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THE EFFECT OF A SMOKING BAN ON ILLINIOIS CASINO PERFORMANCE

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Abstract

Previous studies have shown that smoking and gambling are closely related. Recently, multiple states have passed laws banning smoking in public places, including casinos. Illinois banned smoking in 2007 with the Smoke Free Illinois Act, instantly affecting casino performance. This study estimates the effect of a smoking ban on Illinois' casino revenue and admissions taking into account additional factors not included in previous research. The results indicate that the smoking ban decreased revenue by about 23%.

JEL Classifications: D120, H270, I180

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I. Background

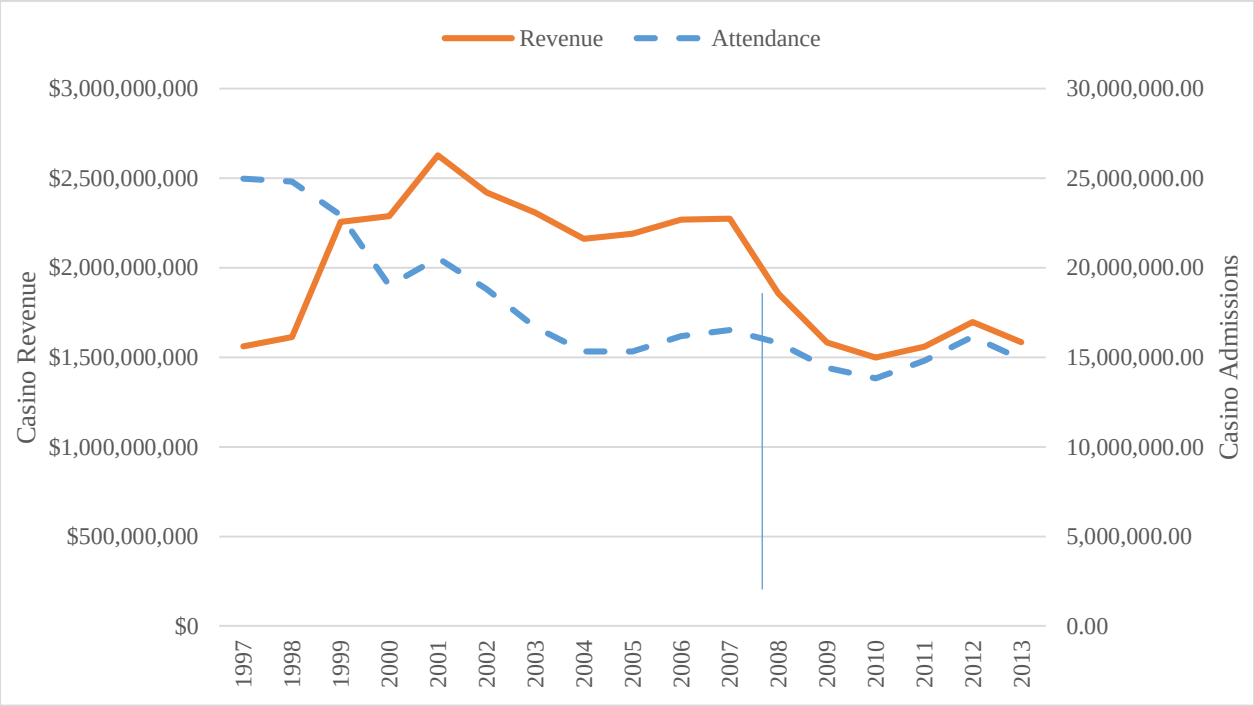
Over the previous decade, nineteen states have enacted a state-wide smoking ban in state regulated gambling establishments. This legislation has ignited a policy debate concerning the effect it has on casino performance and, by extension, gambling tax revenues. Opponents of the smoking ban argue that the ban can diminish casino attendance and time spent playing in the casino by smokers, thus lowering casino revenues. Proponents argue that the smoking ban can reduce the negative externalities associated with second hand smoke and increase casino revenues by attracting non-smokers. Thus, the net effect of the smoking ban on casino performance becomes an empirical question.

Smoking bans have been trending across the nation in restaurants, bars, and casinos. The rising popularity of smoking bans has allowed economists to investigate the effect of this policy on the performance of bars and restaurants as well as the gambling industry. Many studies have shown that restaurants and bars have not suffered much from smoking ban as attendance and revenue have not been affected by the smoking ban. Since most research shows no significant reduction in attendance in bars and restaurants due to smoking bans, it helped fuel the adoption of smoking bans in more states. However, as of present, there has been little research on the effect of smoking bans on casino performance. Due to limited research, states do not consider the difference in population preferences between casino patrons and restaurant or bar customers to be significant, when adopting a smoke-free policy.[1] This paper's estimates suggest that it may not be a valid assumption.

[1] Only 3 studies to date on the effects of a smoking ban on casino revenue. Mandal, Almar, and Glantz (2005), Thalheimer and Ali (2008), and Garret and Pakko (2010).

Riverboat **c**asinos in Illinois began to operate in 1991.[2] The first two to open were Alton Belle and Par-a-Dice, while 14 more firms were applying to open their own riverboat casinos. By 1993, there were 10 active riverboat casinos in Illinois.

Figure 1. Average casino revenue and attendance. Smoking ban was implemented in January 2008



In July of 2007, Illinois passed the Smoke Free Illinois Act. The act became effective in January 2008, banning smoking in places of employment, government vehicles, and all public place, including casinos. Figure 1, shows total annual attendance and revenue beginning in 1997, with a marker indicating when the smoking ban was enacted. As seen in Figure1, there appears to be a gradual decline in attendance and revenue at Illinois' casinos from 2007 to 2010, indicating the importance of controlling for a trend in time-series analysis. This study estimates the effect of the Smoke Free Illinois Act on casino revenue and attendance while controlling for economics, demographics, and seasonal factors that could also impact casino performance.

[2] Annual Report released by the Illinois' Gambling Board.

II. Literature Review

Nancy Petrey and Cheryl Oncken conducted a study in 2002 examining the association between cigarette smoking and individuals with gambling problems in the state of Connecticut. They observed 317 subjects who were divided as daily smokers and daily non-smokers. They used MANCOVA to analyze the difference between the non-smokers and smokers. The results, show that the smoking population showed a much higher inclination to be a gambler, have psychiatric disorders and to have family or social issues.

Grant et al. (2010) conducted a clinical study on a 34 year old female who requested treatment for smoking and pathological gambling. The individual found that gambling was a way to cope with her stress but would cause a heightened desire to smoke cigarettes. She reported that she visited the casino at least three times a week for six to eight hours per visit. They evaluated her pathological gambling with the Yale Brown Obsessive Compulsive Scale, where she scored a 26 indicating that she had a severe addiction to gambling. Upon her initial evaluation and education on pathological gambling and tobacco use, they observed the individual over a five month period. Within the first three months after her evaluation and cognitive behavioral therapy, she reported not going to the casino as often, where she attended once every two weeks. During those visits, she would gamble for six to eight hours and continued to feel urges to smoke from the gambling.[3] When she was not gambling, she was smoking less yet still feeling urges to visit the casino. She began taking an amino acid, N-acetyl cysteine, to reduce the urges to gamble as an alternative to pharmaceutical medications. During the final two months following the use of the amino acid and using the tools she learned in the cognitive therapy, she reported

[3] Routine gambles have a propensity to smoke while gambling due to high level s of stress from a loss or in fear of losing money.

that she had only gambled at the casino once and stayed at the casino for four to five hours during that visit. The individual also reported that she had not smoked since that visit.

Pristos, Prstos and Spears (2008) conducted a study in 2008 at casinos in Las Vegas to capture the percentage of casino patrons who are smokers. They observed 14,052 individuals between three high volume gambling locations in the Las Vegas area, the Las Vegas Strip, Reno/Sparks, and Lake Tahoe. Of the 14,052 individuals, 947 of them were smoking.[4] From the eight casinos located on the Las Vegas Strip, they observed 7,633 individuals and found that 20.3% of the observed population were smokers. In the Reno/Sparks area, they observed 4,737 individuals in seven casinos and found that 21.5% of the observed population were smokers. The three casinos at the Lake Tahoe area, they observed 1,682 individuals and found that 16.4% of the observed population were smokers. They found that 20.2% of the overall gambling population were smokers. These findings are consistent with a study conducted in 2005 by the CDC, indicating that 20.9% of the United States population smoked tobacco products. They concluded that the gambling population in Las Vegas is a reflection of the national smoking population

As of 2011, there are 25 states that have enacted comprehensive smoking bans.[5] Comprehensive smoking bans are designed to create a complete smoke-free environment in workplaces, restaurants and bars. The effects of these smoking bans are debated that they may be harmful to the economy of the regions of the smoking bans. According to Kiser and Boschert (2001) in their research on California's *BREATH* program, California's effort to eliminate smoking in bar establishments, they report that there was no significant economic impact on bar

[4] Pristos, Pristos and Spears observe multiple locations to eliminate risk of location bias.
[5] No-Smoke.org - fact sheet

revenues that participated in the program.[6] They report that nearly 86 percent of Californians do not smoke and that 90 percent of bars in California also operate as restaurants, while only 11 percent of bars operate on their own. The report also provides that 85 percent of bar patrons are in favor of smoke-free establishments.

A study conducted on bars in El Paso, Texas by the CDC (Center for Disease Control, 2002) showed that the bar revenues in El Paso, Texas were entirely unaffected by a smoke-free ban. In this study, they ran two regression analyses measuring the change in bar revenues using time series data. The first model being bar revenue regressed on sales tax, with the second model being the revenue regressed on the mixed-beverage tax collections. These models were tested to see if the "regime shift" was statistically significant. Their results showed that there were no statistically significant variables that indicated that the smoking ban had any effect on bar revenues[7].

Bartosch and Pope (2002) analyzed the impact of smoking bans in Massachusetts' restaurants and bars. They used a single regression analysis to measure how bar revenues were affected by smoking restrictions on a monthly basis and how it affected surrounding smoking friendly establishments. Using a panel-data framework across multiple towns for 84 months, they regressed inflation- adjusted taxable meal receipts of smoking friendly restaurants on variables that measured the relocation of customers. They included a dummy variable, *Border,* which indicated for a smoking friendly establishment neighboring a town with a smoking ban. The variable, *Border, estimate* revealed that smokers would relocate to restaurants that allowed smoking, increasing monthly revenue by an average of 7.85%.[8]

[6] CDC, 2001. Observed the effects of a smoking ban on attendance in restaurants, bars and gambling clubs.
[7] The study was conducted immediately after the ban, not showing any log-term effects or support for model fit. Huang and McCusker suggest a reapplication of the model when more information is available.
[8] Their model compared restaurants that served alcohol and those that did not. All establishments showed a positive and significant increase in per capita sales.

A study conducted in Wisconsin by Dunham and Marlow (2004), analyzed the profit maximization of bar-restaurant owners by optimizing the amount of seating to allocate for smoke-free sections. Upon collecting survey data from the region of study, they found that 30 percent of the restaurants' customers smoke and managers allocate normally 50 percent of their seating for smoking and nonsmoking sections. Their model that included this survey data along with exogenous variables, revealed that restaurant owners will allocate more seating for nonsmokers than for smokers in an attempt to maximize their profits. The model reveals that restaurant owners take multiple variables into account, such as the number of children, customer occupation, and the college student population in the town. Their findings are that restaurants with full-service bars will lose money if they completely ban smoking in their establishment as opposed to allowing some seating for smokers.

Thomas Garret and Michael Pakko (2009) make an assertion that banning smoking tobacco products in Illinois' casinos will significantly lower casino admissions, revenues and state-tax revenues. They argue that in the presence of a smoking ban, smokers will gamble less via decreased casino visits or by time lost taking smoke breaks.[9] By examining the Illinois casino attendance and AGR (Annual Gross Revenue), they are able to determine that the smoking ban effectively reduced AGR by 23%. An important element of determining these values was identifying the smoking population amongst gamblers, which is roughly 21% according to Pristos, Pristos and Spears (2008). The findings of Petry and Oncken (2002), suggest that smokers spend more money at casinos due to more frequent attendance and commonly wagering larger bets compared to nonsmokers. Using the findings of Petry and Oncken, Garret and Pakko utilize multiple regression models for the casinos in Illinois and surrounding states with riverboat

[9] Assuming that a smoke break equates to time lost gambling, thus a zero-profit during that smoke break

casinos to identify the factors that reduced casino revenues. They conduct this analysis on state-level AGR, individual casino AGR, and the regional AGR. Their model included seasonal trends, general economic conditions, previous policy changes, weather events, and a dummy variable to mark when the smoking ban was implemented.

The results for the state level analysis conducted by Garret and Pakko reveal that the state's policy variables were statistically significant and independent of the surrounding states. Surrounding states saw an increase in attendance and steady profit gains after Illinois enacted the smoking ban.[10] The dummy variable for the smoking registered a statistically significant coefficient of -0.25, which is a 25 percent decrease in Illinois casino revenues. These findings hold true with the results produced by Petry and Oncken that casino patrons who smoke will attend casinos more frequently and will gamble with larger amounts of money. These results support the information they discover from applying the model to individual casinos across Illinois.

After obtaining the effects of the smoking ban on statewide casino AGR, Garret and Pakko examine the effect the smoking ban has on casino tax revenues. They find that in total, the state loses $194.8 million in tax revenue, where the local (casino host) community, loses $11.1 million in tax revenue annually.

In conclusion, Garret and Pakko suggest that imposing the smoking ban will cause a reduction in revenue for both the casinos and the state. This suggestion ultimately can be an argument against the legislation of banning smoking in casinos. Their research addresses two concerns. First, they expand on the effects of smoking bans on casino attendance and revenue.

[10] Compared bordering states after the smoking ban to measure if the Subprime Mortgage Crisis of 2007 affected casino revenue and to measure if gamblers relocated to other casinos to avoid the smoking ban. Results showed that bordering states did not suffer a loss in revenue and showed a slight increase in revenue.

The second issue they address, is how the smoking ban affects the performance of a casino in a state where a smoking ban is present compared to a casino in a state where there is no smoking ban present. This particular insight they provide should be considered in future research on smoking bans on the economy. Their overall findings are that attendance fell 10 percent. Also, Illinois' casinos suffered a 22% decrease; approximately $400 million in revenue, and thus, a suggested $200 million drop in state tax revenues.

III. Data and Methodology

As shown in previous literature, a smoking ban can have a detrimental effect on casino revenues. In this paper, I examine the effect of the smoking ban on casino admissions and revenues. The smoking ban can have a negative effect on casino revenue by lowering attendance and reducing time spent gambling by smokers. Casino revenue is a function of attendance, as more people who attend are likely to lose more money to the casino. However, the smoking ban may also reduce the amount of time people gamble due to smokers taking smoke breaks. Gambling is associated with stress and other mental disorders that are commonly found in the smoking population. The amount of time spent by taking smoke breaks equates to time lost gambling, which creates a potential loss in casino revenue. While the smoking ban may decrease the number of smokers who attend the casinos, it may attract more non-smokers to attend, making the net effect ambiguous. Since the net effect is uncertain, I conduct an empirical analysis to measure the effect of the smoking ban on casino attendance.

Microeconomic theory states that the market demand for a good or service is a function of its price, price of related goods or services (complements and substitutes), income, population size, consumer tastes and preferences, and future price expectations. This theory guides the

selection of independent variables for my empirical model. Since there is no explicit price for attending a casino nor is there an expectation for casino costs to rise or fall, these variables are missing from the model. Prices of related goods are proxied by taxes on cigarettes and alcohol, which tend to be consumed jointly with gambling. Income is represented by the coincidental economic activity index (CEAI). The income variable would affect the frequency and amount a person wagers at casinos. If this effect is positive, then gambling might be a normal good. Age and education proxy for demographic and preference factors that may affect the demand for gambling.

A. Data

For the purposes of my research, I use monthly time-series data, from January 1997 to June 2014, totaling 210 observations. The two dependent variables, admissions and revenue, are collected from the Illinois Gaming Board. I include snowfall to measure the number of casino patrons who are not willing to travel due to winter weather conditions. This variable is the amount of snowfall in Illinois reported in inches by the NOAA. The annual cigarette tax rate per pack and alcohol excise tax rates are collected from the Tax Foundation. The CEAI, is an index created and reported by the Philadelphia Reserve Bank. CEAI is derived from payroll hours, average hours worked in manufacturing, state unemployment rate, and the wage/salary disbursement to measure the state's overall economic quality. Graduation rates are collected from the KIDS COUNT DataCenter. Population age data is collected from the Census Bureau Fact Finder.[11] I adjust all data values that are reported in dollars for inflation using the CPI.[12]

[11] Manually specified table data using the Census Bureau Fact Finder.
[12] Revenue, Cigarette Tax Rates and Alcohol Tax Rates are adjusted for inflation using the CPI.

Table 1. Variable Definitions

AGR_t	Adjusted gross revenues of Illinois' casinos (in real dollars), at time t
ADM_t	Casino admissions, at time t
Ban_t	Dummy Variable = 1 when the smoking ban is in effect (0 otherwise), at time t
$Ceai_t$	Coincidental economic activity, at time t
$Snow_t$	Snowfall in Illinois (reported in inches), at time t
Ctr_t	State tobacco tax rate per pack of cigarettes (in real dollars), at time t
$Stpr_t$	State spirit tax rate (in real dollars), at time t
Wtr_t	State wine tax rate (in real dollars), at time t
Btr_t	State beer tax rate per gallon (in real dollars), at time t
Edu_t	State High School Graduation Rate (reported as percentage), at time t
Age_t	State Population of 65 and Older (reported as percentage), at time t
$Trend_t$	Functions controlling for exponential growth[13], at time t
	$\frac{t}{100}$ = Trend $\frac{t^2}{10000}$ = Trend-Squared
$Seas_t$	Seasonal trend – dummy variable for each month[14]

Ban is a dummy variable indicating when the smoking ban took effect in the casinos. The *CEAI* variable is a unique variable that accounts for the amount of money earned by employed persons and also the unemployment rate. Illinois experiences routine winter patterns, so including the amount of snowfall is important to track the effects of winter through the *Snowfall* variable. The variable *Trend* and *Trend*^{2}, offsets the presence of exponential growth in the

[13] Pakko and Garret use this method to control for exponential growth in revenue in their previous research on the effect of the smoking ban in Illinois.
[14] Example: January = 1, 0 otherwise.

dependent variables, *Admissions* and *Revenue*. The *Seas* dummy variable accounts for monthly and seasonal factors to consider seasonal weather patterns and their effects on the monthly admissions and revenue. The summary statistics of the variables for this analysis are below in Table 2. All monetary values are adjusted for inflation.

Table 2. Summary Statistics. Standard error of means in parentheses. Number of Observations = 210.

Variable	Mean
Adm	1,446,904.00
	(21,123.62)
Agr	$ 161,000,000.00
	$ (2,065,124.00)
Ceai	137.4664
	(0.4035)
Snow	1.186667
	(0.3848)
Ctr	1.094465
	(0.0223)
Stpr	6.033066
	(0.1595)
Wtr	0.9068986
	(0.0273)
Btr	0.2227789
	(0.0032)
Edu	0.8478286
	(0.0015)
Age	9.757444
	(0.3332)

B. Model

The model I use is an augmented linear regression created by Garret and Pakko fitted to monthly state level casino revenues.[15] The model estimates associated effects of the smoking ban on statewide casino revenue and attendance.

First, I estimate the effect of Illinois' smoking ban on statewide casino attendance and revenue using the demand function below in models 1 and 2:

$$Adm_t = c + \beta_1 Ban_t + \beta_2 Ceai_t + \beta_3 Edu_t + \beta_4 Age_t + \beta_5 Btr_t + \beta_6 Sptr_t + \beta_7 Wtr_t + \beta_8 Ctr_t + u_t \quad (1)$$

$$Agr_t = c + \beta_1 Ban_t + \beta_2 Ceai_t + \beta_3 Edu_t + \beta_4 Age_t + \beta_5 Btr_t + \beta_6 Sptr_t + \beta_7 Wtr_t + \beta_8 Ctr_t + u_t \quad (2)$$

Secondly, I include variables to include for exponential and seasonal trends to estimate the effect of Illinois' smoking ban on statewide casino attendance and revenue[16] below in models 3 and 4:

$$Adm_t = c + \beta_1 Ban_t + \beta_2 Trend_t + \beta_3 Trend^2_t + \beta_4 Seas_t + \beta_5 Ceai_t + \beta_6 Edu_t + \beta_7 Age_t + \beta_8 Snow_t + \beta_9 Btr_t + \beta_{10} Sptr_t + \beta_{11} Wtr_t + \beta_{12} Ctr_t + u_t \quad (3)$$

$$Agr_t \; c + \beta_1 Ban_t + \beta_2 Trend_t + \beta_3 Trend^2_t + \beta_4 Seas_t + \beta_5 Ceai_t + \beta_6 Edu_t + \beta_7 Age_t + \beta_8 Snow_t + \beta_9 Btr_t + \beta_{10} Sptr_t + \beta_{11} Wtr_t + \beta_{12} Ctr_t + u_t \quad (4)$$

I take the log form of both dependent variables in the models to examine the percentage change in revenue and attendance after the smoking ban below in models 5 and 6:

$$LnAdm_t = c + \beta_1 Ban_t + \beta_2 Trend_t + \beta_3 Trend^2_t + \beta_4 Seas_t + \beta_5 Ceai_t + \beta_6 Edu_t + \beta_7 Age_t + \beta_8 Snow_t + \beta_9 Btr_t + \beta_{10} Sptr_t + \beta_{11} Wtr_t + \beta_{12} Ctr_t + u_t \quad (5)$$

$$LnAgr_t = c + \beta_1 Ban_t + \beta_2 Trend_t + \beta_3 Trend^2_t + \beta_4 Seas_t + \beta_5 Ceai_t + \beta_6 Edu_t + \beta_7 Age_t + \beta_8 Snow_t + \beta_9 Btr_t + \beta_{10} Sptr_t + \beta_{11} Wtr_t + \beta_{12} Ctr_t + u_t \quad (6)$$

[15] Model used is derived from Garret and Pakko's model used in their analysis.
[16] Expansion of model for robustness check.

IV. Results

A. Initial Results

The results from the regression models using the demand function are located in table 3. The values for admissions are reported as a whole number of attendance.

Table 3. Empirical Results: Demand Function. Standard Errors in Parentheses

Variable	**Model 1** **Admissions**	**Model 2** **Revenue**
Ctr	-37,902.26	$ -17,200,000.00***
	(41,881.08)	$ (4,631,629)
Btr	-1,615,743.00***	$ 172,000,000.00***
	(260,276.90)	$ (44,400,000)
Stpr	-14,328.41	$ 3,528,727.00**
	(12,334.61)	$(2,105,309)
Wtr	16,059.87	$ 3,439,009.00
	(66,337.36)	$(11,800,000)
Ceai	-7,073.07**	$ 2,022,588.00***
	(2,298.54)	$(382,601.1)
Edu	-73,893.91***	$ 17,292.07
	(8,863.51)	$ (879,710.8)
Age	11,087.30*	$ 721,503.70
	(5,243.25)	$ (591707.30)
Ban	-135,487.90***	$ -58,400,000.00***
	(34,924.44)	$ (9,671,107)
_cons	9,099,607.00	$ 148,000,000.00
	(580,601.10)	$ (87,300,000)
R-Squared	0.8245	0.8343

******* p<1%, ****** p<5%, ***** p<10%

The estimate of the variable of interest, *Ban*, is negative and statistically significant to both Models 1 and 2. The estimate suggests that the smoking ban will reduce the demand for gambling by reducing admissions by a monthly average of 135,500 gamblers and nearly $60 million in revenue.

B. Testing and Primary Results

I test for minor anomalies using a VIF function to test for multicollinearity and a Portmanteau White Noise test for auto correlation. The VIF indicated that no variables were collinear in models 1 and 2 but in models 3, 4, 5, and 6 multiple control variables become collinear. The Portmanteau White Noise test indicated that the errors terms were correlated across all models.

To test for major statistical anomalies, I use the Breusch-Pagan test for heteroskedasticity and Augmented Dicky-Fuller test for non-stationarity. The results from the Breusch-Pagan test indicate that I do not have heteroskedasticity in the error terms for Models 3 and 5, but the error terms in Models 4 and 6 are heteroskedastic. The Augmented Dicky-Fuller test indicated that there is no unit root in any of the presented models, therefore the models are stationary.

I use the Newey-West Standard Errors to correct for the heteroskedasticity and autocorrelation in the affected models.

Table 4. Regression Results. Standard errors in parentheses Full result table can be found in Appendix 3.

Variables	Model 3 – Admissions	Model 4- Revenue	Model 5 - Ln(Admissions)	Model 6 - Ln(Revenue)
Ban	-170,659.30***	-$35,600,000***	-0.122***	-0.217***
	(46,369.0)	$(4,570,945.0)	(0.030)	(0.033)
Ceai	-823.25	$2,504,355.0***	0.001	0.015***
	(2,913)	$(393,511.7)	(0.002)	(0.002)
Snow	-5,285.97***	-$587,741.0***	-0.005***	-0.004***
	(1,511)	$(95,639.3)	(0.001)	(0.001)
Ctr	-167,773.20***	-$2,718,219.0**	-0.110***	-0.005
	(41,744)	$(3,926,452.0)	(0.027)	(0.022)
Btr	-1,197,012***	$117,000,000.0***	-0.684***	0.727***
	(230,154)	$(35,200,000.0)	(0.150)	(0.202)
Wtr	-5,647.69	$6,012,851	-0.007	0.024
	(53,8490)	$(7,104,724.0)	(0.035)	(0.040)
Stpr	-3,305.80	$5,085,505.0***	0.002	0.028***
	(11,138.0)	$(1,482,572.0)	(0.007)	(0.008)
Edu	-33,128.93**	$29,683.0	-0.025***	-0.003
	(11,259.0)	$(1,339,502.0)	(0.007)	(0.009)
Age	10,246.53*	-$774,133.0	0.006*	-0.005
	(5,328)	$(652,009.3)	(0.003)	(0.004)
R-squared	0.8875	0.8839	-	-

*** p<1%, ** p<5%, * p<10%

The initial results show that the variable of interest, *Ban*, is negative and statistically significant across all models. The estimate indicates that the smoking ban led to an average monthly decrease of 12% of casino patrons and nearly 22% of casino revenue. The revenue model results are supported by the findings of Pristos, Pristos, and Spears.[17] Revenue is also a function of admissions also, it is evident that a reduction in casino patrons would equate to a

[17] Their results indicated that 20.9% of casino patrons smoke cigarettes.

reduction in revenue. The smoking ban also causes smokers to take smoke breaks. These smoke breaks take time away from the smoker to gamble, leading to less money lost to the casino.

V. Economic Implications

Illinois' casinos generate between $1.5 billion to $3 billion in annual revenue. The casinos pay tax on revenue earned and the number of admissions to the casino per month. The tax structure is a gradual tax rate that increases with the amount of revenue.[18] There is a flat tax for each admission of $3. As both admissions and revenue have declined since the smoking ban, this would suggest a proportional loss in state tax revenue. Illinois posted losses from 2004-2009 in tax revenue from casinos, and began to climb in 2010.[19] During that time span, Illinois legislated the Smoke –Free Illinois' Act in 2007 causing casino revenue to decrease even further. Tax collected from casino revenues are often earmarked for government projects such as infrastructure, education and host-region maintenance.[20] As casino revenue decreases, Tax revenue should be expected to fall, hindering state operations.

States are now using casinos as a way to boost tax revenues as a form of tax relief for state residents. In the last decade, multiple states passed legislation to legalize the opening of casinos, such as Ohio and Pennsylvania. As states legalize casinos for tax relief, they need to consider that effects of imposing a smoking ban on tax revenue collected from casinos.

VI. Future Research

Gambling is a very addictive activity that can have a very significant social cost. In 2009 the National Council on Problem Gambling released a fact sheet reporting that the social cost of

[18] Tax structure can be found in Appendix 2
[19] Illinois casino tax revenues, 1997-2013 can be found appendix 3.
[20] Garret and Pakko make note of this in their research on the effect of a smoking ban on Illinois' Casinos

problem gambling is $255.1 million in the state of Illinois. They also report that there are nearly 290,000 problem gamblers in the state of Illinois. Future research ought to include a variable accounting for this gambling population, as addiction is commonly associated with smoking. The effect of the smoking ban on gambling addicts, may reveal their impact on casino revenue in the presence of the smoking ban.

In October 2012, Illinois legalized the use of Video Gaming in liquor serving establishments. There are now over 18,000 video gaming terminals in operation in Illinois. In 2013, Illinois has collected over $90 million in tax revenue from the video gaming terminals.[21] As more information becomes available, future research should include the number of active terminals to measure their effect on casino admissions and revenue.

The estimated results from this analysis suggest that there is a strong negative effect from the smoking ban on state and local tax revenue. Future research can be done on other states given the availability of the resources.

VII. Conclusion

States are continuing to pass laws that ban smoking in public places, including restaurants, bars, places of employment, and casinos. This movement has been motivated by reducing the amount of second hand smoke. Casino owners and administrators often argue against smoking bans.

I use Illinois' as an example to show the possible implications of the smoking ban. Through discussion of previous literature, it is clear that smoking and gambling are heavily related. To examine the effect of the smoking ban, I recreate the model used by previous

[21]Annual Report released by the Illinois Gaming Board.

economists. I include variables of my own that I will would give more explanation to the nature of gambling and smoking. I find that the smoking ban has had a negative effect on both admissions and revenue. The results indicated that revenue would decrease by 23% and admissions would decrease by 110,000 people per month. The results also indicate that there is a significant negative effect on state and local tax revenue via les admissions and less revenue.

The Smoke Free Illinois Act also affects many other markets in the state. The costs and benefits must be included when conducting a full analysis of the Smoke Free Illinois Act and its effect on the state economy.

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IX. Appendices

A. Appendix 1

Table 1. Results of the Breusch-Pagan Test for Heteroskedasticity

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	
Ho: Constant variance	
Dependent Variables: Adm, Agr, LnAdm, LnAgr	
Model 3	chi2(1) = 23.27 Prob > chi2 = 0.0000
Model 4	chi2(1) = 2.91 Prob > chi2 = 0.0880
Model 5	chi2(1) = 1.16 Prob > chi2 = 0.2822
Model 6	chi2(1) = 0.80 Prob > chi2 = 0.3704

Table 2. Results of Augmented Dickey-Fuller Tests for Unit Root

Dickey-Fuller test for unit root					
Interpolated Dickey-Fuller				Number of obs =	209
		Test Statistic	1% Critical Value	5% Critical value	10% Critical value
Model 3	Z(t)	-7.267	-3.474	-2.883	-2.573
	MacKinnon approximate p-value for Z(t) = 0.0000				
Model 4	Z(t)	-7.854	-3.474	-2.883	-2.573
	MacKinnon approximate p-value for Z(t) = 0.0000				
Model 5	Z(t)	-7.267	-3.474	-2.883	-2.573
	MacKinnon approximate p-value for Z(t) = 0.0000				
Model 6	Z(t)	-8	-3.474	-2.883	-2.573
	MacKinnon approximate p-value for Z(t) = 0.0000				

Table3. Variance Inflation Factor: Models 1 and 2

Models 1 and 2		
Variable	**VIF**	**1/VIF**
Age	8.03	0.124597
Wtr	5.69	0.17583
Edu	4.43	0.225837
Ban	2.42	0.413835
Ctr	2.36	0.423352
Ceai	1.97	0.508825
Btr	1.76	0.569165
Snow	1.2	0.835936
Mean VIF	3.48	

Table 5. Variance Inflation Factor: Models 3, 4, 5, and 6.

Models 3, 4, 5, and 6		
Variable	**VIF**	**1/VIF**
Trends	139.47	0.00717
$Trend^2$	119.01	0.008403
Age	12.72	0.078631
Edu	11.96	0.083581
Ban	9.99	0.100091
Wtr	6.91	0.144662
Seas4	4.01	0.249109
Seas5	3.99	0.250435
Seas6	3.99	0.250773
Seas2	3.98	0.251545
Seas3	3.97	0.251967
Ceai	3.87	0.258728
Seas7	3.82	0.262087
Seas8	3.81	0.262265
Seas1	3.69	0.271238
Ctr	3.6	0.277476
Seas11	3.53	0.28299
Seas9	3.52	0.283942
Seas12	3.49	0.286291
Seas10	3.21	0.31154
Btr	2.11	0.473711
Snow	1.41	0.711048
Mean VIF	16.18	

B. Appendix 2

Table 1. Results of OLS Regression. Standard Errors Reported in Parentheses.

Varables	Model 1 - Admissions	Model 2- Revenue	Model 3 - Ln(Admissions)	Model 4 - Ln(Revenue)
Ban	-170,659.30***	-$135,600,000.0***	-0.122***	-0.217***
	(146,370)	$(4,570,945.0)	(0.030)	(0.033)
Ceai	-823.25	$2,504,355.0***	0.001	0.015***
	(12,913)	$(393,511.7)	(0.002)	(0.002)
Snow	-5,285.97***	-$587,741.0***	-0.005***	-0.004***
	(11,511)	$(95,639.3)	(0.001)	(0.001)
Ctr	167,773.20***	-$2,718,219.0**	-0.110***	-0.005
	(141,744)	$(3,926,452.0)	(0.027)	(0.022)
Btr	1,197,012***	$117,000,000.0***	-0.684***	0.727***
	(1,230,154)	$(35,200,000.0)	(0.150)	(0.202)
Wtr	-5,647.69	$6,012,851.0	-0.007	0.024
	(153,850)	$(7,104,724.0)	(0.035)	(0.040)
Stpr	-3,305.80	$5,085,505.0***	0.002	0.028***
	(111,138)	$(1,482,572.0)	(0.007)	(0.008)
Edu	-33,128.93***	$29,683.0	-0.025***	-0.003
	(111,259)	$(1,339,502.0)	(0.007)	(0.009)
Age	10,246.53*	-$1774,133.0	0.006*	-0.005
	(15,328)	$(652,009.3)	(0.003)	(0.004)
Trend	-7,848.87	$212,963.70	-0.005	0.0021661
	(11,464)	$(50,336.4)	(0.001)	(0.001)
$Trend^2$	345,646.40	$26,800,000.0	0.197	-0.1976657
	(158,760)	$(6,285,723.0)	(0.038)	(0.038)
seas1	44,406.30	$3,181,543.0	0.036	0.021619
	(148,650)	$(2067394.0)	(0.032)	(0.013)
seas2	96,397.89	$4,409,100.0	0.069	0.0347628
	(150,603)	$(3,156,079.0)	(0.033)	(0.023)
seas3	195,615.60	$16,900,000.0	0.138	0.1133225
	(150,544)	$(3,604,226.0)	(0.033)	(0.024)
seas4	134,458.30	$11,100,000.0	0.095	0.076338
	(150,830)	$(2,385,811.0)	(0.033)	(0.016)
seas5	142,812.70	$10,300,000.0	0.098	0.0682375
	(150,676)	$(3,294,282.0)	(0.033)	(0.019)
seas6	93,062.94	$5,101,809.0	0.070	0.0387218

	(150,629)	$(2,712,768.0)	(0.033)	(0.019)
seas7	185,732.10	$13,800,000.0	0.130	0.0888413
	(150,788)	$(2,359,288.0)	(0.033)	(0.015)
seas8	173,856.00	$12,300,000.0	0.126	0.0847748
	(150,755)	$(337,767.0)	(0.033)	(0.013)
seas9	77,484.04	$5,371,856.0	0.063	0.0411824
	(148,773)	$(846,780.0)	(0.032)	(0.014)
seas10	62,657.57	$5,526,601.0	0.049	0.0395522
	(146,554)	$(1,085,293.0)	(0.030)	(0.010)
seas11	17,621.78	$2,414,917.0	0.017	0.0209267
	(148,844)	$(131,471.0)	(0.032)	(0.010)
seas12	470.62	$2,992,111.0	0.004	0.0221404
	(148,555)	$(1,514,511.0)	(0.032)	(0.009)
_cons	5,019,929	$-214,000,000.0	16.530	16.86645
	(1,048,164)	$ (126,000,000.0)	(0.685)	(0.777)
R-squared	0.8875	0.8839	-	-

C. Appendix 3

Appendix 3. Illinois' Casino Tax Structure

Tax Rate	AGR Tax Range
15%	≤ $25 Million
22.5%	$25 million ≤ $50 Million
27.5%	$50 million ≤ $75 Million
32.5%	$75 million ≤ $100 Million
37.5%	$100 million ≤ $150 Million
45.0%	$150 million ≤ $200 Million
50%	$200 Million ≤

Appendix 4. Illinois' Casino Tax Revenue, 1997-2013.