On the Economic Analysis of Smoking Bans

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This paper evaluates the literature on the economic effects of smoking bans. Many studies focus exclusively on aggregate impact and thus may overlook the importance of distributional effects, which reveal inefficiencies often undetectable in analyses of aggregated data. These effects also account for the political economy of smoking bans, igniting controversy and public debate. The political resolution often involves exemptions for certain types of establishments, which limits the applicability of many existing studies to the more comprehensive smoking-ban proposals. The paper also analyzes data from Maryville, Missouri—the first city in Missouri to ban smoking in restaurants—to illustrate some of these points.

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In Missouri and across the nation, communities are debating the efficacy of banning smoking in all public places, including privately owned establishments. The policy issues involved are multidimensional, but the public debate is often summarized in terms of public health versus economic impact.

The focus of policymakers is often directed toward considering the aggregate, or overall, economic effects of smoking bans on business in a community. Data on communitywide economic activity are often readily available, and it might seem that the overall effect of a public policy on economic activity is the appropriate measure to consider.

But it is also important to account for the distributional impact and economic inefficiencies that are often imposed by government intervention in the market, particularly in cases where the proposed policy imposes blanket restrictions. These differential effects reveal inefficiencies that are often undetectable in analyses of aggregated data.

Distributional effects also contribute to the political economy of smoking bans, as economic interests clash. The resolution of these conflicts often results in legislation that exempts certain types of businesses from these bans. Such compromises represent a political outcome that reduces the potential inefficiency and welfare losses that might otherwise be imposed by more comprehensive smoking prohibitions. However, the prevalence of these exemptions, in turn, limits the applicability of many studies to the more comprehensive legislation that has been proposed in many communities.

AGGREGATE ECONOMIC IMPACT

The consensus of the literature on the economic effects of existing smoking regulations is that no statistically significant impact on overall business in a community can be ascertained.[1] Some communities appear to experience a decline in sales or

[1] Some of the more prominent studies include Huang et al. (1995), Glantz and Smith (1994 and 1997), Bartosch and Pope (1999 and 2002), Hyland, Cummings, and Nauenberg (1999), and Huang, De, and McClusker (2004). A recent comprehensive survey is provided by Scollo, Hyland, and Glantz (2003).

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employment at restaurants and bars, while others appear to experience an increase, at least over time.[2] Some studies find no evidence of consumer-flight to other locations, while others show some effect on bordering communities.[3] However, the statistical significance of these findings is often weak or lacking.

There are a number of reasons that this conclusion is not very surprising. First, these studies are necessarily conducted with limited data. Sample periods are short, and detailed local data are often scarce. Accordingly, it can be difficult to control for the many possible idiosyncratic factors that may affect economic outcomes without sacrificing some ability to adequately test hypotheses (a statistical problem known as "limited degrees of freedom"). Moreover, the possibility that important variables may have been omitted from the analysis implies that the statistical significance of their conclusions is often fragile ("omitted-variable bias").

In addition, studies of the impact of smoking bans necessarily focus on communities that are among the first to implement such ordinances and are therefore more likely to have a proportionately smaller smoking population and/or fewer businesses that would be adversely affected by a smoking ban.[4] This introduces a source of "sample-selection bias" that limits the general applicability of results, particularly in cases where demographic features differ and policy proposals are more comprehensive or restrictive than those examined in the literature.[5]

More importantly, basic consumer theory suggests reasons that aggregate economic effects might be limited: When an option is denied to consumers, they tend to substitute other similar products and services. A disruption in the availability or price of a good can temporarily skew spending as consumers reallocate their expenditures, but with the ultimate effect of leaving their spending on broad categories such as "entertainment" unchanged.

However, the lack of a measurable overall effect can mask some important distributional and social-welfare effects.

DISTRIBUTIONAL EFFECTS AND ECONOMIC EFFICIENCY

When consumers are forced to reallocate their spending, the notion of "revealed preference" tells us that they are likely to be made worse-off in terms of economic efficiency. In making choices about their spending patterns, consumers reveal their preferred consumption bundle. By eliminating options available to consumers, a ban on an activity forces them to choose a spending allocation that could have been chosen before the ban, but was not.

This notion of economic welfare differs considerably from the analysis implicit in many economic studies of smoking bans, which present the elimination of a risk as an unambiguous benefit and the absence of a significant aggregate economic effect as evidence that a smoking-ban policy would be costless.[6] Neither of these characterizations of costs and benefits is complete, however.

Economists observe that individuals make choices each day based on their preferences and the options provided by the market. Those choices frequently involve uncertainty and risk. People make choices because the benefits they expect to

[2] In an early study of smoking bans, Glantz and Smith (1994) found that, among 15 municipalities, there were two significant positive effects and one significant negative effect on bar and restaurant sales. Evans (1997) cited several methodological criticisms of that study and found that nine cities in the sample were subject to significant negative effects. A subsequent study by Glantz and Smith (1997) showed two statistically significant positive effects and two significant negative effects.

[3] In a study of 239 cities in Massachusetts, Bartosch and Pope (2002) found a statistically significant positive effect for cities bordered by nonsmoking municipalities.

[4] Glantz and Smith (1994) focus their analysis on the first 15 U.S. cities to enact smoke-free ordinances affecting restaurants. The DHSS study of Maryville, Missouri, considered in this paper (Cowan et al., 2004) represents an analysis of "the first such ordinance in Missouri to completely prohibit smoking in all restaurants." Of the first nine states to implement statewide bans, eight were below the U.S. median with regard to percentage of smokers. In fact, the first two states to adopt smoking bans, California and Utah, have the two lowest rates of smoking prevalence in the nation, according to statistics from the Centers for Disease Control and Prevention (see Adams and Cotti, 2006).

[5] More general methodological critiques of the literature include Dunham and Marlow (2000) and Evans (1996 and 1997).

[6] For example, Glantz and Smith (1997) conclude that "legislators and government officials can enact health and safety regulations to protect patrons and employees in restaurants and bars from the toxins in secondhand tobacco smoke without fear of adverse economic consequences" (p. 1690).

gain are greater than the costs and risks involved.[7] This is true whether the decision is about skydiving, smoking cigarettes, or even working in or frequenting establishments where they may be exposed to secondhand smoke. Indeed, the act of driving a car to pursue these activities presents grave risks. To prohibit an activity simply because it involves risk cannot be justified in economic terms. In fact, government intervention can introduce inefficient distortions into those market mechanisms that efficiently deal with risk.

In our free market economy, the "invisible hand" guides businesses to provide the goods and services that consumers demand. For business owners and their employees, the impact of a ban can vary significantly, depending on their specific clientele and their marketing strategies. It is sometimes argued that secondhand smoke imposes external costs, requiring government intervention. But in the case of private businesses—especially those in the entertainment and hospitality sectors—the profit motive provides a mechanism for business owners to internalize those costs. Individuals assess their own risks and benefits, but it is in the business owner's best interest to accommodate customers and employees, smokers and nonsmokers alike. Failure to do so is reflected in the bottom line.

As public attitudes have evolved, an increasing number of restaurants and other entertainment venues offer smoke-free environments.[8] For example, the St. Louis Coalition for Tobacco-Free Missouri lists over 400 smoke-free restaurants (plus multiple chain outlets) in the St. Louis area.[9] Meanwhile, some businesses continue to accommodate smokers and nonsmokers with distinct and separate settings under strictly regulated standards, while others offer venues for a clientele that expects a smoke-filled atmosphere. Each proprietor is making a careful business decision about how to best fill a niche in the market and make a profit in the process.

The increasing number of establishments choosing to go smoke-free reveals that the market is responsive to people's changing attitudes. As consumers demand smoke-free options, businesses find it advantageous to provide them. A government regulation that attempts to force the market toward a new equilibrium, however, is likely to impose transitional costs and/or long-term hardships on many individual businesses.

A number of economic studies have examined these distributional effects. Because detailed data are often limited, much of the research on differential impacts comes from the results of surveys that assess attitudes and expectations.[10] The pattern of these effects is not surprising. Proprietors and customers of businesses such as bars, bingo halls, bowling alleys, billiard parlors, and casinos tend to express greater concerns about revenue losses from smoking bans. Family-oriented restaurants, chain outlets, fast-food restaurants, and take-out establishments are generally considered less likely to be adversely affected by smoking bans.

Survey results reveal that bar owners perceive a particularly significant threat to their business. In one nationwide survey of restaurant and bar owners, 39 percent of restaurant owners expected revenue losses after a smoking ban, while 83 percent of bar owners expected losses.[11]

Among bar and restaurant customers, smokers (who tend to spend more than nonsmokers) are more likely to decrease their patronage after a smoking ban, whereas nonsmokers (who are more numerous) are more likely to increase their patronage. The overall effect of these tendencies on overall restaurant and bar sales is a subject of debate.[12] Differential impacts on bars and restaurants are evident, however. For example, a survey in Massachusetts found that 44 percent of smokers

[7] A seminal article on the topic of risky choices is Friedman and Savage (1948). Viscusi (1992) applies risk analysis to the specific issue of smoking. See also Lemieux (2000) and Petkantchin (2005).

[8] Brooks and Mucci (2001) present evidence of changing attitudes toward smoking in restaurants among adult survey respondents in Massachusetts.

[9] See www.breatheeasymo.org/directory.asp?coal=15.

[10] Survey data are often treated with skepticism by economists, but they can provide relevant information about preferences and therefore, by implication, about economic welfare. Prominent studies of this type include Beiner and Siegel (1997), Dunham and Marlow (2000), Brooks and Mucci (2000), and Tang et al. (2003).

[11] Dunham and Marlow (2000).

[12] For example, Corsun, Young, and Enz (1996) found that smokers in New York City were eating out less after a restaurant smoking ban, but that nonsmokers were eating out more often, resulting in a positive impact on restaurant industry revenues. In a subsequent rejoinder, Evans (1996) raised methodological criticisms and recalculated the net effect to be negative.

predicted decreased patronage at bars, while 24.5 percent of nonsmokers predicted increased patronage. The proportions for restaurant patronage were significantly different, with only 32 percent of smokers reporting decreased patronage and 37.7 percent of nonsmokers reporting increased patronage.[13] This finding is consistent with greater concerns about revenue losses expressed by bar owners than by restaurant owners.[14]

Among studies that have examined detailed sales data after smoking bans, one found that the revenues of bars in Corvallis, Oregon, that offer video poker suffered significant revenue losses.[15] A recent study of gaming in Delaware after a smoking ban found a revenue decline of approximately 15 percent at racetrack casinos in that state.[16] One prominent study of bar sales in several municipalities that had imposed smoking bans showed mixed results, but found that the only statistically significant case showed a negative effect on bar sales relative to a comparison city.[17] A recent comprehensive study of bars and pubs in Ontario found significant declines in sales—over 23 percent in Ottawa, where a comprehensive smoking ban was implemented in September 2001.[18] Several sources document declines in alcohol sales following smoking bans.[19]

The overall change in overall employment at bars and restaurants is another measure of economic activity that is often considered. Just as is the case for aggregate sales figures, overall employment data often show no significant effects from smoking bans.[20] One recent study of hospitality-industry employment in New York City found a negative effect on restaurant employment and a positive effect for hotels. Neither effect was significant, however.[21] Local data and anecdotes that are more specific to subsets of businesses in a community tend to suggest employment losses. For example, a coalition of pub and bar owners in Ottawa, Ontario, estimated a loss of 230 jobs among their members in the first two months of a smoking ban in that city.[22]

As smoking bans proliferate across the nation, county-level employment data have provided useful information about the economic impact of smoking bans. By using pooled data covering the entire United States, Adams and Cotti (2006) and Phelps (2006) have been able to increase the statistical power of tests for economic impact. Both studies find little effect on employment at restaurants after a smoking ban is implemented, although Adams and Cotti find that restaurants in warm-weather climates tend to fare better than those in colder regions of the country. With respect to bar employment, both studies find statistically significant losses that range from 5 percent to 17 percent.[23]

Here again, however, the notion of revealed preference is informative. In the disruption imposed by a smoking ban, some workers will find themselves dislocated. Most will find new employment quickly, one hopes. But by their revealed preference, we can deduce that these employees considered the costs and benefits of their employment—including the potential health risks that their job entails—and chose not to find an alternative. A government ban will force some of these individuals to do so.

The increasing number of smoke-free venues provides options for employees as well as customers. The motivation to retain good workers provides an incentive for proprietors to offer accommodating work environments. In the process, relative risks and returns of employment options can be efficiently allocated by the market.

[13] Biener and Siegel (1997).

[14] Proprietors of billiard parlors and pool halls have expressed concerns that are similar to those of bar owners. See Fabrizio et al. (1995).

[15] Dresser et al. (1999).

[16] Pakko (2006 and forthcoming). These findings contradict earlier estimates by Mandel, Alamar, and Glantz (2005).

[17] Glantz and Smith (1997).

[18] Evans (2005); smoking bans in London, Kingston, and Kitchener, Ontario, that have been implemented more recently were also found to be associated with significant declines in bar and pub sales.

[19] For example, Clower and Weinstein (2004) report a sharp decline in alcoholic beverage sales in Dallas following the implementation of a comprehensive smoking ban, in contrast to increasing sales around the state. Thalheimer (2005) found similar effects for Lexington, Kentucky. An association of pub and bar owners in Ottawa, Ontario, reported statistics from the Brewers of Ontario that beer sales declined 10.5 percent in Ottawa during the first eight months of the smoking ban in that city (PUBCO, 2002). The decline in Ottawa beer sales is also reported in Bourns and Malcomson (2002).

[20] See, for example, Hyland, Cummings, and Lubin (2000).

[21] Hyland et al. (2003).

[22] PUBCO (2001).

[23] The employment data used in these studies report only the number of employees. There may be additional effects on the number of hours worked that would not be revealed in these analyses.

POLITICAL ECONOMY

Among businesses, comprehensive smoking bans tilt the economic playing field in ways that are fundamental to the political economy of the issue: Establishments that cater to a largely smoking clientele are likely to be opposed to a ban, and those who explicitly cater to a nonsmoking customer base might be driven to oppose it—to protect their own market niche. Businesses in communities that have a relatively high proportion of smokers relative to nonsmokers will be opposed to regional smoking bans, as will businesses and municipalities bordering communities that have not adopted a smoking ban. Many establishments that would be largely unaffected might be inclined to stay on the sidelines of the debate.

Tavern and bar owners have been among the most vociferous opponents of a complete ban on smoking. Existing empirical evidence supports the casual observation that bars stand to suffer a greater threat of revenue losses from smoking bans than do restaurants in general. This differentiation is evident in the political dynamics of public debate on smoking bans. It also explains the tendency of many community smoking bans to include exemptions for stand-alone bars or other establishments that receive a high proportion of their revenues in alcohol sales relative to food sales. In many local ordinances, exemptions also exist for bowling alleys, bingo halls, fraternal organizations, and the like.

These political compromises arise in response to the economic pressures that drive particular businesses to actively oppose smoking-ban ordinances. Those who are most threatened by any public policy proposal tend to be more adamant in their opposition and are more likely to have their interests accommodated in final legislation.[24] Exemptions represent something of a second-best outcome (achieved through the political process rather than through market mechanisms) for mitigating the most economically disruptive effects of a proposed public policy.

The prevalence of such exemptions in existing smoking ordinances reflects underlying economic pressures and provides indirect evidence of the potential adverse effects of more comprehensive smoking-ban proposals. In fact, the resources that businesses expend on their opposition to smoking bans, and their lobbying efforts to obtain exemptions, represent direct costs of smoking-ban proposals—whether or not they are ultimately implemented.

The fact that many local ordinances have exempted bars and other establishments is also an important consideration for interpreting previous studies of the effects of smoking bans on bar and restaurant sales. These studies have often considered communities with ordinances that contain numerous exemptions. The applicability of many of these case studies to contemporary policy debates over more restrictive proposals is therefore questionable.[25]

CASE STUDY: MARYVILLE, MISSOURI

On June 9, 2003, Maryville, Missouri, adopted an ordinance that prohibited smoking in restaurants.[26] An examination of the first year of the smoking ban, recently released by the Missouri Department of Health and Senior Services (DHSS), presents data on taxable sales receipts for Maryville that span a period of over five years before and one year after the implementation of the ordinance.[27] The study is being widely distributed and presented as evidence in support of similar (and more restrictive) bans in other communities.

The authors of the DHSS study state at the outset that their findings are "consistent with those from studies of smoke-free ordinances in other U.S. cities"—namely, that no "detrimental changes" in

[24] An alternative explanation of this feature of the political economy of smoking bans is that the hospitality industry has been duped into supporting the interests of a powerful tobacco company lobby. See, for example, Dearlove, Bialous, and Glantz (2002).

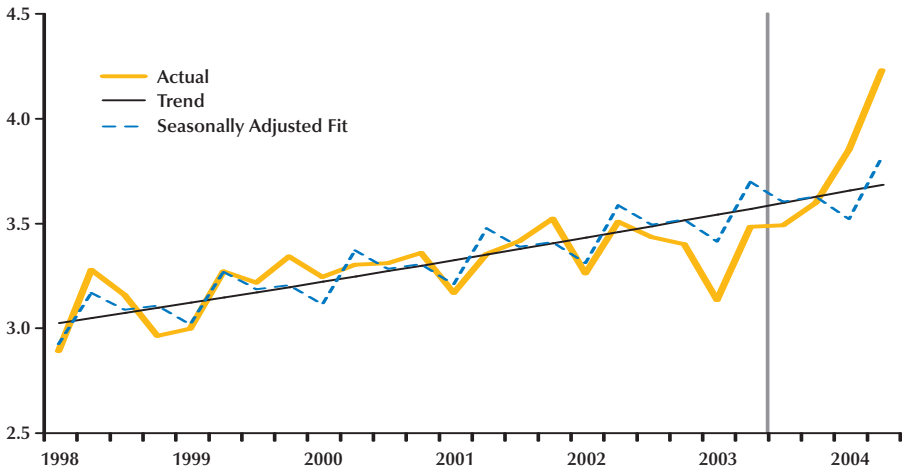
[25] Indeed, one study (Goldstein and Sobel, 1998) is widely cited as showing that "even in the number one tobacco-producing state in the US, ETS regulations present no adverse economic impact" (p. 286). However, it considered only the effects of requiring separate smoking and nonsmoking sections in restaurants. A recent citation is in Scollo, Hyland, and Glantz (2003).

[26] Maryville City Council (2003).

[27] Cowan et al. (2004).

Figure 1

Actual and Fitted Values for the Trend Equation (Fitted Time-Trend and Seasonal Effects Only)



total bar and restaurant revenue were observed after the ordinance was implemented. However, after comparing the growth rates for sales of eating and drinking establishments (standard industrial classification [SIC] code 581) with total retail sales in Maryville—and with corresponding data for the state of Missouri—and noting that eating and drinking establishment sales in Maryville rose sharply in the final two quarters of the study, the authors conclude that "the ordinance may have been beneficial for this area of business."

The purpose of the present study is to subject the data from the DHSS study to a more rigorous statistical analysis. Using the data reported in the DHSS study, I have applied basic linear regression techniques to test the hypothesis that the smoking ban had no significant effect on Maryville bar and restaurant sales. Of particular interest as well is the alternative hypothesis that the ordinance had "beneficial" effects.

An investigation of developments in the Maryville economy turned up an important additional factor that is included in the analysis: the opening of a new, popular restaurant chain outlet during the sample period. That factor appears to be more relevant for explaining total restaurant and bar sales in Maryville than the smoking ban.

Analysis of the Maryville Data

Figure 1 presents the data for eating and drinking establishments in Maryville, as reported in the DHSS study. The sample period runs from the first quarter of 1998 through the second quarter of 2004. As noted by the authors of the DHSS study, a trend and seasonal variation are important features of the data series. A sharp increase in sales at the end of the sample period is also evident.

The first line of Table 1 reports a summary of the regression results that were used to generate the trend line and seasonally adjusted estimates illustrated in Figure 1. The regression includes only a constant, a linear time trend, and quarterly dummy variables for quarters 2, 3, and 4.[28] It shows that sales at eating and drinking establishments grew at an average quarterly rate of 0.77 percent over the sample period and that seasonal variation generated more than $7^1/_2$ percent quarterly variation over a typical year.[29] As a measure of fit, the adjusted R^2 statistic suggests that the regression

[28] The first quarter serves as the baseline for seasonality of the regression.

[29] Although the coefficient on quarter 2 is the only individually significant seasonal variable, F-tests of the joint significance of the seasonal dummies showed them to be significant in all of the specifications reported in this paper (with exceptions noted).

Table 1

Trend Analysis
[Dependent Variable = ln(E&D_Maryville)]

	Constant	Trend	Q2	Q3	Q4	SmokeBan	Applebee's	Adjusted R^2	Q
1	14.8858**	0.0077**	0.0726**	0.0387	0.0376			0.6595	6.4060†
	(0.0225)	(0.0012)	(0.0245)	(0.0255)	(0.0255)				
2	14.9024**	0.0055**	0.0749**	0.0369	0.0381	0.0752*		0.7368	3.2281
	(0.0207)	(0.0014)	(0.0216)	(0.0224)	(0.0224)	(0.0281)			
3	14.8993**	0.0056**	0.0623**	0.0512**	0.0523**		0.1755**	0.8548	1.0313
	(0.0149)	(0.0009)	(0.0161)	(0.0168)	(0.0169)		(0.0325)		
4	14.9020**	0.0052**	0.0637**	0.0497**	0.0512**	0.0172	0.1605**	0.8507	0.9895
	(0.0156)	(0.0010)	(0.0165)	(0.0172)	(0.0172)	(0.0256)	(0.0398)		

NOTE: */** Indicates significant at the 95/99 percent levels. †Q-statistic indicates the presence of autocorrelated residuals.

explains nearly two-thirds of the variation in Maryville bar and restaurant sales.[30,31]

Line 2 shows the results when a dummy variable for the smoking ban is included in the regression. The dummy variable takes on a value of 1 in the final four quarters of the sample period and is zero before. The point estimate of the coefficient on this variable indicates that sales at eating and drinking establishments in Maryville were more than $7^1/_2$ percent higher during the smoking ban than trend growth and seasonal variation would predict.[32] This estimate is significant at the standard 95 percent confidence level. According to this initial evaluation of the effect of the smoking ban in Maryville, the DHSS conclusions appear to be supported. The inclusion of a dummy variable covering the period of the smoking ban improves the overall fit of the equation, and its coefficient estimate is positive and significant.

As an illustration of this finding, Figure 2 shows a plot of the actual and predicted values from the regressions with the smoking-ban dummy variable included. After controlling for the smoking ban, the unexplained increase in the final two quarters of the sample is still present, but its prominence is diminished. However, sales in the first two quarters of the smoking ban now appear to be considerably lower than the values predicted by the estimation equation. In fact, the last four residuals from this equation are outliers, the first two negative and the last two positive.

Results such as this are often fragile. First, the significance of the dummy variable indicates that a correspondence exists in the data, but it does not establish causality. More importantly, findings are often subject to omitted-variable bias. If an important independent influence has been excluded from the analysis, the results can be misleading.

In the following sections, I consider the inclusion of additional data series to control for changes in overall economic conditions in Maryville and Missouri. First, investigation into the local economic environment in Maryville yielded information about one important idiosyncratic event that is relevant to the analysis: the opening of a new Applebee's in town.

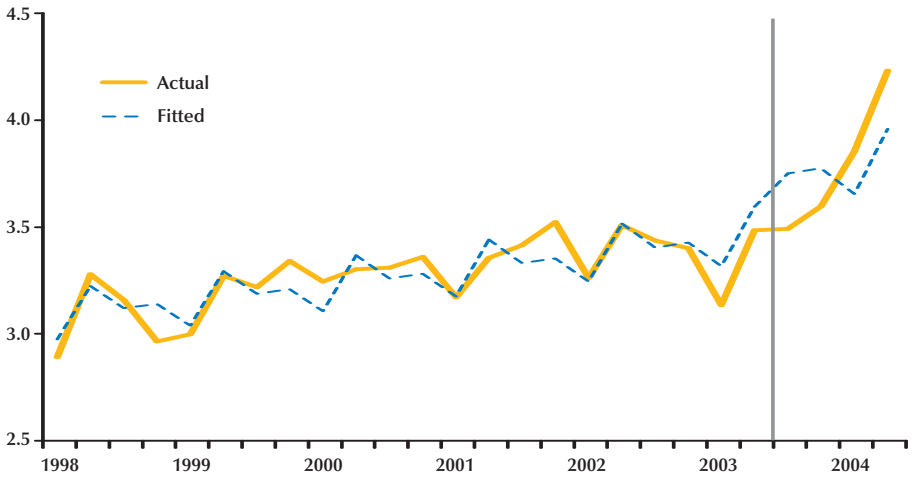
[30] The equation actually explains a greater proportion of the variation: The unadjusted R^2 is 0.714. The adjusted R^2 penalizes the inclusion of superfluous explanatory variables and is a particularly relevant measure of fit for small samples in which degrees of freedom are limited.

[31] Tests of the residuals from this baseline trend/seasonal specification suggested the presence of serially correlated residuals. Subsequent analysis showed that this was an artifact of the outlying observations at the end of the sample period. Serial correlation was not detected in specifications that included dummy variables for end-of-period effects.

[32] The coefficient on a dummy variable in a semilogarithmic equation such as this provides only an approximation to the percentage effect. For a coefficient value ß, the true percentage effect is exp(ß)–1. In this case, the calculated value is 7.81 percent. See Halvorsen and Palmquist (1980).

Figure 2

Actual and Fitted Values for the Trend Equation (Including the Smoking-Ban Effect)



The Applebee's Effect

In mid-February 2004 (halfway through the third quarter of the smoking ban), Applebee's opened a new franchise in Maryville. According to local news reports, it has been a phenomenal success. In a report on the restaurant's one-year anniversary, the *Maryville Daily Forum* quotes the company's vice president of operations for Applebee's parent company as saying that "Maryville has been one of the busiest stores in the country since its opening. We call it our crown jewel."[33]

Maryville is a fairly small town, with a resident population of 11,000. It has only 37 restaurants and bars. It is quite conceivable that the opening of a new, popular restaurant chain outlet would have a significant independent effect on the town's total bar and restaurant sales.

To test for the influence of the "Applebee's effect," I constructed a variable that takes on a value of 1 in the second quarter of 2004 and 2 in the first quarter (since Applebee's opened midway through the quarter). The results of including this variable in the basic trend regression equation are reported in line 3 of Table 1. The Applebee's variable is highly significant, with a point estimate that suggests it accounts for a 19.2 percent increase in Maryville bar and restaurant sales in the second quarter of 2004 (along with a 9.6 increase in the first quarter).[34]

With both the smoking ban and Applebee's dummy variables included in the regression (line 4), the Applebee's effect accounts for an increase of more than 17 percent above trend at the end of the sample period—an effect that remains highly significant. The coefficient on the smoking-ban dummy is small and is not statistically significant. In fact, the fit of the regression deteriorates when adding the smoking-ban dummy variable to the equation that already includes the Applebee's variable (lines 3 and 4).

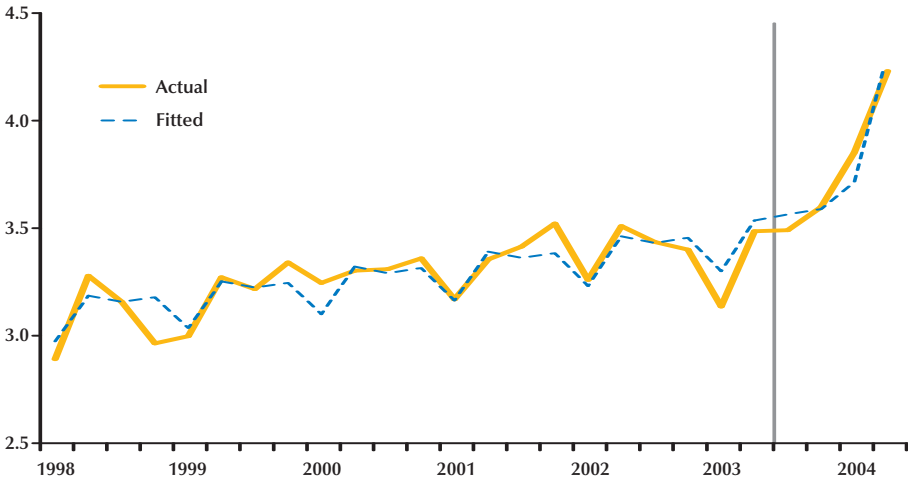
Figure 3 illustrates this result, showing the actual and fitted values from the regression that includes the Applebee's variable (line 3). Compared with Figures 1 and 2, Figure 3 clearly shows that the inclusion of the Applebee's variable effectively accounts for the surge in restaurant and bar sales in the first two quarters of 2004, leaving little additional variation for which the smoking-ban dummy variable can account.

[33] Goff (2005).

[34] These figures are related to the actual coefficient estimates using the method described in footnote 32.

Figure 3

Actual and Fitted Values for the Trend Equation (Including the Applebee's Effect)



The regressions reported in Table 1 include no controls for overall economic conditions. This is another potentially important source of omitted-variable bias in the results, particularly because the sample period includes a national economic recession. A number of variables were applied to the analysis to better control for economic conditions. The results, reported in the appendix, were all broadly consistent with the trend analysis presented in Table 1.

DISCUSSION AND CONCLUSIONS

The findings of this analysis of the Maryville data suggest no significant effect of the smoking ban on bar and restaurant sales. The evident increase in sales near the end of the sample period more closely corresponds to the opening of the new Applebee's in town than it does to the implementation of the smoking ban. Although these findings do not establish causality, a consideration of the particular demographics and the limited scope of the ordinance in this case suggest that any claims about the smoking ban having beneficial effects on bar and restaurant sales in Maryville cannot reasonably be substantiated.

These results illustrate many of the points raised in the first section of this paper. First, the sample period is short. With only 26 observations, limited degrees of freedom make it difficult to test hypotheses with a high degree of confidence. The sharp increase in Maryville bar and restaurant sales in the first two quarters of 2004 is an unusually prominent outlier in the data, so it is more readily associated with statistically significant effects. The key issue is resolving the source of those effects.

More generally, it is not surprising that a smoking ban like the one in Maryville would have no measurable impact on the city's total bar and restaurant sales. Consumers tend to substitute similar expenditures when one set of consumption options is restricted. Spending patterns can change without having a significant impact on broad spending categories such as "entertainment" or on specific categories such as "sales revenues of eating and drinking establishments."

But the lack of aggregate effects does not preclude the existence of significant distributional effects. It is generally acknowledged that some businesses are likely to be affected more than others by a smoking ban. The owners of businesses who are likely to be most severely affected tend to raise the loudest objections and are therefore more likely

to be granted exemptions. It is no accident that bars are often exempted from smoking bans.

In Maryville, the ordinance exempts stand-alone bars. It exempts seven establishments by name and also excludes any other businesses that receive more than 60 percent of their revenues from alcohol sales.[35] By excluding bars, the Maryville City Council mitigated some adverse economic impacts that might have occurred under a comprehensive ban. The specific exemptions included in the ordinance suggest that it represented a political compromise that accommodated concerns raised by local business owners.

Indeed, the Maryville ordinance affected very few businesses at all. According to the Missouri Tobacco Use Prevention Program (2002), 70 percent of the restaurants in Maryville were smoke-free well before the ban. Assuming that figure excludes bars that were exempted, the ordinance affected no more than nine restaurants. It would be very surprising to find that the smoking ban had any significant effect on total bar and restaurant sales in Maryville.

This observation points to a more general reason for exercising caution in extrapolating the findings from this type of study to an evaluation of policy proposals in other municipalities. Studies of the impact of smoking bans necessarily focus on communities that are among the first to implement such ordinances, and which are therefore more likely to have a lower proportional smoking population and/or a smaller number of businesses that would be adversely affected by the proposed ban. This type of sample-selection bias limits the general applicability of results, particularly in cases where demographic features differ and public policy proposals are more comprehensive and restrictive than the Maryville ordinance.

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APPENDIX

Including Economic Controls in the Maryville Regressions

Table A1 presents results that include two economic control variables used in the DHSS study. The first panel includes a variable that is constructed by subtracting eating and drinking sales from total retail sales in Maryville.[36] Although the coefficient on this variable is significant in only one of the equations reported, it is jointly significant with the linear time trend in all four specifications. Comparisons with Table 1 show that including this economic control variable provides for a slightly improved fit. However, the conclusions to be drawn from this specification are the same as before: The smoking-ban dummy variable is positive and significant if included alone, but the Applebee's variable provides for a much better fit, and the smoking ban has no significant influence after controlling for the Applebee's effect.

The second panel of Table A1 reports the results of including a variable for sales at eating and drinking establishments for the rest of Missouri (Missouri minus Maryville). Again, although the coefficient on this variable is not individually significant, it is jointly significant with the time trend. However, the seasonal effects were found to be individually and jointly insignificant in all four specifications. Evidently, the seasonal pattern in total Missouri bar and restaurant sales is able to adequately capture the seasonal variation in Maryville's sales in this regression. In light of this finding, the third panel of Table A1 presents the results of excluding the seasonal dummy variables.

Again, the slightly better fit of these equations relative to the trend specifications in Table 1 shows that bar and restaurant sales in the rest of Missouri help to explain the Maryville sales pattern. When it is included in this specification, the Applebee's variable continues to be highly significant. However, the smoking-ban dummy variable is no longer significant, even when the Applebee's effect is not considered.[37]

As an additional robustness check, I obtained data on employment and unemployment for Nodaway County for use as alternative control variables for local economic conditions.[38] Table A2 reports the results of including these data in the regressions. The first panel shows the results of including (the natural log of) Nodaway County employment. The second panel considers the Nodaway County unemployment rate as a control variable. The regressions including the unemployment rate proved the best overall for fit of all the specifications considered. The findings reinforce those reported in Table A1: The Applebee's effect unambiguously dominates the smoking-ban effect. When the Nodaway county unemployment rate is used as an explanatory variable, the smoking-ban dummy is not significant, even when included alone.[39]

All of the regressions considered above use the log of Maryville bar and restaurant sales as the dependent variable. Two alternative ratios were also considered: The first is the ratio of Maryville eating and drinking establishment sales to total retail sales. The second is the ratio of eating and drinking establishment sales in Maryville relative to the eating and drinking establishment sales for Missouri.[40]

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[36] This difference was included in the regression instead of total Maryville retail sales because the total includes the dependent variable. Inclusion of the total would therefore introduce a problematic correlation of the regressor with the residuals.

[37] In the specification that excludes seasonal factors, the smoking-ban dummy variable is very near the significance threshold.

[38] The data are quarterly averages of monthly figures, obtained from the Bureau of Labor Statistics.

[39] In the specification that includes the smoking-ban dummy variable alone, evidence of serially correlated errors remains. The inclusion of an autoregressive error specification did not alter the overall results, however. In fact, the AR(1) error specification had the effect of reducing the size of the coefficient on the smoking-ban dummy variable.

[40] The use of these ratios as dependent variables can be thought of as imposing ex ante restrictions on the relationships considered in Table 2. Following Glantz and Smith (1994 and 1997) analysis of these types of ratios have been widely used in the literature on the economic effects of smoking bans. Evans (1997) points out the use of ratios can be misleading when the numerator is relatively large. However, Maryville bar and restaurant sales comprise only about 10 percent of total Maryville retail sales and only 0.23 percent of Missouri bar and restaurant sales.

Table A1

Trend Analysis Using Sales Data to Control for Economic Factors
[Dependent Variable = ln(E&D_Maryville)]

	Constant	Trend	X	Q2	Q3	Q4	SmokeBan	Applebee's	Adjusted R^2	Q
A. X = ln(Total_Maryville – E&D_Maryville)										
1	4.4048	0.0019	0.6152	0.0386	–0.0209	–0.0640			0.6923	4.5727†
	(5.8283)	(0.0034)	(0.3421)	(0.0300)	(0.0410)	(0.0615)				
2	2.9130	–0.0014	0.7039*	0.0362	–0.0314	–0.0781	0.0813**		0.7908	0.0907
	(4.8276)	(0.0030)	(0.2834)	(0.0247)	(0.0340)	(0.0509)	(0.0252)			
3	9.7845*	0.0029	0.3002	0.0463*	0.0214	0.0018		0.1646**	0.8588	0.3858
	(4.0943)	(0.0023)	(0.2403)	(0.0204)	(0.0291)	(0.0437)		(0.0332)		
4	8.2930	0.0015	0.3880	0.0441*	0.0101	–0.0149	0.0296	0.1355**	0.8610	0.0398
	(4.2689)	(0.0026)	(0.2506)	(0.0203)	(0.0305)	(0.0458)	(0.0260)	(0.0417)		
B1. X = ln(E&D_Missouri – E&D_Maryville)										
1	–10.3031	–0.0014	1.2051	–0.0829	–0.1397	–0.0364			0.6981	3.5275
	(13.1294)	(0.0049)	(0.6281)	(0.0843)	(0.0960)	(0.0454)				
2	5.1811	0.0023	0.4649	0.0145	–0.0317	0.0095	0.0626		0.7288	3.2178
	(15.1076)	(0.0051)	(0.7226)	(0.0964)	(0.1089)	(0.0500)	(0.0346)			
3	5.7685	0.0024	0.4368	0.0066	–0.0143	0.0245		0.1642**	0.8540	1.0627
	(9.7439)	(0.0035)	(0.4661)	(0.0616)	(0.0719)	(0.0341)		(0.0347)		
4	7.1627	0.0027	0.3701	0.0157	–0.0049	0.0283	0.0076	0.1593**	0.8464	1.0788
	(11.3809)	(0.0038)	(0.5443)	(0.0725)	(0.0822)	(0.0379)	(0.0296)	(0.0404)		
B2. X = ln(E&D_Missouri – E&D_Maryville) - without seasonals										
1	6.3462*	0.0048**	0.4086**						0.6720	3.3851
	(3.0451)	(0.0016)	(0.1451)							
2	7.1113*	0.0032	0.3728*				0.0612		0.7132	1.0364
	(2.8715)	(0.0017)	(0.1368)				(0.0295)			
3	7.2297**	0.0030*	0.3673**					0.1645**	0.8428	0.0003
	(2.1155)	(0.0012)	(0.1008)					(0.0323)		
4	7.2746**	0.0029*	0.3652**				0.0053	0.1604**	0.8356	0.0018
	(2.1743)	(0.0013)	(0.1036)				(0.0261)	(0.0385)		

NOTE: */** Indicates significance at the 95/99 percent level. †Q-statistic indicates the presence of autocorrelated residuals.

Table A2

Trend Analysis Using Employment Data to Control for Economic Factors
[Dependent Variable = ln(E&D_Maryville)]

	Constant	Trend	X	Q2	Q3	Q4	SmokeBan	Applebee's	Adjusted R^2	Q
A. X = ln(Nodaway Employment)										
1	13.1760**	0.0066**	0.6729	0.0665*	0.0622	0.0251			0.6748	5.3472†
	(1.2127)	(0.0014)	(0.4772)	(0.0243)	(0.0300)	(0.0265)				
2	13.9639**	0.0051**	0.3687	0.0713**	0.0499	0.0312	0.0682*		0.7322	3.1574
	(1.1526)	(0.0015)	(0.4528)	(0.0222)	(0.0277)	(0.0242)	(0.0296)			
3	14.2822**	0.0052**	0.2427	0.0604**	0.0592**	0.0473*		0.1691**	0.8513	0.8511
	(0.8496)	(0.0010)	(0.3341)	(0.0165)	(0.0203)	(0.0184)		(0.0340)		
4	14.3714**	0.0050**	0.2085	0.0619**	0.0569*	0.0470*	0.0143	0.1576**	0.8456	0.8619
	(0.8817)	(0.0011)	(0.3464)	(0.0170)	(0.0211)	(0.0188)	(0.0265)	(0.0408)		
B. X = Nodaway Unemployment Rate										
1	15.0337**	0.0107**	–0.0907**	0.0369	0.0127	–0.0336			0.7502	5.9226†
	(0.0539)	(0.0014)	(0.0309)	(0.0243)	(0.0235)	(0.0326)				
2	15.0110**	0.0084**	–0.0695*	0.0468	0.0175	–0.0166	0.0537		0.7814	4.2901†
	(0.0517)	(0.0018)	(0.0308)	(0.0233)	(0.0222)	(0.0317)	(0.0273)			
3	14.9697**	0.0073**	–0.0444	0.0463*	0.0366	0.0153		0.1494**	0.8694	1.5735
	(0.0416)	(0.0013)	(0.0247)	(0.0177)	(0.0179)	(0.0261)		(0.0340)		
(4.)	14.9687**	0.0070**	–0.0427	0.0478*	0.0362	0.0159	0.0111	0.1406**	0.8637	1.6207
	(0.0426)	(0.0015)	(0.0255)	(0.0184)	(0.0183)	(0.0267)	(0.0247)	(0.0398)		

NOTE: */** Indicates significance at the 95/99 percent level. †Q-statistic indicates the presence of autocorrelated residuals.

Table A3 presents the results of regressions using these ratio-dependent variables. A downward trend is found for the ratio of bar and restaurant sales relative to total retail sales in Maryville, but no trend is evident in the ratio of sales in Maryville relative to Missouri. Seasonal effects are significant in both sets of regressions, indicating that seasonal patterns in Maryville bar and restaurant sales differ from total retail sales in Maryville and from bar and restaurant sales for the state of Missouri.[41]

The first panel, using the ratio of bar and restaurant sales relative to total retail sales in Maryville as the dependent variable, shows that the effect of the smoking-ban dummy is positive and highly significant when included without the Applebee's variable in the regression. However, the Applebee's effect again provides for a better fit, and it remains significant (whereas the smoking-ban dummy does not) when both are included in the regression.[42]

The second panel of Table A3 reports the results of using the ratio of bar and restaurant sales for Maryville to bar and restaurant sales for Missouri as the dependent variable. In this set of regressions, the

[41] Given the insignificance of seasonable dummy variables reported in Panel B1 of Table 2, this finding indicates that seasonal sales patterns in Maryville are different from, but have a predictable relationship to, total Missouri bar and restaurant sales. This is likely attributable to the nature of Maryville as a college town, home to Northwest Missouri State University.

[42] The ratio of bar and restaurant sales to total sales for the state of Missouri was considered as an additional explanatory variable, but its inclusion did not improve the overall fit of the regression, nor did it alter any of the results of hypothesis tests.

[43] Two ratios were considered as additional explanatory variables for this specification: Total retail sales for Maryville relative to the state of Missouri and Nodaway employment relative to Missouri employment. Neither variable improved the fit of the equation or altered the results.

Table A3

Analysis of Ratios

	Constant	Trend	Q2	Q3	Q4	SmokeBan	Applebee's	Adjusted R^2	Q
A. Dependent Variable = (E&D_Maryville/Total_Maryville) × 100									
1	10.4377**	–0.0152	0.1605	–0.5295*	–1.1162**			0.6112	3.2560
	(0.1944)	(0.0104)	(0.2115)	(0.2199)	(0.2202)				
2	10.6060**	–0.0383**	0.1837	–0.5477**	–1.1113**	0.7658**		0.7414	0.0787
	(0.1660)	(0.0108)	(0.1726)	(0.1794)	(0.1795)	(0.2251)			
3	10.5365**	–0.0311**	0.0846	–0.4377*	–1.0085**		1.2854**	0.7662	0.0861
	(0.1529)	(0.0090)	(0.1652)	(0.1722)	(0.1730)		(0.3327)		
4	10.6037**	–0.0396**	0.1206	–0.4756**	–1.0379**	0.4401	0.9008*	0.7895	0.4627
	(0.1498)	(0.0098)	(0.1580)	(0.1647)	(0.1649)	(0.2455)	(0.3816)		
B. Dependent Variable = (E&D_Maryville/E&D_Missouri) × 100									
1	0.2431**	0.0001	–0.0133*	–0.0253**	–0.0057			0.4321	4.0358†
	(0.0049)	(0.0003)	(0.0053)	(0.0055)	(0.0056)				
2	0.2457**	–0.0003	–0.0129*	–0.0256**	–0.0056	0.0118		0.4854	2.7680
	(0.0049)	(0.0003)	(0.0051)	(0.0053)	(0.0053)	(0.0066)			
3	0.2459**	–0.0004	–0.0154**	–0.0228**	–0.0027		0.0357**	0.7130	0.9435
	(0.0035)	(0.0002)	(0.0038)	(0.0040)	(0.0040)		(0.0077)		
4	0.2456**	–0.0003	–0.0155**	–0.0226**	–0.0026	–0.0016	0.0371**	0.6989	0.8795
	(0.0037)	(0.0002)	(0.0039)	(0.0041)	(0.0041)	(0.0061)	(0.0095)		

NOTE: */** Indicates significance at the 95/99 percent level. †Q-statistic indicates the presence of autocorrelated residuals.

smoking-ban dummy variable is not significant even when included in the absence of the Applebee's effect. The Applebee's dummy variable is highly significant with or without controlling for the effect of the smoking ban. When both variables are included in the regression, the coefficient on the smoking-ban dummy is negative, but insignificant.