ESTIMATES OF THE PRICE ELASTICITY OF DEMAND FOR GAMING, AND THE IMPACT OF WAGERING AND ADMISSION TAXES ON THE DEMAND FOR GAMING.

Jim Landers
Office of Fiscal and Management Analysis, Indiana Legislative Services Agency

INTRODUCTION

IN 2006, GAMBLING WAS CONDUCTED ON ELECTRONIC gaming devices (EGDs) and on various table games such as poker, black jack, craps, and roulette at commercial casinos in no less than 19 states. Besides New Jersey and Nevada, this group comprised 17 other states that legalized commercial casinos since 1989. Generally, the impetus for legalizing commercial gaming in these states has been twofold—to generate tax revenue and to promote local and regional economic development and tourism.

Most often, states generate tax revenue from commercial casinos by imposing wagering taxes on the casino's gaming *win* (sometimes defined in state statutes as *adjusted gross receipts* or *AGR*). The gaming win is the amount of money the casino retains from the gross dollar amount wagered by players on casino games after payout of winnings. The gross dollar amount wagered by players on EGDs is typically referred to as the *handle* or *coin in*. On table games this total is usually referred to as the *drop*. Currently, states impose flat rate and graduated rate wagering taxes of various percentages on casino win. Several states also impose admission taxes under which the casino pays a fixed dollar amount per patron entering the casino. Admission taxes essentially represent an indirect tax on casino win, albeit where the tax rate varies as a percentage of the win generated from each casino patron.

This study focuses on riverboat casinos and racetrack casinos operating in Illinois, Indiana, Iowa, and Missouri. Each of these states imposes a wagering tax and an admission tax on commercial casinos. The preponderance of the casino tax revenue in these four states is generated from the wagering tax, with the share ranging from 74 percent in Missouri to 96 percent in Iowa. As to the relative importance of casino taxes it's worth noting that the share of state tax revenue generated from these sources ranges from 2.8 percent in Illinois to about 5.9 percent in Indiana.

Due to their growing importance as a revenue source, casino tax increases have occurred in Illinois, Indiana, and Iowa. Missouri's wagering and admission taxes have remained unchanged. As well, proposals to increase casino taxes in these states have been considered periodically over the last few years. In 2002, Indiana changed its wagering tax and admission tax regimes in conjunction with the elimination of cruising requirements for the riverboat casinos. The wagering tax was changed from a flat rate tax of 20 percent to a graduated rate structure topping out at 35 percent. The admission tax rate was not changed, but the method of imposing the admission tax was changed such that tax liabilities were reduced by about 46 percent. In 2004, the top wagering tax rate for riverboat casinos in Iowa was increased from 20 percent to 22 percent, and top rate for racetrack casinos was raised from 20 percent to either 22 percent or 24 percent under certain circumstances.

Illinois's recent tax rate changes are the most notable, with four major rate changes occurring from 1998 to 2005. Illinois shifted from a 20 percent flat rate wagering tax to a graduated rate structure with a maximum 35 percent rate at the beginning of 1998.[1] Since that time, Illinois has instituted two additional increases in the wagering tax coupled with admission tax increases. In July 2002, Illinois's maximum wagering tax rate was increased to 50 percent and the admission tax was increased from $2 to $3 per admission. A year later in July 2003, the maximum wagering tax rate was increased to 70 percent and the admission tax was increased from $3 to $4 per admission for the smaller scale casinos and to $5 per admission for the largest casinos. The last tax rate change occurred in July 2005 when the wagering tax rates and admission tax rates were decreased to the levels instituted in July 2002.

Suits (1979) suggests that the price elasticity of the wagering handle has significant implications for tax policies of states where gaming operations are regulated and utilized to generate tax revenue. The price elasticity of demand for gaming should indicate both the potential effect of casino tax increases on wagering handle—the base for the wagering tax—and the potential yield of tax rate changes. Consequently, this study generates multiple estimates of the price elasticity of demand for casino gaming, specifically wagering on EGDs. These estimates measure the percentage change in wagering handle on EGDs for a given percentage change in the EGD win percentage (the EGD win divided by the EGD handle).

This study extends the current literature estimating the determinants of casino wagering. The current literature provides only one point estimate of the price elasticity of casino wagering, this study provides eight estimates based on different demand model specifications. This study also improves on the prior research utilizing a much larger panel of data to estimate the demand models. The panel for this study includes four states and 50 casinos, and spans 15 years. Thus, the panel encompasses two expansionary periods, an economic downturn, and a number of regulatory and tax rate changes.

The remainder of this paper is divided into the following four sections: (1) a review of pertinent empirical research estimating the demand for state lottery games, pari-mutuel horse racing, and casino gaming; (2) a description of the econometric model, sample data, and estimation methodology; (3) a discussion and analysis utilizing the regression results; and (4) a conclusion section.

LITERATURE REVIEW

Various studies have estimated the determinants of different gaming expenditures. Several studies have estimated the impact of the *take-out rate* on lottery sales and pari-mutuel wagering. The take-out rate for lottery sales and pari-mutuel wagering is equivalent to the EGD win percentage—measuring the total sales or wagers retained by the lottery or pari-mutuel agent. Overall, the studies of lottery sales have generated ambiguous results. Vrooman (1976), Vasche (1985), and Mikesell (1987), for instance, failed to find statistical evidence of a relationship between the take-out rate and lottery sales. In contrast, DeBoer (1986) and Gulley and Scott (1993) both estimated statistically significant relationships between take-out rate and lottery sales, with several price elasticity estimates ranging from -1.15 to -1.20.[2]

In contrast, the literature on pari-mutuel wagering has provided rather clear results. Morgan and Vasche (1979, 1982) find statistical evidence that the take-out rate affects attendance at racetracks but fail to find statistical evidence that the take-out rate affects the handle per patron. However, remaining research on the subject has generated statistically significant elasticity estimates. Gruen (1976), Suits (1979), Pescatrice (1980), and Thalheimer and Ali (1992, 1995) generate statistically significant elasticity estimates on wagering handle ranging from -0.5 to -2.81.

A few studies have investigated the potential determinants of casino wagering. Nichols (1998a; 1998b) estimates wagering demand specifications suggesting that loss limits, casino size restrictions, and cruising requirements for riverboat casinos reduce wagering handle. Research by Moss, Ryan, and Wagoner (2003) suggests that casino gaming revenue exhibits a product life cycle such that gaming revenue growth over time levels off as markets mature. Thalheimer and Ali (2003) develop a much more detailed model specification than prior research to estimate the demand for wagering on EGDs. This demand model specifies measures of casino operations including the EGD win percentage, deregulatory policies, and market attributes such as customer access to the casino and income within the market area of the casino. The demand model was estimated with annual data for a panel of 27 riverboat and racetrack casinos that operated between 1991 and 1998 in Illinois, Iowa, and Missouri. They find that betting limits and cruising requirements have a negative impact on wagering handle. In addition, they generate an estimate of the price elasticity of wagering approximately equal to -1.0 over the period studied. Based on 1991 and 1997 averages, they estimate that the price elasticity declined from -1.5 in 1991 (the initial year casinos operated in the Midwest) to -0.9 in 1998. The data analysis also indicates a strong income effect that is not linear, and suggests that variation in market-specific factors such as customer access and income are important determinants of casino win.

DATA AND METHODOLOGY

The estimating equation for this study takes on the general form specified below:

$$Handle_{it} = \beta_0 + \beta_1 Win\%_{it} + \beta_2 Income_{it} + \beta_3 X_{it} + \varepsilon_{it}$$

where *Handle* is the annual wagering handle at a casino; *Win%* is the percentage of the annual wagering handle that is retained by the casino after paying out winnings to players; *Income* is the annual personal income of players; *X* comprises additional operating, economic, and regulatory policy determinants of wagering handle; and *i* and *t* are, respectively, casino and year indices. In essence, the wagering handle reflects the dollar demand for gaming and the win percentage reflects the price paid by players in order to participate in the gambling games operated by the casino.

The demand function specified above is estimated using measures of annual wagering handle, gaming win percentage, and other casino operating information from an unbalanced panel of 50 riverboat and racetrack casinos operating in Illinois, Indiana, Iowa, and Missouri between 1991 and 2005. The variables utilized in the estimating model and the sources for data used to construct these variables are presented below. Summary statistics for the variables are presented in Table 1 following the descriptions.

(1) ***Per Capita EGD Handle*** is the calendar year per capita EGD handle in real dollars (base year = 1991) within the spatial market of a casino. The spatial market of the casino is assumed to be contained within the counties having a centroid within 100 miles of the casino. Annual EGD handle totals were computed from monthly totals reported by state gaming regulators in Illinois, Indiana, Iowa, and Missouri. Population is taken from the counties contained within the casino market. Annual county population estimates were obtained from the U.S. Census Bureau. EGD handle was selected to represent the demand for casino gaming because: (1) the handle for table games can be difficult to measure, and (2) the win percentage on EGDs can be readily altered by casino owners while win percentage for table games reflects traditional payout rates. This should not bias the estimation results since EGD win represents the overwhelming percentage of total win of the casinos in the four states being studied—ranging from 83 percent in Indiana to 91 percent in Iowa.

(2) ***EGD Win Percentage*** is the calendar year percentage of EGD Handle that is retained by the casinos after winnings are paid from the handle amount to players. Annual EGD handle totals and EGD win totals were computed from monthly totals reported by state gaming regulators. The *EGD Win* Percentage is expected to be inversely related to the *Per Capita EGD Handle* ($\beta < 0$).

(3) ***Days*** represents the number of days during the calendar year that a casino was open for operations. This variable controls for casinos starting up or going out of business and operating for only a partial year during the period of analysis. Annual days of operation for casinos were obtained from monthly financial reports of state gaming regulators. *Days* is expected to be directly related to *Per Capita EGD Handle* ($\beta > 0$).

(4) ***EGDs*** represents the monthly average number of EGDs supplied by a casino during the calendar year. The average EGDs supplied

Table 1
Panel Summary Statistics

Variable[1]	*Mean*	*Std. Dev.*	*Min*	*Max*
Per Capita EGD Handle	335.99	284.68	3.22	1,598.99
Days	345.12	64.57	6.00	366.00
EGDs	1,135.58	617.92	200.00	3,310.00
Table Games	41.40	27.86	0.00	178.00
EGD Win Percentage	6.99	1.25	4.71	12.14
Cruising Requirement[2]	0.35	0.46	0.00	1.00
Loss Limit[2]	0.22	0.41	0.00	1.00
Per Capita Income	21,967.11	2,427.27	15,871.82	26,625.96
Per Capita Income Squared	488,434,408.60	106,685,668.35	251,900,000.00	708,900,000.00

[1]n = 465. Dollar amounts are real dollars (base year = 1991).

[2]Binary dummy variable. Mean equals the percentage of sample observations with score equal to one.

was computed from monthly average totals reported by state gaming regulators. *EGDs* is expected to be directly related to *Per Capita EGD Handle* ($\beta > 0$).

(5) ***Table Games*** represents the monthly average number of table games supplied by a casino during the calendar year. The average table games supplied was computed from monthly average totals reported by state gaming regulators. Presumably, table games are a substitute for EGDs which would mean *Table Games* would be inversely related to *Per Capita EGD Handle* ($\beta < 0$).

(6) ***Cruising Requirement*** is a binary dummy variable equal to one if the state in which the casino is located requires riverboat casinos to cruise or conduct an excursion away from the docking facility in order to conduct gaming. Information on cruising requirements was derived from monthly and annual reports of state gaming regulators. *Per Capita EGD Handle* is expected to be systematically lower for casinos when *Cruising Requirement* = 1 ($\beta < 0$).

(7) ***Loss Limit*** is a binary dummy variable equal to one if the state in which the casino is located prohibits players from losing in excess of a specified amount during the day at a casino. Information on loss limits was derived from monthly and annual reports of state gaming regulators. *Per Capita EGD Handle* is expected to be systematically lower for casinos when *Loss Limit* = 1 ($\beta < 0$).

(8) ***Per Capita Income*** is the calendar year per capita personal income in real dollars (base year = 1991) within the spatial market of a casino. Personal income and population is measured as the annual income or population in counties where the county centroid is within 100 miles of the casino. Annual county personal income estimates were obtained from the U. S. Bureau of Economic Analysis. *Per Capita Personal Income* is expected to be directly related to the *Per Capita EGD Handle* ($\beta > 0$).

Fixed-effects panel regression procedures are employed to estimate the demand function, with casino and year fixed effects employed for all model specifications. In addition, all model specifications are corrected for an AR(1) error structure.[3] Model specifications are estimated in logarithmic form. This ensures that the predicted values of *Per Capita EGD Handle* are non-negative, and controls for the potential nonlinear relationships between *Per Capita EGD Handle* and *Days*, *EGDs*, and *Per Capita Income*. The double-log form also allows the estimated coefficients on the independent variables to be interpreted as elasticities.

EMPIRICAL RESULTS

Coefficient estimates for eight model specifications are reported in Table 2. The estimating models fit the data relatively well, registering a within R-squared between 0.73 and 0.75. All of the variables except for *Table Games* are statistically significant at the 10 percent level or better. The casino operation control variables, *Days* and *EGDs,* and the regulatory control variables, *Cruising Requirement* and *Loss Limit,* are statistically significant at better than the 1 percent level in all model specifications. The coefficient estimates on these control variables are robust, being statistically significant, exhibiting the expected sign, and exhibiting similar values over all model specifications.

The coefficient estimates suggest that EGD handle generated by a casino is: (1) increasing in the number of days the casino operates during the year, (2) increasing in the number of EGDs the casino supplies during the year, and (3) systematically lower for casinos operating in states where riverboat casinos must cruise to conduct gaming operations or where daily limits are imposed on losses casino patrons may incur. The coefficient estimates suggest that cruising requirements for Midwestern riverboat casinos reduced EGD handle by an average of 18 percent to 22 percent, and loss limits reduced EGD handle by an average of 60 percent to 65 percent.

The estimates of the impact of operating days and EGDs by Thalheimer and Ali (2003) were higher, with elasticities of 1.38 and 1.12, respectively. However, the reduced impact of operating days and EGDs generated in this study may reflect maturation of Midwest gaming markets and an increased level of competition that wasn't present in Thalheimer and Ali's sample. Their panel ends in 1998 and excludes Indiana casinos, while the panel for this study extends through 2005 and includes Indiana casinos.

The estimates of the cruising requirement impact (-18 percent to -22 percent) are statistically differ-

Table 2
Regression Estimates

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*
Constant	-2.465779*** (0.3369437)	-1.788003*** (0.3415046)	-1.449593*** (0.3277336)	-20.74335*** (4.293482)
LN(Days)	0.9656574*** (0.0359599)	0.9285181*** (0.036484)	0.928518*** (0.036484)	0.9337485*** (0.0365292)
LN(EGDs)	0.5534192*** (0.1065088)	0.5355861*** (0.1028671)	0.5355864*** (0.1028671)	0.5481851*** (0.1026696)
LN(Table Games)	0.0047174 (0.0420782)	0.0107691 (0.0403974)	0.0107691 (0.0403975)	-0.0032298 (0.0409476)
LN(EGD Win Percentage)	-0.7540078*** (0.1825624)	-0.8754113*** (0.17861)	-0.8754113*** (0.17861)	-0.8707295*** (0.1779422)
EGD Win Percentage	—	—	—	—
Cruising Requirement		-0.1839969*** (0.0566787)	-0.183997*** (0.0566787)	0.2003658*** (0.0571207)
Loss Limit		-0.6179297*** (0.2125193)	-0.6179295*** (0.2125193)	-0.6216122*** (0.2115903)
Time Trend	—		-0.0225486** (0.010375)	—
LN(Per Capita Income)	—	—		1.879111** (1.024918)
(Time Trend)*LN(Per Capita Income)	—	—	—	—
Per Capita Income	—	—	—	—
Per Capita Income Squared	—	—	—	—
Within R-Squared	0.7334***	0.7461***	0.7461***	0.7479***

Groups = 50, Observations = 414.

LN(*) denotes the natural log of the variable.

Dependent Variable = LN(Per Capita EGD Handle).

Entries are fixed-effects panel regression coefficients with standard errors in parentheses. All regression models include casino and year fixed effects.

All dollar amounts are real dollars (base year = 1991) and all percentages are measured on a 0-100 scale.

*.05 < p <=.10; **.01 < p <= .05; ***p <= .01.

Table 2
Regression Estimates (Continued)

Variable	*Model 5*	*Model 6*	*Model 7*	*Model 8*
Constant	-19.41579*** (4.20456)	-29.40115*** (4.815408)	-31.25058*** (4.786622)	-7.047689*** (1.166771)
LN(Days)	0.9337483*** (0.0365292)	0.9380034*** (0.0367163)	0.9401516*** (0.0365628)	0.9397245*** (0.0370287)
LN(EGDs)	0.5481844*** (0.1026696)	0.5415619*** (0.1024074)	0.5363486*** (0.1021789)	0.5410945*** (0.102753)
LN(Table Games)	-0.0032297 (0.0409476)	0.0033014 (0.0408505)	0.0021088 (0.0407804)	-0.000137 (0.0408471)
LN(EGD Win Percentage)	-0.8707306*** (0.1779422)	-0.8178594*** (0.1796261)	—	-0.8504541*** (0.1781338)
EGD Win Percentage	—	—	-0.123433*** (0.0259378)	—
Cruising Requirement	-0.2003658*** (0.0571208)	-0.2185022*** (0.0575226)	-0.2215163*** (0.0574034)	-0.2061105*** (0.0569812)
Loss Limit	-0.6216115*** (0.2115903)	-0.6005455*** (0.2104979)	-0.6459908*** (0.2119088)	-0.6242969*** (0.2104536)
Time Trend	-0.0884444*** (0.0185407)	1.214849* (0.7161076)	1.349097* (0.7146805)	-0.0604392*** (0.0182213)
LN(Per Capita Income)	1.879091* (1.024916)	2.869141** (1.156802)	2.919056** (1.154272)	
(Time Trend)*LN(Per Capita Income)	—	-0.1302071* (0.0715589)	-0.1391239* (0.0713056)	
Per Capita Income	—	—	—	0.0004641** (0.0002289)
Per Capita Income Squared	—	—	—	-8.69E-09* (4.88E-09)
Within R-Squared	0.7479***	0.7478***	0.75***	0.7465***

Groups = 50, Observations = 414.

LN(*) denotes the natural log of the variable.

Dependent Variable = LN(Per Capita EGD Handle).

Entries are fixed-effects panel regression coefficients with standard errors in parentheses. All regression models include casino and year fixed effects.

All dollar amounts are real dollars (base year = 1991) and all percentages are measured on a 0-100 scale.

*.05 < p <=.10; **.01 < p <= .05; ***p <= .01.

ent than the levels estimated by Thalheimer and Ali (2003). In contrast, the loss limit impact estimates (-60 percent to -65 percent) are not statistically different from the prior estimates by Thalheimer and Ali. The coefficient differences may again be the function of the different panels employed in the two studies. Nevertheless, the estimates derived in this study should be superior as the four-state panel spanning 1991 to 2005 contains much more variation in both factors, with loss limits persisting in Missouri after 1998 and cruising requirements being eliminated in Illinois and Missouri in 1999 and in Indiana in 2002. This variation is absent from Thalheimer and Ali's smaller panel.

Per Capita Income is also statistically significant at better than the 5 percent in all the model specifications. As expected, the coefficient estimates suggest that EGD handle is increasing in income. An income elasticity of about 1.9 is estimated in Model 4 and Model 5, however, the estimates are not statistically greater than 1.0 at a standard level of significance.[4] These elasticities are consistent with prior research suggesting that wagering handle could potentially be highly responsive to income variation, whether the wagering is on lottery games, pari-mutuel racing, or casino gaming. The quadratic specification in Model 8 generates coefficient estimates that are also consistent with the prior research by Thalheimer and Ali (1992, 1995) suggesting that the relationship between pari-mutuel handle and income is nonlinear, with handle increasing in income but at a declining rate. The rather large income elasticities exhibited in Model 4 and Model 5 may, to a great extent, be the result of the very large expansion in the supply of casino gaming in the Midwest (from 0 to 43 commercial casinos in 15 years) coinciding with the robust income growth of the 1990s. The Model 6 and Model 7 specifications including *Time Trend* and interacting *Time Trend* and *Per Capita Income* suggest that the income elasticity has declined by about 65 percent over the 1991 to 2005 period from about 2.8 in 1991 to about 0.9 in 2005. These estimates appear to confirm the conjecture above.

The different model specifications generate robust estimates for the focal variable of the research, *EGD Win Percentage*. The coefficient estimates on *EGD Win Percentage* are statistically significant in all model specifications at better than the 1 percent level. In addition, the coefficient estimates exhibit the expected sign and similar values over all model specifications. Excluding Model 1, the price elasticity ranges from a low of -0.82 to a high of -0.87, suggesting that a 10 percent increase in the price of playing EGDs leads to an 8.2 percent to 8.7 percent decline in the EGD handle. The price elasticity estimates are not statistically different from -1.0, thus they suggest that demand is unit elastic if not somewhat inelastic to changes in the win percentage. In comparison, the average price elasticity estimated by Thalheimer and Ali (2003) with their more limited panel dataset, was -0.99.

The elasticity at the mean win percentage for each year in the panel is computed with the coefficient estimate from Model 7 where *EGD Win Percentage* is <u>not</u> log-transformed. These values are reported in Table 3 along with the mean annual win percentage, its standard deviation, and the number of casinos in the four states analyzed. The elasticity estimates suggest that the price elasticity has generally declined since 1991, from elastic levels (e_P < -1.00) to unit elastic or somewhat inelastic levels (-1.00 <= e_P < 0).

The change in price elasticity since 1991 correlates quite well with the increase in the number of casinos operating in the Midwest, and with the decline in the mean win percentage and the variability in the win percentage. This may suggest that gaming markets in the Midwest have matured and stabilized over time consistent with the findings by Moss, Ryan, and Wagoner (2003) relating to the life-cycle behavior of the casino industry in Mississippi. Thus, significant year-over-year growth or shifts in play may be less pronounced as regular players have settled on particular casinos and the games and amenities that these casinos offer.

Overall, the estimating results suggest that in recent years demand for gaming in the subject states may range from somewhat inelastic to being unitary elastic. Given these elasticity estimates, it appears Midwestern casinos could pass tax rate increases forward to players by increasing the win percentage and still generate more total win despite driving down the handle. But, the question remains, when demand is inelastic or unitary elastic, do increases in casino taxes lead to increases in the win percentage? The experience in Illinois in recent years may answer this question. The average casino tax rate (combined wagering and admission tax) in Illinois increased from about

Table 3
Price Elasticity by Year

Year	*Number of Casinos*	*Win Percentage*		*Price Elasticity*
		Mean	*Std. Dev.*	
1991	7	10.51	1.35	-1.30
1992	10	9.67	1.57	-1.19
1993	13	8.38	1.18	-1.03
1994	17	8.01	1.55	-0.99
1995	21	7.26	1.31	-0.90
1996	28	6.65	0.97	-0.82
1997	30	6.41	0.78	-0.79
1998	41	6.21	0.87	-0.77
1999	40	6.24	0.86	-0.77
2000	43	6.30	0.79	-0.78
2001	43	6.63	0.76	-0.82
2002	43	6.87	0.83	-0.85
2003	43	7.09	0.82	-0.87
2004	43	7.35	0.94	-0.91
2005	43	7.60	0.95	-0.94

31 percent of win in FY 2002 to 38 percent in FY 2003. This was a 23 percent increase in the average tax rate. The average tax rate increased again in FY 2004 to about 46 percent, which amounted to a 21 percent increase over the FY 2003 average tax rate. Meanwhile, the average win percentage on EGDs increased from 6.3 percent in FY 2002 to 6.4 percent in FY 2003 to about 6.55 percent in FY 2004. This amounts to only a 1.7 percent price increase in FY 2003 and a 2 percent price increase in FY 2004. Thus, while increases in the win percentage did occur after the casino tax increases, it appears they were not sufficient to fully offset the cost of the tax increases.

Reportedly, Illinois casinos employed various strategies to maintain their profit margins after the 2002 and 2003 tax hikes and did not rely solely on win percentage increases. Argosy (2004), Harrah's (2005), IEFC (2004), and CGFA (2005) report that the strategies employed by Illinois casinos included cuts in marketing and promotion programs, reductions in operating hours and services at the casinos, and imposing admission fees to directly offset the admission tax increases. All of these strategies appear to have affected the wagering handle at the Illinois casinos. Consequently, when revenue forecasters estimate the yield from increased casino taxes they should consider behavioral adjustments relating to potential service reductions, other cost cutting measures, and price increases that might be implemented by the casinos in response to a tax increase.

CONCLUSION

In this paper, I employ fixed-effects regression procedures to estimate the determinants of wagering on EGDs at riverboat casinos and racetrack casinos operating in Illinois, Indiana, Iowa, and Missouri from 1991 to 2005. I estimate various specifications of the demand for wagering on EGDs. I also generate estimates of the elasticity of wagering on EGDs for changes in the win percentage—essentially the price elasticity of demand for gaming on these devices. Generally, the estimating results are intuitive, robust, and consistent with the pertinent, albeit small, literature on the subject. The regression results suggest that demand for gaming at casinos is affected by variations in the casino's own operating structure, regulatory requirements, player's income, and the win percentage imposed by the casino. Specifically, the regression results suggest that the price elasticity of demand for gaming is slightly inelastic to unitary elastic.

The price elasticity estimates suggest that casinos are in a position to raise the win percentage in response to casino tax increases. It also means that tax rate increases could potentially increase government revenue while not decreasing net gaming revenue to the casinos. This assumes that the casinos choose to pass the tax rate increase forward to players by increasing the win percentage on games. The analytical findings also should be informative to revenue forecasters and policymakers as to the potential revenue impact of increases in casino taxes. At this point, the research results provide forecasters with a strong basis for conjecture on the price effects that might arise from an increase in casino taxes. Based on the elasticity estimates, it appears that at least small tax rate increases could potentially generate additional tax revenue and not have a severe impact on wagering handle. Thus, any tax base elasticity would be slight and revenue projections could be done accurately. Nevertheless, additional research still needs to be conducted to flesh out the effects of casino tax increases on the win percentage.

Notes

[1] Illinois eliminated the cruising requirement for riverboat casinos in July 1999.

[2] Cook and Clotfelter (1993) estimate a statistically significant direct relationship between lottery sales and lottery payout rates (the percentage of total sales paid out to winners).

[3] The Hausman (1978) model specification test was employed on all of the model specifications. In each case, the chi-square statistic was significant at the 1 percent level, indicating that the fixed-effects model specification was superior to the random-effects model specification. I also employed the Wooldridge (2002) test for first order autocorrelation in panel data models on all the model specifications. In each case, the F statistic is significant at the 1 percent level, indicating that the models have an AR(1) error structure. I correct for the AR(1) error structure by estimating the model specifications with STATA's xtregar procedure which estimates fixed effects linear models with an AR(1) error structure using Prais-Winsten estimation procedure.

[4] The income elasticity is statistically greater than one at the 19 percent level of significance.

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