No Smoking at the Slot Machines: The Effect of a Smoke-Free Law on Delaware Gaming Revenues

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Abstract

As communities around the nation consider laws restricting smoking in public places, a key political and economic issue that often arises is the effect that such laws have on the sales and profits of particular sectors. The gaming industry has been active in opposition to such ordinances, citing large prospective losses. This article analyzes the revenues of three gaming facilities in Delaware following the implementation of a smoke-free law in December 2002. Revenues are found to have declined significantly at each of the three facilities, with relative magnitudes of losses corresponding to the availability of alternative gaming venues in the region.

*The views expressed in this paper are those of the author and do not necessarily represent official positions of the Federal Reserve Bank of St. Louis or the Federal Reserve System.

1. Introduction

As communities around the nation consider laws restricting smoking in public places, a key political and economic issue that often arises is the effect that such laws have on the sales and profits of particular businesses or sectors of the local economy. The gaming industry has been active in opposition to such ordinances, citing large prospective losses.

The experience of gaming facilities in Delaware following the implementation of a smoke-free law provides a useful case study for evaluating the empirical relevance of such claims. Delaware has three gaming facilities located at racetracks: Delaware Park, Dover Downs, and Harrington. They offer video lottery terminals (VLTs)—slot machines—that operate under the auspices of the Delaware Lottery. The Delaware Clean Air Act—implemented November 27, 2002—prohibited all smoking at these facilities.

After examining the raw data on statewide net proceeds for the Delaware "racinos," Mandel, Alamar, and Glantz (2005) concluded that there was no statistically significant effect of the smoking ban.[1] In a subsequent response, Pakko (2006) found that after correcting for data errors and using a more robust estimation

[1] See also the "Erratum" subsequently published in *Tobacco Control* (Glantz and Alamar, May 2005).

methodology, the model used in Mandel et al. revealed a significant decline in revenues.[2]

In this note I take a closer look at the data, examining revenues of the three racinos individually and considering some of the idiosyncratic features of the data and of the markets served by the three gaming facilities. After adjusting for the irregular reporting period of the data and considering distinct seasonal effects, I find that revenues at each of the three racinos declined significantly after the implementation of the smoke-free law. The effect is modeled as a permanent decline in the level of revenues relative to trend—a specification that is evidently consistent with the data.

Moreover, the relative magnitudes of losses at the three Delaware racinos correspond to the availability of alternative gaming venues in the region, suggesting consumer flight. Efforts to mitigate revenue losses associated with the smoking ban engendered additional costs for racino operators, further reducing the profitability of gaming in Delaware.[3]

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[2] Losses associated with the Delaware smoke-free law are also suggested by Dover Downs (2004a, b) and Marcel (2004).

[3] The distinction between the effects of smoking laws on revenues versus profits is emphasized by Dunham and Marlow (2003).

2. Data

Monthly data on racino net proceeds and the number of VLTs in service are available from the Delaware Lottery.[4]

Gaming was authorized to begin at the three racetracks on December 28, 1995, but Harrington did not begin operations until August 1996. Revenues at each facility experienced rapid growth in their initial months of operation as gaming operations became established. Data for 1996 are therefore uncharacteristic of the more stable growth trends that subsequently emerged. Moreover, the statewide series also includes a discontinuity induced by the opening of the Harrington racino midway through the year. Consequently, the sample period used in this analysis begins in 1997—the first full calendar-year of gaming operations for all three facilities. The sample period extends through March 2005.

The data are reported monthly, covering four- or five-week intervals, with the reporting period ending on the last Sunday of the month. The irregular reporting periods differ from quarter-to-quarter and from year-to-year, so that standard seasonal adjustment techniques do not fully account for this feature of the data.

[Figure 1]

Figure 1 displays the raw data for net revenues at the three racinos and for total statewide revenues, along with series that are adjusted to correspond to calendar months:

$$Adjusted\ Revenues = Reported\ revenues \times (Calendar\ days / Reported\ days) \quad (1)$$

[4] Delaware Lottery (2005).

A clear seasonal pattern is evident in the adjusted data, as is a decline in revenues relative to trend at all three racinos following the implementation of the smoking ban. A significant feature of the decline, however, is a sharp downward spike in February 2003—presumably related to a snowstorm that paralyzed the region for several days.[5]

3. Regression Analysis

To estimate the effects of the smoke-free law on the net proceeds of the Delaware racinos, a simple regression model was estimated. The model is a modified version of the one used in Mandel *et al*. (2005):

$$\ln(REV_t) = C + \beta_1 TIME + \beta_2 TIME^2 + \beta_3 \ln(MACH_t) + \beta_4 \ln(ICEA_t) + \beta_5 FEB03 + \sum_{i=Jan}^{Nov} \gamma_i MONTH_{it} + \delta\, SMOKE \qquad (2)$$

The dependent variable is the natural log of calendar-adjusted real net proceeds, converted to constant dollars using the CPI-U. The regressions include a constant, trend, and trend-squared terms.[6] They also include the variable *MACH*, the

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[5] Mandel et al. assert that initial revenue losses were "mainly caused by inclement weather" (p. 10), but do not control for this factor in their analysis.

[6] The trend terms are based on the variable *TIME*, specified as *t**100. As cited by Mandel et al. (2005), the inclusion of a quadratic trend specification is intended to account for the slowdown naturally associated with the maturing of the industry after a period of rapid initial growth; moreover, it is supported by the data.

number of VLTs in operation at each facility.[7] An Index of Coincident Economic Activity (*ICEA*) for Delaware, as compiled by the Federal Reserve Bank of Philadelphia, was included to control for general economic conditions.[8] Dummy variables for seasonal effects (*MONTH*) and for the snowstorm of February 2003 (*FEB03*) are included, along with a dummy variable that is the focus of analysis (*SMOKE*), which takes on a value of one in December 2002 and thereafter, zero before. An adjustment for potential first-order serial correlation of the residuals is also included in each of the regressions.

[Table 1]

Table 1 shows the results of these regressions. Seasonal dummy variables were found to be highly significant in each case.[9] Coefficients on the dummy variable for the February 2003 snowstorm are also significant. The trend variables, number of machines and *ICEA* contribute, by varying degrees, to explaining the trends in the series. The correction for autocorrelated residuals is only relevant for the Dover Downs and Harrington equations.

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[7] The number of terminals is limited by Delaware law, providing a degree of exogeneity to this supply-side variable.

[8] A regional ICEA, using an average for Delaware, Pennsylvania, Maryland and Virginia was also tested, but made little difference for the results. For methodology used to construct the ICEA, see Crone (2003).

[9] F-tests of showed that seasonal dummies were jointly significant in each regression, with p-values<.01.

More important, the coefficients on the smoking-ban dummy variable are negative and statistically significant for each of the three racinos, as well as for the statewide total.

An alternative approach to controlling for seasonal effects is also considered: A second set of regressions uses seasonally-adjusted (real) net proceeds as the dependent variable, obviating the need for seasonal dummy variables. The Census X12 seasonal adjustment procedure was used to produce seasonally adjusted series for nominal revenues, which were deflated to 2004 dollars using the CPI-U.

[Table 2]

Table 2 reports the results of regressions using the seasonally adjusted data. The results are very similar to the regressions using seasonal dummies. However, point-estimates of the losses attributed to the smoking ban are uniformly lower. Using these results as a conservative estimate, the smoking-ban dummy variable accounted for average monthly revenue declines of 15.8 percent at Delaware Park, 8.6 percent at Dover Downs, and 12.1 percent at Harrington.[10] Because Delaware Park is the largest of the three facilities, the losses in net proceeds at that location account for a large share of the statewide loss—estimated to be 14.9 percent.

Figure 2 shows the actual and fitted values for the seasonally adjusted data and the regression estimates reported in Table 2. Several features of the data and the model specification are clearly revealed in the seasonally adjusted series: The specification of trends, the importance of the snowstorm of February 2003, and—

[10] The conversion of regression coefficients to percentage changes uses the formula $\exp(\delta)-1$ (Halvorsen and Palmquist, 1980).

most important—the relevance of a downward shift in revenues corresponding to the implementation of the smoking ban are evident.[11]

[Figure 2]

Note that the seasonally adjusted data in Figure 2 show no evidence of a change in the growth trend after the implementation of the smoking ban. If the decline in revenues captured by the shift-intercept dummy variable was a transitory phenomenon, we would expect to see higher trend growth during 2003 and 2004 as revenues recovered. However in the two year period from March 2003 to March 2005, total statewide revenues grew at a rate of 7.4% annually, compared with a growth rate of 8.7% in the two years preceding the smoking ban. The data are consistent with the model specification that Delaware's smoke-free law resulted in a permanent downward shift in racino revenues.

4. Discussion

All three racinos experienced significant revenue losses following the implementation of the smoke-free law. However, the magnitudes of the percentage losses differ considerably: the percentage decrease for Delaware Park was nearly twice as large as that for Dover Downs, with Harrington's losses midway between the two.

[11] The fitted regression for Harrington, the smallest of the three racinos, shows the significance of including the number of VLTs as an explanatory variable in the regressions.

The three Delaware racinos draw customers from a wide area. Dover Downs (located in the center of the state) reports that 70 percent of its customers are from Pennsylvania, Maryland, Virginia and the District of Columbia.[12]

Delaware Park, with the largest revenues and the greatest losses following the smoking ban, is located near the northern city of Wilmington—less than 40 miles from Philadelphia. In this market, Delaware Park faces strong competition from Atlantic City (about 60 miles from Philadelphia). Delaware Park is also the closest Delaware racino to Baltimore (70 miles). However, a similar facility in Charles Town, WV offers an equidistant alternative for Baltimore residents.[13]

Harrington, the southernmost of the Delaware racinos, is the closest to the Washington D.C. area (less than 90 miles), and is accessible from Baltimore as well (85 miles). Charles Town, WV is even closer for D.C. residents (64 miles).

The Delaware racinos with the largest proportionate losses are those that face the most direct competition from alternative gaming facilities in the region.

Dover Downs, on the other hand, competes in the same markets as the other two Delaware racinos, but its central location places it further from each of the surrounding major metropolitan areas. By location alone, Dover Downs is likely to draw a larger local customer-base, limiting potential losses to alternative regional gaming venues.

As suggested by Dunham and Marlow (2003), the changes in net revenues documented here might reveal only a part of the overall effects of smoking

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[12] Dover Downs (2004b).

[13] See also, Marcel (2004).

restrictions. Smoke free laws may also "lead owners to alter prices, output, and other business attributes in ways that affect the welfare of all customers and workers."

For example, Dover Downs is the only Delaware racino with an onsite luxury hotel. This asset was actively leveraged to buffer gaming revenues from the effects of the smoking ban: "As a result of the [Delaware Clean Indoor Air] Act, we redirected our marketing efforts to attract more casino customers to our hotel by providing additional complimentary and discounted rooms" (Dover Downs, 2004b). This effort may have stemmed revenue losses from gaming, but it also represents an additional source of profit loss.

In mid-2003, faced with sharply declining gaming revenues, the Delaware legislature authorized a 25 percent expansion in the maximum number of VLTs. Delaware Park and Dover Downs responded by embarking on construction projects to expand their facilities. The authorizing legislation also extended operating hours and imposed an additional state surcharge on revenues of the Delaware racinos, further increasing costs and reducing profit margins for the operators.

Finally, one additional issue is relevant from public finance perspective: Prior to the implementation of the smoke-free law, total revenues at Delaware racinos totaled nearly $570 million per year. With an average distribution of 35 percent going to state coffers, Delaware received nearly $200 million in revenues in 2002 —amounting to approximately 3.6 percent of the state's general revenues. The regression estimates reported in Table 2 are associated with losses of $94 million dollars per year since the implementation of the smoking ban, corresponding to state revenue losses of $33 million annually.

5. Conclusion

The evidence clearly indicates that the Delaware Smoke Free Air Act resulted in statistically significant revenue losses at each of the three Delaware racinos. The patterns of losses suggest customer diversion to competing gaming venues. Moreover, responses to revenue declines following the smoking ban engendered additional costs that reduced operating margins. Losses in business profits therefore exceeded the estimated revenue declines.

As state and local governments consider the efficacy of public smoking bans, the issue is often cast in terms of public health versus economic impact. However, there are few cases for which disaggregated data are available to examine the impact on a specific sector or particular businesses. The data from Delaware racinos therefore provide a valuable case study for illustrating potential economic losses that should be weighed against the public health benefits of smoke free laws.

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Table 1: Regression Results Using Seasonal Dummy Variables

Variable	Delaware Park	Dover Downs	Harrington	Total
SMOKE	**-0.1826****	**-0.0935***	**-0.1402****	**-0.1704****
	(0.0138)	**(0.0389)**	**(0.0327)**	**(0.0140)**
FEB03	-0.1704**	-0.2275**	-0.2372**	-0.2053**
	(0.0269)	(0.0349)	(0.0424)	(0.0264)
C	11.9981**	12.0478**	18.7304**	14.8737**
	(0.6597)	(2.9425)	(2.1331)	(0.7723)
TIME	0.7335**	1.1406**	0.7011*	1.1346**
	(0.0906)	(0.3603)	(0.3398)	(0.1304)
TIME^2	-0.3432**	-0.6169**	-0.2423	-0.4878**
	(0.0616)	(0.2306)	(0.1880)	(0.0773)
ln(MACH)	0.2330**	0.2154	0.4550**	0.1233*
	(0.0287)	(0.1171)	(0.0799)	(0.0515)
ln(ICEA)	0.5448**	0.4419	-1.3203**	0.2072
	(0.1469)	(0.6795)	(0.3949)	(0.1971)
AR(1)	0.0528	0.6562**	0.3772**	0.0870
	(0.1120)	(0.0864)	(0.1048)	(0.1196)
Adjusted R^2	0.9802	0.9671	0.9583	0.9790

* Significant at 0.95 **Significant at 0.99

NOTES: The variables used in the regression are: SMOKE=dummy variable for the smoking ban, FEB03=dummy variable for the snowstorm of February 2003, TIME and TIME2=linear and quadratic time trends, ln(MACH)=natural log of the number of VLTs in operation, ln(ICEA)=natural log of the Index of Coincident Economic Activity for Delaware and AR(1)=first order autoregressive error term.

Table 2: Regression Results Using Seasonally Adjusted Data

Variable	Delaware Park	Dover Downs	Harrington	Total
SMOKE	**-0.1722****	**-0.0901****	**-0.1292****	**-0.1611****
	(0.0144)	**(0.0330)**	**(0.0315)**	**(0.0146)**
FEB03	-0.1757**	-0.2111**	-0.2289**	-0.1923**
	(0.0248)	(0.0308)	(0.0366)	(0.0238)
C	12.0504**	10.8979**	19.4568**	14.5965**
	(0.7036)	(2.2965)	(2.0863)	(0.7199)
TIME	0.7126**	1.2855**	0.8325*	1.1727**
	(0.0953)	(0.2835)	(0.3256)	(0.1103)
TIME^2	-0.3462**	-0.6809**	-0.3127	-0.5200**
	(0.0646)	(0.1843)	(0.1827)	(0.0680)
ln(MACH)	0.2438**	0.0893	0.4120**	0.1017*
	(0.0302)	(0.0888)	(0.0732)	(0.0396)
ln(ICEA)	0.5521**	0.8912	-1.3723**	0.3342*
	(0.1568)	(0.5238)	(0.3918)	(0.1569)
AR(1)	0.1296	0.6066**	0.4262**	0.1772
	(0.1041)	(0.0843)	(0.0962)	(0.1033)
Adjusted R^2	0.9781	0.9687	0.9569	0.9822

* Significant at 0.95 **Significant at 0.99

NOTES: See Notes to Table 1.

Figure 1:

Monthly Net Proceeds at Delaware "Racinos"

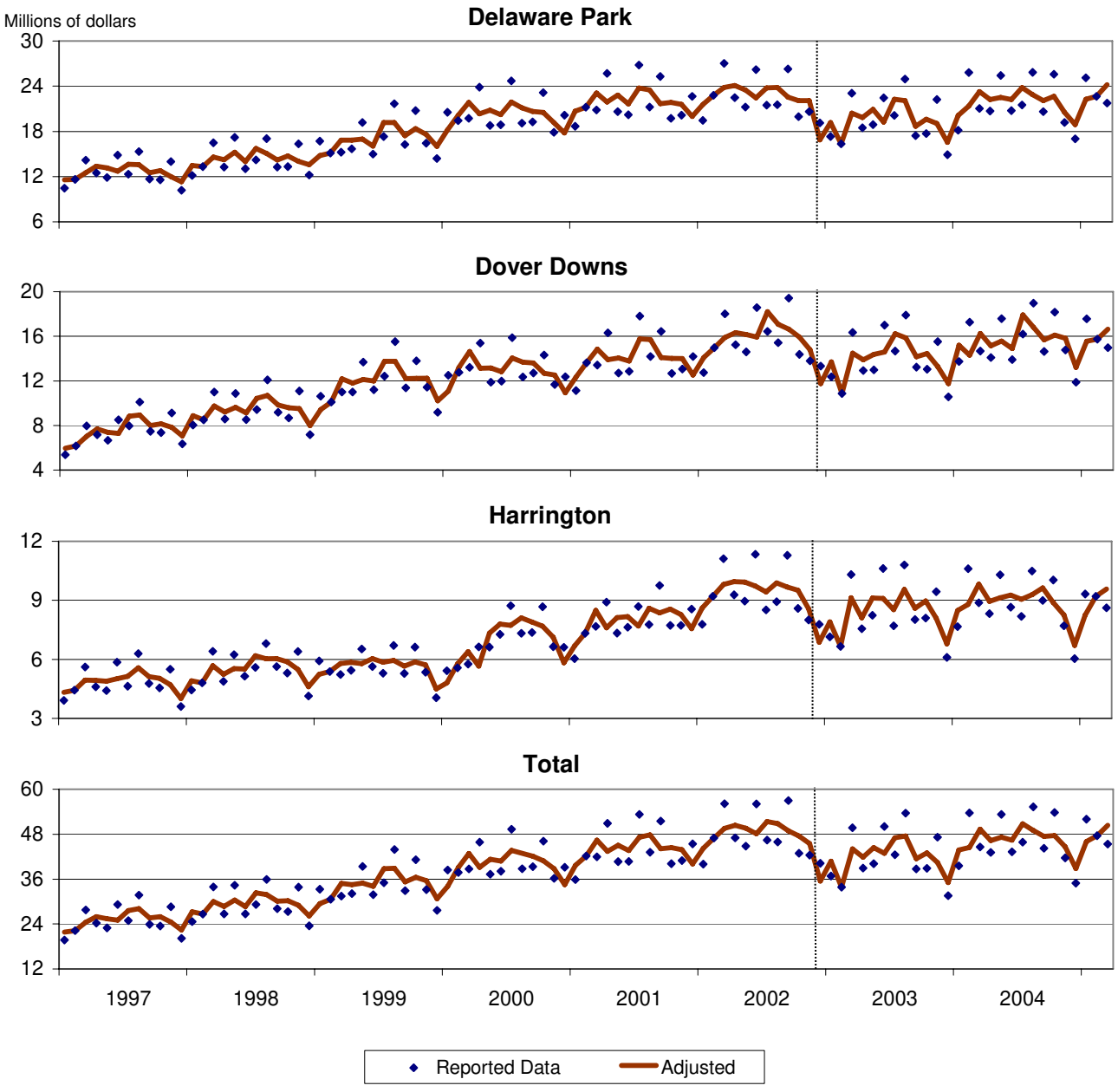

Figure 2:

Actual and Fitted Values for Seasonally-Adjusted Net Proceeds