



A Study of the Cross-state Effects of Smoking Bans on Gaming Revenues: The Delaware / New Jersey Experience¹

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As smoke free laws on public places are being implemented around the country, the economic effects of such policies on the hospitality industry is questioned. The economic impact of Clean Indoor Air Policies (CIAP) on bar and restaurant revenues has been proven to be negligible; smoking bans improve the working conditions of the employees and do not appear to significantly affect revenues (Bartosch and Pope 1999). However, the benefits of CIAP come at a cost; smoke free laws appear to be negatively affecting the gaming industry.

In November of 2002, the State of Delaware approved its first complete smoking ban. The net revenues of the three Delaware Casinos and previous research reveal that the Delaware Clean Air Act had a negative effect on gaming revenues. Moreover, as suggested by Pakko (2005), CIAP appear to have a greater negative effect on the revenue of gaming facilities in closer proximity to Atlantic City due to the substitution effect.

This paper measures the substitution effect between gaming facilities in Atlantic City and Delaware; it finds that the Delaware Clean Indoor Air Act had a positive impact in Atlantic City gaming revenues. Understanding the impact of smoking bans in the gaming industry is of high importance; the public benefit of a smoke-free environment has an underlying private cost to the gaming facility as well as to the State. Due to the decrease in gaming revenue, the State of Delaware suffered a loss in taxing revenue of \$12.2 million in 2003 (Barrish 2009).

I. Literature Review

Since the 1970s, several state governments have joined the anti smoking campaign by introducing both partial and complete smoking bans in public areas including workplaces, bars and restaurants. These policies attempt to reduce the consumption of cigarettes and therefore decrease the health care costs associated with tobacco related illnesses. Several studies have found that tobacco restricting legislation have decreased consumption (Chaloupka and Shaffer 1992; Warner 1977); moreover, research confirms that the increase of anti-smoking laws and/or the severity of them also discourages consumption (Gallet 2004).

The merits of restricting public smoking and reducing cigarette consumption have been well researched and published. Extensive publications suggest that anti-smoking policies have no effect on restaurant and bar revenues (Huang and McCusker 2004). On April 10, 1995, New York City passed its first partial Clean Indoor Air Act which restricted smoking in most public places. The economic impact of this partial smoking ban on hotel and restaurant revenues has been examined by analyzing taxable sale receipts as a proxy for profit (Hyland, Cummings and Nauenberg 1999). The authors conclude that the smoke-free ordinance did not have a statistically significant effect on sales for eating and drinking establishments or hotels. Other publications use similar approaches to measure the economic impact of state wide smoking bans. Bartosch and Pope (1999) used a pre/post quasi-experimental design to compare town-level meal-tax data before and after the imposition of 1992's smoke-free policies in Massachusetts; the model employs inflation adjusted tax receipt data as the dependent variable. Agreeing with

previous publications, the authors find that the descriptive data suggests that the adoption of smoke-free policies did not have a significant impact on aggregate restaurant sales. Unlike previous articles, this model accounted for the difference between partial and complete smoking bans.

Unlike most publications, Phelps (2006) argues that increasing regulations and introducing smoking bans in restaurants and bars in Kentucky does in fact adversely impact the hospitality industry's revenues. It is implied in the research that, holding other variables constant, a total smoking ban on bars in Kentucky reduces industry employment by 17%. It is difficult to accept Phelps' findings due to the large body of research suggesting the opposite.

Although extensive literature can be found on the economic impact of smoking bans in the hospitality industry, research on its impact on gaming revenue is less extensive. On November 27, 2002 the State of Delaware passed the Delaware Clean Indoor Air Act which banned smoking in public places, including gaming facilities. Glantz, Mandel and Alamar (2005), one of the earliest research focusing on CIAP and gaming revenues, employed a controversial model. It concluded that CIAP has little or no significant effect on Delaware gaming revenues³. However, the latest publication, Thaleimer and Ali (2008), provides a more accurate estimation of the economic impact of the ban on gaming revenues. The empirical model is produced by a system of three demand equations, specific to each of the three Delaware casinos. It uses the natural log of annual real slot machine handles for the Delaware casinos as the dependent variable.

Pakko (2005) employed a similar model; a modified versions of the Glantz, Mandel and Alamar (2005) model. Pakko's system of three demand equation was estimated using the Seemingly Unrelated Regressions (SUR) Method. It was concluded that the introduction of smoking restrictions in Delaware casinos had a large negative impact on the demand for slot machine wagering at the three casinos studied. In particular, the impact of smoking ban resulted in reductions in slot machine handling of 15.7% in Delaware Park, 17.8% in Dover Downs, and 12.7% in Harrington Raceway. The findings imply that Delaware Park Casino (located near Atlantic City) suffered higher losses than the other two casinos. This suggests that those casinos with closer competition in locations with no smoking ban are more susceptible to larger losses. In addition, it is observed that the diminished gaming demand in the State of Delaware due to the Clean Indoor Air Act is negatively impacting state revenue. Prior to the implementation of the act, Delaware received \$193 million in revenues, amounting to 8.0 percent of the state's total revenue. In 2003, after the implementation of the ban, the State reported a revenue loss of \$12.2 million (Barrish 2009).

Overall, research has proved the successful impact of Clean Indoor Air policies across the states in reducing consumption of cigarettes. Moreover, with exception of few publications, the overall consensus is that smoking restrictions in bars and restaurants have little or no effect on revenue; both measured by taxable income and employment growth. However, the impact of anti-smoking policies on gaming revenue suggests that smoking bans have a negative effect on the gambling industry. Furthermore, the effects are magnified when close substitutes exist. The following sections will describe the data used to estimate an empirical model that will focus on the effect of the Delaware Clean Indoor Air Act on the gaming revenues of Atlantic City.

II. Data

Three primary sources of data were used; the Delaware State Lottery Office⁴, the New Jersey Casino Control Commission⁵, and the Federal Reserve Bank of Philadelphia. These sources provided monthly gaming revenues for Delaware, monthly gaming revenues for Atlantic City, and the Index of Coincident Economic Activity for the State of New Jersey, respectively. As reflected by Figure 1, the inflation adjusted monthly total revenue for Atlantic City shows high seasonal volatility; the highest revenues are reported in the summer months. Monthly dummy variables were used to adjust for seasonality.

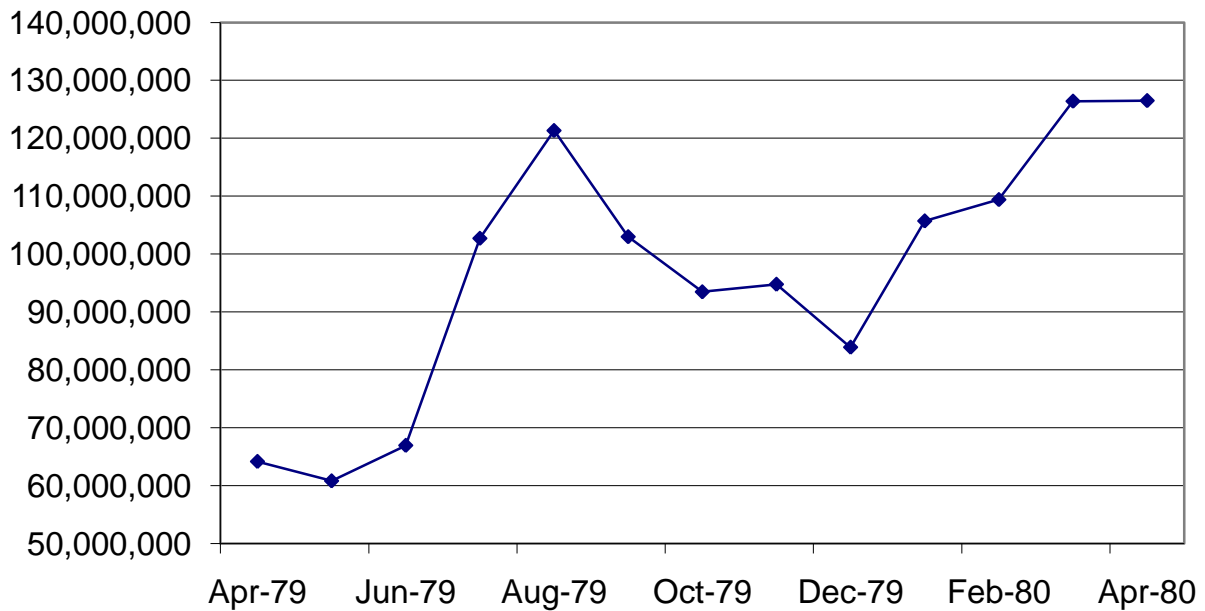


Figure 1: Atlantic City Total Gaming Revenue, 1979.

In his research, Michael Pakko claims that “The Delaware racinos with the largest proportionate losses are those that face the most direct competition from alternative gaming facilities in the region” (Pakko 2005); consequently, dummy variables are used to represent the legalization of gambling in the state of Delaware, as well as to account for Delaware’s 2002 Clean Indoor Air Act.

The data set uses inflation adjusted Atlantic City monthly gambling revenues; the sample period is from April 1979 until December 2008. The reason for the specific time period used is that the control variable $ICEA_{NJ}$ was first published in April 1979; the first Delaware casino opened in 1996. $ICEA_{NJ}$ controls for the economic condition of the State of New Jersey as a proxy for the area’s general economic condition. Table 1 shows the descriptive statistics for total Atlantic City revenues and $ICEA_{NJ}$.

Table 1: Descriptive Statistics⁶

	REV_{AC}	ICEA_{NJ}
Mean	\$373,999,185.283	115.043
Std. Deviation	\$98,893,774.759	28.745
Minimum	\$60,818,602.805	69.794
Maximum	\$548,520,803.232	163.342
Count	357	357

III. METHODOLOGY

The theoretical model illustrated in this section is a modified version of the one constructed by Pakko (2005); adjustments were made to measure the existence of a substitution effect between gambling in Delaware and New Jersey.

$$(1) \quad \ln(REV_{AC})_t = \alpha_0 + \alpha_1 TIME + \alpha_2 TIME^2 + \alpha_3 \ln(ICEA_{NJ})_t + \alpha_4 DELGAMB_{dv} + \alpha_5 DELBAN_{dv} + \alpha_6 FEB03_{dv} + \sum \alpha_7 MONTH + \varepsilon$$

The dependent variable used in this regression is the natural log of the inflation adjusted monthly total revenue for Atlantic City⁷. The regression uses natural logs to account for the non-linear aspects of the relationship among the variables. The model also included a time trend (TIME) and time square (TIME²) in order to account for the natural maturing of the overall gambling industry⁸. In order to account for the economic conditions in the state of New Jersey, the Index of Coincident Economic Activity (ICEA_{NJ}) was used. This index is constructed by the Federal Reserve Bank of Philadelphia; it is the combination of state-level indicators and it summarizes the current economic condition in the state⁹. Unlike the revenue data for Atlantic City, ICEA_{NJ} was not adjusted for inflation because the underlying indicators used to construct this variable are already adjusted according to CPI.

As previously discussed, the objective of this analysis is to discover the magnitude of the substitution effect among gambling in the two states; and, how this substitution in combination with a smoking ban in Delaware affected revenues in New Jersey. Consequently, the following two dummy variables were included in the regression: DELGAMB and DELBAN. The first variable, DELGAMB, takes a value of one after January 1996 when gambling first appeared in Delaware. DELBAN first takes a value of one in November of 2002; this is when the Delaware Clean Indoor Air Act was signed. Dummy variables were also used to account for the seasonal impact on gambling revenues ($\sum \alpha_7 MONTH$)¹⁰ and for the February 2003 snowstorm (FEB03).

IV. Results

Early estimates revealed the presence of heteroskedasticity and auto serial correlation. The Durbin-Watson statistic was calculated and the White's Test was performed; the results confirmed the expectations. Table 2 shows the output of the regression analysis after the data was adjusted to solve the problem of heteroskedasticity and auto serial correlation.¹¹ The sample included 355 observations after adjusting endpoints.

Table 2: Regression Results using Seasonal Dummy Variables and Adjusted for Inflation

Variable	Coefficient	Std. Error	t-Statistic
C	14.888**	1.700	8.755
TIME	0.005**	0.002	3.242
TIME ²	-0.00001**	0.000003	-5.502
Ln(ICEA)	0.947**	0.398	2.380
DELBAN	0.063**	0.030	2.072
DELGAMB	-0.093**	0.038	-2.465
FEB03	-0.114**	0.029	-3.946
<u>Seasonal Dummy Variables</u>			
FEB	0.016	0.013	1.244
MAR	0.114**	0.012	9.336
APR	0.110**	0.015	7.356
MAY	0.156**	0.014	11.345
JUN	0.130**	0.014	9.031
JUL	0.302**	0.016	19.439
AUG	0.310**	0.016	19.651
SEP	0.147**	0.016	9.312
OCT	0.112**	0.015	7.405
NOV	0.061**	0.014	4.339
DEC	-0.060**	0.014	-4.305
AR(1)	0.530**	0.059	9.035
AR(2)	0.321**	0.058	5.550
R-squared	0.977	S.E. of regression	0.055
Adjusted R-squared	0.975	Durbin-Watson stat	2.286

** Significant at the 5%

This research attempts to measure the substitution effect by observing the impact of the smoking ban in Delaware on gaming revenues in Atlantic City. Furthermore, it strives to answer the following question: do smoking bans have a greater negative impact on gaming facilities in close proximity to substitutes? The analysis was based on the assumption that a substitution effect exists between gambling in New Jersey and in Delaware; the results support this assumption. As reflect by the coefficients shown in Table 2; the independent variable DELGAMB shows an inverse relationship with the dependent variable. Holding other variables

constant, the regression coefficient shows that the introduction of gambling in Delaware accounted for a 9.3% loss of revenue for Atlantic City (controlling for other factors). This means that when Delaware slot venues opened, it had a negative effect on gambling revenues in New Jersey; hence, the two locations are substitute goods. Moreover, as reflected by the positive coefficient of the independent variable DELBAN, the smoking ban in the State of Delaware had a positive effect in REV_{AC} ; it resulted in a 6.3% increase in Atlantic City's total revenue (controlling for other factors). As a result of the existence of substitution effect, when Delaware gaming facilities became smoke-free, the gaming revenue in Atlantic City casinos increased. Thus, Delaware gambling venues become less attractive to consumers post-smoking ban; Delaware becomes a less perfect substitute.

Other variable are also of importance when discussing the relationship between smoking bans and gambling revenues. $ICEA_{NJ}$ is the independent variable that accounts for general economic conditions, the positive coefficient result indicate that when the overall economic conditions of New Jersey worsen gambling revenues decrease and vice versa. The seasonal dummy variables $(\sum \alpha_7 MONTH)^{12}$ and the dummy variable to account for the 2003 snowstorm were also statistically significant, which further supports the need to account for the high seasonal volatility of the data. The large t-statistic and positive coefficients of $TIME$ and $TIME^2$, further support the need for time trend variables due to the use of time series data in the regression. The results discussed are significant at the 99% confidence interval. Moreover, the Ordinary Least Square model used resulted in an adjusted R-square of 0.975.

V. Conclusion

The regression results indicate the existence of a substitution effect among gambling in New Jersey versus Delaware. Additionally, the substitution effect in combination with the Delaware Clean Indoor Air Act had a significant positive impact in total gaming revenues for New Jersey. The findings concur with those of Pakko (2005) and Thalheimer and Ali (2008) in that smoking bans have a negative effect on gaming revenues. This particular conclusion is of much importance due to the resulting loss in Delaware's tax revenue. In 2003, the State's revenue decreased from \$193 million to \$180.8 million; although the smoking ban might have not been the only reason for this loss, the regression results show that it did in fact contribute to it. This evidence indicates that special consideration must be given to the future impact of smoking laws on New Jersey's gambling industry; especially since in 2009, the New Jersey smoking ban was extended to include the Atlantic City casinos. The discovery of the substitution effect is not only important for issues concerning clean indoor air policies; it also must be considered in the context of the gaming industry which is facing increase competition. In June of 2004, Pennsylvania opened its first casino and Maryland is in the process of doing the same; these locations may become substitutes for Delaware and Atlantic City.

The problem of the resulting public benefit from smoke free facilities versus the economic cost is one that specially affects this industry. The detrimental impact on casino revenues and tax revenues of smoking bans needs to be considered, particularly when substitute gambling facilities are available.

VI. References

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Notes

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³ This publication is controversial because unlike most other published research, the authors find that there is no significant effect on gaming revenues from the smoking ban. The author's findings are bias due to their affiliation with the Cancer Institute and the Center of Tobacco Control. In addition, the data set used was constructed through estimation and interpolated data.

⁴ <http://lottery.state.de.us/videolottery.asp>

⁵ <http://www.nj.gov/casinos/financia/mthrev/>

⁶ In addition to the variables described in Table 1, the following variables were included in the regression: Time and Time squared and dummy variables for Delaware Gambling, the Delaware Ban, February 2003 (to account for the snow storm) and the Months of Feb-Dec.

⁷ The revenue data was converted into 2008 dollars using the New Jersey CPI data.

⁸ For supporting reasoning for the use of time trend variables, refer to Mandel (2005) and Pakko (2005).

⁹ The four variables used to construct the index are: non-farm payroll, average hours worked in manufacturing, unemployment rate and salaries. (<http://www.philadelphiafed.org/research-and-data/regional-economy/indexes/coincident/>)

¹⁰ In order to avoid multicollinearity, dummy variables were created for every month except January.

¹¹ White's test showed a strong correlation among the month being observed and the two previous. AR (1) and AR (2) were introduced to the regression in order to lag the data by two periods.

¹² Not included in Table 2 but available upon request.