

**An Analysis Of The Economic Effect Of The
Lexington-Fayette County, Kentucky Smoking Ban Of 2004**

by

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Thalheimer Research Associates, Inc. (TRA, Inc.)

Executive Summary

The focus of this study was to determine the economic effect of a smoking ban in Lexington-Fayette County, Kentucky. The smoking ban ordinance was implemented on April 27, 2005. There are few exemptions to the comprehensive ordinance that included restaurants, bars and lounges.

Published Refereed Academic Studies

A comprehensive review of the published academic literature on the economic effect of a smoking ban revealed that articles could be separated into two major areas: those based on historical taxable sales data, and those based on opinion surveys.

Virtually all of the studies of the economic impact of a smoking ban using observed economic data were based historical times series of one or more of the following: taxable restaurant, bar or hotel sales. All of these studies used essentially the same methodology. All of these studies found, in general, no significant impact of a smoking ban on the *ratio* of taxable restaurant, bar or hotel sales to *total* taxable retail sales. Because the ratio of the two taxable sales series was used as the variable of interest, no conclusion can be drawn as to the impact of a smoking ban on taxable restaurant, bar or hotel) sales, the numerator of the ratio, as these studies imply. For example, if the taxable sales *ratio* was found to remain unchanged in the presence of a smoking ban, the most common finding, this could be due to: (1) no change in either taxable restaurant sales or total taxable retail sales, (2) equal relative increases in taxable restaurant sales and total taxable retail sales, or (3) equal relative decreases in taxable restaurant sales and total taxable sales.

These studies were also shown to be subject to sample selection bias and equation misspecification error that could result in biased estimates of the effect of the smoking ban. In addition, insufficient sample size in a number of these studies resulted in unreliable estimates of the effect of the smoking ban.

Results of the articles based on survey opinions were that revenues and profits of restaurants, bars, and/or hotels were expected to decline when owners were faced with a smoking ban. In addition, bars were found to be more than twice as likely to experience such a decline as restaurants. With respect to restaurants, those with a higher percentage of revenues from sales of alcoholic beverages were more likely to experience a decline. These survey studies, while useful in uncovering relationships of various factors to the variables of interest, such as expected change in profits and revenues for businesses facing a smoking ban, by design, were not able to measure observed changes in profits and revenues attributable to a smoking ban.

Previous Report on Economic Impact of a Smoking Ban in Fayette County

In addition to the published articles reviewed in this study, there is one previous report (Hahn, Mullineaux, Thompson, Pyles, and Chizimuzo, 2005) that estimated the economic impact of the Lexington-Fayette County smoking ban. This study investigates the effect of a smoking ban on restaurant and bar employment, on payroll withholding taxes, and on openings and closings of food establishments. Although the report cautions against comparing averages before and after the ban to draw any conclusions as to its impact, much of it is devoted to such comparisons.

Although selected outcomes of a statistical analysis are given in the report, the statistical estimating equations with all of the control factors, including the smoking ban, specified to affect employment, payroll withholding taxes, or business openings and closings are not shown. For this reason, it is not possible to evaluate and confirm the reported results of the statistical analyses.

Following is a brief review of the analysis by sector:

Employment

It was reported in the study that the smoking ban was found to have a statistically significant and negative impact on hotel/motel employment, no statistically significant impact on bar employment and a positive impact on restaurant employment. It was not clear in the report whether or not the increase in restaurant employment was statistically significant. The employment data covered only five months subsequent to implementation of the smoking ban. This is a relatively small period over which to obtain a reliable measure of the effect of the smoking ban.

Payroll Withholding Taxes

The smoking ban was found not to have a statistically significant impact on payroll withholding taxes of bars, restaurants or hotels. Since payroll withholding taxes can be considered as the product of wages and employment, the finding of no change in payroll withholding taxes could have various interpretations such as: (1) no change in either wages or employment, (2) an increase in wages and a decrease in employment, or (3) a decrease in wages and an increase in employment. The study does not address this issue.

No mention is made in the report whether the payroll withholding tax analysis took into account a tax amnesty program that was initiated for the local withholding and net profits taxes in Lexington-Fayette County on September 2, 2003, ending on November 14, 2003. Failure to control for the tax amnesty program may result in a biased estimate of the impact of a smoking ban.

Payroll withholding taxes are collected and reported in the month following the month in which they are incurred. Failure to control for this timing difference may also result in a biased estimate of the impact of the smoking ban.

Openings and Closings of Food Establishments

The smoking ban was found not to have a statistically significant effect on openings and closings of food services establishments as well as on the subset of food service establishments - those that sold alcoholic beverages and those that did not. This finding does not necessarily mean that these businesses have not suffered an economic loss. If such losses did occur as a result of the smoking ban, businesses may remain open in the short run. They will remain open so long as they cover their variable costs. At some point, if long-run costs are not covered, they will shut down. Thus, there will be a lag in business closures following an event that has a negative effect on profit that might not be reflected for some time after occurrence of that event.

Thalheimer Research Associates, Inc.: An Analysis Of The Economic Effect Of The Lexington-Fayette County, Kentucky Smoking Ban Of 2004

In this study, an econometric model was developed to examine the determinants of the demand for alcoholic beverages in Lexington-Fayette County. The major determinants of demand for a product are price and product characteristics of the subject product, price of competing products, consumer income and factors influencing the market environment including government regulations. The importance of using an econometric model to estimate the demand for a product is that the effect of each of the demand determinants on product demand, is estimated, independent of changes in all of the other demand determinants.

Historical sales are the best measure of the demand for a product. Historical monthly data for on-premise sales of alcoholic beverages restricted to establishments in Fayette County were made available to Thalheimer Research Associates, Inc. by four of the largest alcoholic beverage (beer, wine and spirits) wholesalers with sales in the County. These wholesalers accounted for a majority of sales of multiple brands of alcoholic beverages to Fayette County establishments for on-premise consumption. On-premise sales are those made to establishments where the product is consumed at the point of sale. Sales are made largely to retail establishment such as restaurants, bars, and hotels. A much smaller amount of sales are made to others such as recreational or private establishments.

Excluded from the analysis were sales to establishments that do not sell alcoholic beverages to the public. This group includes, for example, many fast food restaurants and hotels or motels that do not serve alcoholic beverages.

The firms from which data were obtained are not identified by name in this study due to confidentiality agreements. Two of the firms were able to provide 51 months of sales through March 2005. A third firm provided 37 months of sales through March 2005 and a fourth firm provided 27 months of data through March 2005.

The demand for on-premise sales of alcoholic beverages in Fayette County was taken to be a function of the following determinants of that demand:

- time trend
- seasonality
- weather
- year
- price of the product
- price of competing product
- government regulations
 - enactment of a smoking ban
 - extension of hours of operation for establishments selling alcoholic beverages for on-premise consumption.

Statistical models were estimated using data from three of the four wholesalers from whom sufficient data were available for reliable statistical estimates of the effects of the demand determinants on alcoholic beverage sales. It was not possible to estimate a statistical model for the fourth wholesaler due to lack of data over a time period sufficient to provide reliable statistical estimates of the impacts of the demand determinants.

The introduction of the smoking ban on April 27, 2004 was found to have a statistically significant and negative impact on the demand for alcoholic beverages by Fayette County restaurant, bar, hotel and other establishments that sell alcoholic beverages for on-premise consumption. The impacts were estimated to result in a decline in sales ranging from 9.8% to 13.3%, controlling for changes in all the other included variables.

The estimated impacts are averages across all types of establishments that sell alcoholic beverages, primarily restaurants, bars and hotels. The review of the literature revealed that retail establishments classified as bars, and those having greater shares of alcoholic beverage revenues as a percent of total revenues, are more likely to suffer declines in revenues or profits than others.

Restaurants are low profit-margin operations. In 2003, the median pre-tax income-to-sales margin for full service restaurants, classified as food and beverage establishments was about 4%. Employment costs are the largest cost for full service restaurants (National Restaurant Association and Deloitte & Touche, 2003). In the study by Hahn, Mullineaux, Thompson, Pyles, and Chizimuzo (2005) the smoking ban was not found to have affected payroll withholding taxes of restaurants, bars or hotels. If this is so, the estimated reduction in sales caused by the smoking ban was not offset by a reduction in costs (i.e. payroll costs). To the extent that retail prices were at or near their revenue maximizing levels before the smoking ban, they are likely to remain at or near those levels after the ban. With little or no change in prices or costs, profits will fall for those establishments that sell alcoholic beverages on-premise. A reduction in profit will, in turn, reduce an establishment's return on investment.

The data and methodology used in the study to determine the impact of the ban to-date may be used as a benchmark for future analysis.

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I. Introduction

The focus of this study was to determine the economic effect of a smoking ban in Lexington-Fayette County, Kentucky. The smoking ban ordinance was implemented on April 27, 2005. There are few exemptions to the comprehensive ordinance that included restaurants, bars and lounges.

On July 1, 2003, the Lexington-Fayette County Urban County Council voted 11-3 to ban smoking in most public buildings. The ban was to take effect on September 29, 2003. The ban was challenged in court but was subsequently upheld by the Kentucky Supreme Court and the ban became effective on April 27, 2004. The only places where smoking is legal are private social functions, private residences or in designated smoking areas of some government buildings. Smoking can also be allowed in retail tobacco shops and warehouses if they can prove that 51 percent of their sales are tobacco-related. Violators of the ban face a \$100 fine for a first offense, \$250 for a second, and \$500 for a third.¹

There are a number of ways an economic analysis could be performed to determine the economic impact of the smoking ban. One of these would be to base the analysis on a survey of restaurants, bars, and hotels. Surveys of owners of these establishments could be made to determine the impact of the smoking ban on establishment sales. Survey data on sales at a period of time, although useful as supplemental information, are not as informative as historical time series of sales data as a basis for determining the magnitude of the economic impact of the smoking ban on local area establishments. In addition, responses to quantitative estimates of changes in sales resulting from enactment of a smoking ban would more than likely not be forthcoming from many of the businesses surveyed. For these reasons, a survey of local

¹ Marsh, Mike, Cigar News http://www.cigaraficionado.com/Cigar/CA_Daily/CA_Daily_News/0,2342,962,00.html

establishments to determine the impact of the effect of the smoking ban was not conducted as part of this analysis.

Published county-level monthly time series of retail establishment sales are not available from known Federal, state, or local sources. There are no known published historical data for retail sales in Fayette County, the subject of this investigation.

Fortunately, a unique data set of monthly on-premise sales and price data, restricted to sales in Fayette County, were made available to TRA, Inc. for this study by four of the six largest licensed alcoholic beverage wholesalers who sell to largely retail establishments in the County². These wholesalers represented multiple brands of alcoholic beverages with overlapping sales to all Lexington-Fayette County establishments where alcoholic beverages could legally be consumed on-site. Statistical economic models were developed and estimated using monthly data to assess the effect of the smoking ban, if any, on sales of alcoholic beverages in Fayette County.

Section II of this study is a review of the literature on the economic effect of a smoking ban. With one exception, the literature review section contains only articles on the economic effect of a smoking ban that have been published in refereed academic journals. The single exception is the only previous study of the economic impact of a smoking ban in Lexington-Fayette County (Hahn, Mullineaux, Thompson, Pyles, and Chizimuzo, 2005). Section III gives an analysis of the economic effect of a smoking ban in Lexington-Fayette County by Thalheimer Research Associates, Inc. Finally, Section IV contains the results and conclusions of this study.

II. Literature Review

Before proceeding to the analysis of the economic impact of the Lexington-Fayette County smoking ban on establishments selling alcoholic beverages there, it is informative to examine the prior published literature on this subject. This literature review includes only those

² In all there were nine distributors of alcoholic beverages identified as having sales in Fayette County in 2005. The three smallest distributors of the nine were very small specialty beer or wine distributors whose data would not be representative of sales to a wide range of establishments in Fayette County as is the case for the six larger distributors. For this reason, sales information was not solicited from these businesses.

studies published in peer-reviewed academic journals. There have been a number of unpublished studies that have examined the economic impact of a smoking ban on the restaurant and bar industry with mixed results showing either no effect, a positive effect, or a negative effect on the restaurant, bar or hotel industries. The benefit of only including studies that have been published in peer-reviewed academic journals is that these studies are not published until they have been subjected to a critical review process by other academic experts in the subject area who have found them acceptable for publication. Acceptance for publication by a journal does not imply that an article is not without fault, only that it has at least been subjected to an independent review process by a referee(s) who as part of the review process are not given the name or affiliation of the author(s). Academic journals and the associated referees vary in quality within disciplines. Following is a discussion of the identified academic research on the topic of the economic effect of a smoking ban on the restaurant, bar and hotel industries.

It is possible to group the published literature on the impact of a smoking ban on restaurants, bars, and hotels into those based on historical taxable sales of these establishments, and into those based on opinion surveys which involved responses to questions such as direction of change in revenues or profits. A summary of findings of the literature review now follows. A more detailed discussion, with comments, of each article reviewed is given in the Appendix to this report.

Published Literature

The literature review begins with an analysis of those studies where the impact of a smoking ban on taxable retail sales was the focus. Six studies were included in this category. All of these studies analyzed historical time series data of taxable retail sales of one or more of the following: restaurants, bars or hotels, to estimate the impact of a smoking ban. A summary of these studies now follows. Glantz and Smith (1994) examined taxable restaurant sales in 15 California counties. This was later updated (Glantz and Smith, 1997) to include both taxable restaurant and taxable bar sales. Following Glantz and Smith (1994), Goldstein and Sobel (1998), examined taxable restaurant sales, in five North Carolina counties. Glantz and Charlesworth (1999) examined taxable hotel sales for three states (CA, UT, VT), and six cities

(Los Angeles and San Francisco, CA, Mesa and Flagstaff, AZ, Boulder, CO, and New York, NY). Glantz and Charlesworth (1999), Huang, De, McCusker, and Officer (2004), examined the effect of a smoking ban in El Paso, Texas restaurants, bars and on mixed-beverage sales. Hyland, Cummings, and Nauenberg (1999), examined the effect of a smoking ban on New York City restaurants and hotels. Sciacca, J.P. and Ratliff, M.I. (1998), examined the effect of a smoking ban on Flagstaff, Arizona restaurants.

All of these studies followed the methodology of the earlier studies of Glantz and Smith (1994, 1997). They found, in general, that a smoking ban does not have a statistically significant effect on one or more of the following ratios: taxable restaurant, bar or hotel sales to taxable total retail sales.

The variable of interest (dependent variable) in these studies was chosen to be the *ratio* of taxable restaurant, bar or hotel sales to total taxable retail sales.³ The denominator of these ratios, according to the authors, is assumed to eliminate (cancel out) the effect of factors affecting the numerator, taxable restaurant, bar or hotel sales, which is the variable of interest⁴. Under this assumption, changes in factors such as population, income, and price of the product and competing products are assumed to have the same effect on the numerator, taxable restaurant, bar or hotel sales as on the denominator, total taxable retail sales (or taxable retail sales of restaurants, bars or hotels in comparable nonsmoking locations). It should be noted that this is a very restrictive assumption since total taxable retail sales are composed of widely diverse categories such as: sales of motor vehicle and parts dealers, health and personal care stores, gasoline stations, general merchandise stores, and nonstore retailers to name a few. It is highly unlikely that the effect of changes in factors such as income, price of the product and price of competing products would have the same effect on the product in the numerator as on the very

³ In certain studies, taxable sales of restaurants, bars, and/or hotels were used as alternate dependent variables in addition to a ratio of these series to total taxable retail sales and/or to taxable sales of the numerator variable of interest in comparable nonsmoking locations: Glantz and Charlesworth (1999), Huang, De, McCusker, and Officer (2004), Hyland, Cummings and Nauenberg (1999), and Sciacca and Ratliff (1998). In these studies the set of determinants chosen to explain the ratio of two taxable sales series also served as determinants for taxable sales. Such identical specification seems to be logically inconsistent.

⁴ In some of the articles, an alternative taxable sales ratio was computed using taxable restaurant, bar or hotel sales for establishments in comparable nonsmoking locations. The comparable selection process seems to be too arbitrary to conduct scientific inquiry.

different product in the denominator. It should also be mentioned that variations in exemptions to taxable sales over the estimation period might also affect the numerator and denominator differently.

In these articles, under the authors' assumption that factors affecting the numerator and denominator cancel out, the ratio variable is specified to be simply a function of a time trend, seasonal factors where appropriate, and a smoking ban variable⁵. A linear regression model was used to determine the relationship of the variable of interest to its specified determinants. The ordinary least squares method was used to estimate the relationship.

To the extent that taxable restaurant sales are not affected the same as the aggregate of all retail sales by changes in the factors mentioned above, using the ratio of taxable restaurant (bar) sales to total taxable retail sales as the variable of interest will not eliminate these differences. If this is the case, these factors must be accounted for explicitly in the equation specification. Failure to do this will result in a misspecified equation, and hence a biased estimate of the relationship.

Taking the variable of interest as a ratio of two different taxable sales time series also leads to a problematic interpretation of the effect of a smoking ban on taxable restaurant, bar or hotel sales. The authors maintain that the change in the *ratio* of taxable restaurant, bar or hotel sales to total retail sales, or, in some cases, to taxable restaurant, bar or hotel sales in comparable nonsmoking locations, indicates the effect of the smoking ban on those sales. The impact estimated by these studies is the impact of a smoking ban on the *ratio* of taxable restaurant, bar or hotel sales to taxable total retail sales or to restaurant bar or hotel sales of comparable nonsmoking establishments.

No definitive conclusion can be made regarding the impact of a smoking ban on taxable restaurant, bar or hotel sales from the estimated impact of a ban on the *ratio* of any of these series to another taxable sales series. For example, if the impact of a smoking ban on the taxable

⁵ In one study, Hyland, Cummings and Nauenberg (1999), unemployment was also included as an independent variable.

sales *ratio* of taxable restaurant sales to total taxable retail sales is found to be positive, this could be interpreted in the following different but equally likely ways: (1) taxable restaurant sales increased after the ban, and total taxable retail sales increased relatively less (2) taxable restaurant sales increased after the ban, and total taxable retail sales were unchanged or declined, or (3) taxable restaurant sales decreased after the ban and total taxable retail sales decreased relatively more. If the taxable sales ratio was not found to change in the presence of a smoking ban, the most common finding, this could be due to (1) no change in taxable restaurant sales or total taxable retail sales, (2) equal relative increases in taxable restaurant sales and total taxable retail sales, or (3) equal relative decreases in taxable restaurant and total taxable sales. Similar alternative scenarios can be constructed for a decline in the ratio variable. This inability of the model, as specified, to isolate the separate effects of numerator and denominator in the ratio variable being analyzed does not permit a determination of the effect of a smoking ban on taxable restaurant, bar or hotel sales. Thus, results of the statistical analysis are not informative with respect to the effect of a smoking ban on taxable restaurant, bar or hotel sales.

A number of the studies reviewed above had inadequate sample size to produce reliable estimate. Sample selection bias was also present in a number of studies. Finally, it should be noted that while all but one of the studies reviewed show the coefficient of the smoking ban variable⁶, none of them reported the complete statistical model(s) with all included variables and statistics describing the individual and overall relationship of these variables to the variable of interest. Thus it is impossible to describe the amount of variation in the variable of interest accounted for by the included variables, including the smoking ban, and hence, to judge the reliability of the findings.

Unlike the studies previously mentioned, Alamar and Glantz (2004) used the sale (purchase) price of restaurants, rather than taxable restaurant sales, as the variable of interest. Results of the weighted least squares analysis were that restaurants in smoke free locations sold for a higher price to gross revenue ratio (P/S) than restaurants in a smoking location. The sale price of restaurants over the period 1991-2003 were drawn from the proprietary *BizComps*® national appraisal database (Sanders, 2003) of small, privately held, income properties. The sale

⁶ Goldstein and Sobel (1998) did not show the coefficient of the smoking ban variable.

price data were not time series data but instead, were observations of sales of different properties occurring at different times over the sample period. All sales that occur in a given year are not included in this database. Only those sales voluntarily reported by contributing brokers to the *BizComps*® database are included. The contributing brokers do not cover all areas of the United States, and may vary as to number and location at any given time. Thus, this is not a random sample of sales since every sale of a business that occurs does not have an equally likely chance of being included. Estimates based on such an arbitrarily selected sample would be biased (known as sample selection bias). The review of Alamar and Glantz (2004) give in the Appendix to this report gives more detail as to the limitations of this database for statistical analysis. It should also be mentioned that the dependent variable in the analysis is defined as the *ratio* of a restaurant's sale price to its annual total gross revenue, (P/S). This ratio is then related to a set of determinants using a linear regression model⁷. As explained earlier, use of a ratio variable such as P/S does not permit an assessment of the effect of a smoking ban on sale price, the numerator of the ratio.

The review of the literature now continues with an examination of published articles that are based on survey response data. There were four articles reviewed in this category: Boyes and Marlow (1996), and Dunham and Marlow (2000a, 2000b, 2003). These articles are now discussed in turn.

Boyes and Marlow (1996) develop a theoretical framework for determining the likelihood that an individual will support a smoking ban in restaurants or bars. They hypothesize that since private markets account for (internalize) the private air space externality, smoking bans will misallocate common airspace shared by smokers and nonsmokers. A random sample of 764 individuals in San Luis Obispo, California, during 1992 was selected for the analysis. San Luis Obispo imposed a smoking ban in all enclosed public places in the summer of 1990. A logit model was used to estimate the likelihood that an individual will support a smoking ban as a function of selected characteristics of the individual respondents. It was found that smokers, ex-smokers, males and those who indicated that smoking/non-smoking sections were effective before the ban, were less likely to support a smoking ban.

⁷ Weighted least squares was used for this analysis.

Dunham and Marlow (2000a) used results of a national telephone survey of 1,300 randomly drawn full-service restaurants and bars in September 1996 to investigate how businesses react to customer preferences for smoking or nonsmoking through allocation of seating. The sample included establishments in states that had smoking laws and states that did not.

The authors hypothesize that there may be differences between bars and restaurants with respect to seating allocation. For example, restaurant customers generally dine in one location in an establishment. On the other hand, bar customers may tend to socialize more and move among different areas in an establishment where they may participate in different activities such as dining, drinking, dancing, and/or listening to music. The authors maintain that due to the interactive nature of bar customers, it is less likely that smokers and non-smokers wish to be separated and bar owners might find it unprofitable or unpopular not to meet these customer preferences.

It was hypothesized that firm size may have a positive impact on nonseating allocation since it might be easier to separate smokers from non-smokers. Membership in a corporate chain (relative to independents) may also result in a larger allocation of nonsmoking seating, especially if this is part of an overall corporate strategy. Older businesses (age) may result in lower nonsmoking seating allocations due to physical constraints of the building and a differing customer base. A higher percentage of smokers in the adult population in a state is expected to result in a lower allocation to nonsmoking seating. Results of the statistical analysis indicated that the percent allocation of seats to nonsmoking was less if an establishment was located in an area with a greater percentage of smokers in the adult population, the number of years it was in business, and if the firm was a bar. The percent of seats allocated to nonsmoking use was found to increase if the firm was larger (employees) or part of a chain. Presence of a smoking law was not found to have a statistically significant impact on nonsmoking seating allocation. This would indicate that the market effectively allocated seating between smoking and nonsmoking use prior to smoking law restrictions. The authors caution that since the data were drawn in 1996, many states did not have complete (100%) smoking bans such as those that currently exist.

Dunham and Marlow (2000b), using the same data set as that in Dunham and Marlow (2000a), investigate the expected change in revenues of restaurant and bar establishment when faced with a virtual smoking ban. They put forth the hypothesis that the effect of a virtual smoking ban on the likelihood of a change in revenues may differ between restaurants and bars. A second hypothesis is that adverse effects of a smoking ban are higher for firms with relatively many smokers as firms with relatively few smokers who have already found it to be profitable to voluntarily meet these restrictions.

Restaurant owners were asked how revenues would change if a virtual smoking ban were enacted. Fifty one percent responded that revenues would not change, 39% responded that revenues would decrease, 6% responded that revenues would increase and 4% did not know. There was no statistically significant difference between this breakdown for firms located in states with smoking restrictions versus firms located in states with no smoking ban.

Bar owners were asked the same question pertaining to changes in revenues. Eighty three percent expected lower revenues, 13% expected no change, 2% expected higher revenues, and 2% did not know. Responses between restaurant and bar owners were found to differ significantly. In locations both with and without smoking ban laws, bar owners were found to be more than twice as likely as restaurant owners to expect a decrease in revenues with implementation of a virtual smoking ban law.

A logit model was estimated relating expected change in revenue from a smoking ban (decrease in revenues versus no change or an increase in revenues) to a set of determinants. It was found for restaurants and bars combined, owners are less likely to expect revenue reductions the greater the percent of seating allocated to nonsmoking use, membership in a corporate chain, and the greater the age of the establishment. Bar owners were found to be more likely to expect revenue reductions than restaurant owners. Results of the restaurants-only equation essentially mirrored those of the all-firms equation with the additional finding that size was also found to be statistically significant. Restaurant owners were more likely to expect less revenue reduction, the greater the size of the establishment.

Dunham and Marlow (2003) examined the effect of a smoking ban on the likelihood of a change in profits for restaurant owners for those who had experienced such a ban (actual effect) and those who had not (predicted effect). The study was based on a survey of 978 owners of restaurants and bars in Wisconsin during February and March 2001. The change in profit reported by owners was related to a set of determinants including, percentage of seats allocated to nonsmoking use, the share of revenues from alcohol sales, membership in a corporate chain, age of establishment, and number of seats (size). One difference in this study from earlier studies is that change in profits, rather than revenues, was the focus of the analysis. Separate logit models were estimated for all restaurants, restaurants with government restrictions or bans, and restaurants with no restrictions. As expected, the greater the share of seating allocated to nonsmoking prior to a ban, the less the likelihood of profits falling. Also, as expected, the greater the percent share of alcohol revenues and the larger the establishment, the greater the likelihood of profits falling.

Summary–Published Articles. The review of the published literature investigating the impact of a smoking ban on taxable restaurant, bar or hotel sales was inconclusive as to the direction or magnitude of the impact. This was also true for the lone article investigating the impact of a smoking ban on the sale price of restaurants. The remaining published articles were based on survey data responses at one period in time. These articles were useful in examining the relationship of the expected change in several economic measures, such as restaurant and/or bar revenues or profits, to a set of characteristics, when owners were faced with a 100% smoking ban. They were not able, however to provide estimates of the magnitude of expected changes. Since these studies were based on survey data at one period in time, they did not have the more accurate result from using actual revenue or profit outcomes, aggregated over all restaurant and/or bar establishments, before and after implementation of a smoking ban.

The Appendix to this study gives a more detailed review of each individual article summarized above, along with comments on the appropriateness of the sample used for the analysis, model specification, and model results.

Previous Study of the Economic Impact of a Smoking Ban in Lexington-Fayette County

There are no published articles dealing with the economic effect of a smoking ban in Lexington-Fayette County, Kentucky. There is however, one previous study that has been released dealing with this issue (Hahn, Mullineaux, Thompson, Pyles, and Chizimuzo, 2005). A discussion of this report now follows.

In this study, three economic series, employment, payroll withholding (license) tax of restaurants, bars and hotels, and openings and closings food establishments were chosen as the subjects of analysis of the effects of the Lexington-Fayette County smoking ban.

In a special note to the reader, the study states that:

A simple comparison of data before and after the implementation of the law is not sufficient to evaluate the law's economic impact. We took into account other factors that could have influenced employment, payroll withholding taxes, and business openings and closings by estimating an economic model for each of the three indicators (p. 2).

However, more than half of the report contains graphical representations of the economic indicators. Much of the body of the report involves a discussion of before-and-after ban comparisons of the graphical data. As stated in the study, comparison of graphical data without controlling for changes in addition to the smoking ban, is not sufficient to evaluate the ban's effects. For this reason a discussion of these visual representations would be irrelevant to the analysis.

The study says that factors influencing the economic series being investigated, in addition to the smoking ban, were taken into account. As given in the report, other factors included "general macroeconomic conditions, business condition fluctuations across counties in Kentucky, demographics, and seasonal fluctuations" (p. 4). Unfortunately, while graphs of the data before and after implementation of the smoking ban ordinance are shown extensively in the

report, the economic models (equations) used for the each of the economic series are not given in the report. Because of this, the equation form, the variables included in the analysis, the statistical significance of each of those variables (smoking ban and all others), and the strength of the relationship between all of the included variables and the economic series of interest, could not be evaluated. All of this makes it impossible to evaluate the results of the statistical models with respect to the impact of a smoking ban. It should also be mentioned that the report does not discuss the data sources fully, variable definitions, and periodicity (annual, quarterly, monthly) of each of the controlling variables.

A summary of results and comments relative to the analysis are now given.

Employment

The employment series are the first to be discussed in the report. These series go through September of 2004, only five months after the April 27, 2004 ban.

The study reports that after controlling for changes in population size, unemployment and seasonality in the restaurant employment series, “there remained a positive relationship between the law and restaurant employment” (p.4). Without being able to see the model, it is not possible to determine if this is a statistically significant relationship or if the relationship is positive but not statistically significant.

With respect to bar employment the study reports that over the five-month period following the smoking ban, the ban was not found to have a statistically significant impact on bar employment, controlling for changes in population size, unemployment and seasonality.

Unlike the findings for restaurant and bar employment the study reports that over the five-month period following the smoking ban, the ban was found to have a statistically significant and negative impact on hotel/motel employment, controlling for population size, unemployment, and seasonality.

Comments. Looking at the graphs in the Appendix, the change in monthly average employment for the pre-ban months (January through April) for 2004 from that of the previous five-year period, appears to be about the same as the change in the monthly average for the post-ban months (May through September) for 2004 from that of the previous five-year period. This suggests that there may be no effect of the ban on employment. If the effect of the ban were found to be statistically significant, one possibility is that in the employment models, all of the potential control factors affecting employment were not included. Among these potential missing control variables could be the wage rate which plays a vital role in determining employment.

Local Payroll Withholding Taxes

Monthly local payroll withholding taxes were available for a ten-month period following implementation of the smoking ban. The study reports that, controlling for seasonal variation, the smoking ban did not have a statistically significant impact on restaurant, bar or hotel payroll withholding taxes. The remainder of this section involves discussion of the graphical trends shown in the Appendix to the report.

Comments. Payroll withholding taxes are a product of wages times employment. The study's estimation of the impact of a smoking ban on payroll withholding taxes is not able to distinguish between the ban's separate impacts on wages or employment. The finding of no change in payroll withholding taxes could be attributable to: (1) an increase in employment and a decrease in wages, (2) a decrease in employment and an increase in wages, (3) no change in both employment and wages.

A tax amnesty program was initiated for the local withholding and net profits taxes in Lexington-Fayette County on September 2, 2003, ending on November 14, 2003. The tax amnesty program forgave penalty and interest on back taxes if filing was made before September 2, 2003. After that period, full penalty and interest was due. The purpose of the program was to increase collections of back-taxes from taxpayers and to put additional taxpayers on the permanent tax rolls. In addition, adding these taxpayers to the tax rolls would increase the level

of future tax collections. The tax amnesty program was not mentioned in the report⁸. Failure to control for the tax amnesty program may result in a biased estimate of the impact of the smoking ban.

Payroll withholding taxes are collected and reported in the month following the month in which they are incurred. The lag between occurrence and reporting of payroll withholding taxes was not mentioned in the report. Failure to control for this difference may result in a biased estimate of the impact of the smoking ban.

In order to compare payroll taxes over time, adjustments should be made for inflation over the analysis period. Adjustment for inflation was not mentioned in the report. Failure to control for inflation may result in a biased estimate of the impact of the smoking ban.

Business Openings and Closings

Data on business openings and closings were available over a ten-month period following implementation of the smoking ban. The study reports that a statistically significant change in openings or closings of food service establishments due to the smoking ban was not found, controlling for seasonal variation. The study also found no statistically significant change in openings or closings of the subset of establishments, alcohol serving and non-alcohol serving establishments.

Comments. There are very few food establishment business openings and closing per month in Fayette County as seen in the data on pages 14 and 15 of the study. Also, it can be seen that there are months in various years where business closures are zero. If this is true, then there are numerous months over the study period that have zero closings, especially when total closures are subdivided into alcohol-serving and non-alcohol serving categories. It is not clear how the study models take into account multiple zero values of the closings variable. Not accounting for these occurrences may result in a biased estimate of the impact of the smoking ban.

⁸ Lexington-Fayette Urban County Government.

Due to the fact that there are few food service openings or closings over time, size of the dependent variable at each period of time becomes a concern in the analysis. Also, although the study reports finding no statistically significant relationship between the smoking ban and food service openings or closing, the amount of variation in openings or closings “explained” by the seasonal variables and the smoking ban is not reported. It is likely that none of the independent variables have a significant effect on the business openings or closings. In other words, the equation(s) could be completely non-informative.

Finally, the fact that the smoking ban was not found to have a statistically significant impact on food service establishment openings or closings does not mean that these businesses are not suffering an economic loss. Reductions in revenue and profit due to the ban would be a better indicator of economic loss. If losses occur, businesses will stay open in the short run so long as they cover their variable costs. At some point if long-run costs are not covered, they will shut down. Thus there will be a lag in business closures following an event that has a negative effect on profit that might not be reflected for some time after occurrence of that event. No mention is made in the report that the lagged response of business openings and closings to implementation of the smoking ban has been included in the estimating equations.

Other Comments. In the study’s Background section the authors report that the New York City smoking ban “had no adverse effects on restaurant employment; restaurant employment growth was three times higher than the rest of the state from 1993 to 1997” (p.3). The source of this information as given in the References section of the report, is: Hyland, A., et al., Restaurant employment before and after the New York city smoke-free air act., *Journal of Public Health Management Practice*, 1999, 5(1), 14-21. A check of this citation showed that the title of the article was misquoted. The correct reference should be: Hyland, A., Cummings, K. M., and Nauenberg, E., “Analysis of Taxable Sales Receipts: Was New York City’s Smoke-Free Air Act Bad for Restaurant Business?”, *Journal of Public Health Management Practice*, 5(1), 14-21. More importantly, the subject of the analysis was taxable sales receipts, not employment. A review of the article yielded no mention of employment, employment growth in New York City or employment growth in the rest of the state.

The study states that the analysis of effect of the smoking ban on the economic series being analyzed controls not only for the introduction of the smoking ban, but also for changes in “general macroeconomic conditions, business condition fluctuations across counties in Kentucky, demographics, and seasonal fluctuations” (p. 4). In the description of model results, the specific factors mentioned are: (1) population size, unemployment and seasonality for the restaurant employment and payroll withholding tax series equations, and (2) seasonal variations for the business openings and closings equations. Although demographics (i.e. population, unemployment) and seasonal variables apparently have been included in the statistical equations, variables reflecting general macroeconomic conditions or business condition fluctuations across Kentucky counties were not mentioned in the report. Had the economic models been included in the report, it would have been clear whether or not these factors had been included. Assuming, that these factors were not included in the analysis, their omission may cause the estimated impact of the smoking ban to be biased.

III. Estimate of the Economic Effect of a Smoking Ban in Lexington-Fayette County- Thalheimer Research Associates, Inc.

The economic effect of the Lexington-Fayette County smoking ban of 2004 on companies that sell alcoholic beverages to customers as part of their product mix is the focus of this analysis. The major determinants of demand for a product are price and product characteristics of the subject product, price of competing products, consumer income and factors influencing the market environment including government regulations. An econometric model was developed to examine the influence of each of the determinants of the demand for alcoholic beverages in Lexington-Fayette County, especially the smoking ban ordinance, on the demand for sales of on-premise alcoholic beverages in Lexington-Fayette County. A property of the econometric model is that it allows us to isolate the effect of each of the demand determinants (especially the smoking ban) from the effects of all the other included determinants, as it relates to the demand for alcoholic beverages.

Model Specification and Data

The formulation of the statistical model used to determine the impact of the smoking ban is based on standard economic theory. It is well known in the economic literature that the demand (sales) for a product is related to its price, the price of competing goods, income and other economic factors as well as market-specific events such as the introduction of government regulations. Unlike previously published studies of the economic impact of a smoking ban, the variable of interest in this case is not a ratio of two series resulting in the inability to isolate the effects of a smoking ban on the variable of interest. Also, the variable of interest is not an opinion based measure obtained from survey samples taken at a particular point in time as was the case for other studies of the economic impact of a smoking ban given in the literature review. In this case the economic variable of interest is a time series of a realized quantitative economic demand measure.

Dependent Variable

Historical sales are the best measure of the revealed demand for a product. As mentioned in the introduction to this report, monthly historical time series of retail sales or profits of establishments at the county level are not available from any known published source. It was determined that obtaining such information through requests of all restaurant, bars and related establishments, or a statistically reliable random sample of such establishments, would not be feasible, and data would not be voluntarily forthcoming. For this reason, a decision was made to focus on sales of the relatively few alcoholic beverage wholesalers in the county.

Historical monthly data for sales of alcoholic beverages were made available to Thalheimer Research Associates, Inc. by four of the six largest alcoholic beverage wholesalers in Fayette County. These wholesalers accounted for sales of multiple brands of alcoholic beverages to all of the establishments selling alcoholic beverages for on-premise consumption. In this case the product whose demand is being determined is on-premise case sales of wholesalers of alcoholic beverages in Fayette County to local establishments. On-premise sales are those made to establishments where the product is consumed at the point of sale. Excluded from the analysis

are sales to establishments that do not sell alcoholic beverages to the public. This group includes, for example, many fast food restaurants and hotels/motels that do not serve alcoholic beverages.

The firms from which data were obtained are not identified by name in this study due to confidentiality agreements. Two of the firms were able to provide 51 months of sales through March 2005. A third firm provided 37 months of sales. A fourth firm provided 27 months of data through March 2005.

The variable of interest (dependent variable) in this analysis then, is the demand for on-premise alcoholic beverages sales in Fayette County. On-premise sales are made largely to retail establishments such as restaurants, bars, and hotels with the remainder being to others such as recreation and private clubs, and other miscellaneous establishments. These retail establishments in-turn, sell the product to their customers for consumption at their establishment. The demand variable is measured by on-premise case sales (CASES_ON). A standard case of beer contains 24 standard alcoholic beverage units. A standard case of wine or spirits contains 12 standard alcoholic beverage units.

Independent (Explanatory) Variables

The monthly demand for on-premise alcoholic beverage sales of wholesalers in Fayette County is taken to be a function of the following determinants:

- time trend
- seasonality
- weather
- year
- price of the product
- price of competing product
- government regulations
 - enactment of a smoking ban
 - extension of hours of operation for establishments selling alcoholic beverages for on-premise consumption.

A discussion of the source and definition of each of these demand determinants now follows.

A linear time trend variable (TREND) was included to capture the effect of variables, not explicitly included, that might affect the demand for on-premise alcoholic beverage case sales. This variable takes the value 1 for the first month of the study period and is incremented by 1 for each succeeding month. The direction or magnitude of the effect of TREND on the demand for a wholesaler's product cannot be determined by economic theory. The variables captured by TREND may not only reflect changes in factors relating to economic and demographic conditions and changes in consumer tastes, not explicitly accounted for in the model, but also might reflect changes in firm-specific programs such as special marketing and promotion programs.

Seasonality in demand for alcoholic beverages is captured by the seasonal variables (JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC). Each binary (0,1) month variable takes the value 1 if sales occur in that month, otherwise the month variable is set to 0. Seasonal factors are included to account for differences in sales between months due to various reoccurring year-to-year factors such as presence of a major holiday during a given month.

Weather, as measured by average daily temperature at the Blue Grass Airport station in Fayette County (TEMP), was included in the model to reflect differences in the demand for alcoholic beverages due to changes in monthly weather conditions. Data for WEATHER were obtained from the National Climatic Data Center (NCDC), National Oceanic & Atmospheric Administration (NOAA), U.S. Department of Commerce (www.ncdc.noaa.gov). The direction and magnitude of the effects of weather on on-premise sales is an empirical question.

Annual variation between years in which the sales occur was captured by the year variables (YR01, YR02, YR03)⁹. Each binary (0,1) year variable takes the value 1 if sales occur

⁹ The effect of each of these year variables is measured relative to YR04 and the three months of YR05.

in that year otherwise the year variable is set to 0. Annual factors are included to account for difference in sales between years due to a variety of factors such as general economic conditions not captured in other included variables, or, for example, more product-specific changes that are introduced in different years.

The price of the product (PRICEOWN) was determined by dividing case sale revenue by the number of cases sold. The price of the product was adjusted for inflation using the monthly producer price index for alcoholic beverages, available from the U.S. Department of Labor, Bureau of Labor Statistics. Standard economic theory predicts that an increase (decrease) in the price of a product will yield a decrease (increase) in the demand for that product.

The price of the competing product for wine and spirits (PRICECROSS) was defined as the price of beer sold in the same month. Similarly the price of the competing product for beer (PRICECROSS) was defined as the price of wine and spirits. Standard economic theory predicts that, if two products are substitutes, the increase (decrease) in the price of a substitute for a product will yield an increase (decrease) in the demand for that product. In this case, an increase in the price of beer is expected to increase the sale of wine and spirits, and an increase in the price of wine and spirits is expected to increase the sale of beer.

Government regulations were present in the Lexington-Fayette County market in the form of a smoking ban ordinance (SMOKEBAN) approved by the Lexington-Fayette Urban County Council and implemented on April 27, 2004. The smoking ban ordinance variable is defined as the number of days in a month over which the smoking ban was present, divided by total days in a month. For months prior to April 2004, SMOKEBAN takes the value 0 (absent all month). In April 2004, SMOKEBAN, takes the value 0.13 to reflect the fact that it was present for 4 days in that month. For months following April 2004, SMOKE BAN takes the value 1 (present all month). It is expected that the introduction of government regulations will result in a decrease in sales of alcoholic beverages.

Government regulations were also present in the Lexington-Fayette County market in the form of an extension of operating hours, approved by the Lexington-Fayette Urban County

Council, to extend hours of operation for Fayette County establishments selling alcoholic beverages for on-premise consumption (EXTENDHRS). Hours of operation were extended from 1:00 a.m. to 2:30 a.m. Monday through Saturday while remaining unchanged at 11:00 p.m. on Sunday. The extension of hours was implemented on August 1, 2004. It is expected that extended hours will have a positive effect on sales of alcoholic beverages.

In addition to the included factors, other factors were also considered for inclusion as demand determinants. One of these was county-level personal income. Unfortunately, monthly county-level personal income data are not available from published sources. Monthly employment and hourly earnings data, however, are available from the U.S. Department of Labor, Bureau of Labor Statistics, and were considered for inclusion in the model as proxies for components of real personal income.¹⁰ Employee compensation is a subset of personal income since personal income also includes proprietors' income, rental income, personal dividend and interest income, and transfer to persons, less contributions for social insurance.¹¹ The employment and wage variables were not found to be statistically significant and so were dropped in the final analysis. The monthly Lexington-Fayette County Metropolitan Statistical Area (MSA) unemployment rate, available from the U.S. Department of Labor, Bureau of Labor Statistics, was also considered for inclusion in the econometric model but, like employment and the hourly wage rate, was not found to be statistically significant and so was dropped from further consideration.

In specifying the functional form of the on-premise alcoholic beverage case sales demand equation, note that the variable on-premise case sales is by definition positive. To guarantee this positive condition, the natural logarithm of CASES_ON is taken as a linear function of the demand determinants. Following is the equation used in the demand analysis.

¹⁰ Monthly hourly earnings in manufacturing was the series used since no other monthly hourly earnings series was available for Fayette County. Hourly earnings were adjusted for inflation using the consumer price index (CPI-U) available from the U.S. Department of Labor, Bureau of Labor Statistics.

¹¹ See for example, Economic Report of the President, February 2005.

$$\begin{aligned}
\text{LCASES_ON} = & \beta_0 \\
& + \beta_1 \text{TREND} + \beta_2 \text{JAN} + \beta_3 \text{FEB} + \beta_4 \text{MAR} + \beta_5 \text{APR} + \beta_6 \text{MAY} \\
& + \beta_7 \text{JUN} + \beta_8 \text{JUL} + \beta_9 \text{AUG} + \beta_{10} \text{SEP} + \beta_{11} \text{OCT} + \beta_{12} \text{NOV} + \beta_{13} \text{TEMP} \\
& + \beta_{14} \text{YR01} + \beta_{15} \text{YR02} + \beta_{16} \text{YR03} + \beta_{17} \text{PRICEOWN} + \beta_{18} \text{PRICECROSS} + \beta_{19} \text{EXTENDHRS} + \\
& \beta_{20} \text{SMOKEBAN}
\end{aligned}$$

The variable YR01 is not present in the model for the wholesaler for which data were available beginning in 2002.

Model Estimation

Using ordinary least squares to estimate the demand for alcoholic beverages will result in inconsistent estimates, since PRICEOWN is determined by *both* demand and supply conditions and is, therefore, an endogenous variable. For this reason, an alternative method, two-stage least squares (2SLS), was employed to estimate the demand for alcoholic beverages. An explanation of this estimation technique can be found in standard econometrics textbooks (e.g., Pindyck & Rubinfeld, 1981, Johnston and DiNardo, 1997). In this case, in the first stage of the 2SLS estimation process, PRICE OWN, was estimated as a function of TREND, PRICEOWN(-1), PRICECROSS, PRICECROSS(-1), YR and TEMP. The estimated value of PRICEOWN was then substituted for PRICEOWN in the demand equation and ordinary least squares was used to estimate the equation. Resultant parameter estimates for the included variables are consistent.

Table 1 gives the estimated on-premise case sale demand models for three of the four alcoholic beverage wholesalers who provided data for the study. A fourth wholesaler was only able to provide 27 months of sales data leaving only 8 degrees of freedom (27 observations less 19 independent variables, including the constant) to estimate the model. This is not sufficient to obtain reliable estimates of the effects of the included variables on on-premise alcoholic beverage demand.

The equations fit the data well as indicated by adjusted R² values that range from 0.74 to 0.85. The Durbin-Watson statistic indicates the absence of serial correlation. This suggests that

the equation is likely free of specification errors such as those caused by omitted variables or incorrect functional form.

The economic variables, PRICEOWN and PRICECROSS, were found to be statistically significant effect in one of the three equations. The signs of the coefficients in that equation were, as expected, negative for PRICEOWN and positive for PRICECROSS. The demand for alcoholic beverages was therefore found to decrease (increase) with an increase (decrease) in its own price. The demand for alcoholic beverages was found to increase (decrease) with an increase (decrease) in the price of the competing product. This indicates that the products are substitutes, as expected.

With respect to government regulations, the extended hours variable was found to have a positive effect in all three equations, but was statistically significant in only one. The smoking ban was found to have a statistically significant and negative effect in all three equations. This indicates that the smoking ban has resulted in a statistically significant decrease in the demand for alcoholic beverages through March 31, 2005.

The smoking ban was estimated to have resulted in a reduction of alcoholic beverage sales of 11.0%, 13.3%, and 9.8% for Wholesalers 1, 2 and 3, respectively¹².

¹² Due to the logarithmic specification of the dependent variable, the percent change is computed as: $\exp(\text{SMOKEBAN})-1$.

Table 1: On-Premise Case Sale Demand Models

	Wholesaler 1 Dependent Variable: LCASES_ON Method: 2SLS Sample(adjusted): 2 37* Included observations: 36			Wholesaler 2 Dependent Variable: LCASES_ON Method: 2SLS Sample(adjusted): 2 51* Included observations: 50			Wholesaler 3 Dependent Variable: LCASES_ON Method: 2SLS Sample(adjusted): 2 51* Included observations: 50		
Variable	Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.	Coefficient	t-Statistic	Prob.
C	7.91	3.056	0.008	42.46	3.409	0.002	11.19	7.578	0.000
TREND	0.0104	1.643	0.120	0.0580	2.304	0.029	-0.0017	-0.402	0.691
JAN	-0.4462	-4.072	0.001	-0.4134	-4.357	0.000	-0.1225	-2.942	0.006
FEB	-0.2806	-2.910	0.010	-0.3069	-3.873	0.001	-0.1005	-2.574	0.015
MAR	0.0715	0.415	0.684	-0.1598	-1.297	0.205	0.1744	4.134	0.000
APR	0.1864	0.919	0.372	0.1341	0.874	0.389	0.2417	3.703	0.001
MAY	0.0089	0.047	0.963	0.0248	0.176	0.861	0.0819	1.017	0.317
JUN	0.2422	1.177	0.256	0.0098	0.060	0.952	0.0773	0.831	0.413
JUL	0.0007	0.003	0.998	0.0528	0.300	0.766	0.1473	1.455	0.157
AUG	0.0233	0.107	0.916	0.0936	0.544	0.591	0.1965	1.984	0.057
SEP	0.3344	1.689	0.111	0.0601	0.395	0.696	0.1796	2.215	0.035
OCT	0.1269	0.938	0.362	0.1731	1.706	0.099	0.2388	4.167	0.000
NOV	-0.1904	-2.408	0.029	-0.1392	-2.055	0.049	-0.0644	-0.004	-1.903
TEMP	-0.0079	-1.772	0.095	-0.0144	-2.727	0.011	-0.0045	-1.659	0.108
YR01				0.2385	0.723	0.475	-0.0354	-0.287	0.776
YR02	0.0906	0.279	0.784	1.5261	2.369	0.025	-0.0255	-0.294	0.771
YR03	-0.0214	-0.090	0.929	1.0118	2.410	0.023	-0.0053	-0.068	0.946
PRICEOWN	0.0129	0.174	0.864	-0.6047	-2.722	0.011	-0.0565	-0.245	0.808
PRICECROSS	-0.0545	-0.084	0.934	1.4924	2.460	0.020	0.0018	0.336	0.739
EXTENDHRS	0.0147	0.213	0.834	0.1661	2.660	0.013	0.0434	1.180	0.247
SMOKEBAN	-0.1165	-1.748	0.100	-0.1430	-2.215	0.035	-0.1036	-2.632	0.013
Equation Evaluation Statistics									
R-squared	0.930			0.846			0.913		
Adjusted R-squared	0.848			0.740			0.854		
F-statistic	11.2			8.0			15.3		
Prob(F-statistic)	0.000			0.000			0.000		
Durbin-Watson stat	1.98			2.06			2.38		
*The first observation is missing due to the inclusion of lagged variables for PRICEOWN and PRICECROSS in the Stage 1 estimation of PRICEOWN.									

IV. Summary and Conclusions

The review of the published literature investigating the impact of a smoking ban on taxable restaurant, bar or hotel sales was inconclusive as to the direction or magnitude of the impact. This was also true for the lone article investigating the impact of a smoking ban on the sale price of restaurants. The remaining published articles were based on survey data responses at one period in time. These articles, while useful in examining the relationship of the expected change in several economic measures, such as restaurant or bar revenues or profits, to a set of characteristics, were not able to provide estimates of the magnitude of expected changes due to a smoking ban. Since these studies were based on survey data at one period in time, they did not have the more accurate result from using actual revenue or profit outcomes, aggregated over all restaurant and/or bar establishments, before and after implementation of a smoking ban.

The only other study of the economic impact of a smoking ban on Lexington-Fayette County was that conducted by the Hahn, Mullineaux, Thompson, Pyles, and Chizimuzo (2005). Review of this study revealed no verifiable evidence of the impact of a smoking ban on Lexington-Fayette county restaurant, bar or hotel employment or payroll withholding taxes, or on food services openings and closings. An analysis of the impact of the smoking ban on restaurant, bar or hotel sales was not a subject for analysis in the study.

In this study (Thalheimer Research Associates, Inc.), an econometric model of the demand for on-premise sales of alcoholic beverages in Fayette County by four of the six largest alcoholic beverage wholesalers in the county was estimated over a time period before, and following, implementation of a smoking ban. The models were found to fit the data well. The presence of a smoking ban was found to have had a statistically significant and negative impact on alcoholic beverage sales to Fayette County establishments that sell alcoholic beverages for on-premise consumption by their customers. The estimated impact of the smoking ban resulted in a reduction in sales of alcoholic beverages ranging from 9.8% to 13.3%, controlling for changes in all the other included variables.

The estimated smoking ban impacts are an average across all types of establishments that sell alcoholic beverages, primarily restaurants, bars and hotels. The review of the literature revealed that retail establishments classified as bars, and those having greater shares of alcoholic beverage revenues as a percent of total revenues, are more likely to suffer declines in revenues or profits (Dunham and Marlow, 2000b, 2003). It should be noted that a reduction in alcoholic beverage wholesaler revenues as a result of the smoking ban is due to decreased demand for their product from, primarily, retail establishments who sell alcoholic beverages for on-premise consumption.

The estimated impact of the smoking ban should be considered in the context of restaurant profit margins. Restaurants are low profit-margin operations. In 2003, the median pre-tax income-to-sales margin for full service restaurants, classified as food and beverage establishments¹³ (as distinguished from food only establishments) was 4.5% for those with an average check below \$15, and 4.0% for those with an average check of \$15 or over (National Restaurant Association and Deloitte & Touche, 2003).

Restaurants are low profit-margin operations. In 2003, the median pre-tax income-to-sales margin for full service restaurants, classified as food and beverage establishments was about 4%. Employment costs are the largest cost for full service restaurants at approximately 30% of total sales (National Restaurant Association and Deloitte & Touche, 2003). However, it should be considered that reducing wait-staff and/or wait-staff wages in these business may cut customer service resulting in loss of customers, with associated revenues, to competing venues. Employment costs are the largest cost for full service restaurants (National Restaurant Association and Deloitte & Touche, 2003). In the study by Hahn, Mullineaux, Thompson, Pyles, and Chizimuzo (2005) the smoking ban was not found to have affected payroll withholding taxes of restaurants, bars or hotels. If this is so, the estimated reduction in sales caused by the smoking ban was not offset by a reduction in costs (i.e. payroll costs). To the extent that retail prices were at or near their revenue maximizing levels before the smoking ban, they are likely to remain at or near those levels after the ban. With no change in prices or costs, profits will fall for those

¹³ Beverage sales are sales of wine, spirits, liquor, beer and ale. They don't include sales of coffee, tea, milk, or fruit juices which are normally served with meals and considered food (National Restaurant Association and Deloitte & Touch, 2003).

establishments that sell alcoholic beverages on-premise. A reduction in profit will, in turn, reduce an establishment's return on investment.

It should be noted that this study, due to data unavailability, does not consider the effects of a smoking ban on sales of restaurants, bars and hotels that do not sell alcoholic beverages on-premise. It also does not address the sale of food and other products by restaurants, bars and hotels that sell alcoholic beverages.

This study may be updated in the future as additional data become available.

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Appendix
Review and Comments on Published Articles
on the Economic Effect of a Smoking Ban

Alamar, B. C., and Glantz, S. A. (2004). "Smoke-Free Ordinances Increase Restaurant Profit and Value", Contemporary Economic Policy, 22(4), 520-525.

This study examines the relationship of the presence of smoke free ordinances on the sale price of restaurants.

Data for the study were drawn from the proprietary *BizComps*® database of sales of small, privately held businesses in varying locations in the United States (Sanders, 2003). All sales of eating and drinking establishments and of drinking places over the period January 31, 1991 through February 10, 2003 were selected for inclusion in the study. The search initially resulted in 1,146 sales. Sales of catering, carry-out, drive-thru, drive-in, espresso stand, take-out, or mobile concessions, 417 in all, were eliminated under the assumption that they would not be affected by a smoke-free law where food is consumed away from the business. Transactions with incomplete data (48) were also eliminated. This left a sample of 608 restaurants, 118 of which were in smoke-free locations.

The dependent variable in the analysis is defined as the ratio of restaurant sale price (value) to its annual total gross revenue (sales), P/S. Determinants of the price to gross revenue ratio were specified as: (1) location in a smoke-free state, (2) profit margin measured as the ratio of sellers discretionary cash flow to gross revenue (SDCF/S), (3) per capita constant dollar gross state product (GSP), (4) percentage growth in GSP, (5) unemployment rate by state, (6) fast food restaurant type, (7) family restaurant type, and (8) year.

The study concluded that restaurants in smoke free locations sold for a higher price to gross revenue ratio (P/S) than restaurants in smoking locations.

Comments. All sales that occur in a given year are not included in the database. Only those sales voluntarily reported by contributing brokers to the *BizComps*® data base are included. The contributing brokers do not cover all areas of the United States, and may vary as to number and location at any given time. Thus, this is not a random sample since every sale of a business that occurs does not have an equally likely chance of being included. Estimates based on such an arbitrarily selected sample would be biased (known as sample selection bias). To give an example of the limitations of the database, consider the geographic distribution of eating and drinking places which sold in the two largest states in the country over the ten-year period 1995-2004.¹⁴ Only 260 restaurant sales, 26 per year, were reported for California and only 6 restaurant sales, 0.6 per year were reported for New York. This is almost certainly far below the actual number of restaurant sales for these two states. Such a discrepancy is clearly evidence of a non-representative sample selected for use in the study. While the database may be useful for appraisal purposes for which it is designed it is clearly not useful for statistical analysis of the effect of a smoking ban on restaurant value.

¹⁴ Number of sales by geographic locations can be obtained from a visitor's search of the *BizComps*® data base through on-line inquiry of their marketing arm, Business Valuation Resources at: www.bvmarketdata.com.

The attempt in this study to explain the price to sales ratio using state-specific economic conditions as measured by GSP and unemployment rates for the state of the location rather than a more location-specific measure such as county income and unemployment rates may have resulted in a serious misspecification of the model. The source of this misspecification is that more localized economic conditions, such as those at the county level, can be quite different from those at the state level. Estimates obtained from such a misspecified model will be misleading.

The estimate of the impact of a smoking ban on restaurant value cannot be assessed from the estimated impact of the smoking ban on the *ratio* of sale price to gross revenue. Thus, for example, if the ratio of sale price to gross revenue is found to increase after introduction of a smoking ban, this does not necessarily mean that the ban has had a positive impact on sale price. As discussed earlier the finding of a positive impact may be due to: (1) sale price increased after the ban, and gross revenue increased relatively less (2) sale price increased after the ban, and gross revenues were unchanged or declined, or (3) sale price decreased after the ban and gross sales decreased relatively more.

Boyes, W. J., and Marlow, M. L. (1996). "The Public Demand for Smoking Bans", Public Choice, 88, 57-67.

Using a theoretical framework of the utility of consumption of services of restaurants or bars by individual customers the authors derived the demand for a smoking ban. The subjects of analysis were individuals in the City of San Luis Obispo, California where a smoking ban had been imposed by the City in all enclosed public places in late summer 1990. Data used for the analysis were obtained from a random sample of 764 individuals in San Luis Obispo in 1992.

Separate logit (qualitative choice) models were specified for: (1) strong support vs. no support for a restaurant ban, and (2) strong support vs. no support for a bar ban. Support for a ban was estimated as a function of an individual's sex, age, education, frequency of visits to restaurants (included in the restaurant equation), frequency of visits to bars (included in the bar equation), whether or not the individual was a smoker, whether or not the individual was an ex-smoker, and whether or not the individual believed that smoking/nonsmoking sections before the ban effectively dealt with the smoking issue. Using the logit analysis, the demand for a smoking ban is estimated as the effect that these individual characteristics have on the odds that an individual will support a smoking ban. For both the restaurant and bar equations, it was found that smokers, ex-smokers, males and those who indicated that smoking/nonsmoking sections were effective before the ban, were less likely to support a smoking ban.

In addition to the survey of individuals, Boyes and Marlow (1996) surveyed all restaurants and bars in San Luis Obispo with a resulting sample of 64 or about 65% of the total. Sixty five percent of respondents were restaurants, 9% were bars, and 26% were both. A statistical analysis was not performed on these data. Descriptive statistics drawn from the survey indicated that 25% of the businesses reported a negative impact of the ban, 17%, a positive impact and 57%, no effect. Firms reporting a negative impact had a relatively high percentage of

customers who were tourists and a relatively low percentage of nonsmoking customers prior to the ban.

Comments. This is an opinion survey and, as such, estimates could only be given for the likelihood that respondents will support or not support a smoking ban.

Dunham, J. and Marlow, M. L. (2000a). "The Effects of Smoking Laws on Seating Allocations of Restaurants, Bars, and Taverns", Economic Inquiry, 38(1), 151-157.

This study investigates how businesses react to customer preferences for smoking or nonsmoking through allocation of seating to satisfy those preferences and in turn, maximize profits. The authors hypothesize that there may be differences between bars and restaurants with respect to seating allocation. For example, restaurant customers generally dine in one location in an establishment. On the other hand, bar customers may tend to socialize more and move among different areas in an establishment where they may participate in different activities such as dining, drinking, dancing, and/or listening to music. The authors maintain that due to the interactive nature of bar customers, it is less likely that smokers and non-smokers wish to be separated and bar owners might find it unprofitable or unpopular not to meet these customer preferences.

A national telephone survey of 1,300 randomly drawn full-service restaurants (650) and bars (650) was conducted in September, 1996. The sample included establishments in states that had smoking laws and states that did not.

The percent allocation of space to nonsmoking seating in a firm (NS) was postulated to be determined by: presence of a smoking law¹⁵; percentage of smokers in the adult population; change in the nonsmoking smoking population (1989-1995); whether the firm is part of a corporate chain or independent, firm size as measured by number of employees, years in business, and whether the firm is a restaurant or bar.

It was hypothesized that firm size may have a positive impact on nonsmoking seating allocation since it might be easier to separate smokers from non-smokers. Membership in a corporate chain (relative to independents) may also result in a larger allocation of nonsmoking seating, especially if this is part of an overall corporate strategy. Older businesses (age) may result in lower nonsmoking seating allocations due to physical constraints of the building and a differing customer base. A higher percentage of smokers in the adult population in a state is expected to result in a lower allocation to nonsmoking seating.

A linear regression model was used to estimate the relationship of percent of nonsmoking seating (NS) to the set of independent variables. Results of the statistical analysis indicated that the percent allocation of seats to nonsmoking was less if an establishment was located in an area with a greater percentage of smokers in the adult population, the number of years it was in business, and if the firm was a bar. The percent of seats allocated to nonsmoking was found to increase if the firm was larger (employees) or part of a chain. Presence of a smoking law was not

¹⁵ Smoking law was estimated as an instrumental variable to eliminate its potential simultaneity with factors related to the social acceptability of smoking.

found to have a statistically significant impact on nonsmoking seating allocation. The authors caution that since the data were drawn in 1996, many states did not have complete (100%) smoking bans such as those that currently exist.

Dunham, J. and Marlow, M. L. (2000b). "Smoking Laws and their Differential Effects on Restaurants, Bars, and Taverns", Contemporary Economic Policy, 18(3), 326-333.

In this study, the hypothesis is put forth that the effect of smoking restrictions on revenues may differ between restaurants and bars. A second hypothesis is that adverse effects of smoking restrictions are higher for firms with relatively many smokers as firms with relatively few smokers have already found it to be profitable to voluntarily meet these restrictions.

The national survey data used in Dunham and Marlow (2000a) and previously described were used in this study. In this case, the change in revenues was the focus of analysis. This allowed for comparisons with other published studies in the literature.

Restaurant owners were asked how revenues would change if a virtual (100%) ban were enacted. Fifty one percent responded that revenues would not change, 39% responded that revenues would decrease, 6% responded that revenues would increase and 4% did not know. There was no statistically significant difference between this breakdown for firms located in states with smoking bans versus firms located in states with no smoking ban.¹⁶

Bar owners were asked the same question pertaining to revenues as restaurant owners. Eighty three percent expected lower revenues, 13% expected no change, 2% expected higher revenues, and 2% did not know. There was no statistically significant difference between this breakdown for firms located in states with smoking bans versus firms located in states with no smoking ban.¹⁷

Finally, responses between restaurant and bar owners were found to differ significantly.¹⁸ In locations both with and without smoking ban laws, bar owners were found to be more than twice as likely as restaurant owners to expect a decrease in revenues with implementation of a 100% smoking ban law.

A logit model was estimated relating expected change in revenue from a smoking ban (=0 for no expected change or a rise in revenues, or 1 if revenues are expected to fall) to the following determinants: percent of seating allocated to nonsmoking (NS), whether the firm is part of a corporate chain or independent, firm size as measured by number of employees, years in business, whether the firm is a restaurant or bar, and whether the firm is located in a state with a smoking law. A discussion of these variables is given in Marlow and Smith (2000a).

Separate equations were estimated for expected changes in revenues for all firms, restaurants only, and bars only. For the all-firms equation, allocation of seating to nonsmoking use (NS), membership in a corporate chain, age of the establishment, and whether the

¹⁶ A χ^2 test was used to test for significant differences between distributions.

¹⁷ A χ^2 test was used to test for significant differences between distributions.

¹⁸ A χ^2 test was used to test for significant differences between distributions.

establishment was a bar, were all found to be statistically significant. Size and presence of a smoking law were not found to be statistically significant. It was found that owners are less likely to expect revenue reductions the greater the percent of seating allocated to nonsmoking use, membership in a corporate chain, and the greater the age of the establishment. On the other hand, bar owners are more likely to expect revenue reductions.

Results of the restaurants-only equation essentially mirrored those of the all-firms equation with one exception. In this case size was also found to be statistically significant and to restaurant owners are more likely to expect a revenue decrease, the greater the size of the establishment.

Only one variable was statistically significant in the bars-only equation, allocation of seating to nonsmoking. The expected effect on revenue change was the same as that for the all-firms and all-restaurants equations. That is, owners are less likely to expect a decrease in revenues the greater the seating allocation to nonsmoking.

The article concludes that a subset of firms is likely to be negatively affected by implementation of a virtual smoking ban. Moreover, bars are more than twice as likely as restaurants to suffer negative effects.

Another result of this study is that the lower the seating allocated to nonsmoking use prior to a virtual smoking ban, the higher the probability of an owner predicting lower revenues. This tends to support the hypothesis that allocation of seating between smoking and nonsmoking use, is made to maximize profits in line with customer preference. That is, firms are responsive to customer preferences without a smoking ban.

Comments. Respondents to this survey indicated whether revenues would increase or decrease as a result of a smoking ban. The magnitude of a realized change in revenues could not be determined in this study.

Dunham, J., and Marlow, M. L. (2003). "The Economic Incidence of Smoking Laws", Applied Economics, 35, 1935-1942.

This study examines the effects of a smoking ban on restaurant owners, customers and workers. With respect to owners, assuming that they maximized profits prior to smoking ban restrictions, it is hypothesized that profits may rise, remain unchanged or fall depending on whether smoking restrictions increase demand and/or lower costs, leave demand and/or costs unchanged, or lower demand and/or increase costs. It is also hypothesized that bars are more likely to have profit declines than restaurants. Finally, to the extent that smoking laws represent a cost to owners, owners may shift these costs to customers through avenues such as increased food and drink prices, reduction in food portions, reduction in hours of operation and reduction in service. Costs may also be shifted to workers in the form of lower wages or increased responsibilities.

To test these hypotheses a survey of the 978 owners of restaurants and bars in Wisconsin was conducted during February and March, 2001. The sample included both owners subject to

smoking restrictions and owners that were not. Responses from those subject to restrictions were based on actual experience. Responses from those not subject to smoking restrictions were predictions of impacts. For restaurants, on average, 44% of seating was nonsmoking while 97% of bars allowed smoking throughout. Average nonsmoking seating was 56% for restaurants with restrictions and 34% for those without restrictions.

Separating owner respondents into all restaurants, restaurants with government smoking restrictions, restaurants not subject to smoking restrictions and bars, increased profits due to a smoking ban were indicated by 5% or fewer respondents. Lower profits were indicated by 54% of all restaurants 38% of those subject to restrictions, 61% of those with no restrictions and 81% of bars. These sample results support the contention that owners not subject to smoking restrictions predict profit decreases more often than those not subject to such restrictions.

A statistical logit (qualitative choice) model relating profit change reported by owners to percentage of seats allocated to nonsmoking use, share of revenues from alcohol, membership in a corporate chain, age of establishment, and number of seats (size) was estimated. Profit change, the dependent variable was defined as 0 for no actual or expected no change or an increase in profits or 1 if actual or expected profit falls. One difference from this study and earlier studies is that change in profits, rather than revenues, are the focus of the analysis. Explanations of the independent variables are given in prior studies (Marlow and Smith, 2000a, Dunham and Marlow, 2000b). Separate logit models were estimated for all restaurants, restaurants with government restrictions or bans, and restaurants with no restrictions. Statistically significant variables in all three profit change equations were, the percentage of seating allocated to nonsmoking, share of revenues from alcohol, membership and firm size (seats). As expected, the greater the share of seating allocated to nonsmoking prior to a ban, the less the likelihood of profits falling. On the other hand, as expected, the greater the percent share of alcohol revenues and the larger the establishment, the greater will be the likelihood of profits falling.

In summary, this study finds that a smoking ban affects profits that vary by establishment. Bars owners are much more likely to predict profit reductions than restaurants. Statistical analysis results indicate that the lower the seats allocated to nonsmoking customers, the higher the percentage of alcohol sales, the greater the size of the restaurant, the greater will be the likelihood of lower profits.

Comments. Respondents to this survey indicated whether profits would increase or decrease as a result of a smoking ban. The magnitude of a realized change in revenues could not be determined in this study.

Glantz, S. A., and Smith, L. R .A. (1994). "The Effects of Ordinances Requiring Smoke-Free Restaurants on Restaurant Sales", American Journal of Public Health, 84(7), 1081-1085.

This study analyzes the effect on sales of local smoke-free ordinances applied to restaurants for the first 15 cities in the United States which enacted such ordinances. Twelve of these cities were located in California and three in resort towns in Colorado.

Data used as the subject of analysis for this study included quarterly taxable restaurant and total retail sales for the 15 communities over the period 1986 through the first or second quarter of 1993 (depending on data availability). Quarterly taxable sales data for “eating and drinking places” and “total retail sales” for the three Colorado cities were also collected.

Data were also obtained for 15 comparison communities which did not have a smoke-free ordinance, or where no more than 60% seating availability for nonsmoking use occurred as a part of an existing ordinance. These comparison communities were chosen by the authors on the basis of similarity to the smoke-free cities with respect to population, income, smoking prevalence, and “other” factors.

Choice of a comparable community from among all potential comparable communities is made on the basis of multiple factors selected by the authors. It is not clear which of these factors is more or less important in the selection process of comparable counties which makes intercounty comparisons difficult. As an example, consider the selection of the nonsmoking ban community of Santa Monica, California as a comparable to the smoking ban community of Beverly Hills, California shown in Table 1 of the Glantz and Smith report. In this case 1989 population and median income for Santa Monica was 87,000, and \$36,000 respectively, compared to population and income of 32,000 and \$54,000 for Beverly Hills. Santa Monica had a partial smoking ban and Beverly Hills had a full ban. Compare this “matched” set with the selection of Oroville, California as a comparable for the smoking ban community of Auburn, California. In this case 1989 population and median income for Oroville was 11,000, and \$37,000 respectively, compared to population and income of 12,000 and \$17,000 for Auburn. Oroville was smoke-free over the estimation period. Comparing the two comparable cities, Santa Monica and Oroville, Santa Monica is not matched closely with its subject with respect to either population or income and had a partial smoking ban over the estimation period. On the other hand, Oroville is matched closely to its subject with respect to population but not income and was smoke-free over the estimation period. These reported extreme differences between the subject and comparable community, negate the assumption that the ratio of taxable restaurant sales in a smoking ban community to taxable restaurant sales in a comparable, nonsmoking ban county, will eliminate the need to account for differences in factors such as population, income and others as they relate to taxable restaurant sales. Results of the analysis using the ratio of taxable restaurant sales in a subject location with a smoking ban, to taxable restaurant sales in comparable locations with no smoking ban, have no merit.

Two dependent variables were analyzed. One was the ratio of taxable restaurant sales to total taxable retail sales, F. This ratio was used as the dependent variable to control for population growth, inflation and changes in underlying economic conditions. The ratio is expected to decrease if a smoke-free ordinance adversely affects restaurants. The second measure of the economic effect of a smoke-free ordinance was the ratio of the ratio of taxable restaurant sales in cities with an ordinance to sales in comparable cities with no ordinances, C. The ratio is expected to decrease if a smoke-free ordinance adversely affects restaurants.

Two linear regression models were estimated, one for F and one for C, relating these measures to a time trend and a variable, L, indicating whether or not a smoke-free restaurant law was in effect (L=0 if no smoking ban ordinance, L=1/3 if ordinance in effect for 1 month of

quarter, $L=2/3$ if ordinance in effect for 2 months of quarter, $L=1$ if ordinance in effect for entire quarter). It should be noted that for cities which had partial smoking bans, L was defined as 0.

Results of the fifteen regressions for both F and C indicate that, in general, the presence of a smoking ban, relative to a partial or no smoking ban, did not have a statistically significant impact on F or C .

Comments. The ratio of taxable retail sales in a locale where a smoking ban has been introduced to total taxable sales in that same jurisdiction, F , is used to measure taxable restaurant sales. The authors reason that dividing taxable restaurant sales by total taxable sales will control for population growth, inflation, and changes in other economic conditions. The assumption is that factors such as population, inflation, and other economic factors such as income, price of the product and price of competing products, will affect taxable restaurant sales in an identical manner to taxable retail sales of all products. Using this assumption, then, that changes in factors such as population, income and prices are expected to have the same effect on taxable restaurant sales as they would on sales of motor vehicle and parts dealers, health and personal care stores, gasoline stations, general merchandise stores, and nonstore retailers to name a few in the retail sales categories, the ratio of these two sales measures is expected to eliminate the effect of each of all of these factors from the analysis. It should also be mentioned that exemptions to taxable sales over the estimation period may affect the numerator or denominator. To the extent that taxable restaurant sales are not affected the same as the aggregate of all retail sales by changes in the factors mentioned above, the ratio F , will not eliminate these differences and so they must be accounted for explicitly in the equation specification. Failure to do this will result in a misspecified equation.

The linear regression models for F and C are specified such that these dependent variables are a function of a time trend variable, seasonal factors in the case of the resort towns in Colorado, and a smoking ban variable which indicates the presence or absence of a smoking ban. This specification assumes that changes in the ratio variables F and C over time are accounted for by a general time trend and a smoking ban variable since no other factors are specified to account for changes in these variables. As discussed, this assumes that all changes in taxable restaurant sales due to changes in other factors, other than a smoking ban or a time trend, are accounted for by taking the ratio of taxable restaurant sales to either total taxable retail sales or to taxable restaurant sales in comparable nonsmoking ban counties.

It is also important to note that the smoking ban variable used in the F and C models is defined as present if there is a smoking ban and absent if there is a partial ban *or* no ban. It might be expected that the effect on a county where a smoking ban was imposed, but which had a partial smoking ban prior to that, would be less than that for a county where a smoking ban was imposed, but was smoke-free before that. No distinction is made between these two effects since the smoking ban variable is not defined in such a way as to account for these differences.

Given the equation specification, the effect of introduction of a smoking ban on the ratios, F or C , can be determined and tested for statistical significance. However, whether the change in F or C is due to a change in the numerator or the denominator cannot be determined. The authors contend that the smoke-free variable in the regression analysis is a measure of the

effect of the smoking ban on the subject restaurant. This is not necessarily the case. For example, if the impact of a smoking ban on F is found to be positive, this could mean: (1) taxable restaurant sales increased after the ban, and total taxable retail sales increased relatively less (2) taxable restaurant sales increased after the ban, and total taxable retail sales were unchanged or declined, (3) taxable restaurant sales decreased after the ban and total taxable retail sales decreased relatively more. If no change is observed in F, this could be due to (1) no change in taxable restaurant sales or total taxable retail sales, (2) equal relative increases in taxable restaurant sales and total taxable retail sales, or (3) equal relative decreases in taxable restaurant sales and total taxable sales. Similar alternative scenarios can be constructed for a decline in the ratio variable. This inability of the model, as specified, to isolate the separate effects of numerator and denominator of the ratio variable being analyzed is also the case for C, the ratio of taxable retail sales of the subject location relative to taxable retail sales of a comparable, smoke-free location.

Results of the fifteen regressions for F indicate that, in general, the presence of a smoking ban did not have a statistically significant impact on F. However, these results, for reasons given above, do not support the conclusion that a smoking ban either increases, decreases, or has no effect on taxable restaurant sales. The same can be said for results of a pooled regression for F and C which was mentioned but not given in the article.

Glantz, S. A., and Smith, L. R. A. (1997). "The Effects of Ordinances Requiring Smoke-Free Restaurants and Bars on Revenues: A Follow-Up", American Journal of Public Health, 87(10), 1687-1693

This study was basically an update of the earlier study (Glantz and Smith, 1994). One difference was that bars were analyzed separately. As before, the findings from the individual linear regression models for each community and from the pooled regression across all communities were that, in general, a smoking ban, relative to a partial or no ban, had no statistically significant impact on the ratios, F and C, for either restaurants or bars.

Comments. Use of the ratio variable does not permit a determination of the effect of the smoking ban on taxable restaurant or bar sales. See comments on this and other issues given in the discussion of Glantz and Smith (1994) above.

Glantz, S. A., and Charlesworth, A. (1999). "Tourism and Hotel Revenues Before and After Passage of Smoke-Free Restaurant Ordinances", Journal of the American Medical Association, 281(2), 1911-1918.

This study compared hotel revenues and international tourism rates before and after passage of a smoke-free restaurant ordinance. Three states (CA, UT, VT) and six cities (Los Angeles, CA, San Francisco, CA, Mesa, AZ, Flagstaff, AZ, Boulder, CO and New York, NY) were selected for analysis.

Following earlier studies (Glantz and Smith, 1994 and 1997) taxable hotel sales data were collected for each jurisdiction for varying periods by location over the period 1987-1998. Annual data were collected for the states of California (11 observations), Utah (8 observations) and

Vermont (10 observations). Annual data were also collected for the cities of San Francisco, California (9 observations) and Los Angeles, California (11 observations). Monthly data were collected for the cities of Mesa, Arizona (90 observations), Flagstaff, Arizona (110 observations), and Boulder, Colorado (90 observations). Quarterly data were collected for the city of New York, New York (40 observations).

The dependent variable is defined in four different ways as follows: taxable hotel sales in current dollars, taxable sales in constant dollars, taxable hotel sales divided by total taxable retail sales, and taxable hotel sales divided by gross national product for hotels and other lodging places. As in prior studies (Glantz, 1994, 1997), the ratio of taxable hotel sales to total taxable sales and the alternative ratio, taxable hotel sales to national gross domestic product-hotel and lodging places, were assumed to account for inflation and other underlying conditions. In the latter case, the authors use gross domestic product-hotel and lodging places in the denominator as a proxy for comparable counties to a smoking ban county used in prior studies (Glantz, 1994, 1997). The authors assumption is that this variable, which is a different measure (gross domestic product) than that used in the numerator (taxable sales), and does not vary between subject locations, is a proxy for taxable sales in comparable locations.

Following earlier studies (Glantz, 1994, 1997), each of the dependent variables was specified as a function of a time trend, a smoking ban variable, and seasonal factors, where appropriate. One slight difference from the earlier specifications was that the smoking ban variable was allowed to have a non-linear effect.

It is not clear why these four equation specifications were used in the analysis since there are a number of inconsistencies in their use. If, as the authors contend, the ratio variables are constructed to eliminate the effects of inflation and other factors that affect taxable hotel sales over time, the use of non-inflation adjusted (current dollar) taxable hotel sales as the dependent variable is inappropriate. It is more appropriate to use constant dollar (inflation-adjusted) taxable hotel sales as the dependent variable. However, since it is not divided by total taxable retail sales or sales of a comparable location, the effects of other factors on taxable hotel sales are not eliminated according to the authors' logic. This being the case, specification of taxable hotel sales as a function only of time and a smoking ban variable does not account for the effect of "other" factors on taxable sales and so the model is subject to specification error.

Eliminating the equation for the ratio of taxable hotel sales (for the locality) to gross-domestic product for hotels and other lodging places, leaves only one specification which is consistent with the authors' logic. That is the equation for the dependent variable, taxable hotel sales divided total taxable retail sales, as used in prior studies (Glantz and Smith, 1994, 1997). Results of this analysis were that a smoking ban was found to have no statistically significant effect on the ratio of taxable hotel sales to total taxable retail sales in four of the nine locations, a positive effect in three of the locations, and a negative effect in two of the locations. It should be noted that the number of degrees of freedom (df) for the five locations using annual data were as follows: California (8df), Utah (5df), Vermont (7df), Los Angeles, CA (8df) and San Francisco, California (6df).

The authors also report results of a pooled regression. In this case all dependent variables (taxable hotel sales divided by total taxable retail sales, F) with their associated independent variables (time trend, smoking ban variable, seasonal factors) are pooled in one data set for analysis. No explanation is given as to how the data set is constructed. Assuming that all of the data are included as reported, there is a major problem with this approach that makes it useless. The dependent variables are not comparable due to different aggregations, annual, quarterly, and monthly. Similarly the independent variables are not comparable. For example the time trend variable for annual data would not be comparable to the time trend for quarterly or monthly data. Similarly, seasonal factors would not be comparable for annual (no values), quarterly (four per year), or monthly (12 per year). Presence of a smoking ban was not found to have a statistically significant impact on the ratio of taxable hotel sales to total taxable retail sales.

Comments. The authors selected for analysis those localities where they determined that the issue of the effect of a smoking ban on tourism was raised. This excluded all other localities where a smoking ban would affect tourism.

Two of the four model specifications for individual locales were not consistent with the authors' choice of a dependent variable. The dependent variable for a third model (taxable hotel sales divided by national gross domestic product for hotels and lodging places) did not account for differences between smoking ban locales and so was not appropriate. The fourth model for which the dependent variable was defined as the ratio of taxable hotel sales to total taxable retail sales was similar to that used in earlier studies (Glantz and Smith, 1994, 1997). Use of the ratio variable does not permit a determination of the effect of the smoking ban on taxable restaurant or bar sales. See comments on this and other issues given in the discussion of Glantz and Smith (1994, 1997) above.

Five of the nine models were based on annual data for which the number of observations, and corresponding degrees of freedom, were too small to produce reliable estimates of the effects of a smoking ban on the dependent variable.

Results of a pooled regression over all of the locales was without merit due to combining variables aggregated over different periods- annual, quarterly, and monthly, in one equation.

Goldstein, A. O., and Sobel, R. A. (1998). "Environmental Tobacco Smoke Regulations Have Not Hurt Restaurant Sales in North Carolina", North Carolina Medical Journal, 59(5), 284-287.

Following Glantz and Smith (1994), this study examines the impact of smoking ordinances on taxable restaurant sales in North Carolina counties.

Five counties with strong local ordinances were selected for inclusion in the study. In addition, five comparable counties with no smoking ordinance were chosen by the authors on the basis of similarity to the subject smoking ban counties with respect to population, per capita income, and unemployment rate. Data were collected for six fiscal years, FY91, FY93-FY97. Data were not available for FY92.

Following Glantz and Smith (1994), two dependent variables were constructed, F and C. F is the ratio of taxable restaurant sales to taxable retail sales for each of the six subject counties, and C is the ratio of taxable restaurant sales for each of the subject smoking ban counties to taxable restaurant sales for the chosen comparable non-smoking ban counties.

The authors state that a paired t-test was performed for the two years before the smoking ordinance and the four years following the ordinance. The sample size for each county (two years before for the pre-smoking ban test for the pre-smoking ban t-test, and four succeeding smoking ban years for the smoking ban test) is too small to yield reliable results.

The authors allude to a regression analysis following Glantz and Smith (1994) where F or C are regressed on a time trend and a smoking ban variable. It is not known whether separate regressions are estimated for each smoking ban county as in Glantz and Smith (1994). If it is assumed that the authors follow the method of Glantz and Smith (1994) there would be only six observations per regression with a corresponding three degrees of freedom.

The authors report that the smoking ban variable was not found to be statistically significant.

Comments. Relationships between the dependent and independent variables in a regression analysis alluded to by the authors are not reported along with accompanying statistical tests of significance. Sample size is so small as to not be useful in a statistical analysis. The dependent variables, C and F, do not measure the effect of the independent variable, smoking ordinance, on taxable restaurant sales.

The use of the ratio variables F and C do not permit a determination of which in direction the smoking ordinance variable affects the numerator, taxable restaurant sales. See comments on this given in the discussion of Glantz and Smith (1994).

Huang, P., De, A. K., McCusker, M.E., and Officer, E.I.S (2004). "Impact of a Smoking Ban on Restaurant and Bar Revenues – El Paso, Texas, 2002", Morbidity and Mortality Weekly Report, Centers for Disease Control and Prevention, Atlanta, GA, 53 (07), 150-152.

This study examined the effect of a smoking ban in El Paso, Texas on taxable sales of restaurants, bars, restaurants and bars combined (excluding sales of mixed beverages), and mixed beverages. The smoking ban ordinance was implemented on January 2, 2002. Quarterly taxable sales data for restaurants and bars were collected over the period 1995 through 2002. Monthly mixed-beverage revenue data, from the state mixed-beverage gross receipts tax, was collected over the period 1995-2002.

The model specification and estimation procedure followed that of Glantz and Smith (1994, 1997), and Glantz and Charlesworth (1999). The authors estimated two sets of regression models for each of the dependent variables: taxable bar sales, taxable restaurant sales, taxable combined restaurant and bar sales, and taxable mixed-beverage revenues. The first regression model of each set used taxable sales or mixed-beverage revenues, as the dependent variable. The second regression model of each set used the ratio (fraction) of taxable sales or mixed-beverage

revenues to total taxable retail sales. All of the models are estimated as functions of the same set of independent variables: seasonal (quarter) factors, and a smoking ban variable.

The smoking ban variable was reported not to have a statistically significant effect on taxable sales of bars, restaurants, and combined bars and restaurants, or on mixed-beverage revenues. Although the entire equation is not reported, the coefficient of the smoking ban variable and its significance are reported along with the overall equation evaluation statistics, R^2 , and the Durbin-Watson statistic.

Comments. Use of the ratio variable does not permit a determination of the effect of the smoking ban on taxable restaurant or bar sales. See comments on this and other issues given in the discussions of Glantz and Smith (1994) and Glantz and Charlesworth (1999) above. The taxable sales (mixed-beverage revenue) models are subject to specification error by excluding economic, demographic and other factors that affect the demand for restaurant, bar, and mixed-beverage revenues.

Hyland, A., Cummings, K. M., and Nauenberg, E. (1999). "Analysis of Taxable Sales Receipts: Was New York City's Smoke-Free Air Act Bad for Restaurant Business?", Journal of Public Health Management Practice, 5(1), 14-21.

The purpose of the study was to determine if the New York City Smoke-Free Air Act had an adverse economic effect on taxable sales receipts of restaurants or hotels. Semiannual data for taxable retail sales by county were collected for each county in New York over the period March 1990 to February 1997. Data were collected for the categories, eating and drinking places, hotels, and retail trade. Data for the five counties comprising New York City were aggregated to obtain taxable sales for the city. Data for the 62 of the remaining 64 counties in New York State, which did not have a smoke free law, were combined and used as a comparable location group for New York City.

The model specification and estimation procedure follow that of Glantz and Smith (1994, 1997). The authors estimate five models as functions of the same set of independent variables: time trend, seasonal (semiannual) factors, the unemployment rate and a smoking ban variable. The dependent variables for each of the five models are: (1) total inflation-adjusted taxable sales from eating and drinking establishments in New York City, (2) total inflation-adjusted taxable sales for hotels in New York City, (3) the ratio of taxable sales from eating and drinking places to taxable sales for all noneating and drinking establishments in New York City, (4) the ratio of taxable sales for eating and drinking places in New York City to taxable sales in nonsmoking counties outside of New York City, and (5) the ratio of taxable hotel in New York City to taxable hotel sales in nonsmoking counties outside of New York City.

The smoking ban variable was reported not to have a statistically significant effect on the ratio of taxable eating place or hotel sales to total taxable sales of other retail establishment in New York City. Similarly the smoking ban variable was reported not to have a statistically significant effect on the ratio of taxable eating place (hotel) sales to taxable eating place (hotel) sales in nonsmoking locations in the rest of New York.

Comments. Use of the ratio variable does not permit a determination of the effect of the smoking ban on taxable restaurant or bar sales. See comments on this and other issues given in the discussions of Glantz and Smith (1994)

As was mentioned in the review of Glantz and Charlesworth (1999), it is not clear why five equation specifications were used in the analysis since there are a number of inconsistencies in their use. If, as the authors contend, the ratio variables are constructed to control for underlying economic trends, then it is inconsistent to specify that total taxable sales are determined by the same set of control factors as those used to determine changes in the ratio variables. According to their logic, since trends in economic variables would not be cancelled out if a ratio variable were not used, total taxable sales would be a function of those variables (e.g. price of the product, price of competing products, income, sales tax exemptions, etc.). This being the case, using the authors' own arguments, specification of taxable sales of eating and drinking places or hotels as a function only of time trend, seasonal (semiannual) factors, the unemployment rate and a smoking ban variable do not control for the effect of "other" factors on taxable sales and so the model is subject to specification error. In fact, the authors mention that price of hotel services increased over the time period. This economic factor was not specifically included their taxable hotel sales equation. While coefficients of the smoking ban variable, with confidence limits were shown, the estimated regression equations were not.

There were 14 observations used to estimate each of the equations. Each equation had five included variables (including the constant) leaving 9 degrees of freedom for model estimation. A larger sample size would be needed to obtain more reliable coefficient estimates.

Sciacca, J.P. and Ratliff, M.I. (1998). "Prohibiting Smoking in Restaurants: Effects on Restaurant Sales", American Journal of Health Promotion, Inc., 12(3), 176-184.

The purpose of this study was to determine the impact of a smoking ban on taxable restaurant sales in Flagstaff, Arizona. Monthly taxable restaurant (hotel/motel) sales and total taxable retail sales were collected for the five-year period, January 1, 1990 through December 31, 1994, 3.5 years before the nonsmoking ordinance and 1.5 years following the ordinance enacted in June 1993. Excluded from the definition of restaurants were bars (within or outside a restaurant) and lounges. In addition to Flagstaff, monthly taxable sales over the same period were collected for the cities of Yuma, and Prescott, the counties of Yavapai, Coconino, and Yuma, and the state of Arizona. These locations were used as nonsmoking comparables, based on non-statistical criteria, for the city of Flagstaff, the only smoking location in the state at the time.

Taxable retail sales were divided into two periods, one before and one after the nonsmoking ordinance. Two regressions of taxable sales on time, one before and one after the ordinance were estimated. The coefficients of the before and after smoking ban time variables were then tested to determine if there was a statistical difference between them. Results of the analysis were taken as evidence of the impact of a smoking ban on retail sales. This procedure was repeated following Glantz and Smith, 1994, using the ratio variables of Flagstaff taxable retail sales to taxable retail sales in the comparable areas and the ratio of Flagstaff restaurant retail sales to total taxable retail sales.

The effect of the nonsmoking was found to be statistically insignificant.

Comments. This study, which used ratios as the variables of interest was subject to the same limitations as discussed in the reviews of Glantz and Smith (1994). The study also specified taxable restaurant (hotel) sales to be a function of the same set of independent variables as the taxable sales ratio variables. As discussed in the reviews of Glantz and Charlesworth (1999) and Hyland, Cummings and Nauenberg (1999) this was inconsistent with their use of ratio variables to control for underlying economic trends. Using taxable sales rather than a ratio of taxable sales would assume that trends in economic variables would not be cancelled out so that total taxable sales would be a function of economic factors such as the price of the product, the price of competing products and income.

Finally, it is not clear why separate models were estimated for the time series before the ban and the time period after the ban instead of using one model for the entire period.