The Economic Impact of a Smoking Ban in Columbia, Missouri: An Analysis of Sales Tax Data for the First Year

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In January 2007, an ordinance took effect in Columbia, Missouri, banning smoking in all bars, restaurants, and workplaces. This paper analyzes data for sales tax collections at eating and drinking establishments from January 2001 through December 2007, including the first 12 months of the smoking ban. The analysis accounts for trends, seasonality, general business conditions, and weather. The findings suggest that the smoking ban has been associated with statistically significant losses in sales tax revenues at Columbia's bars and restaurants, with an average decline of approximately 3½ to 4 percent. Businesses that serve only food show no statistically significant effects of the smoking ban. Those that serve food and alcohol, or alcohol only, show significant losses with estimates in the range of 6½ to 11 percent (with the larger losses associated with bars). Some individual businesses within each category may have been unaffected, whereas others are likely to have incurred much greater losses. (JEL I18, D78, H11)

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In January 2007, the city of Columbia, Missouri, implemented a smoke-free ordinance, banning smoking in all public places, including bars and restaurants. This paper analyzes data on sales tax collections at bars and restaurants for the period before and after this smoking ban was implemented. The sample period covers the first year after the implementation of the new law.[1]

The enactment of laws restricting smoking in bars and restaurants has been a growing trend among states and municipalities around the nation. According to the Americans Nonsmokers' Rights Foundation, 748 municipalities have provisions for 100 percent smoke-free environments in bars, restaurants, and workplaces. Of these, 555 require smoke-free restaurants and 426 require smoke-free bars.[2]

As more U.S. communities have adopted such laws, economic data have accumulated, allowing economists to better identify some of the economic costs of these restrictions. A large body of early evidence on the economic impact of smoking bans, much of which was published in medical and public health journals, tended to find no statistically significant effects.[3] This finding sometimes has been interpreted as demonstrating that there is no negative economic impact of smoke-free laws whatsoever.

[1] This paper represents an extension of my previous study (Pakko, 2007).

[2] These counts are as of July 1, 2008. See American Nonsmokers' Rights Foundation (2008).

[3] Scollo et al. (2003) provide a review of previous literature.

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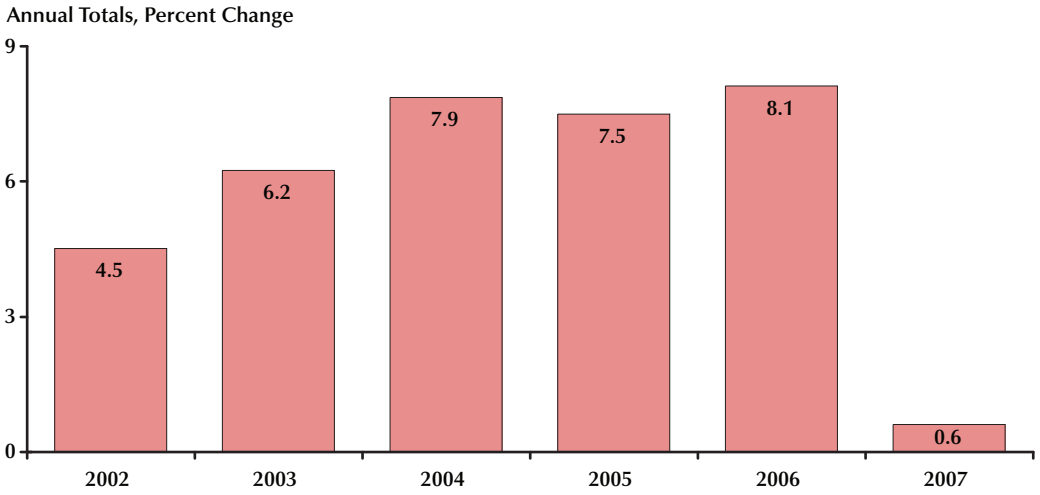
Figure 1

Sales Tax Revenues at Columbia Eating and Drinking Places



This interpretation is far too simplistic. Recent economic research has made it increasingly clear that there are significant economic effects—for some specific businesses—when 100 percent smoking bans are implemented. The evidence suggests that economic costs are borne by businesses that tend to be frequented by smokers. Statistically significant costs have been identified for casinos and bars, in particular.[4]

One of the cities in the Eighth Federal Reserve District that recently adopted a smoking ban is Columbia, Missouri. Since January 9, 2007, all bars and restaurants in Columbia have been required to be smoke free. Only some sections of outdoor patios are exempt from the requirement.

Some local businesses continued to oppose Columbia's smoke-free ordinance throughout its first year in effect. Petitions to repeal the law by ballot initiative were circulated, but the campaign was ultimately unsuccessful.[5] According to local press reports, at least seven establishments cited the smoking ban as a factor in their decision to close their doors in 2007.[6] The owner of one business was quoted as reporting a 40 percent drop in alcohol sales and a 20 to 30 percent drop in food sales over the first several months of the smoking ban.[7] Although such reports are informative, they are anecdotal. A more thorough, systematic analysis of objective data is necessary to properly identify economic costs.

SALES TAX REVENUES AT ALL EATING AND DRINKING ESTABLISHMENTS

Data from the city of Columbia show a distinct decline in the growth rate of sales tax receipts at bars and restaurants (Figure 1). The total for 2007 was only 0.6 percent above 2006. Revenues over the previous four years had risen at an average rate of 7.4 percent. In 2006—the year preceding the implementation of the smoking ban—revenues were 8.1 percent higher than the previous year.

The dramatic slowdown in sales tax revenues from eating and drinking establishments after the

[4] For a review of some recent economic research, see Pakko (2008a).

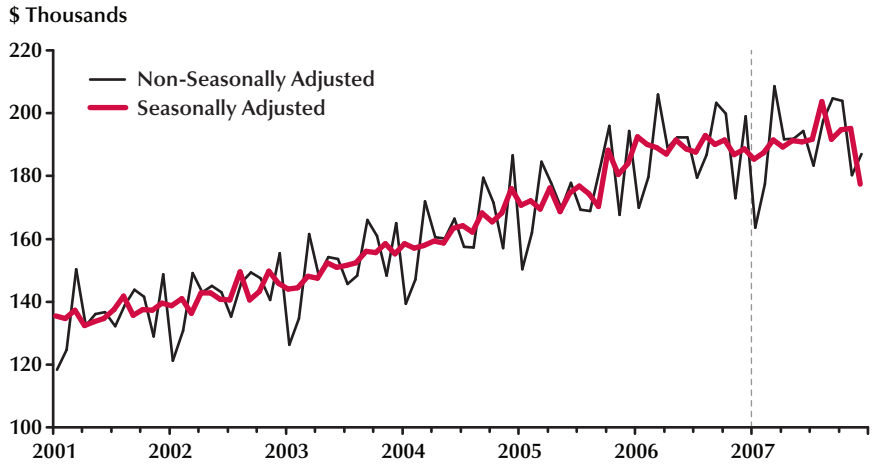
[5] In November 2007, the petition drive fell short of gathering enough valid signatures.

[6] See, for example, LeBlanc (2007) and Coleman (2007).

[7] See Lynch (2007). The business—Otto's Corner Bar and Grill—closed in late 2007, citing the smoking ban as a factor in its demise.

Figure 2

Sales Tax Collected from All Eating and Drinking Establishments



smoking ban was implemented is consistent with the anecdotal reports of revenue losses at Columbia bars and restaurants. However, a simple comparison of growth rates before and after the smoking ban is insufficient for drawing any firm conclusions.

This section reports findings from a more rigorous analysis of the data covering all of Columbia's bars and restaurants. Using regression analysis to account for trends, seasonality, general business conditions, and weather, I find that the smoking ban has been associated with statistically significant losses in sales tax revenues. Point estimates indicate an average loss of approximately 3½ to 4 percent.[8]

Sales Tax Data

The data series examined in this section consists of monthly sales tax revenues for all bars and restaurants in Columbia. Because no changes were made in tax rates over the sample period (January 2001–December 2007), sales tax revenues serve as a direct proxy for sales. Total sales tax receipts also were obtained from the city of Columbia for use as a control variable for overall economic activity. The data are also disaggregated, allowing independent analysis of bars and restaurants (see "Analysis of Disaggregated Data" below).

Figure 2 shows a plot of the raw data for total bar and restaurant tax receipts, along with a series that has been seasonally adjusted using the Census X-12 ARIMA procedure. A cursory examination of the data shows an evident surge in growth during the latter part of 2005 and into early 2006. Growth slowed in late 2006 and turned negative for much of 2007. By December 2007, revenues were down 6 percent from a year earlier.

The appropriate question is not, however, whether sales taxes or revenues have been positive or negative since the Columbia Smoke-Free Ordinance took effect, but whether the pattern is different from what it would have been in its absence. More formal statistical analysis is required to address this question.

Regression Analysis

To test the hypothesis of a significant effect of the Columbia smoking ban, I estimated a series of least-squares regressions. The dependent variable

[8] The range of estimates in this paper represents slightly smaller losses than in my earlier, preliminary analysis of the data (Pakko, 2007). In the earlier paper, the total included establishments classified as "eating places only" and "eating and drinking places." The new dataset also includes "drinking places—alcoholic beverages only." Because the latter category is a very small component of the total (about 4 to 5 percent over the sample period), its inclusion has little impact on the empirical findings. The new estimates reflect the additional data that have accumulated during the second half of 2007.

Table 1

Regression Results for All Eating and Drinking Establishments

	Regression					
Variable	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Smoking ban	–0.0523***	–0.0518***	–0.0364***	–0.0376***	–0.0365***	–0.0403***
	(0.0176)	(0.0157)	(0.0098)	(0.0091)	(0.0091)	(0.0091)
Constant	11.6432***	11.7693***	5.5311***	6.1317***	6.6745***	7.3420***
	(0.0120)	(0.0072)	(1.5513)	(1.6131)	(1.3621)	(1.3576)
Time trend	0.0056***	0.0056***	0.0038***	0.0040***	0.0042***	0.0044***
	(0.0002)	(0.0002)	(0.0005)	(0.0005)	(0.0004)	(0.0004)
Non-dining tax revenues			0.4423***	0.4051***	0.3585***	0.3178***
			(0.1122)	(0.1158)	(0.0986)	(0.0975)
Snowfall					–0.0049***	–0.0033***
					(0.0014)	(0.0011)
AR(1) coefficient	0.2522*	0.2255*	0.1078	0.0674	0.0778	0.0915
	(0.1313)	(0.1340)	(0.1135)	(0.1092)	(0.1252)	(0.1281)
Seasonally adjusted data	No	Yes	No	Yes	No	Yes
Seasonal dummy variables	Yes	No	Yes	No	Yes	No
Adjusted R^2	0.9642	0.9636	0.9728	0.9709	0.9766	0.9739

NOTE: *, **, and *** denote significance at 10, 5, and 1 percent, respectively. The dependent variable for all equations is the log of dining-sector tax revenue. Regressions labeled (a) use data that are not seasonally adjusted, whereas those labeled (b) use data that are adjusted using the Census X-12 ARIMA procedure.

of the regressions is the log of restaurant sales tax revenues. Each regression includes a constant and a time trend, in addition to a dummy variable representing the implementation of the smoking ban (which has a value of 0 before 2007 and 1 for January-December 2007). The full regression also includes controls for overall economic activity and for weather:

$$\ln(DiningTax_t) = \gamma\ SmokingBan_t + \beta_0 + \beta_1 TimeTrend_t + \beta_2\ \ln(OtherTax_t) + \beta_3 Snowfall_t + u_t.$$

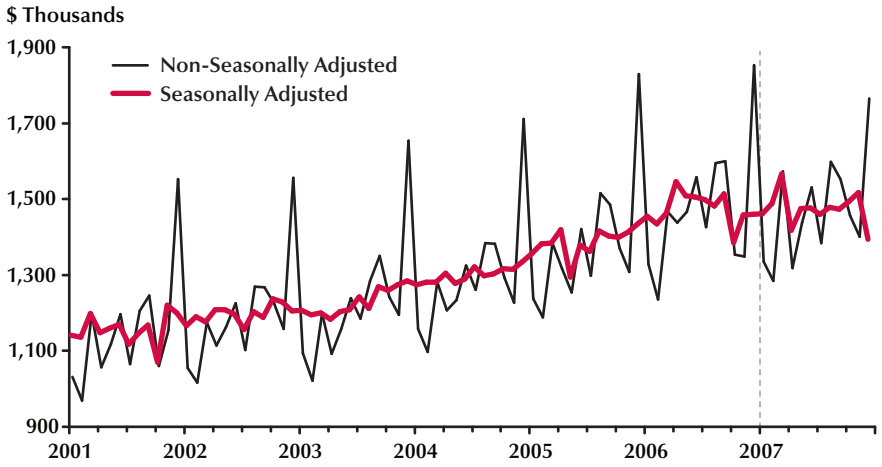
The variable *Other Tax* is the total amount of non-food and beverage taxes collected by the city of Columbia. To control for the influence of adverse weather, the full specification also includes the variable *Snowfall*, which is entered as the deviation of actual monthly snowfall from historic averages. The focus of the analysis is the coefficient on the smoking-ban dummy variable (γ). All regressions include a first-order autoregressive error term $u_t = \rho\ u_{t-1} + \varepsilon_t$ (although the autoregressive coefficient is not significant in many of the regressions). Estimation uses ordinary least squares regression with standard errors adjusted for general autoregression and heteroskedasticity using the Newey-West (1987) procedure.

Baseline Specification. The results of a naive baseline specification, including only a constant and a time trend (plus the autoregressive error term), are shown in the first two columns of Table 1. Regression (1a) uses the non-seasonally adjusted data for the dependent variable and includes a set of monthly dummy variables to account for seasonal patterns (coefficient estimates not reported). Regression (1b) uses the seasonally adjusted data. Each of these basic regressions suggests a highly statistically significant decline in tax revenues associated with the implementation of the smoking ban. Point estimates for the coefficients on the smoking ban dummy variable indicate an average decline of approximately 5 percent.[9]

[9] The coefficient estimates on the dummy variable can be interpreted (approximately) as percentage changes.

Figure 3

Sales Tax Collected from Non-Dining Establishments



Controlling for General Business Conditions. Although these initial estimates control for general trends and seasonality in the data, other factors could be associated with the decline in restaurant tax revenues. In fact, the data suggest an overall decline in non-dining retail sales in Columbia that is unlikely to be associated with the smoking ban. Subtracting dining tax receipts from data for total sales tax receipts yields a measure of non-dining tax receipts. Figure 3 shows this measure of non-dining sales taxes receipts on both a seasonally adjusted and non-seasonally adjusted basis.

A clear slowdown in 2006 and 2007 roughly corresponds with the timing of the slowdown in tax receipts at restaurants and bars. Non-dining tax receipts showed some recovery in early 2007 but sagged through the rest of the year. Overall yearly revenues were flat—the total for 2007 was 0.16 percent lower than in 2006. As of December, non-dining sales tax revenues were down approximately 4.7 percent from a year earlier.

Regressions (2a) and (2b) add the (logged) non-dining revenue variable to the baseline specification to control for this slowdown in business activity. Regression (2a) includes the non-seasonally adjusted measure, whereas regression (2b) uses the seasonally adjusted version. In both cases, the coefficient on non-dining tax revenue is positive and highly significant. The addition of this factor does, in fact, account for some of the slowdown in dining tax revenues: Point estimates for losses associated with the smoking ban are smaller than in the baseline specification. Nevertheless, the coefficients on the smoking ban dummy variable are still highly significant, with point estimates indicating a decline of more than 3½ percent. These results indicate that the slowdown in dining tax receipts is partly related to a slowdown in overall economic activity, but the decline in revenues at bars and restaurants is greater than past patterns would predict.[10]

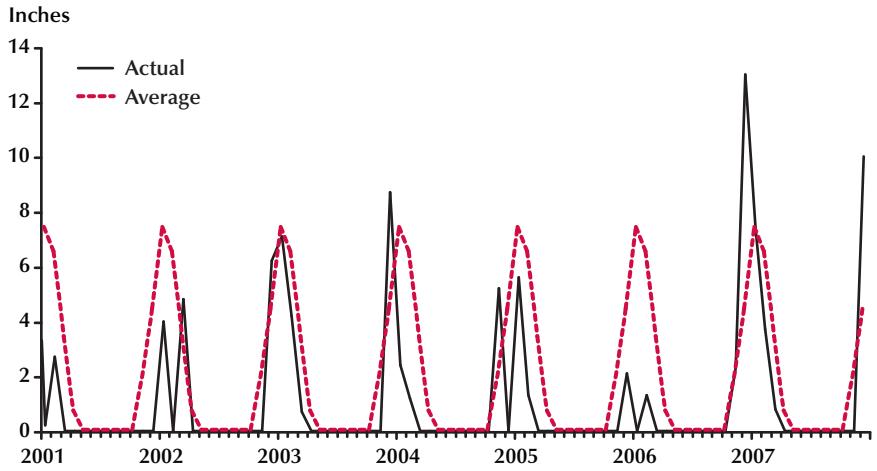
Controlling for Weather. Another factor that can be particularly important for revenues at bars and restaurants (for obvious reasons) is inclement weather.[11] Figure 4 shows the average monthly

[10] The 2008 budget report for the city of Columbia also indicates that dining and entertainment sectors are lagging the rest of the local economy: "General retail sales remain steady, however the current trend indicates the home improvement/construction and dining and entertainment sectors are declining" (City of Columbia, 2007).

[11] Adams and Cotti (2007) find that changes in restaurant employment after the implementation of smoking bans in warm-weather states differ from those in cold-weather states. They speculate that the difference might be related to the feasibility of providing outdoor seating areas where smoking might be permitted. Pakko (2008b) finds that a severe snowstorm on the East Coast had a significant effect on gambling revenues in Delaware after the implementation of a smoking ban in that state.

Figure 4

Average and Actual Snowfall—Columbia, MO



snowfall for Columbia compared with actual snowfall over the sample period.[12] The low snowfall totals during the winter of 2006-07 clearly represent a departure from average weather conditions. These relatively mild winter conditions might help explain the apparent surge in dining tax revenues during that period. In contrast, the relatively heavy snowfall near the end of 2007 might be associated with slower business at bars and restaurants.

Regressions (3a) and (3b) add this consideration to the analysis, introducing a variable that is equal to the difference between actual and average snowfall (in inches). The coefficient on this snowfall variable is of the expected sign, and it is statistically significant. The point estimate indicates that one inch of snowfall in excess of the average tends to lower sales tax revenues by 0.3 percent (in the non-seasonally adjusted regression) to 0.5 percent (in the seasonally adjusted specification). The addition of the snowfall variable improves the overall fit of the model, but it has little impact on the significance of the smoking ban dummy variable. There remains a highly significant downturn beginning in January 2007, measuring approximately 3½ to 4 percent.[13]

A Specification Test. The association of the smoking ban dummy variable with the Columbia Smoke-Free Ordinance in the reported regressions relies on the timing of its adoption. It is possible for a dummy variable to indicate statistically significant effects even if the restaurant sales slowdown began either before or after the implementation of the smoking ban. To test whether the dummy variable is accurately identifying the effects of the smoking ban and not an independent, unidentified factor, the regression specifications in (3a) and (3b) were reestimated using alternative dummy variables to evaluate the timing of the downturn more carefully.[14] Possible breakpoints from July 2006 through June 2007 were considered.

Figure 5 shows the adjusted *R*-squared statistics from these regressions. For both methods of seasonal controls, the results show that the dummy variable specifying a breakpoint of January 2007 provides the best model fit. These results suggest that January 2007 does, indeed, represent the rele-

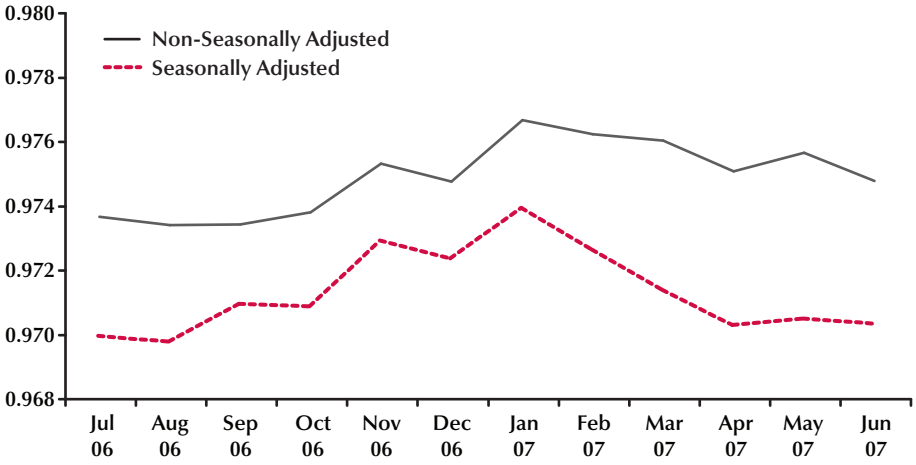
[12] Average snowfall is calculated for the period 1971-2000 (National Oceanic and Atmospheric Administration).

[13] Although these estimates are lower than in my preliminary analysis (Pakko, 2007), the difference between the new estimates and the previous estimate of 5 percent is not statistically significant.

[14] Regressions (3a) and (3b) were reestimated using alternative dummy variables that have a value of 1 for all months after and including a particular starting month and a value of 0 for all previous months.

Figure 5

Adjusted *R*-Squared Statistics for Different Breakpoints



vant breakpoint in the data series on bar and restaurant sales tax revenues.

Analysis of Disaggregated Data

In addition to sales tax data for the total bar and restaurant sector of Columbia, I requested and received data on sales tax revenues for three subsets of the total, along with listings of the specific businesses that fall within each category. The designations correspond roughly to the following SIC codes:

- Group 1 (SIC code 5811): "Eating Places Only"
- Group 2 (SIC code 5812): "Eating and Drinking Places"
- Group 3 (SIC code 5813): "Drinking Places—Alcoholic Beverages"

The categories are not precisely distinguished; business owners select their own category when filing their tax statements. Undoubtedly, some classifications are questionable. Nevertheless, the three categories are distinguished by the types of businesses prevalent on each list.

Group 1 includes fast-food, take-out restaurants, coffeehouses, and many common sit-down restaurants. Group 2 includes restaurants that might be commonly categorized as "bar and grill" establishments, as well as many common sit-down restaurants. The restaurants in group 2 are more likely to have separate bar areas than those in group 1. Group 3, the smallest category, primarily includes establishments that would be commonly classified as "bars."

Figure 6 shows the data series (seasonally adjusted and non-seasonally adjusted) for each of the three groups. Group 2 is the largest of the three, accounting for approximately 61 percent of the total over the sample period. Group 1 accounts for just over one-third (34 percent), while group 3 accounts for only about 5 percent. Over time, the share of total tax revenues for group 1 establishments has been rising slightly (reaching 35 percent in 2007), and the share from group 3 has been falling (4 percent in 2007).

The Columbia Smoke-Free Ordinance is likely to have affected these three categories of businesses differently. Previous research has suggested that the impact on bars differs from the impact on restaurants. For example, both Adams and Cotti (2007) and Phelps (2006) use data from the Bureau of Labor Statistics to identify significant effects on bar employment but find no significant effect for restaurants as a separate category.

One relevant distinction among businesses in these categories is that they may have differed in

Figure 6

Tax Revenues by Type of Establishment

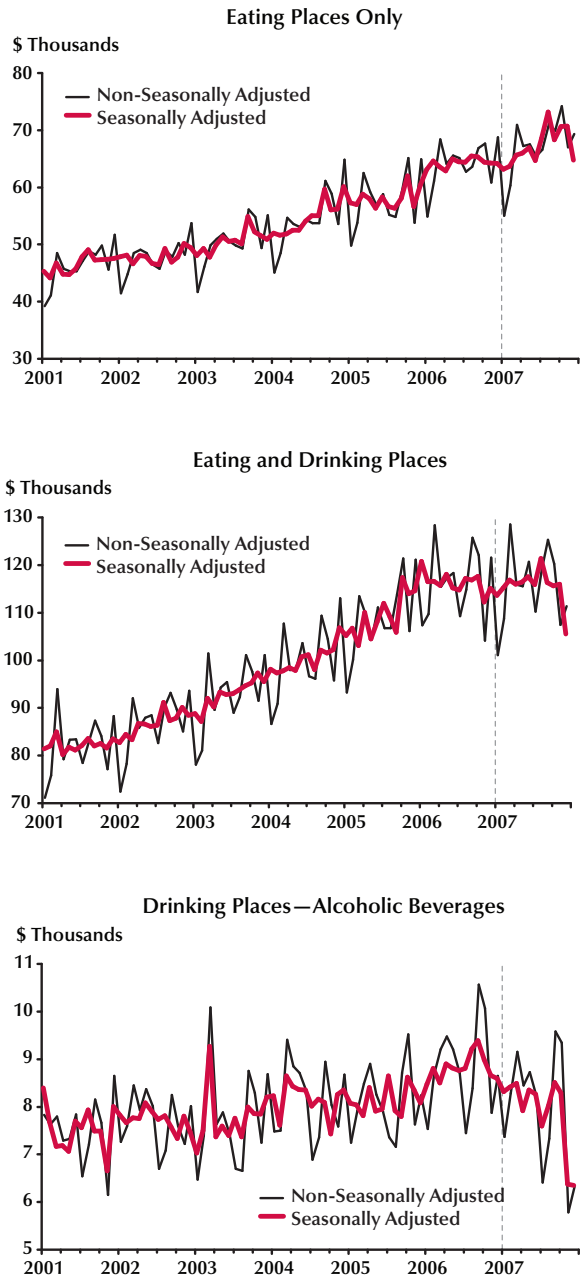


Table 2

Disaggregated Regression Results

	Non-seasonally adjusted data			Seasonally adjusted data		
Variable	Group 1	Group 2	Group 3	Group 1	Group 2	Group 3
Smoking ban	0.0107 (0.0161)	–0.0642*** (0.0120)	–0.1102*** (0.0312)	0.0008 (0.0180)	–0.0671*** (0.0124)	–0.1074*** (0.0287)
Constant	6.1855*** (1.5714)	6.2645*** (1.2468)	3.5898 (3.3697)	6.9832*** (1.5918)	7.1419*** (1.2459)	4.7455 (3.2460)
Time trend	0.0042*** (0.0005)	0.0045*** (0.0004)	0.0010 (0.0011)	0.0045*** (0.0005)	0.0048*** (0.0004)	0.0012 (0.0010)
Non-dining tax revenues	0.3137*** (0.1138)	0.3526*** (0.0903)	0.3751 (0.2440)	0.2655** (0.1144)	0.2962*** (0.0896)	0.2980 (0.2333)
Snowfall	–0.0046*** (0.0018)	–0.0047*** (0.0014)	–0.0038 (0.0039)	–0.0022 (0.0014)	–0.0041*** (0.0011)	–0.0024 (0.0029)
AR(1) coefficient	0.3334*** (0.1028)	0.2807*** (0.1060)	0.2422** (0.1046)	0.4114*** (0.0984)	0.3197*** (0.1055)	0.2103** (0.1052)
Seasonally adjusted data	No	No	No	Yes	Yes	Yes
Seasonal dummy variables	Yes	Yes	Yes	No	No	No
Adjusted R^2	0.9572	0.9707	0.6863	0.9536	0.9700	0.4008

NOTE: *, **, and *** denote significance at 10, 5, and 1 percent, respectively. Regressions in each panel are estimated simultaneously using the technique of Seemingly Unrelated Regressions. The dependent variable for each equation is the log of tax revenue for a subset of the bar and restaurant sector. Group 1 includes food only, Group 2 includes food and beverage establishments, and Group 3 includes those businesses that serve only beverages. Regressions in the "Non-seasonally adjusted data" columns use data that are not seasonally adjusted, whereas those in the "Seasonally adjusted data" columns use data that are adjusted using the Census X-12 ARIMA procedure.

their smoking policies before enactment of the smoking ban. If few businesses within a category were affected by the new law, it is unlikely that a significant effect would be found in the data. If many businesses had to change their policies, the impact of the smoking ban might be more distinct.

To examine the importance of this factor, the list of businesses in each category was cross-referenced against a list of bar and restaurant smoking policies compiled by the Boone Liberty Coalition (BLC) before enactment of the smoking ban.[15] Many of the businesses on the sales tax list were not covered by the BLC survey, including those that had gone out of business before mid-2006 and those that have newly opened since that time. In fact, more than half of the listed establishments were in these unclassified categories. A clear pattern is evident, however, in those covered in the survey: Among restaurants in group 1, only 18 percent permitted indoor smoking before the smoking ban was enacted. For businesses in group 2, 56 percent allowed smoking, while for group 3, 71 percent did.[16]

Regressions of the same general form as reported in Table 1 were estimated for the three subsectors independently. Using both the non-seasonally adjusted and seasonally adjusted data, three equation systems were estimated using the technique of seemingly unrelated regressions. This technique allows for possible correlation among the residuals of the three equations (a distinct possibility in this case). In addition, it allows for testing cross-equation restrictions.

[15] The BLC was active in opposition to the enactment of the Columbia smoking ban. They circulated a report (Boone Liberty Coalition, 2006) indicating that nearly two-thirds of Columbia's restaurants had smoke-free policies before the ban was adopted.

[16] Businesses that allowed smoking on patios before the ban are not counted in the totals for smoking permitted, since the Columbia Smoke-Free Ordinance included an exemption that allowed for some smoking sections to remain in outdoor seating areas.

Table 3

Wald Tests for Equality of Smoking Ban Coefficients Across Equations

	Non-seasonally adjusted data		Seasonally adjusted data	
Test	Chi-square (1) statistic	Probability	Chi-square (1) statistic	Probability
Group 1 = Group 2	18.8373	0.0000	13.7525	0.0002
Group 1 = Group 3	12.4516	0.0004	10.9588	0.0009
Group 2 = Group 3	2.5268	0.1119	2.3193	0.1278

Not surprisingly, estimated effects of the smoking ban differed among these three groups. The results of regression equations for the three groups are reported in Table 2. Both non-seasonally adjusted and seasonally adjusted data are shown. The results are similar for each technique. For the restaurants in group 1, there is no statistically significant effect associated with the smoking ban. For businesses in group 2, the impact is negative and highly statistically significant. The point estimates suggest losses of about 6½ percent. For the bars in group 3, the small sample size means that there is more noise in the data, so the fit of the regression equation is much less precise.[17] Nevertheless, the coefficient on the smoking ban dummy variable is highly significant, with the estimates suggesting losses of nearly 11 percent.

Wald test statistics (reported in Table 3) were calculated for testing the significance of the cross-equation differences in the smoking ban coefficients. The coefficients on the smoking ban dummy variable in the equations for groups 2 and 3 were each significantly different from the coefficient estimated for group 1. However, because of the relatively large standard errors for the group 3 estimates, the hypothesis that the effect on group 2 and group 3 businesses was the same could not be rejected at standard levels of statistical significance.[18]

[17] Although neither the time trend nor the other tax revenues variable is individually significant in these regressions, the two variables are jointly significant (p-value < 0.001), and together account for much of the explanatory power of the equation.

[18] In a regression equation estimated using the (logged) sum of group 2 and group 3 businesses as the independent variable (full results not reported), the coefficient on the smoking ban dummy variable was found to be –0.065 for the non-seasonally adjusted data and –0.068 for a regression using seasonally adjusted data.

DISCUSSION AND CONCLUSION

The results reported in this paper indicate statistically significant losses to bar and restaurant sales tax revenues following the implementation of the Columbia Smoke-Free Ordinance in January 2007. After accounting for trends, seasonality, an overall downturn in retail sales, and an unusually harsh winter, there remains a 3½ to 4 percent loss in dining tax revenues associated with the smoking ban. The effects of the smoking ban vary for different types of businesses. Restaurants that serve primarily food only show no significant effect, whereas bars and restaurants with bars show significantly greater losses. For the latter categories, losses are estimated to be in the range of 6½ to 11 percent.

It is important to note that the point estimates identify only average losses. Many businesses in this category are likely to have been unaffected (e.g., take-out businesses, fast-food franchises, and other restaurants that already had smoke-free policies). Accordingly, some businesses are likely to have incurred losses that are far greater than the average. Anecdotal reports from specific business owners suggesting losses in the range of 30 percent do not seem unreasonable.

One interesting feature of the Columbia experience is the response of restaurant owners to the patio exemption. According to the *Columbia Missourian*, owners of at least two bars are building or planning outdoor patio expansions. One owner was quoted as saying, "You have to have a patio to survive."[19] The expenses associated with these renovations may help offset losses in sales revenue of these establishments, but they also represent

[19] Solberg (2007), Greaney (2007).

profit losses above and beyond the measured declines in revenues.

Measuring the economic effects of smoking bans can sometimes be difficult. For the case of Columbia, Missouri, this analysis of data on sales tax revenues indicates that losses are of a magnitude that is clearly identifiable and statistically significant.

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