR + AC + CM}{TTS} \qquad (2.2)$$

OR

$$\frac{TTS - PZ}{TTS}$$

Where

TK = take-out

TTS = total ticket sales

NR = net revenue

AC = administrative costs

CM = commissions and bonuses

PZ = prize pay-outs.

One of the salient distinctions of the tax scheme that governs the lottery is the magnitude of the take-out rate--i.e., the ad valorem tax rate. The tax rate is limited to no more than 50% of the amount of disposable income a district allocates to the lottery, and has averaged 46% over the past years. The percentage of disposable income

allocated to the lottery averaged 1.23 percent in 1997, as indicated in column 5 in table 2A. The take-out rate exceeds that of the highest income tax rate and the average property tax rate combined in Montgomery County. The tax paid on both real property and income each averaged 3% of their respective taxable base in 1997, as indicated in columns 7 and 11 of Table 2 A.

To determine the effective take-out, consideration must be given to the beneficiaries of the tax revenue. Results from research found that players do give consideration to the fact that lottery tax revenue is used to provide support for their public schools. This consideration is associated with the benefits good schools provide to a community. These benefits enhance the marketability of the community as a place to live or do business. Thus, in addition to the probability that chance will redistribute to them prize pay-outs, players derive utility from the added benefits lottery profits provide to their community. The primary focus of the remainder of this paper will be on the expected utility associated with the second term on the right-hand side in equation 2.1.

Evaluating a Lottery Ticket

More than $93.5 million dollars of lottery revenue net of winnings was produced in Montgomery County. The figures in

column 4 of Table 2 show that the percentage of discretionary income that school districts in Montgomery allocated to the lottery in 1997 is approximately 3 percent. This corresponds to a per capita expenditure of $383 for the county when Oakwood, which shares in the benefits but has no lottery agents within the district, is included; and $389 per capita when Oakwood is not included. The second item in column 4 of Table 3 is the districts' lottery receipts as a percentage of total receipts to the district from all sources. Lottery receipts as a percentage of total receipts ranged from 1.76% in Kettering to 9.1% in New Lebanon. Column 6 lists the statutory expectancy amount which is 30 percent of sales. The first item in column 4 of Table 3 is the market price of a lottery profit dollar (LPD) in each district. The market price, P, is determined by:

$$P = TR/Q$$

Where TR is the total amount of lottery revenue net of prizes generated in a district, and Q is the quantity of LPDs the district received in exchange. Redistribution policy has the effect of imposing higher prices on lottery products for players in some districts and discount prices to players domiciled in other districts. Approximately 88 percent of the districts ranked in the top 50 percent, with respect to income or property values, had prices lower than at least half the districts that ranked in the lower 50 percentile. The mean market price of a LPD in Montgomery County was $3.44, and the standard

TABLE 3

LOTTERY TAX LIABILITY AND EXPECTED BENEFIT

1	2	3	4	5	6
SCHOOL DISTRICT	RECEIPTS FROM LOTTERY	LOTTRY TAX CHARGED = TK	P = TK PROFIT AS % OF TR	TOTAL RECPT FROM ALL SOURCES	LOTTERY XPECTANC (.3 * SALES)
BROOKVILLE LSD	599,337.00	601,906	1.00 6.15%	9,741,932	419,935
CENTERVILLE CSD	1,438,371.00	2,144,595	1.49 2.95%	48,784,740	1,496,229
DAYTON CSD	14,966,293.00	26,884,006	1.80 7.04%	212,539,556	18,756,284
HUBER HEIGHTS CSD	3,082,344.00	17,366,298	5.63 7.80%	39,522,348	12,116,022
JEFFERSON TWNSHP	506,286.00	507,123	1.00 7.23%	7,002,790	353,807
KETTERING CSD	863,310.00	14,235,781	16.49 1.76%	49,054,368	9,931,940
MAD RIVER LSD	1,901,468.00	1,873,668	0.99 7.96%	23,894,730	1,307,210
MIAMISBURG CSD	741,728.00	1,852,287	2.50 2.55%	29,084,210	1,292,293
NEW LEBANON LSD	709,009.00	400,539	0.56 9.09%	7,795,615	279,446
NORTHMONT CSD	2,261,306.00	5,103,634	2.26 6.83%	33,119,720	3,560,675
NORTHRIDGE LSD	689,641.00	4,985,955	7.23 4.04%	17,062,183	3,478,573
OAKWOOD CSD	259,785.00	0	0.00 2.10%	12,385,861	0
TROTWOOD-MADISON	2,024,752.00	7,104,123	3.51 7.12%	28,443,467	4,956,365
VALLEY VIEW LSD	814,036.00	439,428	0.54 7.19%	11,326,921	306,578
VANDALIA-BUTLER CS	600,450.00	2,136,913	3.56 2.49%	24,147,834	1,490,870
WEST CARROLLTON	1,223,672.00	7,995,786	6.53 4.82%	25,402,683	5,578,455
TOTALS:	32,681,788.00	93,632,042	1.80 5.64%	579,308,958	65,324,681

deviation was 4.12, and the statutory price for 1997 is $1.43—NR/(.3TTS) = P. The variation in price indicates price discrimination.

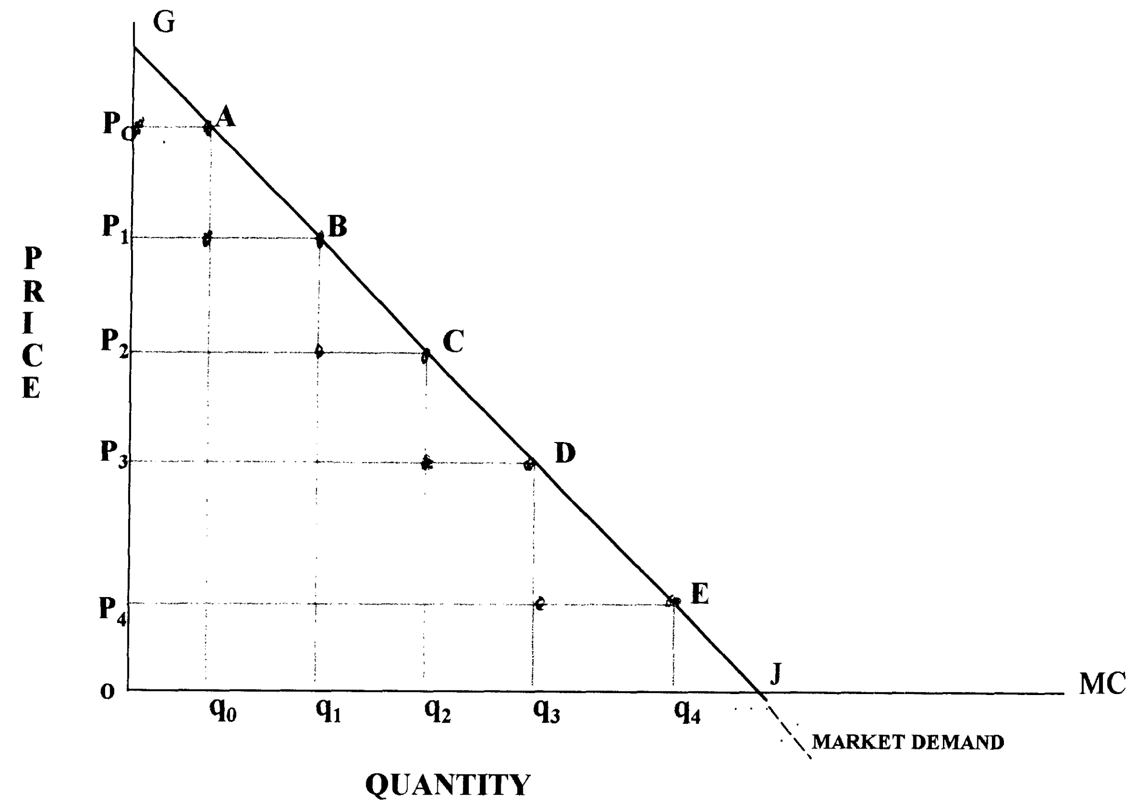
Pricing Policies in The Lottery Market

Price discrimination occurs when different consumers or different groups of consumers pay different prices for a homogenous good. It is possible when various parts of a market are separated, communication between the various parts of the market is precluded or extremely difficult, and price elasticities vary across the market. Additionally, the discriminator must have monopoly power, which facilitates its power to set prices that maximize its own profit. The monopolist uses information about demand function differentials to extract as much surplus as it can obtain from the market. Generally, the most feasible means possible is to use multi-part pricing. Because the demand function, D(x), gives the quantity of a good or service that would be demanded at a given price, the more accurate the discriminator's estimates of D(x) for each of the various parts of the market the greater will be the discriminator's ability to extract surplus from the market and hence increase its own profits. When demand functions are unknown, the discriminator divides consumers into groups, using a certain characteristic as a basis for setting prices.

Figure 2.1 depicts a market in which a price-discriminating monopolist practices multi-part pricing by dividing the market into

FIGURE 2.1

PRICE DISCRIMINATION

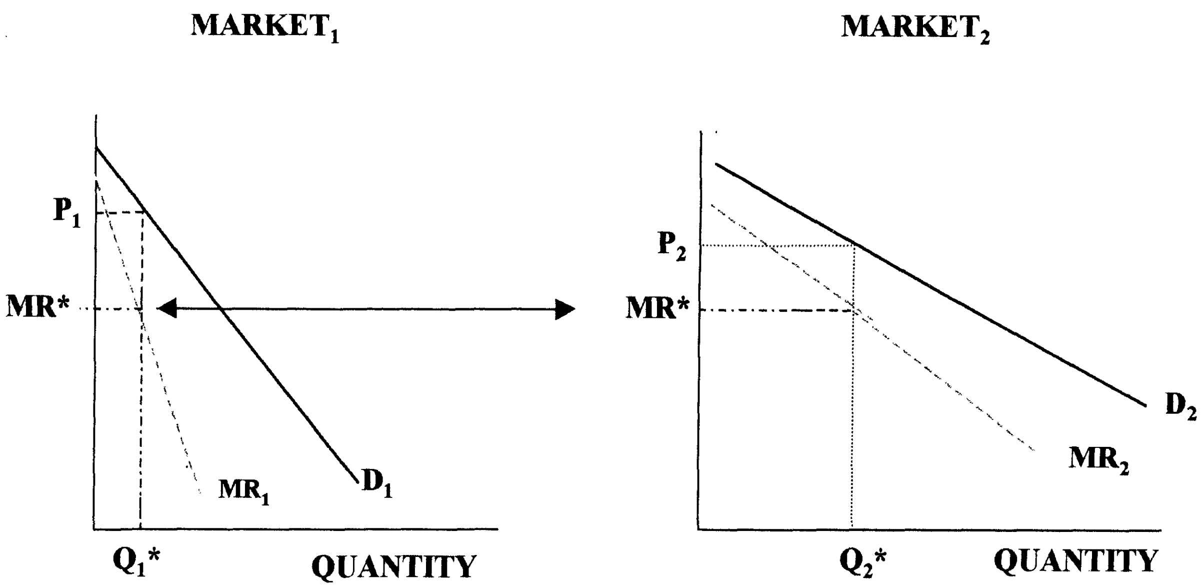


five parts. Before price discriminating, output is set to q_4 and a single price p_4. At the uniform price of p_4, consumer surplus is the area of $\triangle P_4EG$, and profit is the area of trapezoid P_4OJE. Multi-part pricing enables the discriminator to extract surplus from the market equal to the sum of the areas outlined in red, and consumer surplus is then equal to the triangles with blue vertices along the market demand curve. The discriminator charges p_0 for q_0 in market A, p_1 for $(q_1 - q_0)$ in market B, p_2 for $(q_2 - q_1)$ in market C, p_3 for $(q_3 - q_2)$ in market D, and p_4 for $(q_4 - q_3)$ in market E.

The technique the monopolist would use to determine output in each part of the market would involve allocating each successive unit of output to the part of the market in which marginal revenue is highest and above long-run marginal cost, until marginal revenue equals long-run marginal cost, MC_L, in all parts of the market. At MC_L marginal revenue is zero. This process is depicted graphically in Figure 2.2, where MC_L = MR*, and the monopolist has divided the market into two parts. Marginal revenue for each part of the market is set equal to MR*. Output (along the x-axis) in a given part of the market corresponds to the point where the marginal revenue curve, MR, intersects MR*. Price (along the y-axis) in a given part of the market is then the price that corresponds to the point on the demand curve, D_i, that corresponds to output for that part of the market. Combined output for the two parts of the market is depicted in Figure

FIGURE 2.2

EQUALIZING MARGINAL REVENUE



2.3 as q* and corresponds to point (B) on the marginal revenue function (sum)MR* in panel a. The monopolist's demand curve is elastic up to point B, it is unit elastic at point B, and inelastic for output beyond point B. The corresponding total revenue curve is depicted in panel b, which shows that marginal revenue continuously increases as output increases through point (A) up to point (B). Marginal revenue is zero at point (B) and decreases if output increases beyond point (B), as indicated by the direction of tangent lines m, m', m''. Summarized mathematically, profit maximization occurs where the following statements are satisfied:

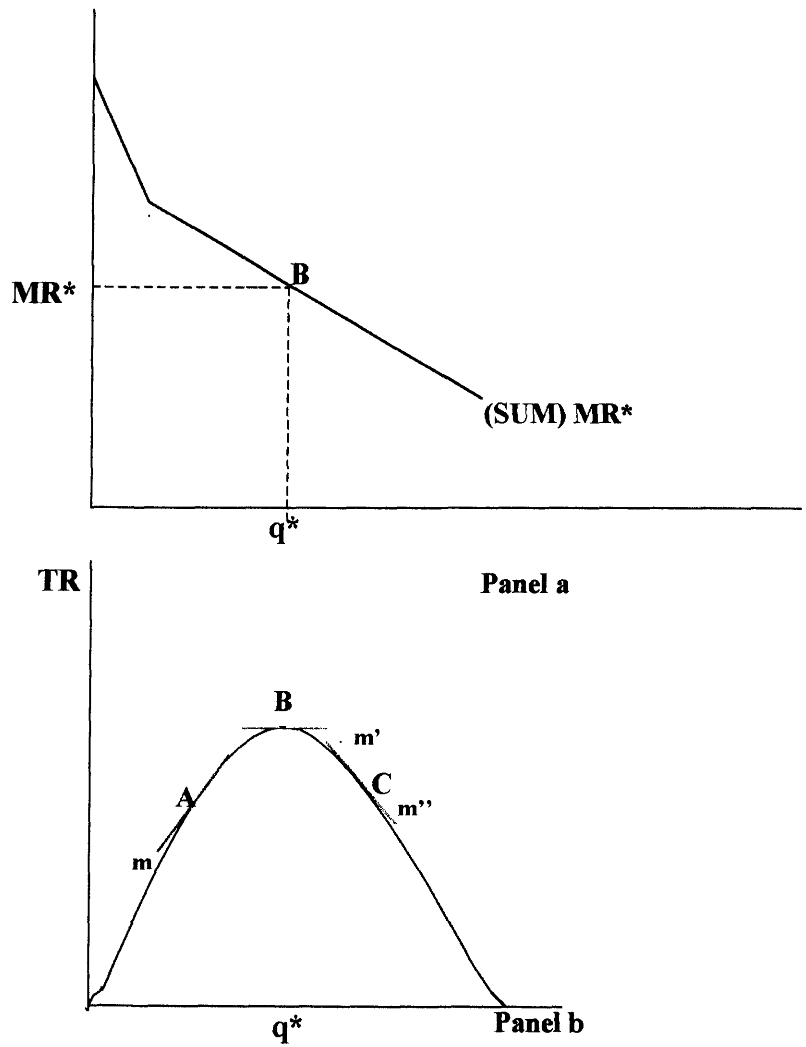
$$\frac{\partial \pi}{\partial Q_1} = D_1(Q_1) + Q_1 \frac{dD_1}{dQ_1} - \frac{dC_L(Q)}{dQ}\frac{dQ}{dQ_1} = 0$$

$$\frac{\partial \pi}{\partial Q_2} = D_2(Q_2) + Q_2 \frac{dD_2}{dQ_2} - \frac{dC_L(Q)}{dQ}\frac{dQ}{dQ_2} = 0.$$

Table 2B gave districts' return as a percent of sales and take-out. Column 4 of Table 3 showed the prices districts paid for a LPD in various parts of Montgomery County in 1997. The discriminatory prices are a product of Ohio's redistribution policy. In addition to price discrimination, another aspect of the pricing policy is bundling.

FIGURE 2.3

TOTAL REVENUE OF COMBINED MARKET



Bundling is an effective means of increasing revenue when demand functions across a market are negatively correlated. That is, marginal revenue increases from a bundling pricing strategy when the various consumer groups have heterogeneous demand functions. The bundling aspect of the lottery is shown by equation (2.1), restated here:

$$E(R) = (P)(R_m) + R_e \qquad (2.1)$$

By tying school funding, R_e , to $(P)(R_m)$, a game of chance, the resultant mixed bundling strategy allows legislators to increase school funding with voluntary contributions. For some districts, however, the lottery is in affect an additionlal compulsory tax, due to the relatively higher price of the lottery products in those districts. Table 3B, below, shows why a mixed bundling strategy would be preferred to traditional types of school funding. Specifically, bundling allows legislators to increase school funding without having to raise state taxes—a move that would cost legislators in the political market because raising taxes lowers the number of votes legislators would receive in the election booths.

In Table 3B, for simplicity, the marginal cost of producing R_m is 10 and the marginal cost of producing R_e is 15. The cost differential is due in part to the additional campaign cost some legislators would have to incur to overcome the negative affects of raising taxes in the political market. If R_e and R_m are sold separately at prices $P_e = 50$ and $P_m = 54$, none of the

TABLE 3B

BUNDLING

CONSUMER GROUP PROFILE	WILLINGNESS TO PAY R_e	R_m	BUNDLE
Group A: Below average wealth index, but above average income; local school funding below state average; Constituency lottery participation rate 20/30 constituency voting rate 18/30	40	60	100
Group B: Below average wealth index, and below average income and below average real property. Local school funding below state average; Constituency lottery participation 30/50; voting participation rate 15/50	45	55	100
Group C: Above average wealth index, above average income and real property. Local School Funding capacity above average. Constituency lottery participation rate 15/20, voting participation rate 20/20	10	50	60

PRICING STRATEGY

	P_E	P_M	P_B	Profit
SELL SEPARATELY	50	54	NA	2200
PURE BUNDLING	NA	NA	100	3750
MIXED BUNDLING	50	50	95	4100

consumers would be willing to buy R_e since its price would be above the reservation price of all consumers. Consumers from group A and B would buy R_m since they would both end up with consumer surplus and total profit would be (20+30)(54-10) = 2200. A pure bundling strategy would extract all surplus from groups A and B and exclude group C. Profits would be (20+30)(100 – 10 – 15) = 3750. With mixed bundling, which allows buying separately—such as a school levy or simply lottery--, group C would buy only R_m , and groups A and B would be induced to buy the bundle at 95 since they would obtain surplus by doing so. With mixed bundling, profits would be 15(50-10)+ (20 + 30) (95 - 10 – 15) = 600 + 3500 = 4100. Thus, the mixed bundling strategy would be the preferred pricing strategy. A redistribution policy that transfers surplus from group B, which has a relatively low voting participation rate, would also increase legislators' votes in the political arena, since such intervention would lower the effective price other groups pay and hence the utility or satisfaction with the lottery for the majority of the voting populace.

PLAYER UTILITY

The level of utility of a district's players depends upon the number of LPDs their own schools receive, and the quantity of a composite product, y, consumed. The composite product includes (lottery products – Re) Players produce X^S lottery take-out dollars in exchange for LPDs. Player's share of LPDs are paid to the player's

own public schools that provide primary and secondary education. Player's schools use LPDs to purchase capital. The more LPDs player's schools receive, the more improvements in eductional facilities and quality of education of their youth in the community. Better schools enhance the marketability of youth in the job market, and the marketability of player's community as a place to live or do business. For players to maximize utility, they must consider constraints: the prevailing price, P_X, of LPDs for members in their community, and total disposable income available for lottery products, x, and composite product, y. The composite product includes both R_m and non-lottery products. For given prices P_X and P_Y of LPDs, x, and the composite product, y, and player's utility function $kx^{\alpha}y^{(1-\alpha)}$, which is increasing at all (x,y)>>0 and is homogeneous of degree one, player's utility maximizing problem can be stated as:

$$\text{Max:} \quad \alpha \ln x + (1-\alpha)\ln y$$

$$\text{s.t.} \quad P_x x + P_y y = w$$

The partial derivatives give rise to the following system as the first order condition:

$$\frac{\alpha}{x} - P_x\lambda = 0$$

$$\frac{(1-\alpha)}{y} - P_y\lambda = 0$$

$$P_x x + P_y y - w = 0$$

Applying the substitution property of equality and solving for λ, the marginal utility realized from an additional dollar expenditure:

$$\frac{\alpha}{P_x x} = \frac{(1-\alpha)}{P_y y} = \lambda$$

For a given budget constraint and prevailing prices, the quantities of x and y that maximize utility are

$$x(p,w) = \frac{\alpha w}{p_x}$$

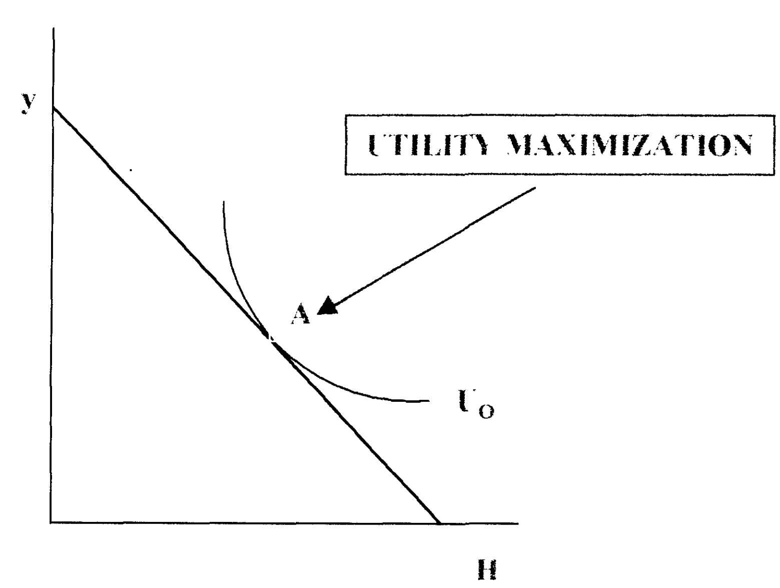
and

$$y(p,w) = \frac{w(1-\alpha)}{p_y}$$

where αw is the portion of wealth players prefer to allocate to player's own school and (1-α) is the portion allocated to composite product. The optimal level of utility is shown graphically in Figure 2.4 at A.

FIGURE 2.4

PLAYER UTILITY MAXIMIZATION



At point A, the marginal rate of substitution (mrs_{xy})of LPDs for non-lottery products is determined by

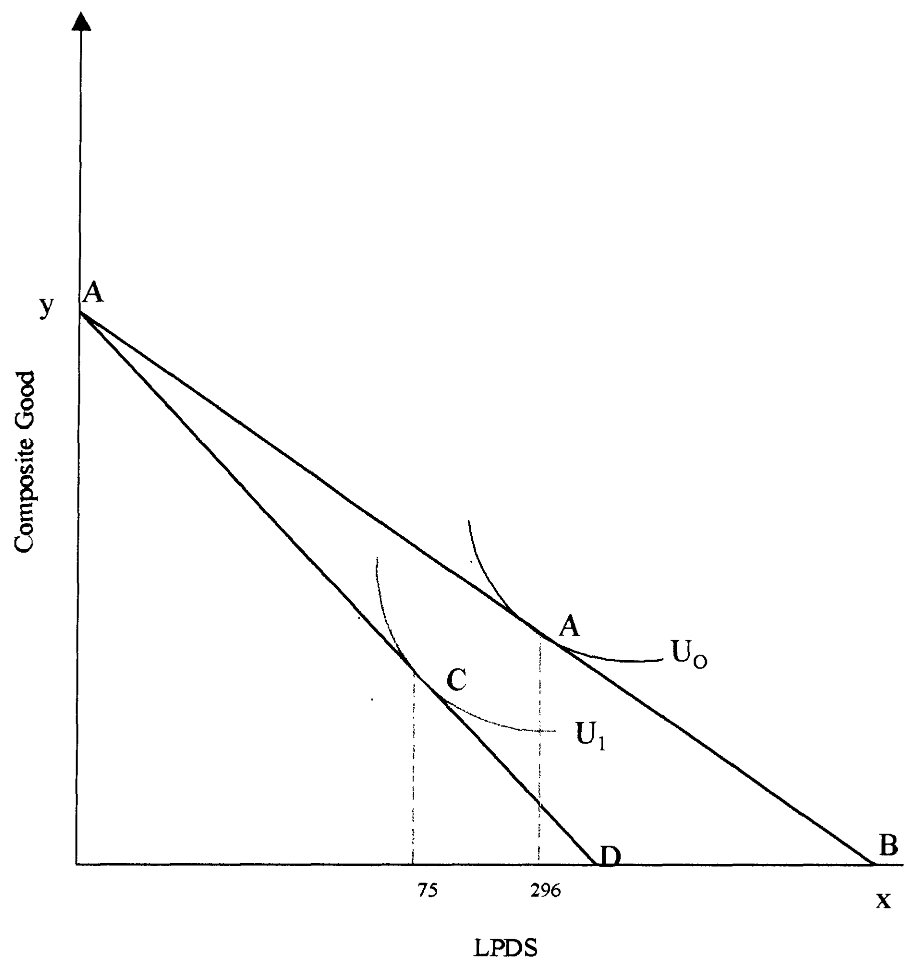
$$\frac{U_X}{U_Y} = \frac{\alpha y}{(1-\partial)x} = \frac{p_X}{P_Y}.$$

As players substitute LPDs for the composite good on the vertical axis, and vice versa, along the level curve U_o their level of utility would remain constant. However, when government intervention causes the relative price of LPDs to increase, player utility decreases, since for the same outlay player receives less utility. Figure 2.5 shows the effect redistribution had on player utility in Huber Heights in 1997.

In 1997, Huber Heights' players had per capita disposable income of \$14,881 to allocate towards their utility, U^H. The take-out in 1997 was 43 percent of all sales in Ohio, so that the statutory return on lottery take-out was .30/.43 = 69.8% of the take-out and unit price of \$1.433. A typical player in Huber Heights allocated \$424 (tax/pop) to the lottery profit fund and the player's school district should have received 296 LPDs (.698*424) at a unit price of \$1.433. As shown in figure 2.5, player's original budget line is AB and the player maximizes utility on indifference curve U_o at point A, where \$424 was allocated to schools and \$14,457 was allocated to the composite good.

FIGURE 2.5

Utility Maximization of Huber Heights Player



Redistribution resulted in a 293.7 percent increase in price from $1.43 to $5.63, and caused Huber player's budget line to rotate inward to line AD. As a result of price intervention, player's original level of utility is no longer attainable because the new budget line, AD, is lower than indifference curve U_o. Player moves down to U_1 and maximizes utility at point C where actually 75 LPDs and the original amount of the composite good was then actually being consumed. The loss of income to a typical Huber Heights player was 221 LPDs or $317 at the LPDs statutory price of $1.43. This is because players would not be able to exchange the LPD for $5.63 per LPD they paid unless they were able to pass on their losses to their schools. (The incidence of schools internalizing cost will be discussed in chapter 4) The effect the price increase would have on a players future demands depends on player's elasticity of demand. For poor players the loss could be relatively significant, particularly if a levy is needed to take up the slack that resulted from players being forced to subsidize others in the county at a price of $5.63 per LPD. Players may opt to use a different vehicle to provide funding for their schools, such as a direct payment of $75 or more to their local schools. Players may also opt to incorporate other items into their composite good such as interstate lottery or casino gambling in which the take-out is 3 percent. Clotfelter pointed out that states with casino gambling or games with higher jackpot prizes are giving neighboring states

without these types of games much competition. Players would substitute away from lottery when the expected return to them decreases.

III. REGRESSIVE TAXATION

Game Preferences and Demography

A regressive tax system taxes income at a marginal rate that decreases as the level of income increases. To determine whether a tax scheme associated with a public lottery is regressive, the effective tax rate must first be determined, which involves an examination of the tax rate inherent in both the collection and redistribution processes. As pointed out by Borg and Mason, studies of public lotteries that emphasize the regressive tax inherent in the collection process but fail to address the state's uses of the funds or the demography of the beneficiaries tend to draw conclusions that are incomplete. In this section, emphasis will be put on the regressive tax inherent in both the collection and redistribution processes.

The distribution of lottery expenditures over the 16 school districts in Montgomery County is shown in Table 4. The districts are ranked in descending order according to income. The 2 items listed in column 1 of the table are districts' average individual income and the per capita income, respectively, for 1997. Columns 2 thru 7 in Table 4

TABLE 4

SALES FOR EACH LOTTERY GAME

SCHOOL DISTRICT	1 AVG INDIVIDUAL INCOME/ PER CAP Y	2 PICK3/% OF DISTR TOT/ % CO. TOT	3 PICK 4/% OF DISTR TOT/ % CO. TOT	4 BUCKEY5/ % DIST TOT/ % CO. TOT	5 KICKER/% DIST TOT/% CO. TOT	6 LOTTO/% OF DIST TOT/% CO. TOTAL	7 INSTANT/% DIST TOT/% CO. TOT	8 GRAND TOTAL/ % AGGRE TOT	9 % OF TOTAL LOTTERY EXPEND.
OAKWOOD	$90,240	$0	$0	$0	$0	$0	$0	$0	
	$39,393							0.00%	0.0%
CENTERVILLE	$63,093	$598,099	$174,550	$205,896	$147,327	$1,397,577	$2,463,982	$4,987,431	
	$30,946	11.99%	3.50%	4.13%	2.95%	28.02%	49.40%	2.29%	2.3%
		0.27%	0.08%	0.09%	0.07%	0.64%	1.13%		
KETTERING	$47,953	$2,384,153	$620,452	$589,085	$410,554	$3,224,858	$25,877,366	$33,106,468	
	$19,920	7.20%	1.87%	1.78%	1.24%	9.74%	78.16%	15.20%	17.5%
		1.09%	0.28%	0.27%	0.19%	1.48%	11.88%		
VANDALIA BUTLER	$44,240	$629,676	$352,322	$177,440	$142,451	$1,115,877	$2,551,799	$4,969,565	
	$19,320	12.67%	7.09%	3.57%	2.87%	22.45%	51 35%	2.28%	19.8%
		0.29%	0.16%	0.08%	0.07%	0.51%	1.17%		
NORTHMONT	$42,323	$546,865	$906,925	$207,302	$170,390	$1,227,748	$8,809,686	$11,868,916	
	$17,406	4.61%	7.64%	1.75%	1.44%	10.34%	74.22%	5.45%	25.2%
		0.25%	0.42%	0.10%	0.08%	0.56%	4.05%		
BROOKVILLE	$37,039	$134,050	$61,910	$83,697	$52,783	$393,358	$673,984	$1,399,782	
	$17,377	9.58%	4.42%	5.98%	3.77%	28.10%	48.15%	0.64%	25.9%
		0.06%	0.03%	0.04%	0.02%	0.18%	0.31%		
MIAMISBURG	$38,613	$509,698	$323,819	$172,878	$129,438	$924,389	$2,247,422	$4,307,644	
	$16,455	11.83%	7.52%	4.01%	3.00%	21.46%	52 17%	1.98%	27.8%
		0.23%	0.15%	0.08%	0.06%	0.42%	1.03%		
VALLEY VIEW	$36,819	$135,690	$28,619	$44,400	$36,740	$244,754	$531,722	$1,021,925	
	$15,345	13.28%	2.80%	4.34%	3.60%	23.95%	52.03%	0.47%	28.3%
		0.06%	0.01%	0.01%	0.02%	0.11%	0.24%		
HUBER HEIGHTS	$37,661	$19,356,831	$393,096	$367,495	$278,745	$1,809,451	$18,181,121	$40,386,739	
	$14,881	47.93%	0.97%	0.91%	0.69%	4.48%	45.02%	18.55%	46.9%
		8.89%	0.18%	0.17%	0.13%	0.83%	8.35%		
WEST CARROLLTON	$34,298	$1,173,455	$297,623	$313,328	$195,502	$1,396,118	$15,218,824	$18,594,850	
	$14,121	6.31%	1.60%	1.69%	1.05%	7.51%	81.84%	8.54%	55.4%
		0.54%	0.14%	0.14%	0.09%	0.64%	6.99%		
NEW LEBANON	$32,112	$92,420	$20,017	$31,795	$28,047	$187,452	$571,755	$931,486	
	$12,106	9.92%	2.15%	3.41%	3.01%	20.12%	61.38%	0.43%	55.8%
		0.04%	0.01%	0.01%	0.01%	0.09%	0.26%		
TROTWOOD MADISON	$31,603	$2,617,959	$712,696	$242,060	$159,958	$852,759	$11,935,784	$16,521,216	
	$10,372	15.85%	4.31%	1.47%	0.97%	5.16%	72.25%	7.59%	63.4%
		1.20%	0.33%	0.11%	0.07%	0.39%	5.48%		
MAD RIVER	$30,921	$480,754	$263,672	$143,488	$845,181	$776,789	$1,847,484	$4,357,368	
	$9,344	11.03%	6.05%	3.29%	19.40%	17.83%	42.40%	2.00%	65.4%
		0.22%	0.12%	0.07%	0.39%	0.36%	0.85%		
DAYTON	$27,432	$17,935,179	$4,432,382	$1,316,857	$836,536	$4,610,397	$33,389,594	$62,520,945	
	$8,721	28.69%	7.09%	2.11%	1.34%	7.37%	53.41%	28.71%	94.1%
		8.24%	2.04%	0.60%	0.38%	2.12%	15.33%		
NORTHRIDGE	$28,218	$843,839	$243,848	$191,886	$124,122	$854,921	$9,336,628	$11,595,244	
	$8,503	7.28%	2.10%	1.65%	1.07%	7.37%	80.52%	5.33%	99.5%
		0.39%	0.11%	0.09%	0.06%	0.39%	4.29%		
JEFFERSON	$31,349	$599,480	$192,152	$30,346	$19,452	$82,226	$255,700	$1,179,356	
	$7,943	50.83%	16.29%	2.57%	1.65%	6.97%	21.68%	0.54%	100.0%
		0.28%	0.09%	0.01%	0.01%	0.04%	0.12%		
TOTALS		$48,038,148	$9,024,083	$4,117,953	$3,577,226	$19,098,674	$133,892,851	$217,748,936	
		22.06%	4.14%	1.89%	1.64%	8.77%	61.49%		

show districts' expenditures for the various types of lottery games, the percentage of total expenditure for each game type, and the percentage of aggregate county expenditure the district's expenditure represents for the game type, respectively. Column 8 shows each district's aggregate lottery expenditure and the percentage of the county's aggregate expenditure the district's expenditure represents. Column 9 is a cumulative percentage for the county.

In table 4, the three most preferred games in each district are highlighted in red, blue, and green, with red being the most preferred, blue is the second most preferred, and green is the third most preferred. Game preferences for the eight school districts with the highest per capita income levels are virtually uniform, with the highest concentration of expenditures going to the instant ticket games, followed by lotto, and then the pick three(the one exception is the Northmont district, in which pick 4 is the third most preferred game.). Column 9 shows that lottery expenditures for the top 8 out of 16 school districts, ranked in descending order by personal income, account for 28.31 percent of aggregate lottery expenditures in Montgomery County. Column 3 of table 5 shows that this group represents 39% of Montgomery County's population. Column

TABLE 5

DISTRICT'S PERCENTAGE OF INCOME ALLOCATED TO EACH OHIO LOTTERY GAME

	1	2	3	4	5	6
SCHOOL DISTRICT	AVG INDIVIDUAL INCOME/ PER CAP Y	POPULATION/% OF TOT POP.	CUMULATIVE % OF POP	PICK3 SALES PER CAP EXP % OF INCOME	PICK4 SALE PER CAP EX % OF INC	BUCKY5 PER CAP E % OF INCM
OAKWOOD	$90,240 $39,393	8957 1.57%	1.57%	$0	$0	$0
CENTERVILLE	$63,093 $30,946	46609 8.19%	9.76%	$598,099 $12.83 0.04%	$174,550 $3.74 0.01%	$205,896 $4.42 0.01%
KETTERING	$47,953 $19,920	61624 10.83%	20.60%	$2,384,153 $38.69 0.19%	$620,452 $10.07 0.05%	$589,085 $9.56 0.05%
VANDALIA BUTLER	$44,240 $19,320	23179 4.07%	24.67%	$629,676 $27.17 0.14%	$352,322 $15.20 0.08%	$177,440 $7.66 0.04%
NORTHMONT	$42,323 $17,406	32240 5.67%	30.34%	$546,865 $16.96 0.10%	$906,925 $28.13 0.16%	$207,302 $6.43 0.04%
BROOKVILLE	$37,039 $17,377	8586 1.51%	31.85%	$134,050 $15.61 0.09%	$61,910 $7.21 0.04%	$83,697 $9.75 0.06%
MIAMISBURG	$38,613 $16,455	30504 5.36%	37.21%	$509,698 $16.71 0.10%	$323,819 $10.62 0.06%	$172,878 $5.67 0.03%
VALLEY VIEW	$36,819 $15,345	10022 1.76%	38.97%	$135,690 $13.54 0.09%	$28,619 $2.86 0.02%	$44,400 $4.43 0.03%
HUBER HEIGHTS	$37,661 $14,881	40918 7.19%	46.17%	$19,356,831 $473.06 3.18%	$393,096 $9.61 0.06%	$367,495 $8.98 0.06%
WEST CARROLLTON	$34,298 $14,121	27729 4.87%	51.04%	$1,173,455 $42.32 0.31%	$297,623 $10.73 0.08%	$313,328 $11.30 0.08%
NEW LEBANON	$32,112 $12,106	7485 1.32%	52.36%	$92,420 $12.35 0.10%	$20,017 $2.67 0.02%	$31,795 $4.25 0.04%
TROTWOOD MADISON	$31,603 $10,372	24234 4.26%	56.62%	$2,617,959 $108.03 1.04%	$712,696 $29.41 0.28%	$242,060 $9.99 0.10%
JEFFERSON	$31,349 $7,943	8038 1.41%	58.03%	$599,480 $74.58 0.94%	$192,152 $23.91 0.30%	$30,346 $23.91 0.30%
MAD RIVER	$30,921 $9,344	25999 4.57%	62.60%	$480,754 $18.49 0.20%	$263,672 $10.14 0.11%	$143,488 $5.52 0.06%
NORTHRIDGE	$28,218 $8,503	12535 2.20%	64.81%	$843,839 $67.32 0.79%	$243,848 $19.45 0.23%	$191,886 $15.31 0.18%
DAYTON	$27,432 $8,721	200160 35.19%	100.00%	$17,935,179 $89.60 1.03%	$4,432,382 $22.14 0.25%	$1,316,857 $6.58 0.08%
TOTALS		568819		$48,038,148 $84.45	$9,024,083 $15.86	$4,117,953 $7.24

TABLE 5 CONT.

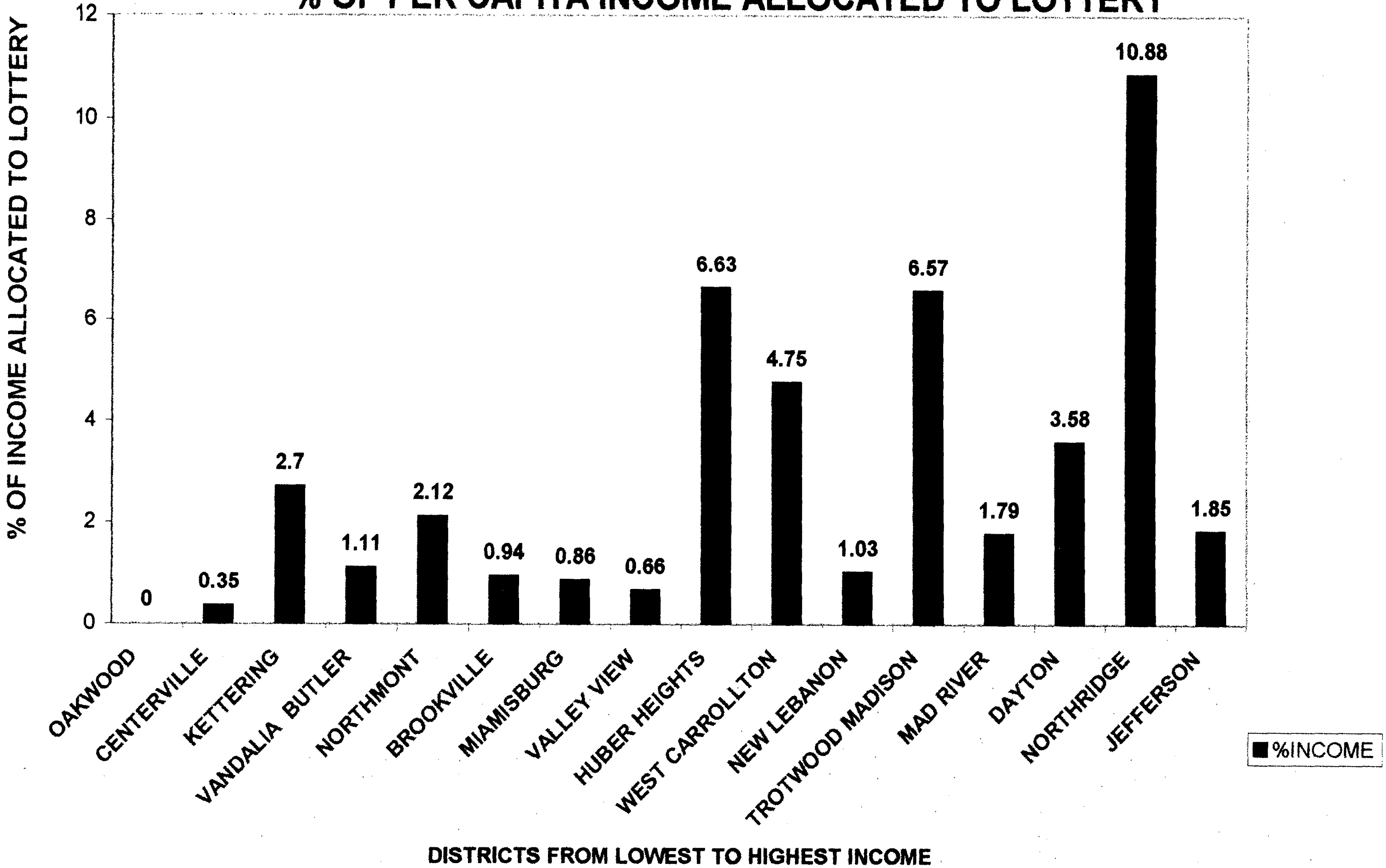
SCHOOL DISTRICT	7 KICKER S PER CAP E % OF INCM	8 LOTTO SALES PER CAP EXP % OF INCOM	9 INSTANT SAL PER CAP EX % OF INCOME	10 GRAND SUM/ PER CAP S % INCOME	11 %BLACK	12 % POV ERTY
OAKWOOD	$0	$0	$0	$0 0.00% 0.00%	0.00%	3.00%
CENTERVILLE	$147,327 $3.16 0.01%	$1,397,577 $29.99 0.10%	$2,463,982 $52.86 0.17%	$4,987,433 $107.01 0.35%	0.91%	3.27%
KETTERING	$410,554 $6.66 0.03%	$3,224,858 $52.33 0.26%	$25,877,366 $419.92 2.11%	$33,106,471 $537.23 2.70%	0.74%	4.35%
VANDALIA BUTLER	$142,451 $6.15 0.03%	$1,115,877 $48.14 0.25%	$2,551,799 $110.09 0.57%	$4,969,569 $214.40 1.11%	0.94%	3.65%
NORTHMONT	$170,390 $5.29 0.03%	$1,227,748 $38.08 0.22%	$8,809,686 $273.25 1.57%	$11,868,921 $368.14 2.12%	1.90%	3.34%
BROOKVILLE	$52,783 $6.15 0.04%	$393,358 $45.81 0.26%	$673,984 $78.50 0.45%	$1,399,788 $163.03 0.94%	0.00%	4.90%
MIAMISBURG	$129,438 $4.24 0.03%	$924,389 $30.30 0.18%	$2,247,422 $73.68 0.45%	$4,307,651 $141.22 0.86%	1.30%	6.51%
VALLEY VIEW	$36,740 $3.67 0.02%	$244,754 $24.42 15.01%	$531,722 $53.06 0.35%	$1,021,933 $101.97 0.66%	0.79%	5.51%
HUBER HEIGHTS	$278,745 $6.81 0.05%	$1,809,451 $44.22 0.30%	$18,181,121 $444.33 2.99%	$40,386,748 $987.02 6.63%	6.76%	4.07%
WEST CARROLLTON	$195,502 $7.05 0.05%	$1,396,118 $50.35 0.36%	$15,218,824 $548.84 3.89%	$18,594,860 $670.59 4.75%	1.78%	5.37%
NEW LEBANON	$28,047 $3.75 0.03%	$187,452 $25.04 0.21%	$571,755 $76.39 0.63%	$931,497 $124.45 1.03%	0.20%	3.55%
TROTWOOD MADISON	$159,958 $6.60 0.06%	$852,759 $35.19 0.34%	$11,935,784 $492.52 4.75%	$16,521,228 $681.74 6.57%	44.90%	12.23%
JEFFERSON	$19,452 $2.42 0.03%	$82,226 $10.23 0.13%	$255,700 $31.81 0.40%	$1,179,369 $146.72 1.85%	63.86%	18.47%
MAD RIVER	$845,181 $32.51 0.35%	$776,789 $29.88 0.32%	$1,847,484 $71.06 0.76%	$4,357,382 $167.60 1.79%	6.72%	7.28%
NORTHRIDGE	$124,122 $9.90 0.12%	$854,921 $68.20 0.80%	$9,336,628 $744.84 8.76%	$11,595,259 $925.03 10.88%	8.91%	24.95%
DAYTON	$836,536 $4.18 0.05%	$4,610,397 $23.03 0.26%	$33,389,594 $166.81 1.91%	$62,520,961 $312.35 3.58%	38.51%	24.23%
TOTALS	$3,577,226 $6.29	$19,098,674 $33.58	$133,892,851 $235.39	$217,749,071 $382.81		

10 of Table 5 shows that the percentage of income allocated to lottery products for this group ranges from 0.0 percent to 2.7 percent, and more than 62 percent of them allocated less than 1% of their income to the lottery.

On the other hand, for the 8 out of 16 school districts with the lowest per capita income game preferences are less uniform. Though the three most preferred games tend to be the same as those of the higher income group, their ordered ranking is different. The instant ticket games were the most preferred for 75 percent of the lower income group, while the lotto and pick 3 are tied for the second most preferred game. Consistent with results from research done in various parts of the country, across Montgomery County there was notable positive correlation between preference for the relatively low-payout/low-odd pick 3 game to the high-payoff/high-odd lotto game and the portion of a districts population that was Afro American or poverty level. (See Clotfelter, Morgan, and Borg). Lottery expenditure as a percentage of income for the 8 lowest income districts ranged from 0.63 percent to 10.88 percent, with the average being 4.4%. Chart 1 shows lottery expenditures as a percentage of income for the 16 districts in Montgomery County. District per capita income is ranked from the highest (Oakwood) to the lowest

CHART 1

% OF PER CAPITA INCOME ALLOCATED TO LOTTERY



(Jefferson) along the x-axis. The distribution shows that lottery expenditures as a pertage of income tended to decrease as income increased. The concentration of lottery expenditures is shown in charts 2.A and 2.B. The level of concentration is highest among those districts that allocate between 5 and 11 percent of their income to the lottery. These districts--Northridge, Trotwood, Huber Heights, and West Carrollton--, which are among the 8 lower-income districts, represent 18.5 percent of the county's population and account for more than 40 percent of the county's lottery expenditure.

Regressive Tax Via Redistribution

The regressiveness of the lottery tax in Montgomery County is augmented by government redistribution policy. Columns 3 and 4 of Table 6 show the portion of the county's aggregate lottery take-out tax that was borne by each district, and the portion of the county's aggregate profits for education each district received, respectively. These figures are based on aggregte receipts in Montgomery County rather than 30 percent of sales. Given a proportional take-out tax rate, an equitiable distribution of profits would also be proportional, and paralell the following proportion:

$$\frac{DTB}{CTB} = \frac{DR}{CR} \qquad (3.1)$$

CHART 2.A

% OF INCOME TO LOTTERY, % OF COUNTY TAX PAID,AND % OF COUNTY POPULATION

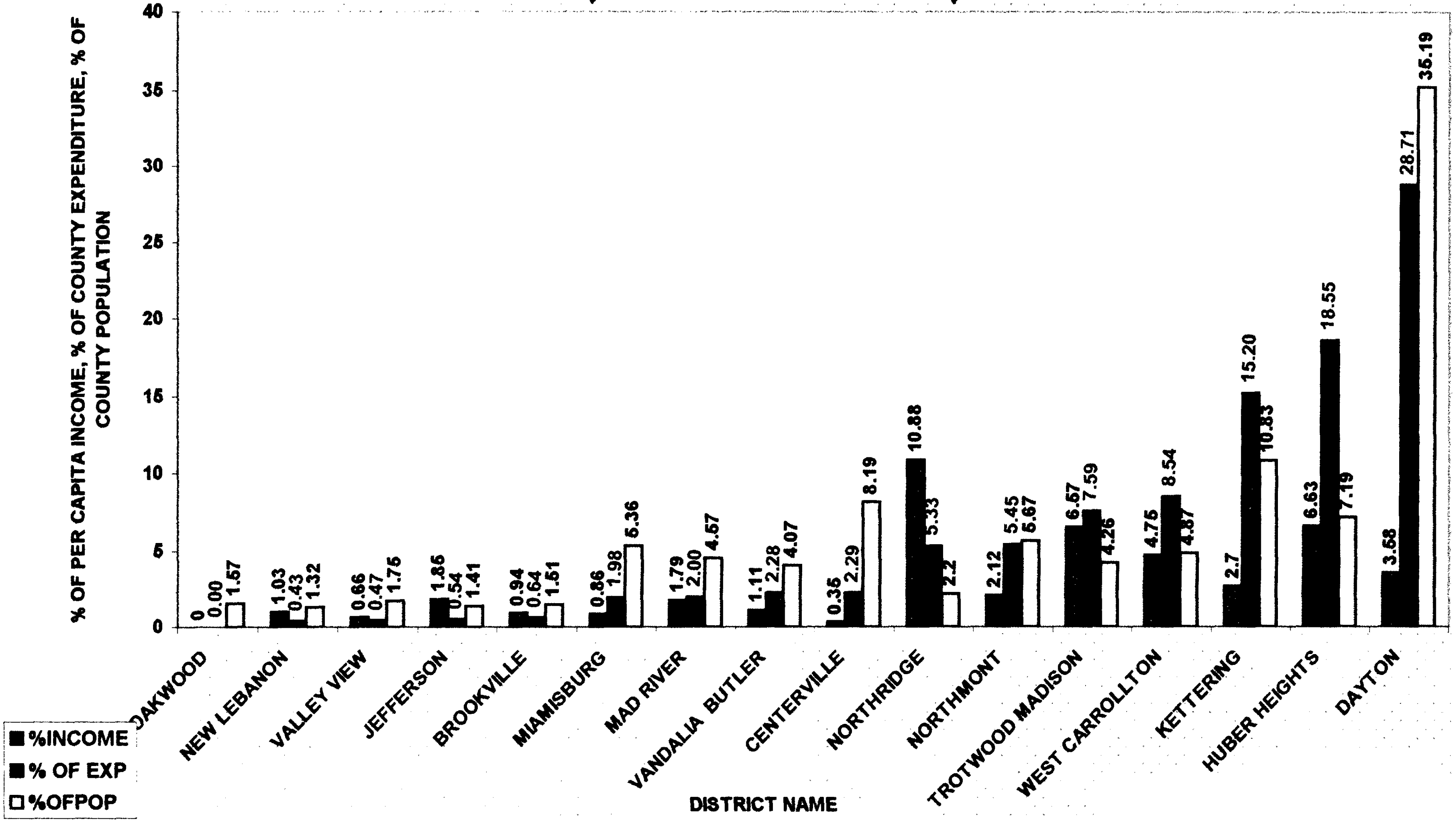
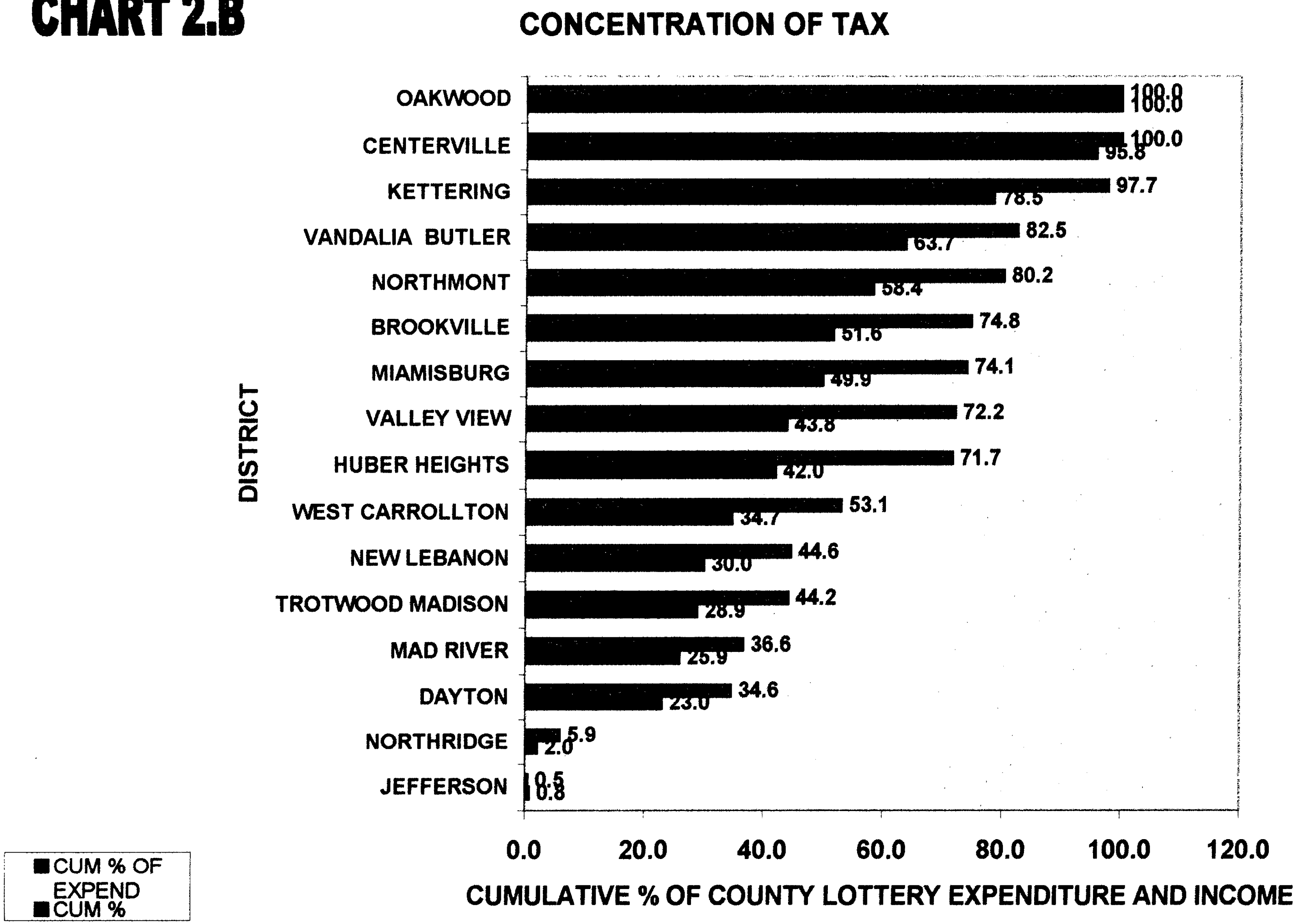


CHART 2.B


CONCENTRATION OF TAX
DISTRICT
OAKWOOD 100.0 100.0
CENTERVILLE 100.0 95.8
KETTERING 97.7 78.5
VANDALIA BUTLER 82.5 63.7
NORTHMONT 80.2 58.4
BROOKVILLE 74.8 51.6
MIAMISBURG 74.1 49.9
VALLEY VIEW 72.2 43.8
HUBER HEIGHTS 71.7 42.0
WEST CARROLLTON 53.1 34.7
NEW LEBANON 44.6 30.0
TROTWOOD MADISON 44.2 28.9
MAD RIVER 36.6 25.9
DAYTON 34.6 23.0
NORTHRIDGE 5.9 2.0
JEFFERSON 0.5 0.8
0.0
20.0
40.0
60.0
80.0
100.0
120.0
CUMULATIVE % OF COUNTY LOTTERY EXPENDITURE AND INCOME
CUM % OF EXPEND
CUM %

Where:

DTB = district tax burden

DR = district benefit received

CTB= county tax burden

CR = county benefits received.

Columns 3 and 4 of Table 6 also show that 4 districts—Oakwood, Mad River, New Lebanon, and Valley View—received LPDs in excess of their actual net outlay to the lottery fund. Ten districts received funding disproportionately greater than their relative share of the tax burden. A measure of disproportion is shown in Charts 4 and 5 and column 5 of Table 6. In charts 4 and 5, the districts are ranked in descending order according to income along the horizontal. Of the 6 districts that received LPDs in an amount disproportionately less than their share of the tax burden (listed in red), four of them were among the eight districts with the lowest per capita income, and two of them have relatively extreme levels of poverty (see column 12 of Table 5). Among the 4 districts that received LPDs in excess of the outlay to the lottery, two were from the eight districts with the highest per capita income, and one was the district—Oakwood-- with the highest per capita income, the lowest poverty level, and least diverse population. The redistribution arrangement is such that the principles of vertical equity, horizontal equity, and the benefit principles are violated.

TABLE 6

MEASURES OF DISPROPORTION

SCHOOL DISTRICT	1 LOTTERY RECEIPTS (IN THOUSANDS)	2 TAKE-OUT TAX PAID (IN THOUS.)	3 DISTRICT'S % OF COUNTY"S TAX PAID	4 % OF COUNT-'S BENEFIT RECEIVED	5 MEASURE OF DISPRO-PORTION
OAKWOOD	260	0	0.00%	0.79%	0.0079
CENTERVILLE	1438	2,145	2.29%	4.40%	0.0211
VALLEY VIEW	814	439	0.47%	2.49%	0.0202
MIAMISBURG	742	1,852	1.98%	2.27%	0.0029
BROOKVILLE	599	602	0.64%	1.83%	0.0119
NEW LEBANON	710	401	0.43%	2.17%	0.0174
VANDALIA	600	2,137	2.28%	1.84%	**-0.0044**
MAD RIVER	1901	1,874	2.00%	5.82%	0.0382
JEFFERSON TWP	506	507	0.54%	1.55%	0.0101
NORTHMONT	2261	5,104	5.45%	6.92%	0.0147
KETTERING	863	14,236	15.20%	2.64%	**-0.1256**
DAYTON	14966	26,884	28.71%	45.79%	0.1708
WEST CARROLLTON	1224	7,996	8.54%	3.74%	**-0.048**
TROTWOOD	2025	7,104	7.59%	6.20%	**-0.0139**
HUBER HGTS	3082	17,366	18.55%	9.43%	**-0.0912**
NORTHRIDGE	690	4,986	5.33%	2.11%	**-0.0321**
TOTALS:	32,683	93,633	100.00%	100.00%	

CHART 4

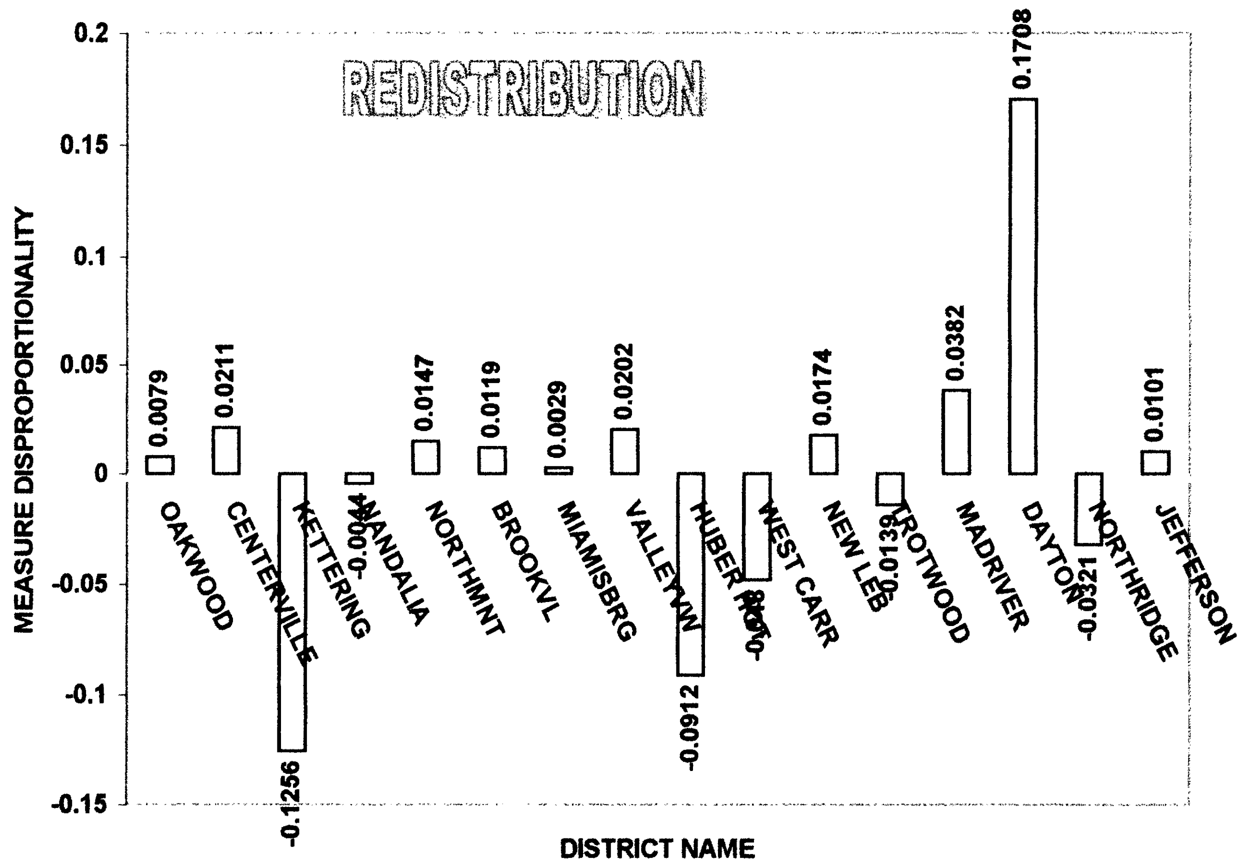
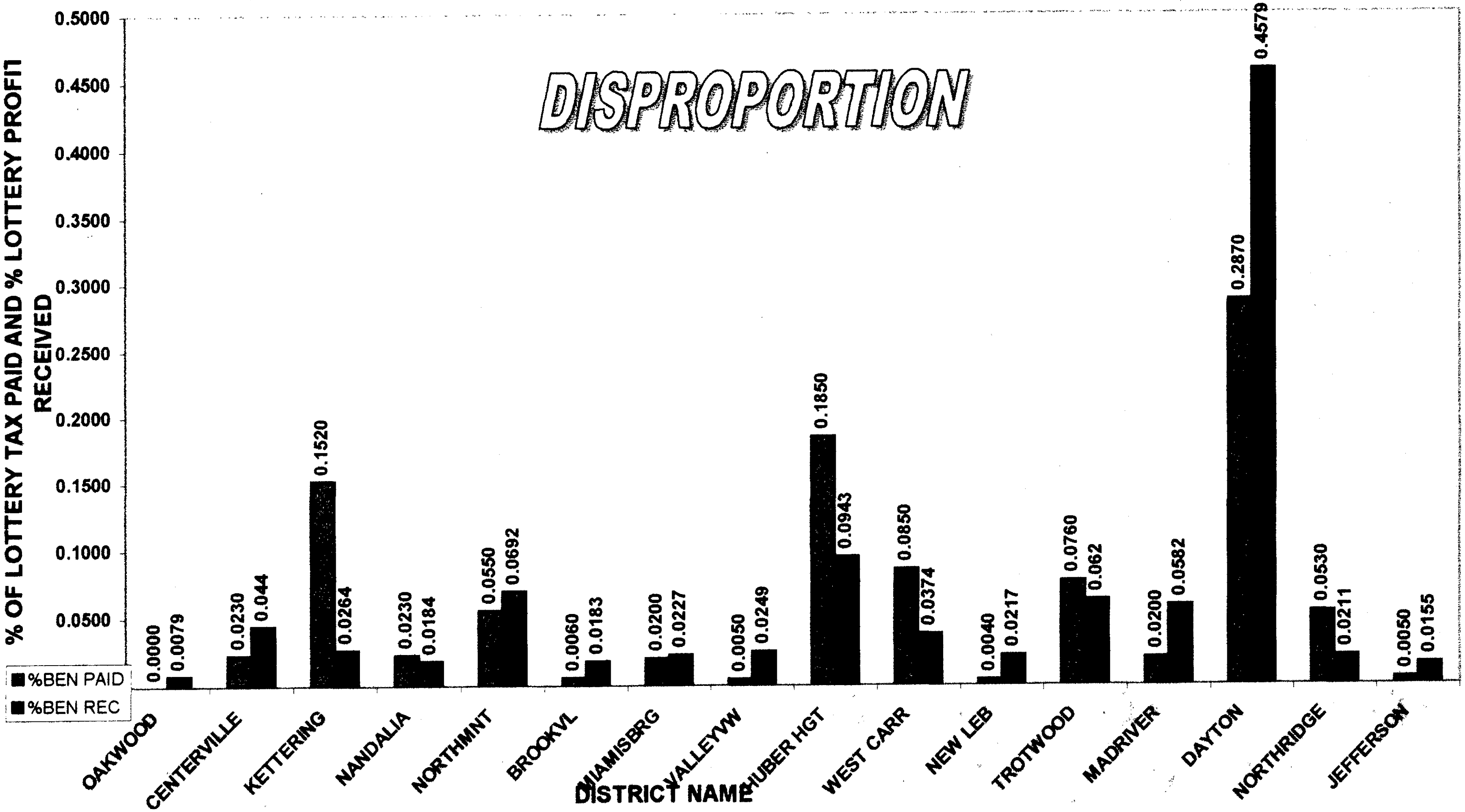

REDISTRIBUTION
MEASURE DISPROPORTIONALITY
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
DISTRICT NAME
OAKWOOD
CENTERVILLE
KETTERING
VANDALIA
NORTHMNT
BROOKVL
MIAMISBRG
VALLEYVW
WEST CARR
NEW LEB
TROTWOOD
MADRIVER
DAYTON
NORTHRIDGE
JEFFERSON
0.0079
0.0211
-0.1256
-0.0044
0.0147
0.0119
0.0029
0.0202
-0.0912
0.0174
-0.0139
0.0382
0.1708
-0.0321
0.0101

CHART 5


DISPROPORTION
% OF LOTTERY TAX PAID AND % LOTTERY PROFIT RECEIVED
0.5000
0.4500
0.4000
0.3500
0.3000
0.2500
0.2000
0.1500
0.1000
0.0500
%BEN PAID
%BEN REC
OAKWOOD 0.0000 0.0079
CENTERVILLE 0.0230 0.044
KETTERING 0.1520 0.0264
NANDALIA 0.0230 0.0184
NORTHMNT 0.0550 0.0692
BROOKVL 0.0060 0.0183
MIAMISBRG 0.0200 0.0227
VALLEYVW 0.0050 0.0249
HUBER HGT 0.1850 0.0943
WEST CARR 0.0850 0.0374
NEW LEB 0.0040 0.0217
TROTWOOD 0.0760 0.062
MADRIVER 0.0200 0.0582
DAYTON 0.2870 0.4579
NORTHRIDGE 0.0530 0.0211
JEFFERSON 0.0050 0.0155
DISTRICT NAME

Lottery participants can be categorized as either producers or consumers, neither of which is mutually exclusive or exhaustive. Recalling equation (2.1), the expected return from a lottery ticket is described by the following equation:

$$E(R) = (P)(R_m) + R_e \ .$$

The first term is associated with the risk involved in the redistribution by chance of the prize payout. The second term, however, is associated with the distribution of profits for education from the take-out tax. A redistribution arrangement of profits for education that involves risk is not assumed. What is assumed is a redistribution process that is consistent with public interest theory. As pointed out by Clottfelter et al, lottery players do give consideration to the fact that the take-out tax is used to provide a public good for their communities, and all the benefits associated with this alternative to traditional school funding, as well as the potential cash prize for their individual benefit. In Ohio, lottery profits provide funding for primary and secondary public schools.

Lottery Profits and Public Good

Presently lottery profits for education are appropriated such that school districts have much autonomy in deciding how their LPDs will

be used in their districts. The only restriction the state imposes is that lottery funding be used solely for the support of public elementary and secondary schools. In most districts lottery profits provide a feasible substitute for local school levies. In 1997, Montgomery County Lottery Profits for Education receipts were more than 20% of the real property taxes charged on average. Table 7 below shows the actual real property taxes and district lottery profits received for the school districts in Montgomery County. (Approximately 70 percent of real property taxes go to fund public schools.)

TABLE 7

DISTRICT LOTTERY PROFITS AND REAL PROPERT TAX LIABILITY

SCHOOL DISTRICT	LOTTERY PROFITS	REALTY TAX LIABILITY
BROOKVILLE	$ 599,337	$ 3,870,326
CENTERVILLE	1,438,371	30,545,390
DAYTON	14,966,293	55,336,897
HUBER HEIGHTS	3,082,344	15,531,089
JEFFERSON TWP	506,286	2,056,786
KETTERING	863,310	27,604,197
MAD RIVER	1,901,468	5,268,823
MIAMISBURG	741,726	14,375,336
NEW LEBANON	709,009	1,936,943
NORTHMONT	2,261,306	14,961,813
NORTHRIDGE	689,641	5,166,491
OAKWOOD	259,785	8,719,973
TROTWOOD	2,024,752	8,348,353
VALLEY VIEW	814,036	2,615,400
VANDALIA-BUTLER	600,450	13,094,585
WEST CARROLLTON	1,223,672	9,895,727

The net profit, NP_L, player's schools receive from lottery activity in their respective district is determined by

$$NP_L = [R - (PZ + N)]^{\delta} \quad (3.3)$$

Where:

R = Sales in district

PZ = Prize Payout in district

N = Administrative Cost and Operating Expense

δ = redistribution term

The term δ is the redistribution term and it is determined by

$$\delta = \frac{\ln(\text{realized profits})}{\ln[R - (PZ + N)]} \quad (3.4)$$

Where the denominator is the statutorily determined profit, and the numerator is the actual amount of profits received. The amount of subsidy or tax a district receives is determined by:

Tax/Subsidy = [1- (realized profit/statutory profit)] (statutory profit)

The redistribution term varies across districts, and its magnitude determines whether lottery profit generated in a district is taxed or subsidized. A district's effecive tax rate or take-out rate is determined by the following formula:

$$\text{Effective Tax Rate} = \frac{\text{Take-out} - \text{net profit to district}}{\text{TTS}} \quad (3.6)$$

According to the legislative history of the Ohio Lottery, the purpose of the lottery is to help districts improve their schools so that the students in the district will have educational opportunities equal to that of students in relatively affluent districts. Thus when a relatively affluent district is subsidized at the expense of a relatively poor district, the statutory intent is frustrated. Table 6, shows each instance where poor districts were taxed and affluent districts were subsidized. In the table the closer the measure of disproportion is to zero, the more proportional and equitable the tax, given the purpose of the lottery. Similar to traditional forms of local bases such as real property, the lottery tax derived in the district would then better serve its intended purpose, as revenue for the district's public schools.

Some Cost Associated With The Lottery

Statutory law requires that at least 50 percent of lottery revenue be returned to players in the form of prizes, and that at least 30 percent go to public primary and secondary schools. The remainder represents the total cost associated with collecting revenue for the lottery profits fund. Lottery agents are paid commissions at fixed rates: 5.5 percent of sales; 1.5 percent of prize payouts, PZ, which by statute average 50 percent of sales, so that this component of total cost equals .75 percent of sales (.015 * .6 * sales); thus commission

payments represent 6.25 per cent of sales. Lottery agents also receive an average of .05 percent of total lottery sales in bonuses for selling winning jackpot tickets. According to the report issued by Thompson, the cost associated with producing lottery products represents a specific tax of 5 cents. (In Ohio, lottery tickets can be purchased in increments as little as 50 cents or as much as $350 when a ticket has the maximum wager amount, number of wagers, and number of future drawings—a source of variability in total cost). The resultant combination of cost, prize, tax revenue, and redistribution parameters determine in part local marginal revenue to education in a district.

Community support of the lottery as a means of augmenting local tax bases varies across districts. Lack of support in some instances is associated with disincentives posed by government intervention which restricts the amount of lottery profits that a player or players' own schools can derive from the lottery. One disincentive is the state's double tax rule. Approximately half the states that operate lotteries exempt winnings from additional state income taxation. This policy has had positive impact on sales and the participation rate in those states. (Clotfelter, 167). Another disincentive in Ohio is that government intervention has undesirable redistributional effects. Some state laws prohibit using their state lottery as a base to

substitute G.R. funds rather than to supplement traditional sources of school funds. Id. In some states, the portion of lottery profits a school district recieves is proportional to the lottery revenue derived in the district. (National Commission). Since the purpose of the Ohio Lottery is to provide a means to get voluntary contributions for a public good from after-tax income—i.e., disposable income—it seems reasonable to expect that policies adopted in other states that had the affect of increased participation, and hence revenue, would be adopted by the Ohio Lottery.

IV. THE IMPACT OF THE LOTTERY TAX ON SOCIAL WELFARE

TRANSFERRING LOCAL WEALTH

According to public interest theory, a primary role of government is to institute regulations that are designed to eliminate deadweight loss. Dead weight loss can emerge from monopoly practices or illegal barriers to trade. In order to minimize deadweight losses, enforceable government regulatory policies that foster both economic equality and improved economic growth must be put in place.. The rapid growth in lottery sales is but one indication of lottery participant's ratification of the lottery as a less taxing means to provide support to their local schools, and hence, community. However, some supply-side effects are in some instances crowded out by the undesirable effects of redistribution policy. According to a recent report, "schools get less than 1 percent of lottery money." (Locher). As indicated in the Locher report, this obvious surprise created disincentives to use the lottery to augment local tax bases once the real price of LPD was realized. The loss in surplus would be lagged due to informational inefficiencies—i.e., the non-availability of low-cost information to consumers

regarding the portion of their contributions that their own local schools receive or the effective prices of LPDs, which by definition, determines the price players pay for the lottery product. Consumers should also be informed of the probability of winning a jackpot prize, the present value of the jackpot prizes,...etc..

Figure 4.1 shows the affect of what is essentially an increase in the take-out rate. For clarity, we assume there are only two school districts, T and O, and a school district's share of lottery profits is statutorily fixed and is proportional to lottery revenue generated in the district. Thus, (P^* - MC) is the initial and statutory constant of proportionality that represents marginal profit(I assume that fixed cost are sunk cost). Initially, players in district T allocate a percentage of their disposable income to lottery and purchase Q*lottery products. The resultant addition to T's tax base is represented by rectangle GJCA, the area (profits) of which is

$$\pi = (J - G)(A - G)$$

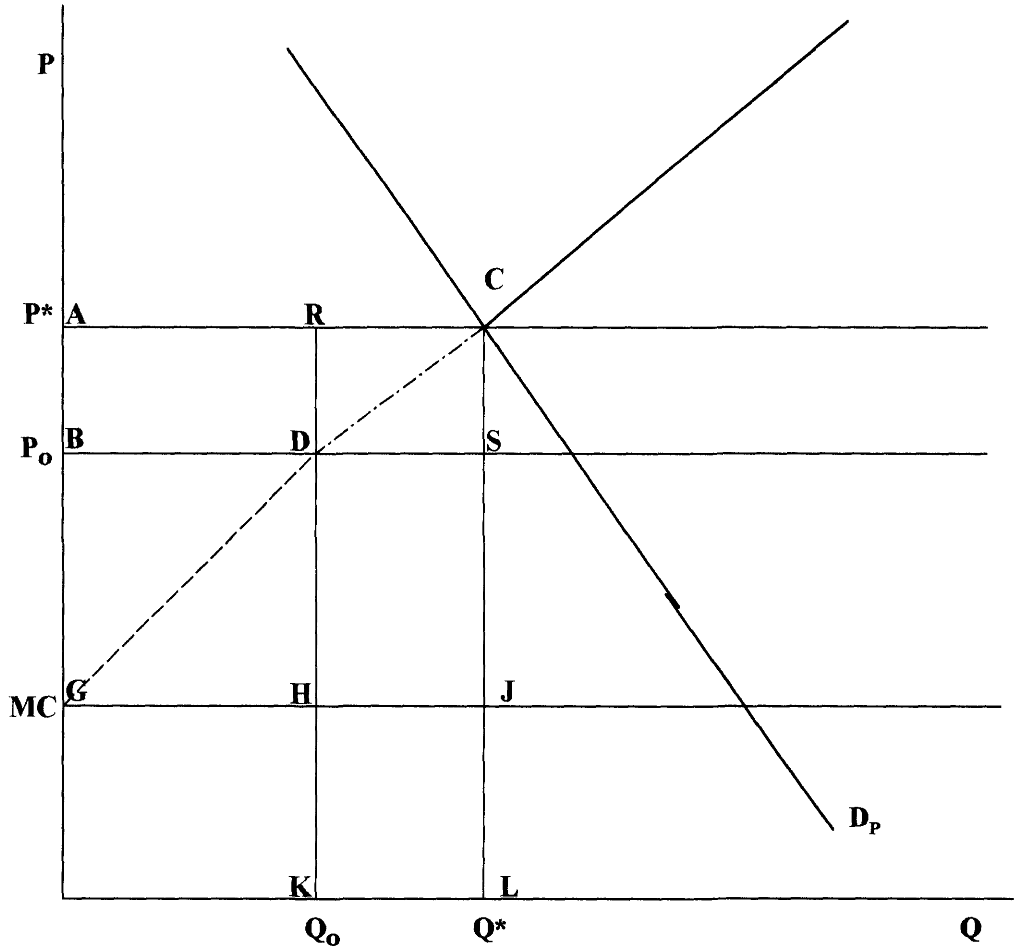
or

$$\pi = \int_0^{Q^*} [R'(Q) - C'(Q)]$$

Here, G = ATC = MC which is presumed to be statutorily fixed or constant (ATC ≈ .2 in Ohio). Also, A = P*, which is presumed to be

FIGURE 4.1

EFFECT OF PROFIT TAX



statutorily fixed ($P^* \approx .5$ in Ohio). Before redistribution, T's surplus , S_T, is represented by Δ CAG which is determined by:

$$S_T = .5(C - A)(A - G) \quad (4.2).$$

When the government levies an effective profit tax through redistribution of ($P^* - P_O$), the portion of T's demand schedule that accrues to T is then ($P^* - P_O$) below the statutory rate-- i.e., the state take-out rate has increased, and hence a decrease in the taxed district's tax base, by a constant of variation equal to $P^* - P_O$. T's increase in tax base declines to [(H – G)(B- G)] or rectangle GHDB. Surplus to T falls and equals Δ DBG. At P_O , the effective take-out is higher, T's player's will purchase only Q_O due to disincentives--i.e., price elasticity is less than one, E< 1. The welfare gains to other districts is rectangle BDRA. Deadweight loss in production and consumption is then equal to rectangle CRDS. Because of informational inefficiencies, the affect of the effective price increase will be lagged.

Moving Towards a More Regressive Tax Scheme

A second primary role of government is to provide subsidies to the needy. Typically, this is accomplished by transferring wealth from the wealthy to the poor. A plausible indication of a Ohio's policy to use

state lottery revenues as substitute general revenue funds is the present redistribution policy. As pointed out earlier, the purpose for the lottery is to enable poor districts to enhance their local tax bases. Given this intent, a reasonable redistribution policy would be one that enables poor districts to enhance their tax base such that they could circumvent a welfare trap. Referring back to figure 4.1, we assume again that only two districts, T and O, exist, and all other assumptions previously stated. The profit tax, indicated by rectangle ABDR becomes a subsidy to O, and total deadweight loss in production and consumption is equal to the area of rectangle CRDS.

The present allocation policy fails to mitigate deadweight loss or the free-rider problem. As pointed out by Morgan, simply asking each entity to voluntarily contribute to a public good to the degree possible results in underprovision. Keeping in mind that the purpose for the lottery is to provide poor districts a means to raise their local tax base, it seems quite contradictory to simultaneously take profits away by way of a redistribution scheme that extracts property rights from poor districts in order to subsidize still wealthier districts. Equation (3.1) should be a primary function of a taxing system in a market in which players are both producers and consumers. Additionally, regulatory policy should embrace both vertical equity and horizontal equity. Allowing school districts with relatively low tax

bases and above average school expenditures to circumvent a welfare trap in their endeavor to become more self-sufficient would provide long-run benefits to society. This is particularly the case when consideration is given to the costly externalities such as unemployment, higher propensity to commit crimes, need for public aid, ...etc. that are associated with lower student achievement.

Table 8.A shows another aspect of the problem with using a uniform and productivity neutral allocation function in a population in which the distribution of wealth and contributions are inversely skewed. Table 8.A gives districts' wealth profile. Columns 1 and 2 give a wealth index and average per capita wealth figure. Column 3 relates to Montgomery County, and shows each district's total contribution to education based on income tax payments, lottery payments, and real property tax payments. Average wealth is determined by

$$W_A = (P + I)/2$$

Where W_A = average wealth

P = per capita real property

I = per capita income.

The wealth index is the z-statistic and is determined by

$$z = (x - xbar)/\sigma.$$

TABLE 8.A **DISTRICT WEALTH PROFILE**

SCHOOL DSTRICT	WEALTH INDEX = Z-SCORE sum P&I WEALTH PERCAP	AVERAGE PER CAP WEALTH= (Y + P)/2 Y=incm P=proprty	TOTAL TAX TO ED.	percap Y to ed Before lotto tax	percap Y to ed after lotto	% of Y to ed before lotto	% OF Y to ed AFTER lotto	price
	1	2	3	4	5	6	7	8
JEFFERSON	-1.08	7,936	2,236,693	215	278	2.30%	2.96%	$1.00
DAYTON	-1.02	8,387	73,216,255	232	366	2.26%	3.57%	$1.80
MADRIVER	-0.94	9,008	6,594,267	182	254	1.65%	2.31%	$0.99
TROTWOOD	-0.76	10,347	14,085,072	288	581	2.36%	4.76%	$3.51
NORTHRIDGE	-0.75	10,452	9,058,414	325	723	3.25%	7.22%	$7.23
NEW LEBANON	-0.57	11,806	2,167,203	236	290	1.66%	2.03%	$0.56
WEST CARR	-0.27	14,082	16,793,248	318	606	1.91%	3.65%	$6.53
HUBER	-0.21	14,495	31,298,008	341	765	1.95%	4.37%	$5.63
VALLEY VIEW	-0.17	14,818	3,031,755	259	303	1.44%	1.68%	$0.54
BROOKVILLE	0.07	16,614	4,060,050	403	473	1.97%	2.31%	$1.00
NORTHMONT	0.09	16,794	18,694,393	422	580	2.06%	2.83%	$2.26
MIAMISBURG	0.28	18,239	14,512,197	415	476	2.15%	2.46%	$2.50
KETERING	0.45	19,524	41,131,855	436	667	1.86%	2.85%	$16.49
VANDALIA	0.57	20,455	13,873,851	507	599	2.23%	2.63%	$3.56
CENTERVILLE	1.77	29,508	33,371,427	672	718	1.75%	1.97%	$1.49
OAKWOOD	2.56	35,479	8,931,398	997	997	2.15%	2.15%	$0.00

Where x is the districts per capita average wealth, xbar is the county's mean average, and sigma is the county standard deviation. Columns 4 through 7 show districts' nominal contribution to education both before and after the gross lottery tax was factored in, and the resultant percentage of income contributed to education before and after the gross lottery tax, respectively. Column 7 shows districts' prevailing prices, some of the prices are shown in red to indicate the incidence of a profit tax , which will be discussed later. The districts are listed in ascending order by income.

In 1997, 89.5 percent of income tax payments received by the state of Ohio went to the general revenue fund, and of that amount , 16.4 percent went to education. (State of Ohio) Thus, a district's contribution from income is determined by:

$$I_C = (0.895)(0.164)T$$

Where I_C is the contribution to education from income, and T is the districts total income tax liability as stated in Column 7 of Table 2. Lottery tax contributions are the same as stated before. Property tax contributions are approximately 70 percent of the local property tax liability shown as the first item in column 10 of Table 2. (According to the state of Ohio's published material, 70 percent of the property tax payments go to schools.)

Though all districts in Montgomery County were subsidized with state basic and categorical aid from the General Revenue Fund of The State Ohio before the lottery tax (see appendix I), however, after the lottery tax was factored in, three districts—Huber, Kettering, and West Carrollton—made aggregate tax payments in excess of the basic and categorical aid they received from the state. (See appendix I for details). Lottery profits accounted for 24.3 percent of all districts' basic aid and categorical from the general revenue fund, regardless of district wealth index or the amount of profits produced in the district. This supports Clotfelter's contention that lotteries are designed to shift more of states' cost of providing public goods onto the poor—i.e., move from progressive taxation to regressive taxation.

Descriptive statistics are listed in Table 8.B As a result of the lottery tax, the mean per capita expenditure for education increased from 2% to 3% in Montgomery County. Before the lottery tax, the skewness coefficient was 1.45 and afterwards it was 1.9, suggesting a few districts extended their expenditure for education to relatively higher levels as a result of the lottery. Other indications of this is that before the lottery tax, the mean was only slightly above the median, and the coefficient of variation , C.V., was 19.4%; after the lottery tax was factored in, the mean was one percentage point above the median and the C.V. was 45.2 %, indicating that the increase in skewness was

TABLE 8.B DISTRICT WEALTH PROFILE STATISTICS

DISTRICT STATISTICS

1		2		3	
WEALTH INDEX		**AVERAGE PER CAP WEALTH**		**TOTAL DISTRICT TOTAL TO ED**	
POOR AB		*POOR AC*		*POOR AD*	
Mean	-0.7011375	Mean	10813.8125	Mean	19431145
Standard Error	0.115758048	Standard Error	876.2496583	Standard Error	8382881.526
Median	-0.7559	Median	10399.25	Median	11571743
Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	0.327413203	Standard Deviation	2478.408302	Standard Deviation	23710369.49
Sample Variance	0.107199406	Sample Variance	6142507.71	Sample Variance	5.62182E+14
Kurtosis	-1.150898255	Kurtosis	-1.150709711	Kurtosis	4.434031611
Skewness	0.520069465	Skewness	0.520108551	Skewness	2.052460287
Range	0.8664	Range	6558.5	Range	71049052
Minimum	-1.0813	Minimum	7936	Minimum	2167203
Maximum	-0.2149	Maximum	14494.5	Maximum	73216255
Sum	-5.6091	Sum	86510.5	Sum	155449160
Count	8	Count	8	Count	8

RICH AB		*RICH AC*		*RICH AD*	
Mean	0.7011625	Mean	21428.6875	Mean	17200865.75
Standard Error	0.337644686	Standard Error	2555.794149	Standard Error	4811698.399
Median	0.36465	Median	18881.5	Median	14193024
Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	0.95500339	Standard Deviation	7228.877496	Standard Deviation	13609538.27
Sample Variance	0.912031474	Sample Variance	52256669.85	Sample Variance	1.8522E+14
Kurtosis	0.907475354	Kurtosis	0.907297471	Kurtosis	-0.189496502
Skewness	1.391897971	Skewness	1.391838415	Skewness	0.92196512
Range	2.7295	Range	20661	Range	38100100
Minimum	-0.1722	Minimum	14817.5	Minimum	3031755
Maximum	2.5573	Maximum	35478.5	Maximum	41131855
Sum	5.6093	Sum	171429.5	Sum	137606926
Count	8	Count	8	Count	8

TABLE 8.B (CONT)

4 PER CAP TAX BEFORE LOTTO		5 PER CAP TAX AFTER LOTTO		6 % OF INCOME TO ED BEFORE LOTTERY ADDIN	
POOR AE		*POOR AF*		*POOR AG*	
Mean	267.125	Mean	482.875	Mean	0.021675
Standard Error	20.70061895	Standard Error	74.07294607	Standard Error	0.0018293
Median	262	Median	473.5	Median	0.02105
Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	58.55019214	Standard Deviation	209.5099299	Standard Deviation	0.005174042
Sample Variance	3428.125	Sample Variance	43894.41071	Sample Variance	2.67707E-05
Kurtosis	-1.683713465	Kurtosis	-2.042351931	Kurtosis	2.369678787
Skewness	-0.089346044	Skewness	0.201991174	Skewness	1.350493971
Range	159	Range	511	Range	0.016
Minimum	182	Minimum	254	Minimum	0.0165
Maximum	341	Maximum	765	Maximum	0.0325
Sum	2137	Sum	3863	Sum	0.1734
Count	8	Count	8	Count	8

RICH AE		*RICH AF*		*RICH AG*	
Mean	513.875	Mean	601.625	Mean	0.0195125
Standard Error	80.17802458	Standard Error	72.7171471	Standard Error	0.00092494
Median	429	Median	589.5	Median	0.02015
Mode	#N/A	Mode	#N/A	Mode	0.0215
Standard Deviation	226.7776995	Standard Deviation	205.6751513	Standard Deviation	0.002616124
Sample Variance	51428.125	Sample Variance	42302.26786	Sample Variance	6.84411E-06
Kurtosis	2.836429519	Kurtosis	1.444420382	Kurtosis	0.906219387
Skewness	1.577427431	Skewness	0.720479489	Skewness	-1.10514897
Range	738	Range	694	Range	0.0079
Minimum	259	Minimum	303	Minimum	0.0144
Maximum	997	Maximum	997	Maximum	0.0223
Sum	4111	Sum	4813	Sum	0.1561
Count	8	Count	8	Count	8

TABLE 8.B (CONT)

7 PERCENT OF INCOME TO ED AFTER LOTTO		8 PRICE	
POOR AH		*POOR AI*	
Mean	0.0385875	Mean	3.40625
Standard Error	0.005832374	Standard Error	0.96032163
Median	0.0361	Median	2.655
Mode	#N/A	Mode	#N/A
Standard Deviation	0.016496444	Standard Deviation	2.716199748
Sample Variance	0.000272133	Sample Variance	7.377741071
Kurtosis	1.858056534	Kurtosis	-1.918472507
Skewness	1.198686111	Skewness	0.40059072
Range	0.0519	Range	6.67
Minimum	0.0203	Minimum	0.56
Maximum	0.0722	Maximum	7.23
Sum	0.3087	Sum	27.25
Count	8	Count	8

RICH AH		*RICH AI*	
Mean	0.0236	Mean	3.48
Standard Error	0.001466897	Standard Error	1.901971721
Median	0.02385	Median	1.875
Mode	#N/A	Mode	#N/A
Standard Deviation	0.00414901	Standard Deviation	5.379588407
Sample Variance	1.72143E-05	Sample Variance	28.93997143
Kurtosis	-0.841707527	Kurtosis	6.94187413
Skewness	-0.37598529	Skewness	2.579843708
Range	0.0117	Range	16.49
Minimum	0.0168	Minimum	0
Maximum	0.0285	Maximum	16.49
Sum	0.1888	Sum	27.84
Count	8	Count	8

TABLE 8.B (CONT)

COUNTY STATISTICS

WEALTH INDEX		AVERAGE PER PER CAPITA WEALTH		TOTAL TAX TO ED	
1		2		3	
wlthindx		*avgpcwlth*		*tottx to ed*	
Mean	1.25E-05	Mean	16121.25	Mean	18316005.38
Standard Error	0.250003311	Standard Error	1892.415265	Standard Error	4677830.986
Median	-0.19355	Median	14656	Median	13979461.5
Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	1.000013244	Standard Deviation	7569.661058	Standard Deviation	18711323.94
Sample Variance	1.000026488	Sample Variance	57299768.53	Sample Variance	3.50114E+14
Kurtosis	1.940994241	Kurtosis	1.940775639	Kurtosis	4.176118431
Skewness	1.395072281	Skewness	1.395017734	Skewness	1.915030763
Range	3.6386	Range	27542.5	Range	71049052
Minimum	-1.0813	Minimum	7936	Minimum	2167203
Maximum	2.5573	Maximum	35478.5	Maximum	73216255
Sum	0.0002	Sum	257940	Sum	293056086
Count	16	Count	16	Count	16

TABLE 8.B(CONT)

TAX BEFORE LOTTERY	4	TAX AFTER LOTTERY	5	% OF INCOME BEFORE LOTT	6
B4TX		*AFTR TX*		*%B4*	
Mean	390.5	Mean	542.25	Mean	0.02059375
Standard Error	51.13446326	Standard Error	52.43182081	Standard Error	0.001028772
Median	333	Median	580.5	Median	0.02015
Mode	#N/A	Mode	#N/A	Mode	0.0215
Standard Deviation	204.5378531	Standard Deviation	209.7272832	Standard Deviation	0.004115089
Sample Variance	41835.73333	Sample Variance	43985.53333	Sample Variance	1.6934E-05
Kurtosis	4.618243924	Kurtosis	-0.225804731	Kurtosis	4.059505926
Skewness	1.966448769	Skewness	0.335957454	Skewness	1.454869637
Range	815	Range	743	Range	0.0181
Minimum	182	Minimum	254	Minimum	0.0144
Maximum	997	Maximum	997	Maximum	0.0325
Sum	6248	Sum	8676	Sum	0.3295
Count	16	Count	16	Count	16

TABLE 8.B(CONT)

COUNTY STATISTICS

% OF INCOM TO ED AFTER LOTTO		PRICE	
7		8	
%AFTR		price	
Mean	0.03109375	Mean	3.443125
Standard Error	0.003490421	Standard Error	1.029250827
Median	0.0273	Median	2.03
Mode	0.0231	Mode	1
Standard Deviation	0.013961684	Standard Deviation	4.117003309
Sample Variance	0.000194929	Sample Variance	16.94971625
Kurtosis	4.281332126	Kurtosis	6.59372806
Skewness	1.910026145	Skewness	2.366519304
Range	0.0554	Range	16.49
Minimum	0.0168	Minimum	0
Maximum	0.0722	Maximum	16.49
Sum	0.4975	Sum	55.09
Count	16	Count	16

attributable to the fact that a few districts were pulling up the mean by extending their expenditure for education significantly further above the rest of the districts in Montgomery County. Some of these districts are poor.

After dividing the county into two sub-groups based on wealth, the statistics show that as a result of the lottery, among the 8 districts with wealth indices below the county median of –1.935, the mean percentage of income allocated to education increased by 1.69 percentage points from 2.17 to 3.86. On the other hand, for districts that ranked in the upper 50 percentile range, the increase was only 0.41 percentage points, moving from 1.95 to 2.36 percent of income—an indication of regressive taxation. The C.V. of the wealthier group was 17% verses that of 43% in the poorer group. This indicates that the lower mean expenditure rate for the wealthy became more peaked or concentrated around the mean for the distribution of the wealthier districts' expenditure rates as a result of the lottery. Further support of this is that their was a significant decrease in the skewness coefficient from –1.05 to -.37. The increased allignment of the mean and median for the wealthy group suggests that the few districts that were pulling the average down before the lottery—Kettering, for instance—increased their relative expenditure, via lottery tax, and the overall result was a somewhat normal distribution of relatively lower

expenditures among the wealthy districts. This is also indicated by the kurtosis figure.

With reference to the portion of income allocated to education among the 8 poorest groups, both the standard deviation and the C.V. virtually doubled. Coupling this with the significant misalignment of the mean and median that resulted from the lottery tax, and the resultant skewness factor, is an indication that a few districts' education expenditure levels are significantly higher than other districts and thus are pulling up the mean. The decrease in kurtosis is also an indication of this. Thus, an apparent impact of the lottery has been a more regressive taxing scheme, with some instances of extreme regressiveness.

The increase in regressiveness due to voluntary lottery contributions is not in and of itself an indication of inequity or a decrease in social welfare. In some instances, no doubt, players believed they were contributing to their own local schools, exclusively, to increase their own local tax base, and to provide additional and well needed funding to their local schools by alternative means—i.e., an alternative to a school levy. Here, the issue of inequity is not only rooted in the relative expenditures. The equity issue has to do with vertical and horizontal equity, and the effect of government intervention and the resultant disparities in marginal benefits from

lottery contributions. Column 8 of Table 8.A shows prices, and hence returns (Q/TR).

A consequence of the present redistribution policy can best be summed up as violation of both vertical equity and horizontal equity. As shown in Table 8.B, there is negligible differences between the average prices of the two groups. However, as indicated by the coefficients of variation, CV, mean-median differentials, and the coefficient of skewness differentials, the magnitude and incidence of tax is greater among the low-income school districts. The relative magnitude of the CV of the low-income group indicates that the higher average price is more representative of the price of a LPD in low income districts. It is noteworthy that Kettering, which represents 20.6% of the population in Montgomery County, appears to be an outlier where prices are concerned, and is the primary cause of the higher C.V. in the upper income group, and is pushing up the mean price. Removing Kettering makes it all the more clear that the incidence of tax is higher among the relatively poor districts. It should be recalled from Chart 2.B and column 3 of Table 5 that less than 40 percent of Montgomery County's population owns 58 percent of the county's wealth, and that districts in the lower 50 percentile range produced approximately 72% of the lottery profits.

Another point that should receive attention is that while the lower wealth districts received 76 percent of the lottery profits, the incidence of subsidy was relatively low. The primary beneficiary of subsidies received in the low wealth group was New Lebanon. It should also be noted that New Lebanon's wealth index is above the median index of –0.7559 for the low-income districts. In fact, three out of the five districts with a wealth index below that of New Lebanon's were taxed rather than subsidized. In addition, approximately 40 percent of the districts in the high income group received subsidies while 62.5 percent of poor districts were taxed. These results do not parallel a redistribution policy that would be consistent with the legislative intent expressed in the lottery's legislative history. The result is horizontal and vertical inequity.

Economic Bungling via Externalities

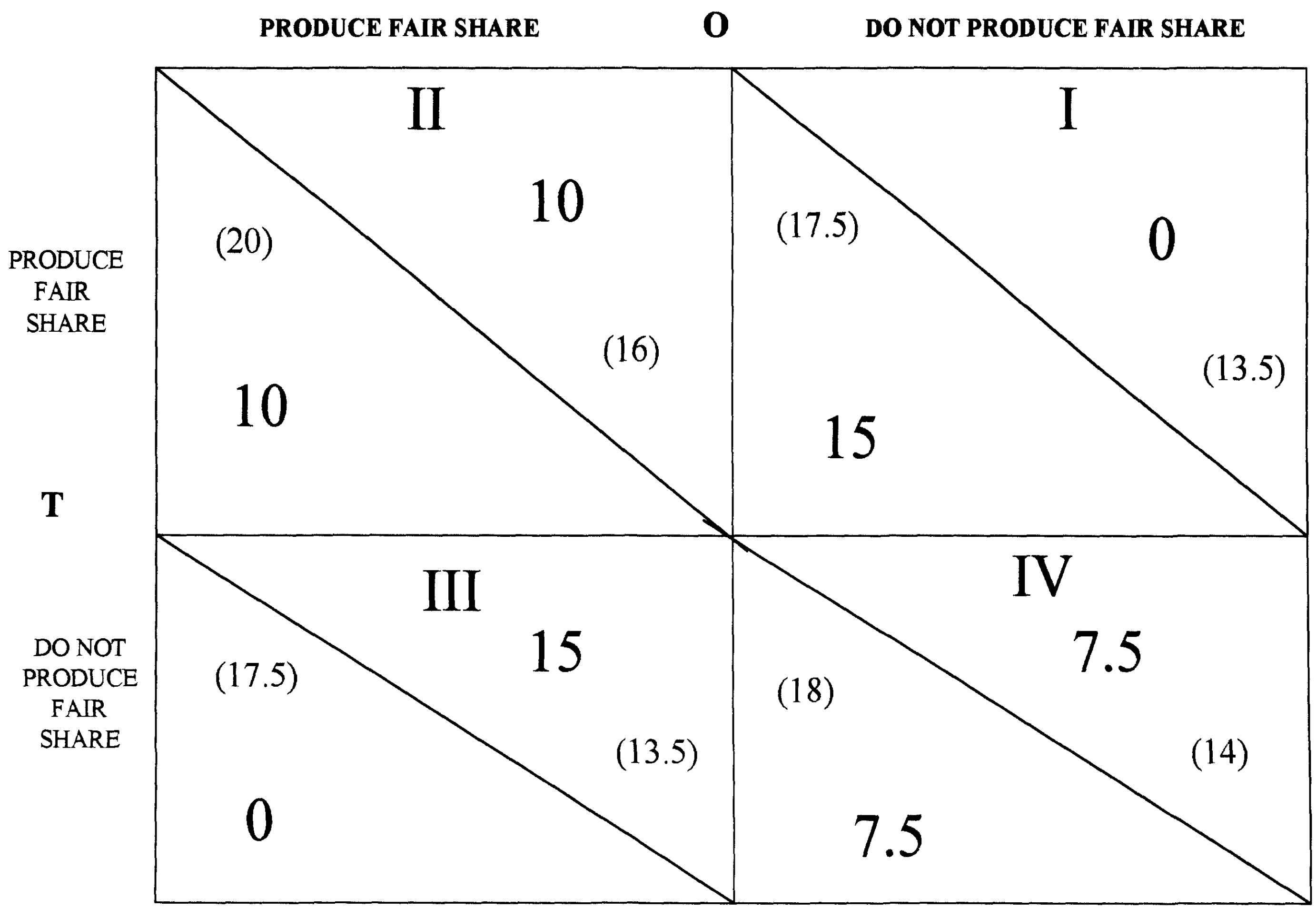
Externalities exist when producers or consumers do not bear the full marginal cost or enjoy the full marginal benefit of their economic activities. A primary reason externalities emerge is that there is insufficient coordination of the activities of agents or the lack of well defined property rights. This lack of coordination can lead to market failure when externalities are significantly large, and would likely require internalization of externalities through government intervention. Government intervention typically involves spreading

the cost of enforcing property rights, and collectively can become quite costly to society in the form of higher taxes under the progressive tax function. One way to avoid coordination problems or market failure is to open the doors of communication between agents regarding property rights and the extent to which they should be protected in a capitalist economy. This would promote social welfare and obviate high transaction costs that might otherwise occur.

The Nash payoff matrix depicted in figure 5 shows 4 possible outcomes that might occur in the absence of coordination and communication between two economic agents, imaginably representing two districts. Each quadrant represents a particular equilibrium level of output and costs (MC = MPP=1) to each agent is shown in large integers, and each of two district's aggregate additional school funding (shown in parentheses) with a uniform 1% school levy being supplemented by lottery funding under present redistribution policies. In each quadrant, the wealthy district is relatively better off than the poor district. Output is highest in quadrant II, where each agent is producing 10 units. Quadrant II provides the highest payoff possible for both districts. However, the payoffs in quadrants I and III are not deterrence to the free rider problem if opportunity costs differ significantly. While there is some incentive to produce, there is incentive for one district to exploit or

FIGURE 5

PAYOFF MATRIX



abuse the other, and either event is equally likely without enforceable property rights. The determinant of the outcome rests mainly on the elasticities of demand, each district's opportunity cost, and the type of government intervention that will take place with each of the four outcomes. An important policy objective, then, should be to regulate the market only to the degree necessary and such that the outcome will parallel the preference of the mass of the community, and promote economic growth and equality. To that end, interactive communication in which input is taken from stratified groups to ensure the production of an agreement in which property rights are well defined for a free market. The invisible hand will handle the rest if it is not constrained.

The Cournot model depicted in Figure 6 shows the workings of a market in which initially there are poorly defined property rights and poor or no communication between two entities. Again, in figure 6, we assume that there are only two districts, T and O, each of which has monopoly output of 15 and predatory output of 30. A principal assumption of the Nash equilibrium is that each entity is doing the best that it can given what its competitor is doing. In addition to of the principal assumption of Nash equilibrium, a behavioral assumption of the Cournot model is that each entity takes the others output as constant. Figure 6 shows the dynamic process of

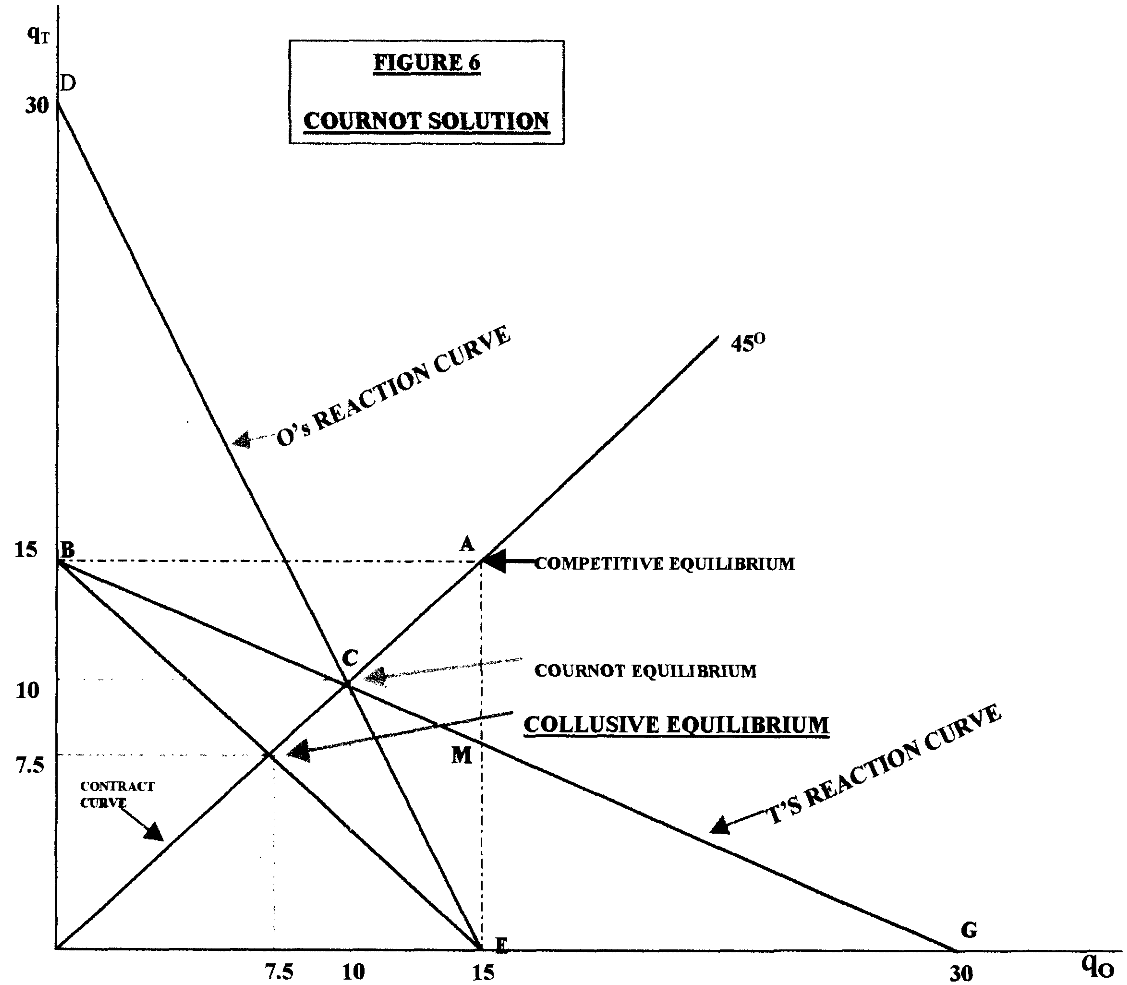


FIGURE 6
COURNOT SOLUTION
q_T
D
30
O's REACTION CURVE
45°
15
B
A
COMPETITIVE EQUILIBRIUM
C
COURNOT EQUILIBRIUM
10
COLLUSIVE EQUILIBRIUM
7.5
M
T'S REACTION CURVE
CONTRACT CURVE
E
G
7.5
10
15
30
q_O

adjustments that lead to the Cournot equilibrium. Each district is assumed to be faced with the same profit maximizing output:

$$Q^*_T = (a - Q_O)/2 \qquad 4.4$$

Equation 4.4 can be restated as

$$Q^*_O = (a - Q_T)/2 \qquad 4.5$$

The equilibrium outputs are given by their simultaneous solution known as the Cournot Equilibrium:

$$Q_O = Q_T = a/3. \qquad 4.6$$

Here, Q^*_T is T's market demand curve , given what T thinks O will continue to do, and Q^*_O is the share of the market O assumes based on what it thinks T will continue to produce. Variable (a) represents the capacity of both firms.

In figure 6, which relates to equation (4.4), we assume once again that there are only two districts, T and O. Line BG is district T's reaction curve and DE is district O's reaction curve. The reaction curves are the set of points that correspond to the district's perspective of its share of the market. Each district independently chooses its optimal level of production assuming that the other's is fixed. Here output equals cost as well as benefits. In figure 6, when O thinks district T will produce nothing, O expands output along DE to

point E, and it produces its monopoly output 15. T then enters the market mistakenly assuming that O will continue to produce 15, and thus T moves along segment GM of its reaction curve and produces 7.5 units indicated by point M. But O then assumes T's output is fixed and reacts by moving along segment EB of its reaction curve adjusting its output level down to 10, which corresponds to point C. T reacts by adjusting its output along segment MC up to 10 at point C. Point C is the Cournot equilibrium point, to which agents were moved by the invisible hand. The Cournot equilibrium is on the 45-degree line; however , monopoly output of only 15 is still possible if T and O collude. Once player's realize their true demand function due to the rate of taxation and hence price they are each paying and the redistribution to others in and out of their district, they may collude and demand higher returns from R_m or R_e, or simply jointly produce monopoly output, which would lead to government intervention in the form of higher taxes to take up the slack and spread the cost of education across all beneficiaries. Another outcome might be that one or the other would independently produce zero assuming the outcome in quadrant I or III in the payoff matrix. Government intervention should then also be invoked to internalize the externalities caused by free riding and deadweight losses.

The Cournot model shows that the market is dynamic and self adjusting, as economic agents act to maximize their own profit; however, agents sometimes ignore the external cost of their actions, which may impose the free rider problem, or dead weight associated with collusive contracts. When property rights are clearly defined, however, external cost are internalized by the agent imposing cost--- i.e. the agent that receives the external benefit ultimately pays in one form or another. So, then, economic agents are interdependent, because efficiency requires agents to incorporate external cost and benefits into their private cost benefit analysis. Information efficiency, though, is essential .

As pointed out by Clotfelter, in spite of the morality issues some have with lotteries, lotteries do generate revenue, in a manner that many taxpayers obviously find enjoyable and less taxing than a compulsory tax. The issue, then, is whether poor school districts can increase their relative local bases while surplus that could make a significant difference in their own communities is being extracted. Government regulations should involve regulating market risk and compliance with the expressed legislative intent, and maintaining a free market. As advocated in most research involving an examination of lottery operations, the best way to off-set the regressivness of the lottery tax would be a return of profits to the

players. One way to do this would be to make lottery profit share a function of lottery production share. Some states, California for insance, prohibit the use of lottery profits as substitutes for general revenue. Substituting lottery profit for general revenue is, in affect , double-taxing. A feasible solution would be to treat districts' property rights in lottery profits in a manner similar to that of their property rights in other local factors that form a districts' tax base, such as real property. Schools in a district would then have the exclusive right to the lottery contributions collected from their residents, and the expressed legislative intent would be realized. Under such a policy, all districts would enjoy the same marginal cost and marginal benefits from the lottery.

Some Effects of Status Quo Redistributional Policy

The various school districts in Montgomery County are not equally endowed. Each district has its own set of needs and objectives that are as unique as the population its schools serve. A redistribution policy that provides subsidies for some districts at the expense of less endowed districts produces a two-fold disparity. Not only is the taxed district displaced from its pre-tax status, but the original endowment differential broadens by twice the amount of the tax levied against the poorer district. When the schools in the taxed school district have special or unique needs in order to meet the demands of their task, the

welfare loss becomes increasingly and insidiously augmented. One case and point is the unique needs and objectives of the schools in Dayton City School District, which has taken charge of educating the county's most diverse student body. Along with this diversity comes a unique set of needs, and involves internalizing externalities or problems unique to that district.

Column 5 of Table 6 is a list of districts' disproportion indices that resulted from the present redistribution policy. Entries in red indicate a tax based on the aggregate LPDS actually received in Montgomery County rather than the statutory amount. The closer an index is to zero, the less the disproportion and the more equitable, given the purpose of the lottery. Column 4 of Table 8.C gives the amount of the tax or subsidy received, a positive figure indicates a tax was levied on the district, a negative number indicates the district received a subsidy, based on the statutory amount of at least 30 percent of sales. As indicated , Dayton shared less in the profits than it did in the production of lottery revenue. Yet other districts with an appreciably higher wealth profile received a subsidy. The most economically wealthy district—in every sense of the word -- and within whose boundary lines no lottery profits were generated—-also received a subsidy.

TABLE 8.C

DISTRIBUTIONAL EFFECTS: TAX OR SUBSIDY

SCHOOL DISTRICT	1 TAKEOUT PAID (IN THOUSANDS)	2 LOTTERY RECEIPTS (IN THOUSANDS)	3 PROFIT EXPECTED (IN THOUSANDS)	4 (COL. 3 - 2) TAX/SUBSIDY (IN THOUSAN)	5 PROF TAX COL 4/3
OAKWOOD	0	260	0.00	-260	UNDEFIND
CENTERVILLE	2,145	1438	1,496	58	3.88%
VALLEY VIEW	439	814	307	-507	-165.15%
MIAMISBURG	1,852	742	1292	551	42.65%
BROOKVILLE	602	599	420	-179	-42.62%
NEW LEBANON	401	710	279	-431	-154.48%
VANDALIA	2,137	600	1,497	890	59.45%
MAD RIVER	1,874	1901	1,307	-594	-45.45%
JEFFERSON TWP	507	506	354	-152	-42.94%
NORTHMONT	5,104	2261	3,561	1299	36.48%
KETTERING	14,236	863	9,932	9069	91.31%
DAYTON	26,884	14966	18,756	3790	20.21%
WEST CARROLLTON	7,996	1224	5,578	4354	78.06%
TROTWOOD	7,104	2025	4,956	2932	59.16%
HUBER HGTS	17,366	3082	12,116	9034	74.56%
NORTHRIDGE	4,986	690	3,479	2789	80.17%
TOTALS:	93,633	32,683	65,330	32,648	49.97%

The real irony has to do with the fact that Dayton City players have been double taxed, even though the district had a mounting budget deficit at the time millions in lottery profits flowed out of the district. Because of the budget deficit, an unconscionable burden has been shifted onto the district's teachers, administrator's, and other personnel. In some cases administrators must work from six o'clock in the morning to eleven o'clock at night at the building in order to meet with both working and non-working parents, and provide students with extra needed support. In addition to the long hours that teachers have traditionally worked between school and home, they must also deal with the growing spillover effects of an array of externalities in their classrooms, as well as meet with the parents or guardians of students much more frequently. The deficit--which most conceivably would not have emerged had Dayton City received its fair share of lottery profits in the first place-- stems from both the district's low tax base and the inability of city hall to collect tax payments due from absentee landlords. Thus, even if voters support a levy it is not likely that the district will collect all of the taxes that become due. As a consequence of under-funding; teachers, administrators and, most importantly the student body, whom the district is entrusted to lead, are being forced to perform their respective duties in the learning process under unconscionable

conditions. The reductions in faculty and staff has made it increasingly more difficult to meet the needs of the student body.

Because of the growing spillover effects from externalities that the district is being forced to internalize, far too many administrators and teachers were let go. This has created a setback and a major obstacle to meeting the needs and rights of the student body. Some members of the community have had to take their children out of the public schools and put them into the private schools. In most instances, the tuition they pay to private institutions is equal or more than the tax that they had already paid to ensure that their children go through the educational process under reasonable conditions, and similar to that of students in other districts. Other parents are being successful in using public funds to escape the problems by working to proliferate more charter schools which serve a non-stratified group from the student body. Frustration has caused some teachers to leave their assignments, or leaving their profession altogether, because of the extreme difficulty involved in serving their students in a manner that will ensure that they will be able to meet marketable standards under present policies.

The rippled effects of transferring funds from poor districts to wealthier districts is becoming exceedingly large in size and number.

To penalize a district for trying to improve its local tax base, and hence the academic as well as moral standards of its youth, creates deadweight losses, particularly in light of the long run trickle out effect that would be shifted to the community at large. Given the legislative intent expressed in the legislative history of the lottery, there are clear indications that the affects of the present redistribution policy are incongruous with the legislative intent. An essential policy objective should be to provide schools with a fair opportunity to use all of their property rights from all legal sources to improve their schools and help students reach higher levels of achievement. This can not be accomplished under policies that help create large student-educator ratios and at the same time extract surplus from the district in order subsidize districts that are capable of more easily raising their own local funds.

Educator Utility

Teachers and administrators derive utility from the number of students that successfully get through the education system with a marketable knowledge base and social moral base ,X, Y units of consumer goods and H hours of leisure. Educators aid in the production of X^E marketable students, X of whom become productive adults in the community, consume Y units of consumer goods, and allocate H hours to leisure. In this model I assume that

educators' utility function is homothetic and weakly seperable in g(X,Y) and H. The subutility function g is assumed to be homogeneous of degree one in X and Y:

$$U^E = U[g(X,Y); H] \quad 4.7$$

Subject to the constraint:

$$g = e/\delta = y \quad 4.8$$

$$H = T - L \quad 4.9$$

Where:

U^E = Educator utility

X = Welfare gains from seeing former student as productive adult in community

Y = units of consumer goods purchased from other professionals in community

H = Number of leisure hours

T = Total hours available to educators (24 hr per day)

L=Total hours allocated to planning activities, teaching, nurturing, and providing support to their students

e = educators total expenditure or utility from labor

y = real income

δ = index of negative social externalities that are shifted onto educators by the rest of the community that requires educators to work many more hours for the same pay and is conducive to

a higher failure rate of youth academically, socially, and morally; as well as unsafe conditions in the schools.

Equation (4.7) can be restated as:

$$U^E = U[y; T\text{-}L] \qquad (4.10)$$

Substituting e/δ for y we get

$$U^E = U[e/\,\delta; T - L] \qquad (4.11)$$

Educators maximize (4.10) subject to:

$$e = W_X X^E(L)$$

Where $X^E(L)$= number of successful students produced by educators and the production of X^E depends on the number of hours, L, educators must allocate to labor.

W = wage rate which encompasses the utility educators derive from student success

Substituting $W_X X^E(L)/\,\delta$ for $e/\,\delta$ (2.5) can be rewritten without constraint as:

$$U^E = U[W_X X^E(L)/\,\delta\,; T - L] \qquad (4.12)$$

Educators maximize (4.12) with respect to L and the first order condition would be:

$$\frac{\partial U^E}{\partial L} = \frac{\partial U}{\partial y} \cdot \frac{W_x X^E{}_L}{\delta_i} - \frac{\partial U}{\partial H} = 0 \qquad (4.13)$$

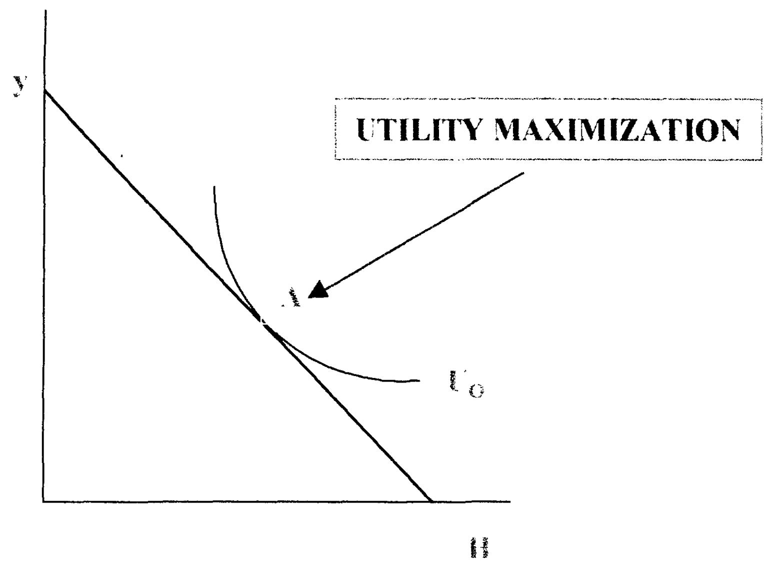
or

$$U_H/U_Y = W_X X^E{}_L / \delta_I \qquad (4.14)$$

Equation (4.13) gives the first order condition for optimization, and defines the optimal number of L and H. The left hand of equation (4.13) is the subjective rate of substitution, or the marginal utility of an hour of labor, L. The first term on the right hand side is the marginal utility of y, the number of successful students and money income that can be derived from an addition hour of labor under present policies. The second term on the right is the marginal utility from an additional hour of leisure. The marginal rates of substitution are also stated in equation (4.4) The optimal level of utility for educators is shown in figure 7 as point A.

FIGURE 7

EDUCATOR UTILITY MAXIMIZATION



Education Production Function

Educators have some—but limited—influence over certain exogenous factors or the spillover effect they have in to the educational process. These factors originate outside of school but influence student's performance in school. When students give educators confidential information about their personal living arrangements, educators necessarily become involved. Some of the factors that influence student productivity are negligent or abusive parents (domestic violence), drugs, students being required to work hours and longer hours than the law allows, teenage pregnancy,...etc.. As social anomalies increase, more educators are needed and educators need more time to nurture, counsel, discipline and otherwise attend to the special needs of affected students. Sometimes the effect of social anomalies are expressed as student misbehavior in the classroom. This surely takes away from teacher's' instruction time, and detracts from the learning of other students in the class. Anomalies require teachers to sometimes refer students to administrators. As the anomalies increase, more—not fewer—administrators are needed. Thus, when there is a reduction of teachers and administrators, the remainder of the faculty and staff must try to take up the slack—which can become overwhelming—by working longer hours. Sometimes the externalities are of such a large

magnitude that it becomes impossible, in the legal sense, for equilibrium to occur at a desirable academic or moral standard.

The exogenous anomaly enters into the education production function as H. The anomaly function can be expressed as

$$H = h[\ m;\ \theta;\ \gamma]$$

Where h is the original level of anomaly, θ is a list of social anomalies, m is the number of students influenced, and γ is the impact term. Thus the Cobb Douglas production term becomes

$$Y = AH^{\Psi}(MX)^{\alpha}K^{\beta}$$

Where Ψ, α, and β are fractions and Ψ carries negative factor(-1). A is the usual constant and positive integer, M is the number of students influenced by the anomaly, X is the number of students not initially affected. The grouped factor (MX) shows the spillover or externalities of anomaly from those students with influence on those initially without it. So that $[(-\Psi + \alpha) + \beta]$ gives the returns to scale of the production process. The factor K here is capital which includes learning aids-teachers, textbooks, visual aids, computer technology,...etc.

The effectiveness of the factors are essentially determined by the policy decisions of policymakers and district administrators. It is important to recognize that the outputs of the educational process become leaders in the next generation. Therefore, the long run welfare of the community at large depends on choices made today. The cost of the necessary remedial action necessary to eliminate H from the production function should be shared by the community at large—not just educators. Thus the policy to transfer lottery profits generated in the Dayton City School district--or any other school district--to districts that are more endowed is inconsistent with pareto optimum.

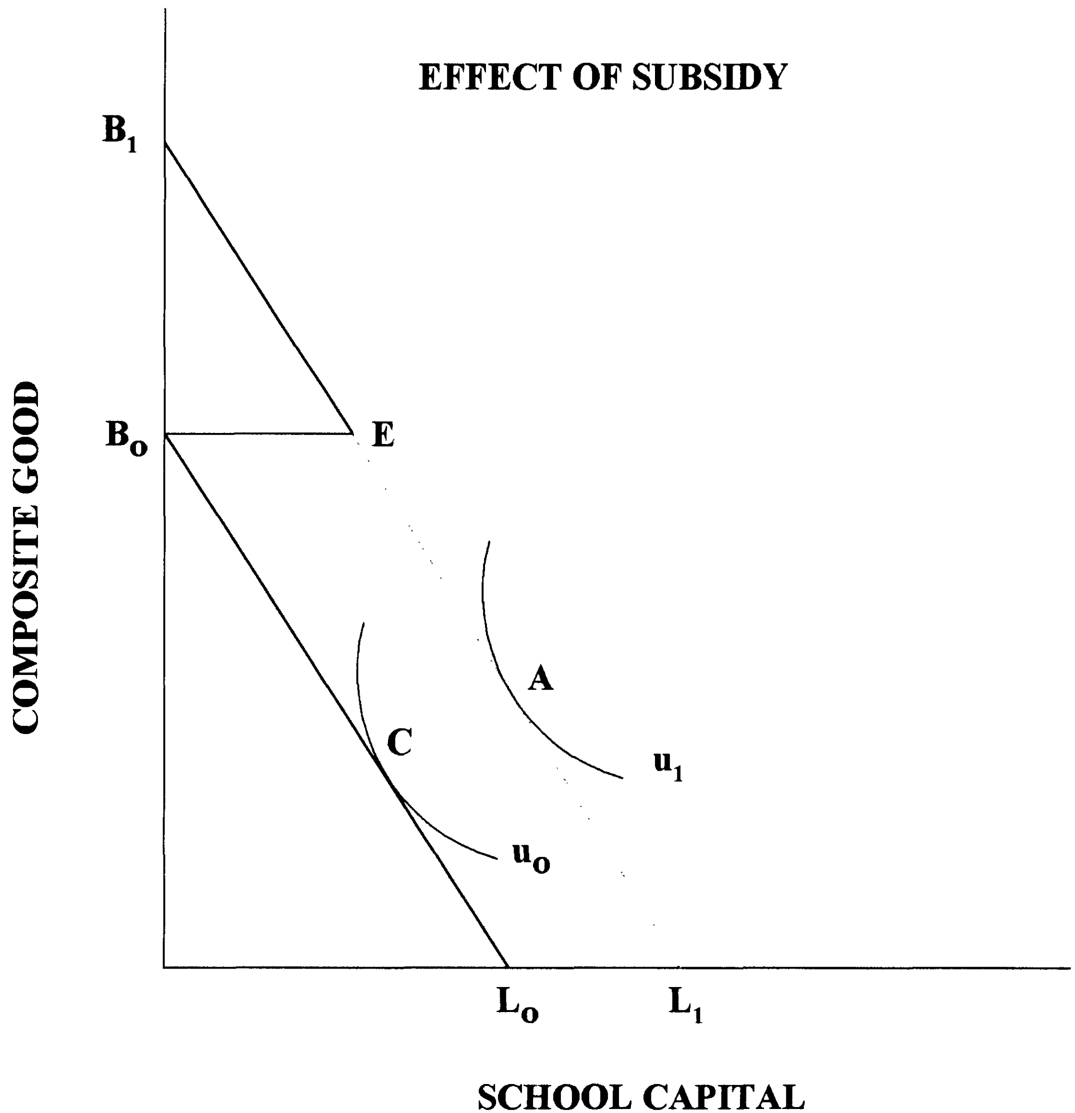
V. EXTERNALITIES

The Opportunity Cost of the Lottery

According to the Ohio Department of Taxation, $0.895 cents out of every dollar collected in income taxes goes into the general revenue fund. In 1997, 16.4 percent of the general revenue fund went to primary and secondary education. Given that the maximum state income tax is 7 percent, this means that in 1997, no more than a little over a penny out of every taxable income dollar earned went towards primary and secondary education [$0.0103 = (.07 • .895 • .164)] or less than fifteen cents out of every tax dollar collected [($.895 • .164)= .148].

The asymmetry between the legislative intent expressed in the legislative history and the present redistribution policy can be recognized from the fact that subsidies result in the use of lottery profit dollars for goods other than public primary and secondary schools. This is shown geometrically in figure 8. Before a district receives a subsidy, residents purchase bundle C on budget line $B_O L_O$. A subsidy of B_O E, which is equivalent to a cash subsidy of $B_O B_1$,

FIGURE 8


EFFECT OF SUBSIDY
COMPOSITE GOOD
B1
B0
E
A
C
u1
u0
L0
L1
SCHOOL CAPITAL

produces a kink in the budget line such that the budget line becomes $B_O EL_1$ and bundle A is then purchased. Bundle A has more of both goods, the subsidy is, therefore, used to buy more of the composite good.

As I pointed out earlier, the quantity of LPDs a district receives also provides a feasible substitute for a school levy that would otherwise be necessary to finance school enhancements such as the adoption of new educational technology into a school's education production function. On the other hand a subsidy may be used to internalize external costs unique to the recipient school. The incidence of subsidies at the expense of less endowed districts, which appears across the state as well as among districts in a given county, is non-pareto optimum given long-run social cost differentials.

As shown in figure 8, at the new level of utility, the beneficiaries in the subsidized district enjoy a higher level of utility, and lottery tax dollars will be allocated to other types of commodities that carry a lower return rate to education. It has been pointed out by various sources (Clotfelter, Morgan,...etc.) that the state lottery tax is higher than any other state or federal form of taxation. Thus, when lottery revenue is used to purchase other goods that carry a lower rate of

return to education funding than the 30 percent return associated with the lottery, lottery profits are divested away from education and deadweight loss is created. The net result would be that less state funding for education is provided than would have been had the lottery profits produced in a district been used for the purpose it was intended in the revenue-producing district. Then there would be no way for it to leak out and or used first for other goods once captured and placed into the educational fund. This is consistent with statutory mandates.

Keeping and using LPDS to educate our youth would better promote social welfare. There is no mandate that the beneficiaries of a subsidy use all of their realized benefits to further support primary and secondary schools; however, statutory mandates do, however, require that producers of the profit use their realized profit share exclusively to provide funding for primary and secondary schools. This gives rise to a paradox, particularly in light of the intent expressed in the legislative history. Furthermore, given that the lottery is suppose to be a mechanism to help poor districts enhance their tax base and thus become more self sufficient in providing support for their schools, that purpose is frustrated by a policy that unduly burdens poor districts with multi-digit rates of taxation and

such that a welfare trap precludes them from realizing profits in proportion to the revenues the districts produced.

Evaluation of Redistribution Effects in 1997

Column 4 of Table 8 shows the dollar value, R, by which district net profits deviated from the statutory profit values , based on the assumption that a district's share of profit is a function of the revenue generated in the district. If we let (w) be the wage rate paid to educators, and (r) the rent on other capital used in the education production function, then R/w equals the number of teachers loss by the taxed district; or R/r the loss of units of other capital. The result is that (R/w)n or (R/r)n youth are put at a relative disadvantage. Here n represents the number of students that were served by each unit of loss capital. In instances where a significant number of students in a taxed district fail to meet state academic and moral standards, success in meeting state standards becomes more difficult when lottery profits are taxed. (See note) This is because under present redistribution policy, districts whose student body has already achieved a high level of success in meeting state standards are subsidized at the expense of less endowed districts whose student body has been less successful in meeting state standards, and need their lottery profits to facilitate their achievement in meeting state

standards. Students in the subsidized district are therefore enabled to reach and set appreciably higher state standards, while the taxed students remain at their status quo standard. The taxed district becomes further away from the new and appreciably higher standard set by the subsidized district.

Given the link between quality of education and income, under present redistribution policies the lottery tax is increasingly regressive and inequitable. Another undesirable impact the lottery has had is a broadening of preexisting disparities in student achievement across school districts. Present redistribution policies tend to frustrate the legislative intent expressed in the legislative history.

VI. STATISTICAL RESULTS

Ordinary Least Squares (OLS) was used to determine whether some of my findings from referenced material, which were based on research done in other parts of the country, hold in Montgomery County. One of my inquiries was whether certain features of districts' demographic profile explain the differences in taste for lottery products, or the demand for lottery products. My second inquiry was whether there was a relationship between the amount of lottery profits a district received and the district's tax base. Virtually all of the betas were consistent with those found in referenced material, but in some instances the explanatory variables used in the model were not statistically significant at the .95 confidence level for sample size 16. The statistical significance of some variables, or the model in general, may have been stronger for a larger sample and if the models had contained two explanatory variables that were included in the models of referenced material but are missing from my model. Unfortunately, data was not available for all of the local school districts in Montgomery County. One explanatory variable that is missing from my model is players' years of education. This variable was quite significant in large-scale models. A second missing explanatory variable is the number and amounts of wagers

that were placed by players with agents located outside their local school districts. Data for this variable could be generated by having lottery agents enter players' tax codes when wagers are placed. The assumption that players tend to place wagers with agents located in their district is reasonable. This assumption is supported by the fact that the number of agents in a school district was the one variable that was significant in explaining sales. Additionally, the correlation matrix showed that the size of the population correlated with the number of lottery agents. The computer printout of the OLS results and copies of both the correlation matrix and covariance matrix are attached.

The results of OLS do not show that the percentage of a district's population that is black explains the variation in Pick 3 sales, Lotto sales or Instant sales in Montgomery County. The sign of the betas were, however, consistent with large-scale tests conducted in other parts of the country, which indicated that blacks prefer pick-3 to the higher- payoff/higher-odds games. The sign of the beta for the *concentration of blacks* was negative for the multi-million dollar lotto game, negative for instant games, and positive for the pick-3 game. In the model used, the only statistically significant explanatory variable for sales of specific game types was *population,* as one might expect.

The test results of the test to explain the variation in percentages of income allocated to the lottery produced a p-value of .09 for the *concentration of poverty* in a district. Though this result suggests the variable *concentration of poverty* is not statistically significant at the .95 level, there is still a somewhat high probability of a type II error. Perhaps a larger sample would have given p values comparable to tests done on a larger scale. The sign of the beta is positive and consistent with test done on state and national levels. In those tests, the concentration of poverty in a geographic area was statistically significant. Neither the R^2 nor the F-statistic render promising prospects for the model as a tool to explain the variation in the *percentage of income* allocated to lottery products. All of the other variables—per capita income, property values, concentration of blacks—were statistically insignificant.

The model used to explain the variation in the share of lottery profits a district receives rendered somewhat positive results. The R^2 was .992, the adjusted R^2 was .984, and the F-statistic was $(1.04)^{-8}$. The variables that were statistically significant and inversley related to the *profits received* were: *district sales* and *local real property values.* This result highlights the disproportion between profit share and production share that arises from tying a constant allocation function to a population in which the contribution distribution is highly

skewed. The inverse relationship between property values and receipts suggest that the redistribution policy is working, to some degree, to allow districts with high real property bases to derive more school funding from that base. The variables that were statistically significant and positively related were: *number of agents,* and *per capita income.* These results support the findings of the analysis of the raw data and the results of the analysis of the descriptive statistics, which indicated the share of profits wealthier districts received were disproportionately greater than their relatively low share of contributions. The percentage of income players allocated to the lottery was not statistically significant, at the .95 level of significance, in explaining the variation of district lottery receipts. The results suggest that districts with political and economical muscle may have some influence on the policy decisions.

My last inquiry was to explain the variation in the number of lottery agents in a district. The results from the model showed that districts' poverty level, which is positively related to the no. of agents, accounted for most of the variation. The low-pay-out pick 3 game, which was positively related to the number of lottery agents stationed in a district, was also statistically significant in explaining the variation in the number of lottery agents in a district. The more popular instant games were not statistically significant. The real

property base was statistically significant but had less influence than the low-pay-out pick 3 game or the poverty level. The fact that sales tend to go up with the number of lottery agents coupled with the fact that the number of agents situated in a district is in part a function of the poverty rate suggests that a significant amount of the lottery profits are attributable to the contributions made by the poor via the low pay-out pick-3 game.

Given the regressiveness of the lottery tax and the low probability that players will receive positive benefits from the redistribution by chance associated with the first term on the right hand side of equation (2.1), namely $[(P)(R_m)]$, as has been suggested by others that have researched lotteries, it seems only equitable that these players receive their respective statutorily determined share of the lottery profits associated with R_e.

PICK 3 AND INSTANT GAME SALES

SUMMARY OUTPUT
Pick 3 SALES

Regression Statistics	
Multiple R	0.712373
R Square	0.507476
Adjusted R	0.384345
Standard E	4831326
Observatio	16

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	3	2.89E+14	9.62E+13	4.121428	0.03178
Residual	12	2.8E+14	2.33E+13		
Total	15	5.69E+14			

	Coefficients	*'andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Ipper 95.0%*
Intercept	1137661	3585161	0.317325	0.75645	-6673735	8949056	-6673735	8949056
PER CAP I	-83.4066	169.5912	-0.49181	0.631727	-452.914	286.1009	-452.914	286.1009
BLACK	2706.83	74905.36	0.036137	0.971768	-160498	165911.6	-160498	165911.6
pop	90.04377	27.88962	3.228576	0.007238	29.2775	150.81	29.2775	150.81

SUMMARY OUTPUT
INSTANT GAMES

Regression Statistics	
Multiple R	0.812847
R Square	0.66072
Adjusted R	0.5759
Standard E	6631965
Observatio	16

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	3	1.03E+15	3.43E+14	7.78968	0.003765
Residual	12	5.28E+14	4.4E+13		
Total	15	1.56E+15			

	Coefficients	*'andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Ipper 95.0%*
Intercept	6181366	4921354	1.256029	0.233009	-4541344	16904075	-4541344	16904075
PER CAP I	-210.624	232.798	-0.90475	0.383403	-717.847	296.5992	-717.847	296.5992
BLACK	-48820.6	102822.7	-0.4748	0.643451	-272852	175210.7	-272852	175210.7
pop	173.8829	38.28411	4.541909	0.000676	90.46903	257.2969	90.46903	257.2969

LOTTO SALES

SUMMARY OUTPUT
LOTTO SALES

Regression Statistics	
Multiple R	0.92762
R Square	0.860479
Adjusted R	0.825599
Standard E	505289.4
Observatio	16

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	3	1.89E+13	6.3E+12	24.66961	2.03E-05
Residual	12	3.06E+12	2.55E+11		
Total	15	2.2E+13			

	Coefficients	*'andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Ipper 95.0%*
Intercept	636588.4	374958	1.697759	0.115311	-180375	1453552	-180375	1453552
PER CAP I	-12.0244	17.73688	-0.67793	0.510674	-50.6698	26.62089	-50.6698	26.62089
BLACK	-11130.3	7834.058	-1.42076	0.180846	-28199.3	5938.602	-28199.3	5938.602
pop	24.69885	2.916866	8.467598	2.09E-06	18.34355	31.05416	18.34355	31.05416

SUMMARY OUTPUT

% OF INCOME

% OF INCOME

Regression Statistics	
Multiple R	0.659328
R Square	0.434713
Adjusted R	0.229154
Standard E	2.610232
Observatio	16

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	4	57.63476	14.40869	2.114785	0.147163
Residual	11	74.94643	6.813312		
Total	15	132.5812			

	Coefficients	*andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Ipper 95.0%*
Intercept	2.886177	2.559673	1.127557	0.283502	-2.74763	8.519983	-2.74763	8.519983
PER CAP I	-9.8E-05	0.000126	-0.77934	0.452219	-0.00038	0.000179	-0.00038	0.000179
PROP. VA	-1.6E-07	2.5E-05	-0.00638	0.995025	-5.5E-05	5.49E-05	-5.5E-05	5.49E-05
BLACK	-0.05129	0.049164	-1.04331	0.319192	-0.1595	0.056917	-0.1595	0.056917
POVERY	0.258634	0.140563	1.839984	0.092887	-0.05074	0.568011	-0.05074	0.568011

LOTTERY PROFIT RECEIPTS

SUMMARY OUTPUT
Lottery PROFIT RECEIPTS

Regression Statistics	
Multiple R	0.992207183
R Square	0.984475094
Adjusted R	0.976712642
Standard E	538967.331
Observatio	16

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	5	1.84E+14	3.68E+13	126.8252601	1.04E-08
Residual	10	2.9E+12	2.9E+11		
Total	15	1.87E+14			

	Coefficients	*'andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*.ower 95.0?*
Intercept	1344474.128	503599.5	2.669729	0.023503481	222384.3	2466564	222384.3
PROP. VA	-26.3236653	5.01632	-5.2476	0.000374676	-37.5007	-15.1466	-37.5007
AGENTS	92801.47788	7736.375	11.99547	2.93179E-07	75563.76	110039.2	75563.76
%OF Y	74435.88177	68947	1.07961	0.305666316	-79187.6	228059.4	-79187.6
PER CAP '	62.32168023	25.71347	2.423698	0.035834293	5.0285	119.6149	5.0285
TOT SALE	-0.051618076	0.021209	-2.43376	0.035223055	-0.09888	-0.00436	-0.09888

DATA SET

LOTTERY	PROP. VALUE	NO. OF AGENTS	%OF Y	PER CAP Y	TOT SALES
599337	82410.79	6	0.94	$17,377.02	1399782
1438371	159166.62	24	0.35	$30,945.98	4987431
14966293	69408.73	192	3.58	$8,721.29	62520945
3082344	70843.25	39	6.63	$14,880.84	40386739
506286	79231.73	2	1.85	$7,943.07	1179356
863310	149503.26	50	2.70	$19,920.32	33106468
1901468	56117.29	16	1.79	$9,344.03	4357368
741728	140342.53	20	0.86	$16,454.57	4307644
709009	52364.73	7	1.03	$12,106.80	931486
2261306	79397.89	19	2.12	$17,405.83	11868916
689641	108842.84	17	10.88	$8,503.31	11595244
259785	129568.77	0	0.00	$39,392.57	0
2024752	61769.99	24	6.57	$10,371.97	16521216
814036	72781.95	7	0.66	$15,345.04	1021925
600450	151855.74	22	1.11	$19,320.28	4969565
1223672	99308.66	27	4.76	$14,121.98	18594850

SUMMARY OUTPUT
RECEIPTS

Regression Statistics	
Multiple R	0.992207
R Square	0.984475
Adjusted R	0.976713
Standard E	538967.3
Observatio	16

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	5	1.84E+14	3.68E+13	126.8253	1.04E-08
Residual	10	2.9E+12	2.9E+11		
Total	15	1.87E+14			

	Coefficients	*'andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Ipper 95.0%*
Intercept	1344474	503599.5	2.669729	0.023503	222384.3	2466564	222384.3	2466564
PER CAP I	62.32168	25.71347	2.423698	0.035834	5.0285	119.6149	5.0285	119.6149
%OF Y	74435.88	68947	1.07961	0.305666	-79187.6	228059.4	-79187.6	228059.4
PROP. VA	-26.3237	5.01632	-5.2476	0.000375	-37.5007	-15.1466	-37.5007	-15.1466
TOT SALE	-0.05162	0.021209	-2.43376	0.035223	-0.09888	-0.00436	-0.09888	-0.00436
AGENTS	92801.48	7736.375	11.99547	2.93E-07	75563.76	110039.2	75563.76	110039.2

NO. OF LOTTERY AGENTS

SUMMARY OUTPUT
NO. OF AGENTS

Regression Statistics	
Multiple R	0.937781
R Square	0.879433
Adjusted R	0.83559
Standard E	18.36464
Observatio	16

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressior	4	27060.14	6765.035	20.05882	5.16E-05
Residual	11	3709.858	337.2599		
Total	15	30770			

	Coefficients	*'andard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*	*Ipper 95.0%*
Intercept	-17.1789	9.141736	-1.87917	0.086958	-37.2997	2.941942	-37.2997	2.941942
PROP VAL	6.37E-08	1.45E-08	4.395787	0.001071	3.18E-08	9.56E-08	3.18E-08	9.56E-08
INSTANT	-8.1E-07	4.8E-07	-1.69046	0.119046	-1.9E-06	2.45E-07	-1.9E-06	2.45E-07
PICK 3 SA	2.8E-06	9.35E-07	2.999681	0.012087	7.46E-07	4.86E-06	7.46E-07	4.86E-06
POVRTY	2.245773	0.677565	3.314477	0.006899	0.754462	3.737084	0.754462	3.737084

SALES REVENUE

SUMMARY OUTPUT
SALES REVENUE

Regression Statistics	
Multiple R	0.889065
R Square	0.790437
Adjusted R	0.685656
Standard E	9881059
Observatio	16

ANOVA

	df	SS	MS	F	ignificance F
Regressior	5	3.68E+15	7.37E+14	7.543674	0.003557
Residual	10	9.76E+14	9.76E+13		
Total	15	4.66E+15			

	Coefficients	andard Err	t Stat	P-value	Lower 95%	Upper 95%	ower 95.0%	Ipper 95.0%
Intercept	10069227	9689887	1.039148	0.323209	-1.2E+07	31659645	-1.2E+07	31659645
PER CAP I	-288.208	478.706	-0.60206	0.560539	-1354.83	778.4158	-1354.83	778.4158
PROP. VA	7.940311	94.73046	0.08382	0.934854	-203.132	219.013	-203.132	219.013
POVERY	-399400	578679.3	-0.69019	0.505775	-1688778	889978.1	-1688778	889978.1
AGENTS	359898.8	65068.11	5.531109	0.000251	214918	504879.6	214918	504879.6
BLACK	20790.79	186350.8	0.111568	0.913374	-394425	436006.4	-394425	436006.4

CORRELATION MATRIX

	INSTANT	BLACK	ER CAP D	ROP. VALL	POVERY	AGENTS	LOTTO	PICK 3	MILAGE	%OF Y	TOT SALES	INSTANT
INSTANT	1											
BLACK	0.212304	1										
PER CAP I	-0.26091	-0.4898	1									
PROP. VA	-0.05263	-0.37708	0.638895	1								
POVERY	0.365389	0.681851	-0.58204	-0.24774	1							
AGENTS	0.82234	0.30468	-0.24733	-0.10453	0.495762	1						
LOTTO	0.925272	0.124632	-0.15376	0.116829	0.305818	0.905317	1					
PICK 3	0.720575	0.253773	-0.23195	-0.27652	0.296231	0.73377	0.678824	1				
MILAGE	0.317433	0.638267	-0.08964	-0.19101	0.608254	0.363018	0.196438	0.32607	1			
%OF Y	0.459159	0.242316	-0.49319	-0.21387	0.582325	0.168441	0.212119	0.357386	0.396651	1		
TOT SALE	0.963679	0.250828	-0.26895	-0.13502	0.381212	0.880414	0.918084	0.873053	0.346962	0.419288	1	
INSTANT	1	0.212304	-0.26091	-0.05263	0.365389	0.82234	0.925272	0.720575	0.317433	0.459159	0.963679	1

COVARIANCE MATRIX

	INSTANT	BLACK	ER CAP D	ROP. VALL	POVERY	AGENTS	LOTTO	PICK 3	MILAGE	%OF Y	TOT SALES	INSTANT
INSTANT	1.04E+14											
BLACK	42417529	384.9078										
PER CAP	-2.2E+10	-81127.9	71275702									
PROP. VA	-2E+10	-273381	1.99E+08	1.37E+09								
POVERY	27803996	99.95648	-36717.1	-68404.9	55.83245							
AGENTS	3.79E+08	270.7327	-94571.2	-174950	167.778	2051.333						
LOTTO	1.14E+13	2958507	-1.6E+09	5.22E+09	2764855	49611779	1.46E+12					
PICK 3	4.52E+13	30656396	-1.2E+10	-6.3E+10	13629210	2.05E+08	5.06E+12	3.79E+13				
MILAGE	18475452	71.56745	-4324.99	-40341.3	25.97545	93.9683	1358398	11474746	32.66403			
%OF Y	13901666	14.13369	-12378.8	-23496	12.93613	22.681	763029.2	6542306	6.739671	8.838746		
TOT SALE	1.73E+14	86727232	-4E+10	-8.8E+10	50200784	7.03E+08	1.96E+13	9.47E+13	34947614	21968916	3.11E+14	
INSTANT	1.04E+14	42417529	-2.2E+10	-2E+10	27803996	3.79E+08	1.14E+13	4.52E+13	18475452	13901666	1.73E+14	1.04E+14

VII. Conclusions and Recommendations

Conclusion

In Montgomery County, the affect of the present appropriation policies that govern the Profits For Education Funds are not consistent with the legislative intent expressed in the legislative history of the Ohio Lottery. The statistical analyses show that, by and large, the lottery has had the affect of shifting more of the cost of public education away from the relatively wealthy districts and onto the relatively poor districts such that both vertical equity and horizontal equity are violated. A districts share of lottery profits is now being tied to the amount of categorical and basic aid a district receives rather than being tied to the share of lottery revenue a district produces. This aggravates the free rider problem, deadweight loss, and other undesirable externalities aforementioned.

Under the present system, districts can avoid their fair share of the tax burden to increase school funding--which traditionally has been accomplished primarily with both income taxes and property taxes--by simply abstaining from making lottery contributions. Yet, the abstaining districts gets a share of the profits produced by players in other districts, and abstainors are thus in a must win position where the lottery and school funding is concerned. On the other hand, the

revenue-producing districts are put in a must loose position, because a significant portion of their needed profits are being extracted and given to abstainors. The principles of vertical equity are thus violated. This is based on the fact that the revenue producing districts' profit share is being allocated among districts that are more needy, less needy, or equally needy. Thus the lottery is a biased and unfair game that aggravates the free rider problem.

The redistribution policy also creates deadweight. If districts received lottery profits in proportion to their contributions, districts would raise local school funding either through the lottery or through more traditional means such as local school levies. As I pointed out in my coverage of the pricing policies, mixed bundling leads to maximum profits. When agents are unwilling to pay the average price of the bundled good—a chance to win money and raise local tax base—, more revenue for education would be generated by excluding that group from that segment of the market, but also provide the excluded group alternative means of acquiring only their single most preferred good by selling that good separately. On the other hand, agents that are induced to buy the bundle because the average price of both goods is below their reservation price would acquire the inherent surplus associated with their ownership of the bundle. Thus, if the amount of additional funding a district needs can not be derived from

voluntary lottery contributions--not because profits are being extracted but because of lack of mutual support among the members of the district--, then the members of the district should use other means for raising funds for their schools as a supplement or substitute--such as a school levy, for instance. The result would be more funding for education due to increased lottery sales, or more funding due to lottery sales plus other means, without constraint.

As indicated by the statistical analyses, there is a positive relationship between a districts' sales and the number of lottery agents in the district. There is also a positive relationship between the number of lottery agents in a district and pick-3 sales, as well as the level of poverty in a district. One equity concern is that the lottery's advertising activities as well as its daily tax collecting activities are designed to motivate players that prefer making contributions through the pick-3 game to contribute more. (Though there are also two pick-4 game drawings daily, as I pointed out earlier, except in a couple of districts pick-4 is not a highly preferred or high revenue-generating game). However, a significant portion of the population of pick-3 players are relatively poor, and they are the very ones for whom the lottery was established to facilitate in building their own tax base in the first place. Thus, the redistribution policy facilitates exploitation in that it attempts to motivate low-wealth districts to

increase their lottery contributions, which will then be used partially to facilitate tax avoidance schemes for districts that are more needy, less needy, or equally needy.

Recommendations

While this thesis is not intended to serve as advocacy for or against the lottery as an efficient means for school districts to raise their tax bases, it is intended to serve as illustration of the inequities inherent in the redistribution policy. More importantly, more considration should be given to the fact that wealthy districts could avoid additional taxes under current proposed tax schemes simply on the fact that the lottery provision enables poorer districts to contribute more of their own share of contributions to the public good. Their endeavor should not be frustrated by free riding, welfare traps, or unrealized profits. The most efficient way to reconcile the countervailing forces would be to let districts self-select the means by which they will increase local funding. To that end, a more equitable policy would be to make a districts' share of lottery profits a function of their contributions rather than a function of the insatiable wants of others—among whom are the highly endowed. Given the present workings of the lottery, one must wonder whether many of the majority of the populace that voted to establish the lottery had their

own personal agendas, which included but was not limited to exploiting and abusing the poor or less informed.

APPENDIX A

TABLE A1

NET AFFECT OF LOTTERY

DISTRICT	Per Pup State Aid	Enrollmnt	Apprx amt pd Income Tax	Amt. From State G.R.	Subsidy/Tax	Lotto Paid	Net Tax After Lotto
BROOKVIL	2568	1485	748,916	3,813,480	-3,064,564	602,000	-2,462,564
				0	0		0
				0	0		0
CENTERVLL	1727	7075	9,845,059	12,218,525	-2,373,466	2,145,000	-228,466
				0	0		0
				0	0		0
DAYTON	3698	25972	7,596,421	96,044,456	-88,448,035	26,884,000	-61,564,035
				0	0		0
				0	0		0
HUBER	2683	7063	3,059,948	18,950,029	-15,890,081	17,366,000	1,475,919
				0	0		0
				0	0		0
JEFFERSON	4100	755	289,820	3,095,500	-2,805,680	507,000	-2,298,680
				0	0		0
				0	0		0
KETTERING	1268	7636	7,573,136	9,682,448	-2,109,312	14,236,000	12,126,688
				0	0		0
				0	0		0
MAD RIVER	3320	3717	1,032,423	12,340,440	-11,308,017	1,874,000	-9,434,017
				0	0		0
				0	0		0
MIAMISBURG	1352	4490	2,597,175	6,070,480	-3,473,305	1,852,000	-1,621,305
				0	0		0
				0	0		0
NEW LEBANON	3328	1397	410,804	4,649,216	-4,238,412	401,000	-3,837,412
				0	0		0
				0	0		0
NORTHMONT	2593	5673	3,117,490	14,710,089	-11,592,599	5,104,000	-6,488,599
				0	0		0
				0	0		0
NORTHRIDGE	2310	2026	455,915	4,680,060	-4,224,145	3,300,824	-923,321
				0	0		0
				0	0		0
OAKWOOD	1808	1703	2,827,417	3,079,024	-251,607	0	-251,607
				0	0		0
				0	0		0
TROTWOOD	3393	4026	1,137,102	13,660,218	-12,523,116	7,104,000	-5,419,116
				0	0		0
				0	0		0
VALLEYVW	2616	1888	761,547	4,939,008	-4,177,461	439,000	-3,738,461
				0	0		0
				0	0		0
VANDALIA	1445	3428	2,570,728	4,953,460	-2,382,732	2,137,000	-245,732
				0	0		0
				0	0		0
WEST CARR	2083	4084	1,870,453	8,506,972	-6,636,519	7,996,000	1,359,481

Appendix B

Note

B1. In 1993, Dayton City Schools received a grant to fund an intervention initiative that involved providing remedial instruction to students who had failed the math portion of the ninth-grade Ohio Proficiency Test at least once. Two math teachers worked with a group of 30 students for 4 hours a day for 4 weeks over the summer. All of the students that participated in the program passed the math portion of the subsequent math proficiency test.

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