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## Estimating the effect of the 2003 Illinois gaming tax restructuring on riverboat gaming volume

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ESTIMATING THE EFFECT OF THE 2003 ILLINOIS GAMING TAX  
RESTRUCTURING ON RIVERBOAT GAMING VOLUME

by

Mikael Ahlgren

Bachelor of Arts  
Concordia University, St Paul  
2004

A thesis submitted in partial fulfillment  
of the requirements for the

**Master of Science in Hotel Administration**  
**William F. Harrah College of Hotel Administration**

**Graduate College**  
**University of Nevada, Las Vegas**  
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ABSTRACT

**Estimating the Effect of the 2003 Illinois Gaming Tax Restructuring  
on Riverboat Gaming Volume**

by

Mikael Ahlgren

Dr Michael Dalbor, Examination Committee Chair  
Associate Professor  
University of Nevada, Las Vegas

This thesis analyzed the effect of the 2003 Illinois gaming tax increase on the states gaming demand. Slot machine coin-in was chosen to best represent gaming demand. Coin-in data was retrieved from Illinois Gaming Commission reflecting the period from January 2000 to December 2005.

Multiple regression analysis with dummy variables was used to model both the tax increase and account for seasonality in the data. Because of autocorrelation issues, a Box Jenkins model was employed to address correlation of error terms.

The findings revealed that Illinois experienced a decrease in gaming demand when the tax increases took effect. In spite of the temptation to rely on gaming taxation to solve state budgetary shortfalls, legislators should acknowledge and evaluate the negative economic pressures tax increases have on the gaming industry.

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## CHAPTER 1

### INTRODUCTION

The effects of changes in gaming taxes are widely debated among the various stakeholders of commercial gaming. The commercial gaming industry and its proponents accept the general incidence of gaming taxes in part as an acceptable cost of doing business in an industry that in many cases is difficult if not impossible to enter. The restricted access to operate legal commercial gaming is partially due to the restricted nature of licensure. The variance in the degree of difficulty a potential commercial gaming entity faces depends largely on state and local laws.

The Midwestern United States commercial gaming market has experienced two trends since they opened in the early nineties: states have consistently deregulated to better position their operators to compete for local and interstate gaming business. The second trend has been the consistent increase in the various states' percentage draw from gaming revenues. These monies are paid in the form of gaming taxes and have often occurred in conjunction with deregulation. The purpose of this research is to quantify the effect of one of these gaming tax increases on gaming demand/wagering volume which in this thesis is represented by coin-in. Coin-in is a gaming term describing the total amount of monies inserted into a slot machine. In contrast, table drop, a term occasionally used by researchers to represent gaming volume, only describes the amount

a player purchases at a table and not the amount wagered (Kilby, Fox, & Lucas, 2004). It is entirely conceivable a casino patron could purchase a million dollars in chips and put none of them at risk. Coin-in by contrast represents actual monies wagered and therefore, functions as a more accurate representation of demand (Eisendrath, Bernhard, Lucas, & Murphy, 2008).

Illinois riverboats operators saw their highest tier gaming tax rate reach 70 percent on July 1, 2003. The rate had grown steadily from the original flat rate of 20 percent of adjusted gross revenue that the Illinois legislature had deemed suitable when commercial gaming was initially introduced in 1991 (Illinois Gaming Board, 2005). The outcry from commercial gaming and its benefactors to both this particular increase and the general trend of inflating gaming taxes was considerable. Christenson (2005) warns that gaming taxes that rise above the 20 percent threshold begin to sway the industry from a focus on economic development and related job creation and capital investment. Christenson also cautions that rates that climb above the 35 percent level prohibit the economic viability of riverboat or racino operations in all but the most significantly undersupplied markets such as the Chicago area in Illinois (Christiansen, 2005). Journalists Jamie McKee and Marc Falcone predict that Illinois' attempt to capture increased revenues by increasing gaming taxes would have the opposite effect. The tax increase trend had already restricted operators innovations and additions that had been previously been planned to maintain competitiveness with operators in surrounding states like Indiana, Missouri, and Iowa (McKee, 2003). Falcone (2003) who is also a gaming analyst with Deutsche Bank foretells that the three boats in the Illinois marketplace that had the potential to hit the 70 percent gaming tax threshold would actively attempt to manage their operations to reduce

revenues. He also foretells that all operators will engage in layoffs, restrict comps, rely on fewer table games, and close ancillary facilities such as restaurants and hotels (Falcone, 2003b). It is noteworthy to mention that if Falcone is correct in his prediction, the gaming tax scenario provides gaming managers a motivation contrary to the universal capitalist goal of maximizing profits.

In an effort to examine the impact of the 2003 tax restructuring this thesis is organized as follows. To give the reader some perspective, a brief overview of gaming taxes in general will be presented. In particular, by examining gaming taxes with respect to how they are levied in Illinois, the reader will better understand the market under scrutiny. Through an examination of how the Midwestern gaming industry has evolved over the decade preceding the tax increases, a perspective of how these changes impact the market will be provided. After the overview is completed, a review summarizing existing literature on implementation of other similar tax increases on hospitality concerns, commercial real estate, the tobacco industry, and eventually the gaming industry will be undertaken. This literature review will address the content, the related research, and the particular methodologies chosen by various researchers to analyze data with similarities to the data reflecting the Illinois gaming tax increase.

The framework constructed by the study of related literature will direct the researcher to the methodology appropriate to analyze the changes in gaming demand related to the gaming tax changes. Using slot machine coin-in as representative of gaming demand, the research will employ a multiple regression model with dummy variables to represent the 2003 tax restructuring as well as account for the seasonal influences inherent in hospitality time series models. Finally, the analysis will examine the residuals from the

multiple regression model to determine whether autocorrelation issues are resolved. The results will reveal whether the implementation of a 70% tax tier and the accompanying gaming tax restructuring had a statistically significant negative effect on gaming demand as represented by the coin-in variable.

The implications of the findings of this study are of importance to both operators of commercial gaming and the state and local entities that both oversee and profit from commercial gaming's revenues. If, as the gaming interests allege, state governments regard commercial gaming as "magical money pumps exempt from the economic laws that govern other activities – and able to pay whatever taxes are needed to make budgets balance" (Christiansen, 2005) and the results of this study indicate a increased gaming taxes correlates with a decrease in gaming demand, state legislators may want to reconsider past decisions or at the very least, consider these results when future policy on gaming taxes is instituted. If gaming demand negatively impacted by inflated gaming taxes, legislators who have legalized commercial gaming to supplement state and local governments must be held to account if their decision to grab short-term revenue to ease budgetary woes, negatively impacts their communities ability to share in long-term revenues.

The results of this research along with their inherent implications must be considered with perspective to this study's limitations. First and foremost this study looks at a single gaming tax increase in Illinois. Additional research addressing gaming tax fluctuations in other states or foreign locales would help determine the representative value of this study. Secondly, coin-in is chosen as the variable representing gaming demand. Additional

research examining other measures of demand such as table drop would further the overall understanding of how gaming demand reacts to fluctuations in gaming taxation.



## CHAPTER 2

### REVIEW OF RELATED LITERATURE

#### *Introduction*

This chapter provides a framework for understanding the impact on gaming demand from changes to the Illinois gaming taxes in 2003. In addition, research in both gaming and related topics such as real estate taxes and hotel occupancy taxes, is drawn upon to provide reference for methodological alternatives. A general overview of gaming research assessing regulation and tax changes is included to provide a more comprehensive understanding of gaming taxes, regulation changes, and gaming proliferation in the Midwestern, United States.

#### *Illinois and Commercial Gaming*

##### *Illinois Legalizes Riverboat Gaming*

In February 1990, Illinois became the second U.S. state to legalize riverboat gambling when the Riverboat Gambling Act was enacted. Neighboring state Iowa preceded Illinois when they legalized riverboat gambling in July of 1989 (American Gaming Association, 2006). Illinois' legislation authorized their Gaming Board to license up to ten operators. The first riverboat, in Alton, opened September 11, 1991. The communities of Alton, Aurora, East Dubuque, East St. Louis, Elgin, Joliet, Metropolis, Peoria, and Rock Island were all granted licenses by 1996 (Illinois Gaming Board, 2005).

### *Approaches to Legalized Gaming*

Illinois adopted the “New Jersey” approach when it legalized commercial gaming within its borders. The “New Jersey” approach is characterized by the use of gambling for the purpose of directing economic development to a restricted number of communities, in this case along particular waterways. The “New Jersey Approach” tends to base decisions on the potential negatives and actively differentiate the gaming industry from other industry, justifying a more encompassing role for government. This model utilizes commercial gaming to create enterprise zones which contribute benefits; such as, capital investment, public sector revenue, jobs and increased tourism to a predetermined number of locations. This approach lends itself to relatively stricter controls on the industry. The utilization of riverboats further underscores the “New Jersey” approach as the boats are both symbolically and physically separated from the community at large. This divide emphasizes the intention to adopt gaming to address a particular need, while mitigating anticipated negative repercussions (*The national gambling impact study commission final report, 1999*).

The “Nevada” model is different from the “New Jersey” model primarily in that it views gambling as a business, which despite necessary safeguards, is best shaped by market forces. Government’s role is primarily the oversight function. By ensuring honest games and discouraging organized crime, the gaming industry is left with the responsibility of choosing location and deciding whether to add facilities. Other than Nevada itself, Mississippi is an example of a state that followed the “Nevada” model (*The national gambling impact study commission final report, 1999*).

### *Midwest Riverboat Gaming*

Illinois and the three commercial gaming states on its border, Iowa, Indiana, and Missouri, all followed the “New Jersey” model to the extent that they limited both the number of facilities and locations (*The national gambling impact study commission final report*, 1999).

The state of Illinois authorizes each licensed riverboat operation to offer up to 1,200 gaming positions. These positions may be a combination of table games and electronic devices. The Riverboat Gambling Act was amended in 1999 to allow riverboats to be permanently moored at docksites, thus ending the requirement that operators must conduct cruises on waterways. The Gambling Act further requires that patrons of gambling areas of the boats be 21 years of age. Wagering in the casinos must be conducted by cashless means, including; chips, tokens or vouchers.

Indiana, on the eastern border of Illinois, legalized commercial gaming in November of 1993. The first, of what has grown to ten Riverboats, opened in December of 1995. Commercial gaming in Indiana was restricted to Riverboats (Anderson, 2005).

Since the main topic of this research is gaming taxes, it may be necessary to acknowledge that some dispute exists as to whether collection of revenues generated from gaming actually constitutes a tax. Some scholars have suggested that revenues collected by the state from gaming operations do not constitute a tax, since gaming is a voluntary act (Rivenbark & Rounsaville, 1996). However, Mikesell and Zorn (1988) argued that net revenues generated from lottery operations were not discernable from revenues captured from other sumptuary excise taxes. In both cases, revenues were generated by means of a voluntary proposition and result in mandatory payments to the

state treasury (Mikesell & Zorn, 1988). For the purpose of this thesis, revenues generated from gaming operations which are paid to the state are referred to as gaming taxes.

Gaming taxes are typically generated by wagering taxes, fees, and/or admissions taxes. Wagering taxes are collected by all U.S. states that host commercial casinos (American Gaming Association, 2006). Despite some minute differences in how particular states define the tax base, all states use some form of gross gambling receipt minus payouts, or adjusted gross receipts (AGR) (Anderson, 2005). Fees are an additional source of revenue for many commercial gaming states. Riverboat states often charge a licensing fee, which in the case of Iowa is assessed based on capacity or in Mississippi, it is assessed as a percentage of AGR (Anderson, 2005). Admission taxes are the third source of revenue for both states and local government units, and are typical in riverboat states. In these states, each gambler is required to pay a fee when entering or boarding the facility (Anderson, 2005). Admission taxes range from a set dollar amount to a graduated tax assessment. For example, some states vary the charge with respect to size of facility or past visitor volume (American Gaming Association, 2006). Table 1 illustrates the changes to Gaming taxation in Illinois and its neighbor state Indiana from years 2000 to 2005.

Table 1

2000-2005 Illinois & Indiana State Riverboat Taxes

State	2000	2001	2002	2003	2004	2005
Illinois	Graduated Tax Rate from 20% to 35% of gross gaming revenue,\$2 per patron admissions tax	Graduated Tax Rate from 15% to 35% of gross gaming revenue,\$2 per patron admissions tax	Graduated Tax Rate from 15% to 50%(Maximum tax rate through June 2002 – 35%) of gross gaming revenue,\$3 per patron admissions tax	Graduated Tax Rate from 15% to 70% of gross gaming revenue,\$3-\$5 per patron admissions tax	Graduated Tax Rate from 15% to 70% of gross gaming revenue,\$3-\$5 per patron admissions tax	Graduated Tax Rate from 15% to 50% of gross gaming revenue,\$2-\$3 per patron admissions tax
Indiana	20% tax on gross gaming revenue	20% tax rate on gross gaming revenue,\$3 per patron admission tax	Graduated tax rate from 15% to 35% (Maximum tax rate through June 2002 – 20%) of gross gaming revenue, \$3 per patron admissions tax	Graduated tax rate from 15% to 35% of gross gaming revenue, \$3 per patron admissions tax	Graduated tax rate from 15% to 35% of gross gaming revenue, \$3 per patron admissions tax	Graduated Tax Rate of 15% to 35% of gross gaming revenue,3\$ per patron admissions tax

Note. Gaming Taxation Rates were retrieved from American Gaming Association State of the States 2000-2006. Retrieved April 12, 2007 from <http://www.americangaming.org/survey/index.cfm>

It is significant to note that all gaming taxes illustrated in Table 1 are in addition to and not in lieu of regular business income and real estate taxes. Gaming taxes are often characterized as being paid for the privilege of operating gaming facilities (Christiansen, 2005).

*Illinois Gaming Tax Rates*

By means of the Riverboat Gambling Act, the State of Illinois assesses taxes on riverboat gambling operations by both an admission tax and a wagering tax. Table 2 illustrates in greater detail the changes in the graduated gaming taxes in Illinois from July 2001 to July 2005.

Table 2

Detailed Overview of Illinois Gaming Taxes

July 1, 2002 – June 30, 2003 Adjusted Gross Revenue Tax Rates						
15% up to	22.5% over	27.5% over	32.5% over	37.5% over	45% over	50% over
\$25	\$25 up to	\$50 up to	\$75 up to	\$100 up to	\$150 up to	\$200
Million	\$50 Million	\$75 Million	\$100 Million	\$150 Million	\$200 Million	Million

July 1, 2003 – June 30, 2005 Adjusted Gross Revenue Tax Rates						
15% up to	27.5% over	32.5% over	37.5% over	45% over	50% over	70% over
\$25	\$25 up to	\$37.5 up to	\$50 up to	\$75 up to	\$100 up to	\$200
Million	\$37.5 Million	\$50 Million	\$75 Million	\$100 Million	\$200 Million	Million

Note. Admission tax rate: \$3, \$4 or \$5 Per Admission-Dependent upon previous calendar year admission total (Less than 1 million = \$3, 1 million to 2.3 million = \$4, greater than 2.3 million = \$5) Local share = \$1, All over \$1 = State share

AGR Tax: Progressive Tax Rate (indicated above) on calendar YTD AGR level (Gross Gaming Receipts minus Patron Win) Local Share = 5% of AGR at all levels, State Share = remainder of progressive % Common School Fund receives the increased AGR Taxes (Increase of 7/1/2003 AGR Rates over 7/1/2002 Rates

The new rates were applied to the calendar YTD AGR levels on the July 1, 2003 game date.

July 1, 2005 Adjusted Gross Revenue Tax Rates						
15% up to	22.5% over	27.5% over	32.5% over	37.5% over	45% over	50% over
\$25	\$25 up to	\$50 up to	\$75 up to	\$100 up to	\$150 up to	\$200
Million	\$50 Million	\$75 Million	\$100 Million	\$150 Million	\$200 Million	Million

Note. Information retrieved from Illinois Gaming Board annual report 2005. Retrieved March 10, 2007 from <http://www.igb.state.il.us/annualreport/>

*Illinois Overview*

The initial tax increase noted above that was approved by the Illinois Legislature on June 3, 2002, had a profound negative impact on the gaming market. As a reference the Dow Jones Industrial Average declined by 2.2 percent on that date. Gaming stocks declined significantly further as illustrated in Table 3.

Table 3

Gaming Stock Market Performance June 3, 2002

<u>Company</u>	<u>Closing Price</u> <u>Percentage Change</u>
Mandalay Resort Group	-6.4%
Harrah's Entertainment	-7.7%
Boyd Gaming	-14.4%
Hollywood Casinos	-20%

Note. Prices are reported from the Michael Pollock's Gaming Industry Observer in the report, Examining impacts on Atlantic City of proposed tax increases, VLT competition, Report retrieved from the files of the American Gaming Association, 1299 Pennsylvania Ave., NW Suite 1175, Washington, D.C. 2004.

MGM, who did not have any gaming interest in Illinois, withdrew a bid of \$615 million to acquire a casino license in a Chicago suburb. A Harrah's conference call to investors revealed the cancellation of plans to build a \$40 million hotel to enhance the Metropolis riverboat. MGM Mirage released a statement announcing their intention to focus their efforts on jurisdictions that provide a "stable and reasonable tax environment" (Pollock, Morowitz, & Gushin).

### *Tax Effects*

In an attempt to draw parallels to other situations that mirror the increase in gaming taxes in Illinois, reviewing research that addressed hotel occupancy taxes, the 1986 Tax Reform Act on Real Estate, and sin taxes on cigarettes proved instructive. These particular examples not only informed the understanding of likely effects of inherent changes to taxation rates but also provided insight into various suitably applicable methodologies that provided valuable analysis into the Illinois gaming tax restructuring.

#### *Occupancy Taxes*

Hiemstra and Ismail (1992) examined the enactment of occupancy taxes by municipalities. They asserted that legislators erroneously chose these means of generating revenues because occupancy taxes primarily affect travelers who are non-constituents. However, the researchers showed by analyzing the elasticity of demand (occupancy) that the saying *Tanstaaf!* rang true. There was no such thing as a free lunch in this case, as a 9.8% room tax resulted in a 3% drop in occupancy (Hiemstra & Ismail, 1992; Hiemstra & Ismail, 1993). The aforementioned scenario mirrors the allegations of gaming's stakeholders who suggest that legislators view commercial gaming as a bottomless source of income which is impermeable to classic economic pressures (Christiansen, 2005).

#### *1986 Tax Reform Act*

The 1986 Tax Reform Act was characterized as the most significant adaptation of the tax code since its formation in the 1950's. When the tax reform was analyzed, real estate, in particular, proved to occupy the mantle of most affected industries. The primary aspects of real estate investment impacted were depreciation scheduling; in



addition, flow-through tax losses were reduced, and loss offset limitations were instituted (Sanger, Sirmans, & Turnbull, 1990).

Sanger (1990) utilized intervention analysis (defined as an intervention in a time series) because an event, in this case the tax reform, represented a change in the stochastic process. The dependent variable in this study was the security returns of Real Estate Investment Trusts, known as REITS. These entities invest in real estate and real estate related assets with the purpose of generating a return for their investors (*US securities & exchange commission*.2004). Sanger employed dummy variables to model the tax intervention as well as account for seasonal effects. The study's results indicated that the market assessed the changes in the tax code to the disadvantage of real estate owners (Sanger et al., 1990).

Another study that sought to understand the effects of the 1986 Tax Reform Act was undertaken by Smith and Woodward (1996). The researchers sought to evaluate the effects of the above mentioned tax reform in terms of the consequence the changes had on the value of apartments. Utilizing a time-series cross-sectional panel data design to examine their data, the researchers found that a couple of obstacles threatened the quality of their results. The degree of overbuilding needed to be controlled for the examined regions. In addition, because of the nature of time-series analysis the authors acknowledged the potential for autocorrelation. Tests proved autocorrelation was a factor and the researchers relied on the Parks method of analysis to address the issue.

Applying a dummy variable to represent the tax changes and controlling for the degree of overbuilding, the researchers concluded the 1986 Tax Reform Act had a statistically significant negative effect on apartment values (Smith & Woodward, 1996).

### *Cigarettes and Sin Taxes*

Sin Taxes are taxes that are attached to services or products that are viewed as vices. This form of tax is retained in part to discourage an activity or the acquisition of a product. These taxes also serve to generate revenue for the government entity be it a federal, state or local municipality, who levies the tax (*Investopedia*). Cigarette smoking, drinking alcohol and wagering are all activities that are subject to sin taxes.

Former United States Surgeon General, C. Everett Koop, wrote in 2004 that studies have consistently shown that increasing the cost of tobacco products reduces their demand (Koop, Richmond, & Steinfeld, 2004). Koop dubiously suggested that these “sin taxes” only affect the sinner, ignoring the impact of loss of demand for a product an entire industry and its many stakeholders depend on to provide salaries, investment returns, and pensions.

An example of a study that supports Koop’s correlation between sin taxes and a reduction in demand is Wei Tan’s use of statistical simulations in his work with smoking rates. Tan’s simulations consistently reinforced the negative impact tax increases had on smoking rate in both the short and the long term (Tan, 2006).

### *Gaming Forecasting*

#### *Deregulation*

A number of researchers have addressed how deregulation has affected gaming volume. Methodologically, these examinations of deregulation were often similar as well as pertinent to understanding how to approach a tax increase. Although the effect of deregulation and a tax increase might be opposite, they both share a main characteristic. In both events a single inflection point is introduced in the analysis of a time series

(Eisendrath, 2005). In the Midwestern commercial gaming market, these acts of deregulation have often been tied to increases in gaming tax rates.

### *Deregulation in Atlantic City*

In Nichols (1998) looked at the 1991 deregulation of Atlantic City commercial gaming, Nichols chose a Box Jenkins autoregressive moving average or ARIMA model to conduct his analysis. Nichols measured the effect of an increase in operating hours and slot machine space on gaming win. The study acknowledged an inherent shortcoming of operationalizing the demand or volume variable as casino win. Win, or gambler's losses equals gross gaming revenue. Gross gaming revenue is problematic as a measure because it includes money that is originally distributed by the casino as complimentary or "comps"; therefore the casino is winning back its own cash. Nichols quantified the comp ratio as 8.5% of total win. Nichols supported his choice of gaming win because, unlike EBITDA and general revenue related data for example, win does not include non-gaming revenues which distort the results (Nichols, 1998b).

Prior to Nichol's research, Shonkwiler (1993) relied on a structural time series model to evaluate the impact of Atlantic City commercial casinos on gaming volume in Nevada. This study addressed the impact of an extraneous event on time series data. Shonkwiler supported his methodological choice by promoting the value of structural time series for the modeling of linear (stochastic) trends and seasonality. Shonkwiler's research concluded that the introduction of Atlantic City casinos reduced Nevada gaming revenues by between 10 and 12 percent (Shonkwiler, 1993).

### *Deregulation of Midwest Riverboats*

Nichols (1998a) also addressed deregulation of the United States Midwestern riverboat market the same year he produced his study on Atlantic City. In a response to the 1994 Illinois' introduction of less regulated riverboat gambling, Iowa revamped their 1991 original strict inaugural regulations and eliminated mandated sailing, loss limits and space restrictions. Choosing casino win, total admissions and win per admission as his dependent variables, Nichols used regression analysis to control for the effect of day of the week, seasonality, location, and per capita income while attempting to evaluate the impact of deregulation. Nichols' results indicated that deregulation was an impetus for significant cross-border substitution as well having been responsible for increases in the three dependent variables: win, win per admission, and admission (Nichols, 1998). Nichols work with Iowa and Illinois riverboat deregulation has obvious similarities to this study's investigation into the impact of gaming taxation in Illinois.

### *Econometric Models*

Thalheimer and Ali (2003) developed an econometric model to identify determinates of demand, particularly slot demand, for 24 Midwestern riverboats and racinos. The researchers examined the effects of "traditional demand" variables as well as location and government restrictions. Thalheimer and Ali identified variables such betting limits, access, win, and number of tables in an effort to explain changes in slot volume. Slot volume was divided by the market area population surrounding the riverboat or casino in an effort to control for the population effect. The study's model showed an extremely impressive degree of explanatory power ( $R^2 = 0.937$ ) thus concluding that population and its access to facility was positively related to slot demand, access to

competing facilities had a negative impact, and restrictive limits on gaming was also negatively related to slot demand (Thalheimer & Ali, 2003). Despite the similarities, it is noteworthy to point out that the Thalheimer and Ali (2003) research examined the impact of the independent variable such as access and limits at the single property level rather than gaming volume at the state level (Eisendrath, 2005).

In an effort to assist the accuracy of Nevada's budgetary planning and with the recognition of the significance that gaming taxes play in the Nevada state budget, Cargill and Eadington (1978) endeavored to construct a means for forecasting gaming revenues. By first assessing seasonal variations and patterns and then employing multiple regression equations to identify statistically significant correlations, the researchers finally chose the Box Jenkins method to provide the forecasting. The earlier stages of this often cited study of gaming reflected the methodology choice of this more narrow research (Eadington & William R., 1978). Like Cargill and Eadington, this study sought to identify whether a particular tax increase has an effect on gaming volume. Unlike Cargill and Eadington, this study of the 2003 Illinois tax increase did not attempt to forecast the long term effects of the restructuring primarily because the change was not permanent.

#### *The Illinois Market*

Turco and Riley (1996) looked at the factors that are important to riverboat gamblers when choosing a facility and also investigated alternate activities a gambler might consider engaging in with their gaming budget. The researchers' concentrated their study on the Illinois market. Loyalty as reflected by favorite place to play was shown to be an important factor for gamers when choosing gambling venues (Turco & Riley, 1996).

Based on Turco and Riley's investigation it is feasible to investigate an impact on gaming demand from a reduction of complimentary which are dispensed to gamers in an effort to build loyalty

Bowen (1994) addressed the value of relationship marketing when he pointed out the connection between satisfaction and loyalty. His article described the emergence of slot clubs and the use of targeted promotions to develop relationships with known players whose values were then tracked by the casino. Bowen identified an Aurora, Illinois riverboat as an example of a facility that tracked and rated its players. After assessing a player's worth, the casinos could choose to forgo parking revenue in exchange for what the operator believed would be a better relationship with their customer (Bowen, 1994). Gaming analyst Falcone echoed this relationship and predicted a reduction in comp play, food, and lodging when describing the 2003 Illinois tax restructuring (Falcone, 2003b). To understand the pressure that falls onto marketing expenditures such as costs, it is important to understand that unlike products like tobacco and alcohol, casino operators do not provide a product with price elasticity because of their relative difficulty in passing on increases in operator expenses to their customers. An operator could employ unpopular measures such as tightening the hold or par of their slot machines and thereby raise the price to play but this may lead to a decrease in demand. Typically, the burden of tax increases rests on operators and is expressed through lower rates of invested capital, decreased development projects, reduction in employees, and in the limitation of marketing and/or complimentary expenses (Falcone, 2003a).

### *Measuring Demand*

When forecasting or quantifying gaming volume, researchers have relied on numerous variables as mentioned throughout this review of related literature. This study will utilize slot machine coin-in as the indicator of gaming demand or volume. The decision to rely on coin-in is based on a number of factors. First and foremost, all the alternative measures of gaming demand are fundamentally problematic. The majority of operators do not and/or cannot quantify the amount wagered on table games (Eisendrath et al., 2008). The measure of table drop, as previously mentioned, reflects the amount converted to chips and does not represent the amount wagered. Revenue figures can vary with short-term luck and volatility on both the player and casino's part (Kilby et al., 2004). Therefore, coin-in reflects the most accurate and least contaminated measure of gaming volume (Eisendrath et al., 2008; Lucas, Dunn, & Kharitonova, 2006).

The second reason this research relied on coin-in to represent gaming demand is the predominance of the coin-in contribution to the overall commercial casino revenue sources. Numerous researchers on the Las Vegas, Nevada market have chosen coin-in as the preferential proxy for gaming demand and justified the decision partially due to the important contribution coin-in makes towards overall revenues. Slot win accounts for approximately 50 percent of gaming win in the Las Vegas market (Eisendrath et al., 2008). In contrast, slot machines or electronic gaming devices (EGDs) account for nearly 90 percent of Illinois adjusted gaming revenues (Illinois Gaming Board, 2005). In an effort to compare the contributions of table games as they compare to slots, a researcher might choose to contrast table drop to coin-in or simply compare the adjusted gross revenues of the games. As previously mentioned both AGR and table drop are

problematic. For the sake of comparison comparing the games on the basis of AGR is the most accurate because it reflects actual play, which is not guaranteed when table drop enters the equation. Figure 1 shows the different AGR contributions by the two revenue sources: table games and slots (described as EGD's in this example).

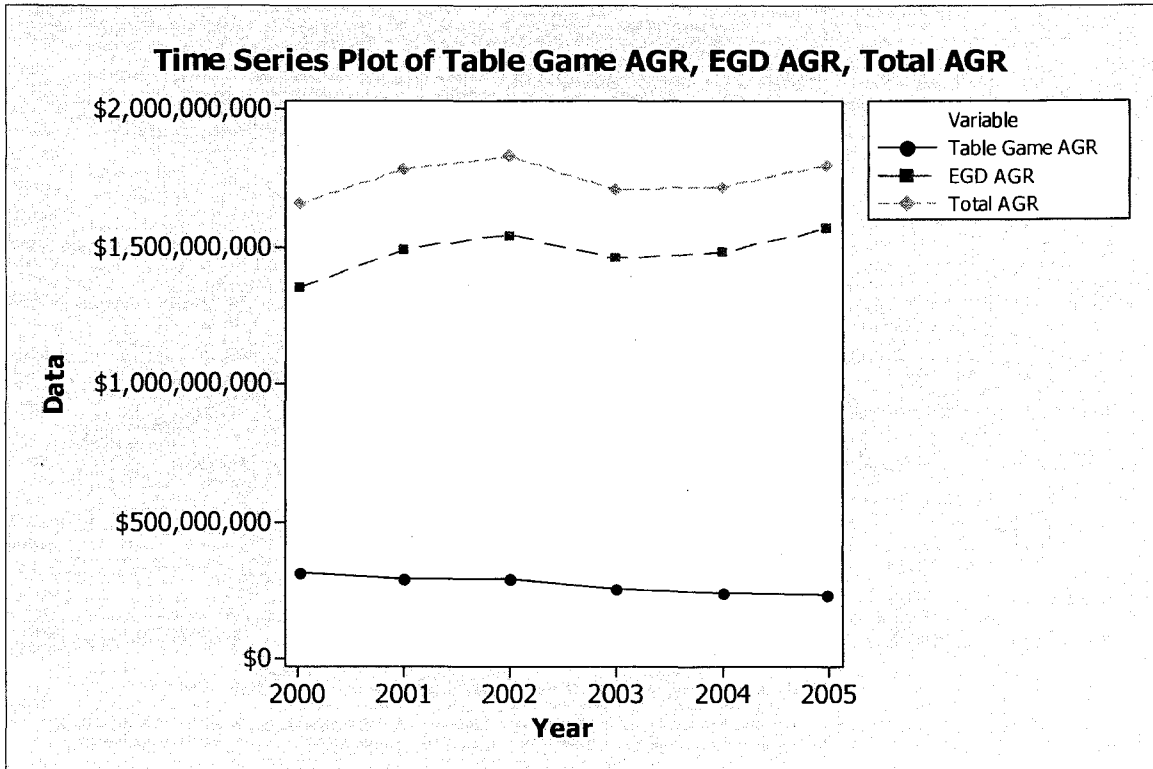


Figure 1. Adjusted Gross Revenue contribution of both Table Games and EGD's (Slots) Data retrieved from the Illinois Gaming Board Annual Reports 2001, 2003, and 2005.



## CHAPTER 3

### DATA AND METHODOLOGY

#### *Introduction*

This chapter first presents the hypotheses to be tested. In addition the source and type of data are revealed. Dependent and independent variables are identified and the use of multiple regression is briefly explained. In addition, assumptions inherent to the use of multiple regression is presented along with the frequent violation of these assumptions that typically occurs when analyzing time series data. Lastly, methods for countering the aforementioned violations are discussed.

#### *Hypotheses*

It is hypothesized that the restructuring of the Illinois gaming tax in 2003 will show a negative impact on gaming demand as represented by the dependent coin-in response variable. The term “2003 70% tax and overall tax restructuring” represents the independent or predictor dummy variable for the tax change.

#### *Main Hypothesis*

The null hypothesis states that there is no difference in coin-in after the Illinois tax restructuring. The null is expressed by the equation:

$$H_0: \text{Coefficient of “2003 70\% tax and overall tax restructuring”} = 0$$

The research hypothesis which predicts that there will be a difference in coin-in is expressed by the equation:

$H_1$ : Coefficient of “2003 70% tax and overall tax restructuring”  $\neq 0$

#### *Secondary Tests for Trend and Seasonality*

The multiple linear regression will include a time variable testing for trend. The time variable is assigned as follows: the first month is “1”, second month “2” and so forth. Trend is characterized as the upward or downward movement of a time series over a period of time. Trend is typically referred to as long-term growth or decline. When analyzing data from a particular industry, trend generally reflects factors such as changes in total population, market growth, or long-term changes in per capita income (Bowerman, O'Connell, & Koehler, 2005).

Seasonality will be assessed by the use of dummy variables representing the months February through December. Seasonality or seasonal variations describe the time series' flow of peaks and valleys that are completed within a calendar year. Factors such as weather and customs tend to impact the seasonality of a time series. When using dummy variables to test monthly data for seasonality, only 11 months are represented by variables. The twelfth month is represented by the constant term of the equation. It makes no difference which month is omitted.

#### *Data Collection*

Secondary data for this study is compiled from Illinois Gaming Board Monthly Revenue Reports (IGB, 2000-2006), comprised of monthly commercial gaming information from January 2000 to December 2006. This public data is available from the Illinois Gaming Board website and via request from the same entity. Each Illinois

docksite is required by their licensure to provide this information in a timely manner to the state office of the Illinois Gaming Board. The information is made public shortly thereafter. As previously discussed, this research will use the independent variable coin-in as reported by the various docksites in Illinois for the 60 monthly periods covered. Coin-in is reported on a monthly basis by each docksite to the Illinois Gaming Board. Coin-in has been chosen as the proxy for gaming demand due to its reliability and due to the dominant contribution of slots/EGDs to overall gaming revenue. Figure 2 illustrates a detailed breakdown of the relative importance of Slot (EGD) contribution to revenues on a docksite by docksite basis.

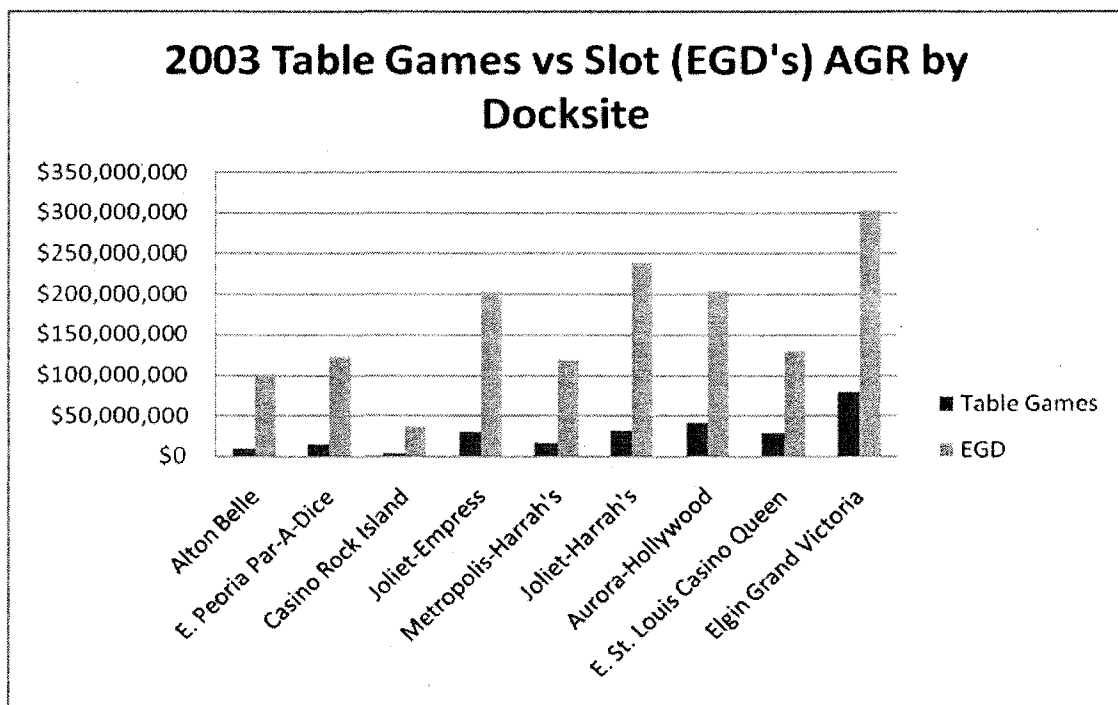


Figure 2 Illinois Docksite AGR Comparison of Table Games vs. Slots.

### *Linear Regression Model*

With a multiple linear regression model (MLR) we have a single dependent variable (y) or response variable and more than one independent or predictor variables (x) and the objective is to fit a linear equation

This thesis we will attempt to fit the regression model:

$$Y_t = \beta_0 + \beta_1 t + \beta_2 \text{Feb} + \beta_3 \text{Mar} + \beta_4 \text{Apr} + \beta_5 \text{May} + \beta_6 \text{June} + \beta_7 \text{July} + \beta_8 \text{Aug} + \beta_9 \text{Sept} + \beta_{10} \text{Oct} + \beta_{11} \text{Nov} + \beta_{12} \text{Dec} + \beta_{13} 70\% \text{tax} + e_t$$

$Y_t$  = Illinois Statewide Coin-in in dollars

The unknown parameters are found by minimizing the error sum of squares. The regression equation relates the average value of y when the independent variables are set at  $(X_1, \dots, X_n)$ .

A dummy variable is used for period that reflects the 70% tax level and the overall 2003 Illinois tax restructuring = {1 if period with tax hike, 0 otherwise}. The “t” variable represents the trend component which as previously mentioned assesses whether there is long-term positive or negative movement in the data over time. The months February-December are treated as seasonal dummy variables. For example: Feb = {1 if period t is February, 0 otherwise}.

The assumption of this model is that error terms are independent and normally distributed with mean 0 and a common unknown variance sigma squared. With hospitality and gaming data this assumption of independence is often violated. In time series regression residuals are tested for autocorrelation. Autocorrelation occurs when error terms are not random and positive terms tend to be followed by positive terms and negative terms tend to be followed by negative terms. Without assessing diagnosing

autocorrelation, the predictive value of the model is compromised. Lastly, an additional implied implication is that the regression model is linear.

### *Selection of Time Series Model*

Because of the seasonal nature of hospitality and gaming, it is necessary to employ time series modeling to deal with autocorrelation. One method of addressing seasonality is through the use of dummy variables. The main advantage of the dummy variable approach is that it results in a regression equation that visibly reveals the impact of statistically significant seasonal variation unlike a Box Jenkins Model which operates like a 'black box' into which the data are entered and a forecast is produced with no insight into the impact of the individual variables such as seasonality or trend.

Treating monthly data (coin-in) captured from the Illinois Gaming Board requires the creation of dummy variables for 11 months. The twelfth month is represented by the constant term of the regression equation. Each month is then tested for significant variation and discarded if it proves insignificant. The model implies that the magnitude of seasonal variation is independent of the trend of the constant seasonal change.

An important value of the use of dummy variables is their ability to ensure that appropriate seasonal parameters are included in the model for each time period. Once the regression model is established, the next step is to examine the error terms for autocorrelation. If autocorrelation is a significant factor, then the correct procedure is to use a Box Jenkins model to address the problematic error terms.

Intervention models are often employed to model the occurrence of exceptional external events or "interventions". Examples include labor strikes, terrorist acts like September 11, 2001 or policy changes like a tax restructuring. This model adopts the

appropriately defined dummy variable to represent the occurrence of the intervention or in this case the tax restructuring. The addition of dummy variable can be permanent if the intervention such as September 11 is a onetime intervention that continues to impact Las Vegas tourism for an indefinite amount of time or in the case of the Illinois gaming tax restructuring, the dummy variable can be added when the restructuring occurred and subtracted when the gaming tax was returned to previous levels.

### *Conclusion*

The research hypothesis asserting that gaming demand will be negatively impacted by increased levels of taxation in Illinois will be tested by multiple regression analysis. The regression will include variables describing the long-term movement or trend of Illinois gaming demand. In addition, variables will be created to assess the impact of seasonality on the time series under scrutiny. The regression's error terms will be tested for autocorrelation, which if present, will be controlled by a Box Jenkins model. The next chapter presents the analysis of the data and the results.

## CHAPTER 4

### FINDINGS OF THE STUDY

#### *Introduction*

The following pages provide a detailed description of the analysis of the data with the methodology presented in the previous chapter. The regression model will be tested and refined. The impact of autocorrelation will be measured and countered. Finally, the chapter concludes with the presentation of the results of the analysis.

#### *Analysis of the Data*

The following regression model was tested using Minitab 15.

$$Y_t = \beta_0 + \beta_1 t + \beta_2 \text{Feb} + \beta_3 \text{Mar} + \beta_4 \text{Apr} + \beta_5 \text{May} + \beta_6 \text{June} + \beta_7 \text{July} + \beta_8 \text{Aug} + \beta_9 \text{Sept} + \beta_{10} \text{Oct} + \beta_{11} \text{Nov} + \beta_{12} \text{Dec} + \beta_{13} 70\% \text{tax} + e_t$$

The variables were tested for significance at the .05 level.

The first regression was run to test all the variables identified in the model. The intention is to eliminate any variables that fail to meet the .05 significance threshold.

Figure 3 illustrates the Minitab output assessing the significance of the variables of interest.

Predictor	Coef	SE Coef	T	P	VIF
Constant	1939589342	25004291	77.57	0.000	
t	417122	292029	1.43	0.158	1.154
DFeb	4128735	32294243	0.13	0.899	1.833
DMar	167643185	32298204	5.19	0.000	1.834
DApr	93402777	32304804	2.89	0.005	1.835
DMay	121833655	32314043	3.77	0.000	1.836
DJun	10924962	32325916	0.34	0.736	1.837
DJul	151304124	32374642	4.67	0.000	1.843
DAug	67085289	32357559	2.07	0.042	1.841
DSep	-13593833	32377320	-0.42	0.676	1.843
DOct	5870903	32399701	0.18	0.857	1.845
DNov	-34818934	32424697	-1.07	0.287	1.848
DDec	-30747198	32452301	-0.95	0.347	1.851
70%	-143804986	15386723	-9.35	0.000	1.139

Figure 3. Assessment of significance of independent variables of interest. The Illinois tax restructuring dummy variable is noted as “70%”. Each month is described by the notation “D” representing dummy + monthly abbreviation. Hence the variable representing February in the model is noted as “DFeb” and so one for the eleven months examined.



The trend variable was eliminated based on the inability to reject  $H_0 = 0$  ( $p=.158$ ).

The following graph reflects the lack of overall upward trend to Illinois coin-in during the period under scrutiny.

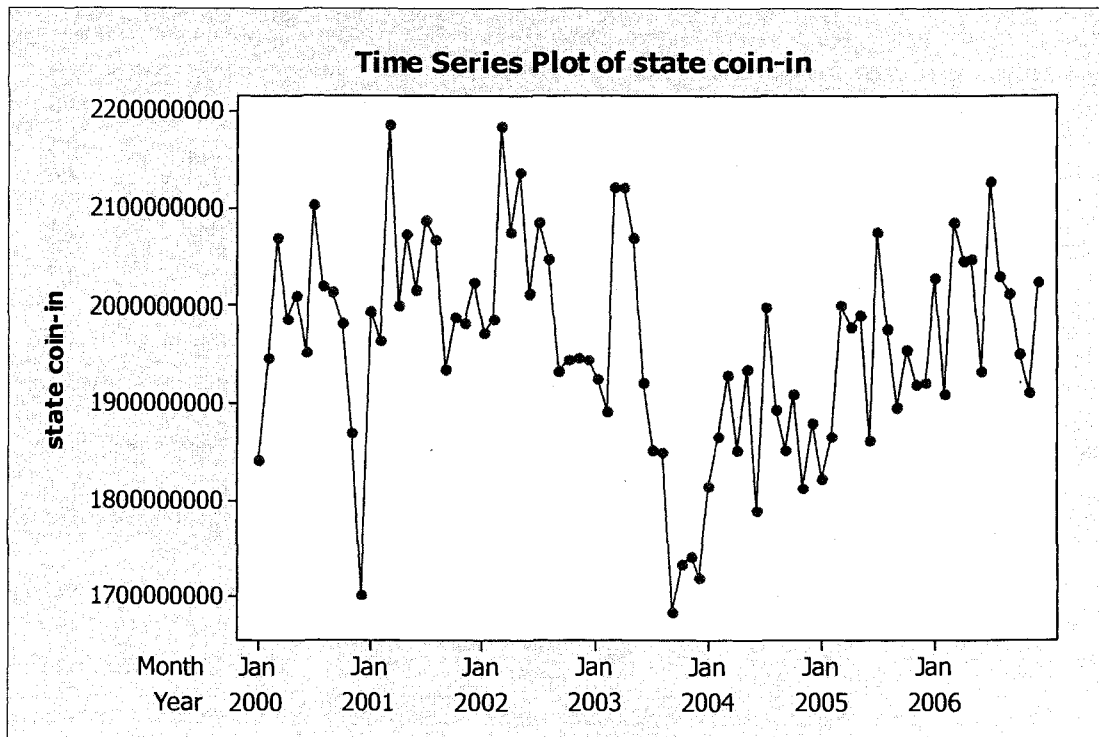


Figure 4. Time Series Plot of Illinois coin-in from 2000-2006 which details the lack of negative or positive trend in the data.

A number of the dummy variables representing the months proved to be statistically insignificant when measured at the .05 significance threshold. For example: the February dummy variable was eliminated based on the inability to reject  $H_0 = 0$  ( $p=.899$ ). Based on the same standard; June, September, October, November, and December were all discarded from the regression equation. Discussion of possible reasons for the lack of significance will be presented at the end of the chapter.

The remaining variables were then retested with the following results:

The regression equation is

$$\text{state coin-in} = 1.95\text{E}+09 + 1.74\text{E}+08 \text{ DMar} + 1.00\text{E}+08 \text{ DApr} + 1.29\text{E}+08 \text{ DMay} \\ + 1.58\text{E}+08 \text{ DJul} + 75702571 \text{ DAug} - 1.36\text{E}+08 \text{ 70\%} + \text{Et}$$

Predictor	Coef	SE Coef	T	P	VIF
Constant	1947191948	9473873	205.53	0.000	
DMar	174174857	24166114	7.21	0.000	1.048
DApr	100351571	24166114	4.15	0.000	1.048
DMay	129199571	24166114	5.35	0.000	1.048
DJul	158437546	24252621	6.53	0.000	1.055
DAug	75702571	24166114	3.13	0.002	1.048
70%	-136337820	14326133	-9.52	0.000	1.008

S = 59808082    R-Sq = 71.0%    R-Sq(adj) = 68.8%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	6	6.75878E+17	1.12646E+17	31.49	0.000
Residual Error	77	2.75430E+17	3.57701E+15		
Total	83	9.51308E+17			

Figure 5. Minitab output detailing final regression equation.

All coefficients were found to be significant at the .05 level, thus rejecting all null hypotheses. Most significantly, the variable representing the Illinois 2003 70% tax and overall tax restructuring was found to be a statistically significant ( $p = .000$ ) factor on gaming demand as represented by statewide coin-in. Variance inflation factors (VIF), which indicate potential multicollinearity were also calculated. Numbers over 10 indicate a significant multicollinearity problem, however the results all show a VIF under 2, which is considered acceptable and indicates that multicollinearity is not an issue with the model.

The residuals were tested with Minitab 15 for autocorrelation as shown in Figure 6:

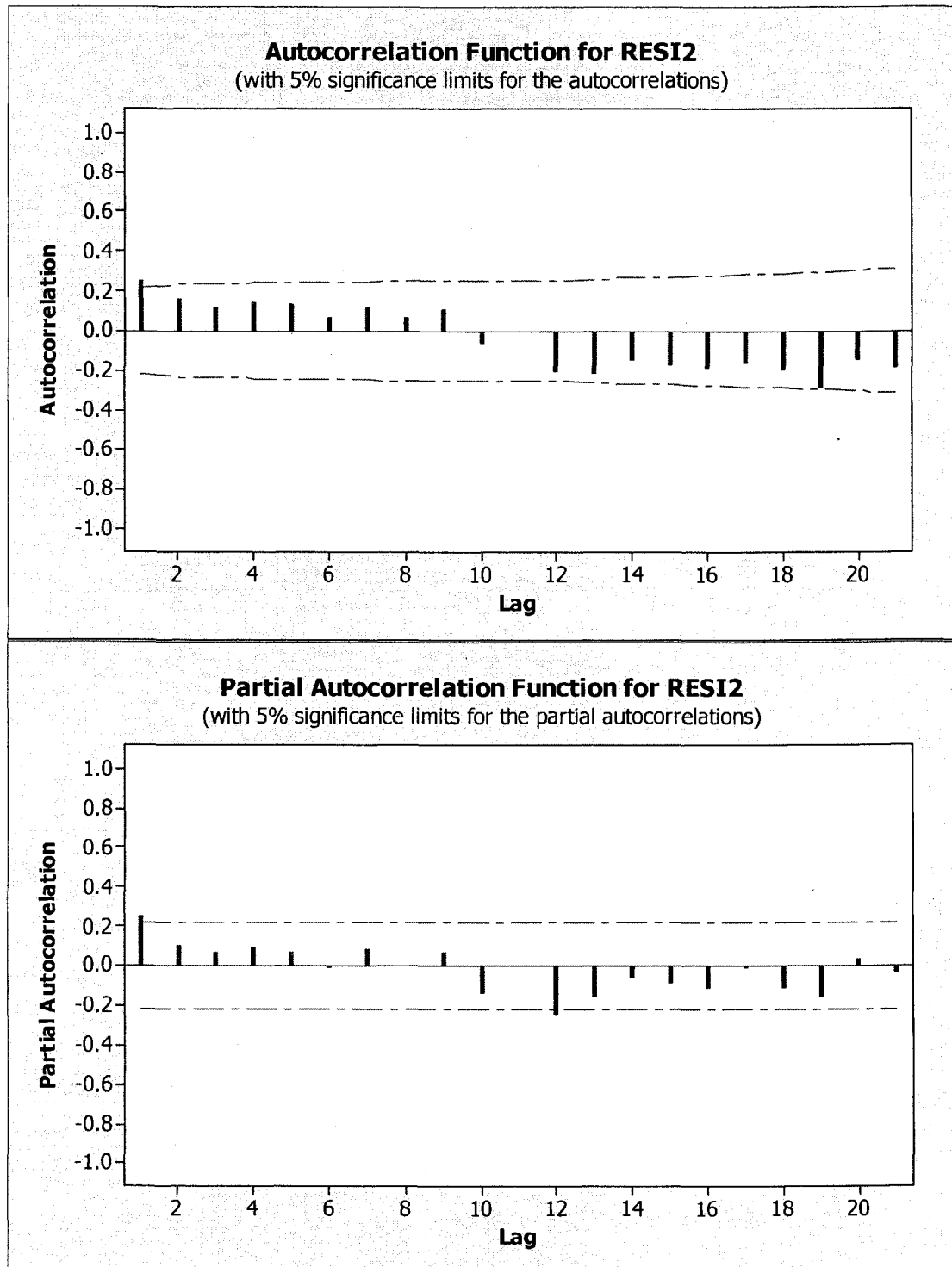


Figure 6. ACF and PACF Minitab plots of regression residuals.

The ACF plot depicted in Figure 6, also called the sample autocorrelation function (SAC) and the PACF also called the sample partial autocorrelation function are used to define the correct Box Jenkins model. The behavior, severity, and pattern of spikes determine which model is the best fit.

The spikes revealed on the above autocorrelation function for Residual 2 suggest the influence of autocorrelation in the error term of the first lag (1 month). An ARIMA or Box Jenkins model is adopted to resolve the issue of autocorrelation. Based on the spike at lag one of the autocorrelation chart, a non seasonal (0,0,1) ARIMA model was used. The (0,0,1) ARIMA residuals (Residual 3) were then examined to access whether the autocorrelation problem was resolved.

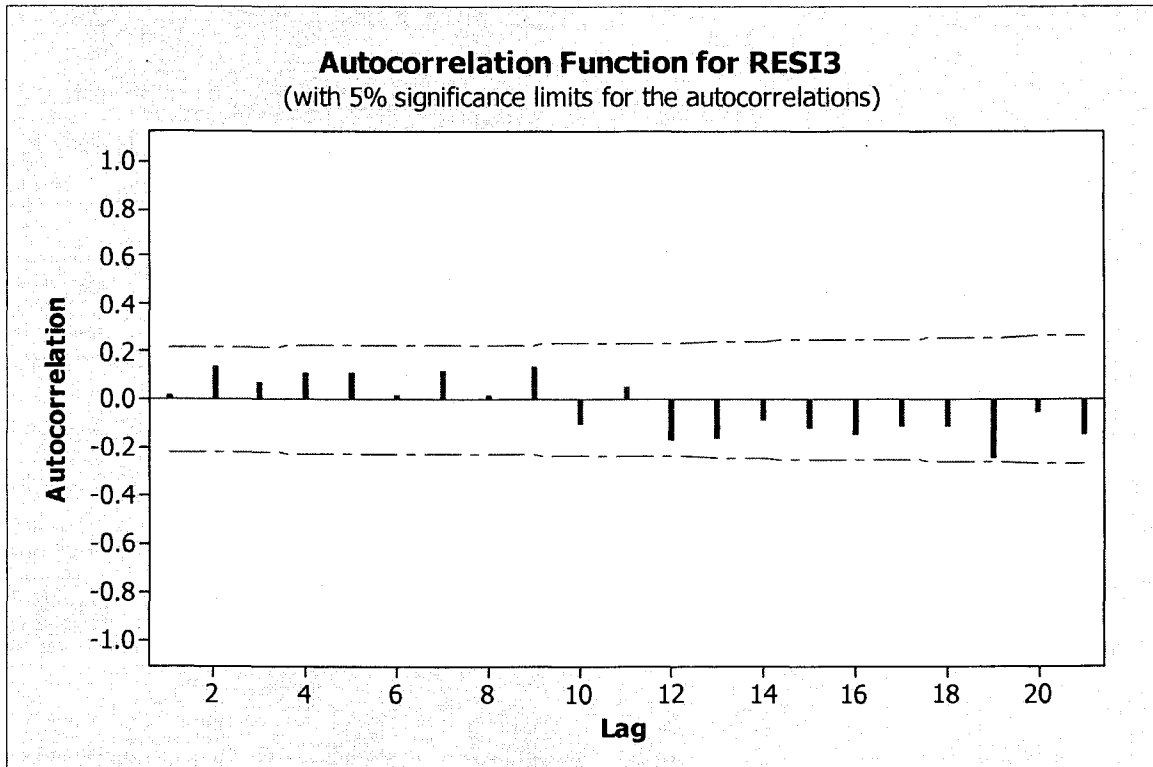


Figure 7. ACF Minitab output confirming the effect of (0,0,1) ARIMA.

The autocorrelation function for RESI3 confirms that the autocorrelation issues were successfully addressed. The final regression equation is now modified to reflect the Box Jenkins.

$$\text{Illinois coin-in} = 1.95\text{E}+09 + 1.74\text{E}+08 \text{ DMar} + 1.00\text{E}+08 \text{ DApr} + 1.29\text{E}+08 \text{ DMay} \\ + 1.58\text{E}+08 \text{ DJul} + 75702571 \text{ DAug} - 1.36\text{E}+08 \text{ 70\%} + e_t$$

Where  $e_t = a_t + .2264a_{t-1}$  where  $a_{t-1} \sim N(0, \sigma^2)$

The notations in the final regression equation reflect the following. “E” is a scientific notation for an exponential. In the above example: 1.95E+09 is the same as 1.95 billion. The “e” in the equation represents the error term for the regression equation. The “a” signifies the error term from the Box Jenkins treatment. The following figure depicts the output of the ARIMA:

### ARIMA Model: RESI2

Final Estimates of Parameters

Type	Coef	SE Coef	T	P
MA 1	-0.2264	0.1085	-2.09	0.040

Number of observations: 84

Residuals: SS = 259290087533527170 (backforecasts excluded)  
MS = 3123976958235267 DF = 83

Modified Box-Pierce (Ljung-Box) Chi-Square statistic

Lag	12	24	36	48
Chi-Square	11.3	32.4	46.8	65.2
DF	11	23	35	47
P-Value	0.420	0.091	0.087	0.040

Figure 8. Minitab final (0,0,1) ARIMA output. “MA” as noted under “Type” refers to moving average.

The Chi-Square presented towards the bottom of Figure 8 confirms behavior of the ACF graph from Figure 7. The Chi-Square “Lag 12” column (bold type column in Figure 8) has a P-Value of .420 which is the result of testing if the correlations up to lag 12 are significant or not. The lag correlations are tested by the chi-square by setting up each lag as a null hypothesis. The null hypotheses all state that no correlation of lags exists. The alternate hypothesis in this case states that there exists a correlation. The .420 indicates that the null should not be rejected and there is no correlation in the final model.

The regression equation reported an R squared of 71%. R squared represents the proportion of the sample variation of coin-in that was due to the variation of the independent variables in the final regression equation. The ideal R squared value is 1 or 100%.

### *Discussion of Results*

The regression model confirms that the 2003 Illinois Tax Restructuring had a negative effect on gaming demand. Trend was not a component in the final model. Previous tax increases, increased competition with surrounding states, and the increase in price for the final Illinois docksite license which hindered the sale of the last license all contribute to explain the overall lack of change in coin-in trend. The months of March, April, May, July, and August were all significant positive seasonal components in the final regression model. It should be remembered that Illinois is a Midwestern state where weather plays a factor in most activities. This may explain why the spring and summer months reveal a positive influence on gaming demand. It is conceivable that June does

not reflect this increase since it is associated with the end of the school year and families might vacation around non-gaming activities.

### *Conclusion*

The regression modeling of assessing impact of the 2003 Illinois tax restructuring on gaming demand successfully demonstrated a statistically significant negative correlation. The increased taxes resulted in decreased gaming demand. The following chapter will discuss inherent limitations, managerial implications, and lastly provide guidance for future research.

## CHAPTER 5

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

#### *Introduction*

This chapter focuses on conclusions that can be drawn from the results section of the data analysis. In addition, implications of the results as well as recommendations for future studies are discussed. The general purpose of the research was to investigate whether the gaming industry was governed by the same economic forces with respect to taxation as other industries and specifically the main research question asked whether increases in gaming taxes resulted in a decrease in gaming demand.

The research project entailed obtaining Illinois state monthly coin-in data from January 2000 to December 2006. After a thorough literature review, the researcher chose regression analysis with dummy variables to model the intervention of the 2003 70% gaming tax and the general gaming tax restructuring. Dummy variables measuring seasonality in the monthly data were also included in the regression model. Finally, because the regression's error terms indicated autocorrelation a Box Jenkins model was employed to resolve this issue.



### *Findings and Contributions*

The results of the study support the findings of research on occupancy taxes, real estate taxation, and sin taxes that have consistently found a negative correlation between demand and increased taxation and restrictions. Specifically, this thesis supports the research hypothesis predicting that increased gaming taxes will have a negative impact on gaming demand.

Despite frequent editorial supposition estimating the impact of increases in gaming taxes on the commercial gaming industry, there exists no prior empirical study examining this issue the knowledge of this researcher. Previous research has addressed changes in commercial gaming restrictions with similar results. Commercial gaming's stakeholders have frequently advocated the economic penalties inherent in inflated gaming taxation but have been unable to reference academically rigorous research supporting or refuting their position.

### *Limitations*

As mentioned in the introduction, the findings of this thesis must be considered with regard to the inherent limitations. Since this research analyzes only a single tax increase in a single Midwestern state in the United States, the degree to which the results are generalizable is limited. Further study of other state tax changes and possibly tax restructuring in foreign locales will help address this limitation. Coin-in while ostensibly the best representative of gaming demand does not constitute the entire revenue equation. Therefore understanding the table game contribution to revenue will strengthen the understanding of the correlation between gaming taxation and gaming demand. Further

insight into table games play will become possible when tracking systems for table games become both more prevalent and effective.

### *Recommendations for Further Study*

#### *Table and games analysis*

Although slot revenue comprises the greatest proportion of Illinois total gaming revenue, table play nevertheless fulfills an important function in the overall revenue mix. In addition, it is unclear whether table players are more or less impacted by expense alterations in conjunction to tax changes. Therefore understanding this market segment is critical and slot demand should not be assumed to reflect generalized gaming demand which includes table games. The ability to measure table game play should improve as casino based table game systems become more efficient and more widely adopted.

#### *Managerial Implications*

Much speculation has been cast upon the adjustments managers of commercial gaming operations invoke when pressured by increased gaming taxes. Future research attempting to uncover whether and to what degree marketing expenditures, capital improvement, and employee retention/hiring rates are curtailed would be useful.

#### *Comparison across States*

Further analysis of the impact of other states gaming tax changes and the effect on gaming demand would contribute to a comprehensive understanding of the relationship between gaming taxes and gaming demand. It is conceivable that other Midwestern states with limited gaming licenses are either more or less tolerant to gaming tax increases than less restricted states such as Nevada or Mississippi. In addition, research designed to understand how gaming tax restructuring affects gaming demand in

neighboring states might serve to illuminate the interstate balance among commercial gaming states. If gaming tax increases move gaming demand and tax receipts from the legislator's own state to their neighbor, state governments may become increasingly cautious before making drastic changes.

### *Conclusion*

By examining the relationship between the 2003 Illinois tax restructuring and coin-in this thesis indicates that increases in gaming taxation had a significant negative effect on Illinois gaming demand. A multiple regression model utilizing dummy variables was developed to analyze coin-in data collected from the Illinois Gaming Board representing the time period of January 2000 to December 2006. Since the regression equation's error terms reflected autocorrelation, a Box Jenkins model was incorporated to resolve this issue.

The results of this study affirm previous inquiry into the relationship between hotel room demand and increases in occupancy taxes. Furthermore, this thesis reinforces the findings of prior studies which identified a correlation between increases in cigarette taxes and decreased tobacco consumption; and also supports studies examining the negative impact on real estate investors from the 1986 Tax Reform Act.

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Thesis Title: Estimating the Effect of the 2003 Illinois Gaming Tax Restructuring  
on Riverboat Gaming Volume

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