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The Economic Impact of a Smoking Ban in Columbia, Missouri: A Preliminary Analysis of Sales Tax Data

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Abstract:

In January 2007, a smoke-free ordinance took effect in Columbia, Missouri, banning smoking in all bars, restaurants, and workplaces. This paper analyzes initial data for dining-sector sales tax collections for the period January 2001 through July 2007—including the first seven months since the smoking ban was implemented. The analysis accounts for trends, seasonality, general business conditions, and weather. The findings suggest that the smoking ban has been associated with statistically significant losses in sales tax revenues at Columbia's bars and restaurants. Point-estimates indicate an average effect of approximately 5 percent. The estimated 5 percent decline in business is only an average; many individual businesses may have been unaffected, while others are likely to have suffered much greater losses.

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Introduction

In January 2007, the Clean Indoor Air Ordinance took effect in Columbia, Missouri, banning smoking in all bars, restaurants, and workplaces. This paper analyzes initial data on restaurant sales tax collections for the period before and after this smoking ban was implemented.

The enactment of laws restricting smoking in bars and restaurants has been a growing trend among states and municipalities around the nation. According to the Americans Nonsmokers' Rights Foundation, there are presently 656 municipalities that have provisions for 100% smoke-free environments in bars, restaurants and workplaces. Of these, 461 require smoke-free restaurants and 344 require smoke-free bars.

As more communities around the nation have adopted such laws, economic data has accumulated, allowing economists to better identify some of the economic costs of these restrictions. A large body of early evidence on the economic impact of smoking bans, much of which was published in medical and public health journals, tended to find no statistically significant effects.[1] This finding has sometimes been erroneously interpreted as demonstrating that there is no negative economic impact of smoke-free laws.

Recent economic analyses indicate that this is a far too simplistic view of the issue. Using appropriate econometric techniques and carefully designed hypothesis testing, economic researchers have made it increasingly clear that there are significant economic effects of smoking bans. The evidence suggests that economic costs are likely to be focused on some specific categories of business—those that tend to be frequented by smokers. Statistically significant costs have been identified for casinos and bars, in particular.[2]

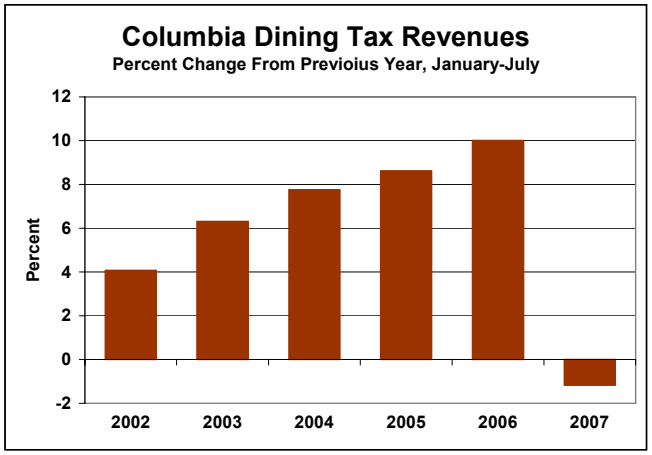
[1] Scollo et al. (2003) provide a review of previous literature.

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

One of the cities in the eigth Federal Reserve District to recently adopt a smoking ban is Columbia, Missouri. As of January 2007, all bars and restaurants in Columbia are required to be smoke free. Only some sections of outdoor patios are exempt from the requirement.

Some local businesses have continued to oppose Columbia's smoke-free ordinance, circulating petitions to repeal the law by ballot initiative.[3] According to local press reports, at least four establishments have cited the smoking ban as a factor in their decision to close their doors in 2007.[4] One business owner has reported a 40 percent drop in alcohol sales and a 20 to 30 percent drop in food sales. For the year, he expects a 30 to 33 percent decline.[5] Although such reports are informative, they are anecdotal. A more thorough, systematic analysis of objective data is necessary for identifying overall economic costs.

Figure 1:



Source: City of Columbia and *The Columbia Missourian*

Data from the city of Columbia show a distinct decline in sales tax receipts at bars and restaurants (see Figure 1). As reported in the *Columbia Missourian*, revenues at dining businesses declined by 1.2 percent in the period from January to July 2007 (compared with the same period for 2006).[6] Over the previous four years, revenues had risen at an average rate of 6.8 percent. In the first seven months of 2006—prior to the implementation of the smoking ban—dining revenues were 10 percent higher than the same period a year earlier.

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

[4] LeBlanc (2007), Coleman (2007).

[5] Lynch (2007).

[6] Solberg (2007).

The decline in sales tax revenues from dining establishments that occurred after the smoking ban was implemented is consistent with the anecdotal reports of revenue losses at Columbia bars and restaurants. However, a simple comparison of growth rates before and after the smoking ban is insufficient for drawing any firm conclusions.

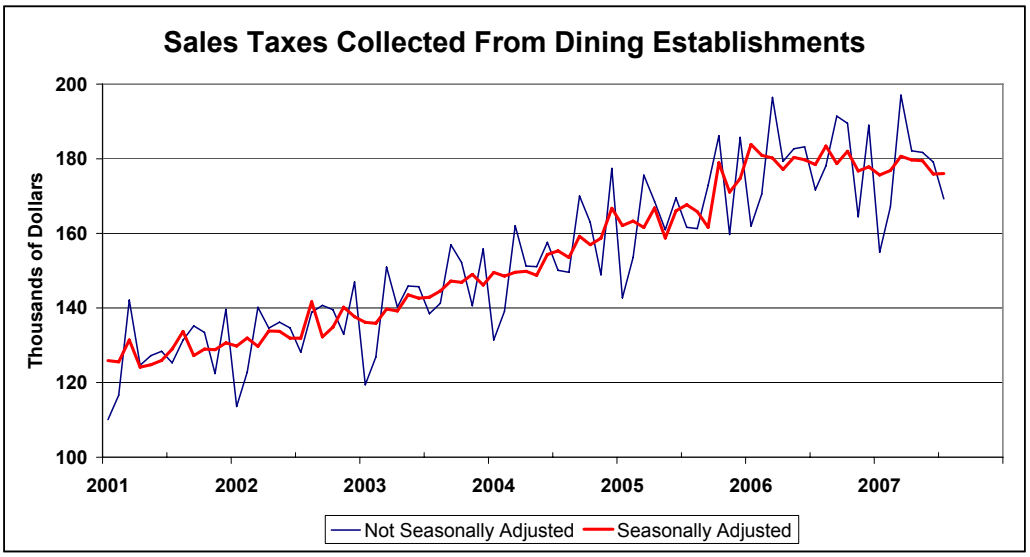
In this paper, I report findings from a more rigorous analysis of the data. Although the data cover only the first seven months after implementation of the Columbia Smoke-Free Ordinance, this initial analysis suggests a statistically significant decline in sale tax revenues at Columbia dining establishments. Point estimates suggest average losses of approximately 5 percent. These estimates take account of past trends, seasonal fluctuations in the data, and an overall slowdown in sales tax revenues in Columbia.

Sales Tax Data

The data series examined in this paper consists of monthly sales tax revenues for bars and restaurants in Columbia. Because there have been no changes in tax rates over the sample period (Jan 2001- July 2007), sales tax revenues serve as a direct proxy for sales. Total sales tax receipts were also obtained from the City of Columbia for use as a control variable for overall economic activity.

Figure 2 displays a plot of the raw data for restaurant tax receipts, along with a seasonally adjusted series that has been adjusted using the Census X12 ARIMA procedure. A cursory examination of the data shows an evident surge in growth during the latter part of 2005 and into early 2006. Growth slowed in late 2006 and turned negative in 2007. On a year-over-year basis, growth rates were positive in every month from March 2002 through December 2006. During the first seven months of 2007, growth was negative for every month except March and April (but averaging less than 1 percent for those two months). In July 2007, sales tax revenues were 1.4 percent lower than a year earlier.

Figure 2:



Source: City of Columbia; Author's calculations

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

Regression Analysis

To test the hypothesis of a significant effect of the Columbia smoking ban, I estimated a series of least-squares regressions. The dependent variable of the regressions is the log of restaurant sales tax revenues. Each regression includes a constant and a time trend, along with a dummy variable representing the implementation of the smoking ban (which takes on the value of zero prior to 2007 and one for January-July 2007):

$$\ln(DiningTax_t) = \beta_0 + \beta_1 TimeTrend_t + \gamma\ SmokingBan + u_t .$$

The focus of the analysis is the coefficient on the smoking-ban dummy variable (γ). All regressions include a first-order autoregressive error term $u_t = \rho\ u_t + \varepsilon_t$ (although the autoregressive coefficient is not significant in most of the regressions). Estimation employs

ordinary least-squares regression, with standard errors adjusted for general autoregression and heteroskedasticity using the Newey-West (1987) procedure.

Baseline Specification

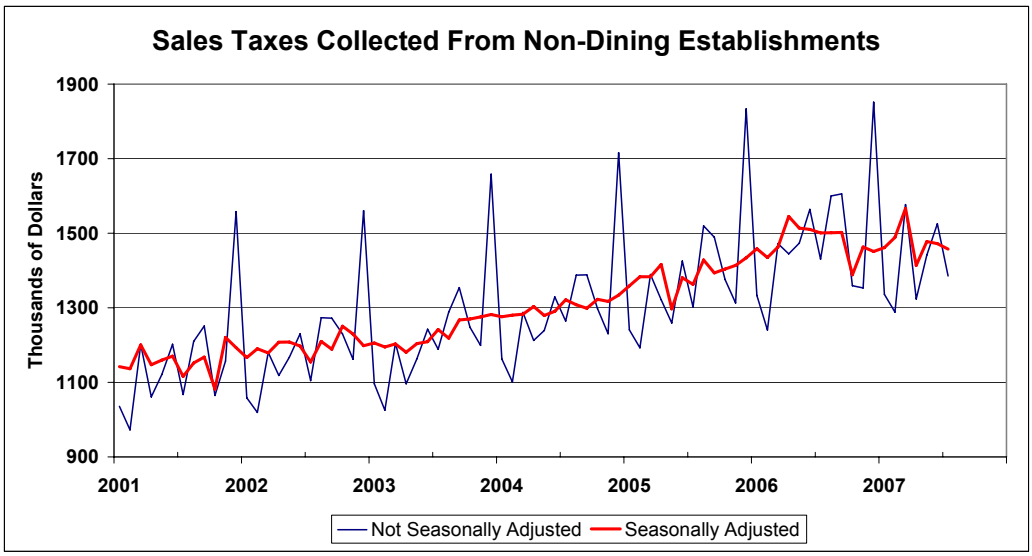
The results of a naive baseline specification, including only a constant and a time trend (plus the autoregressive error term), are shown in the first two columns of Table 1 (page 14). Regression (1a) uses the not-seasonally-adjusted data for the dependent variable, while regression (1b) uses the seasonally adjusted data. Equation (1a) includes a set of monthly dummy variables to account for seasonal patterns (coefficient estimates not reported). This basic regression analysis suggests a highly statistically significant decline in tax revenues associated with the implementation of the smoking ban. Point estimates for the coefficients on the smoking ban dummy variable indicate an average decline of more than 5 percent.[7]

Controlling for general business conditions

Although these initial estimates control for general trends and seasonality in the data, there are other factors that could be associated with the decline in restaurant tax revenues. In fact, data suggest that there has been an overall decline in non-dining retail sales in Columbia, which is unlikely to be associated with the smoking ban. Subtracting dining tax receipts from data for total sales tax receipts yields a measure of non-dining tax receipts. The resulting data, both for seasonally adjusted and non-seasonally adjusted measures, are shown in Figure 3. There is a clear slowdown in 2006 and 2007, roughly corresponding to the timing of the slowdown in tax receipts at restaurants and bars. Non-dining tax receipts showed some recovery in early 2007, but have sagged during the summer. As of July 2007, non-dining sales were down approximately 3 percent from a year earlier.

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

Figure 3:



Source: City of Columbia; Author's calculations

In order to control for this overall business downturn, regressions (2a) and (2b) add the (logged) non-dining revenue variable to the baseline specification. Regression (2a) includes the non-seasonally adjusted measure, while regression (2b) uses the seasonally adjusted version. In both cases, the coefficient on non-dining tax revenue is positive, and it is highly significant. The addition of this factor does, in fact, account for some of the slowdown in dining tax revenues: point estimates for losses associated with the smoking ban are smaller than in the baseline specification.[8] Nevertheless, the coefficients on the smoking ban dummy variable are still highly significant with point estimates indicating a decline of more than 4½ percent.

These results indicate that the slowdown in dining tax receipts is partly related to a slowdown in overall economic activity, but that the decline in revenues at bars and restaurants is greater than past patterns would predict.[9]

[8] Note that the autoregressive error coefficients are no longer significant, which suggests that omitted-variable bias in the baseline specification has been addressed by the inclusion of the new variable.

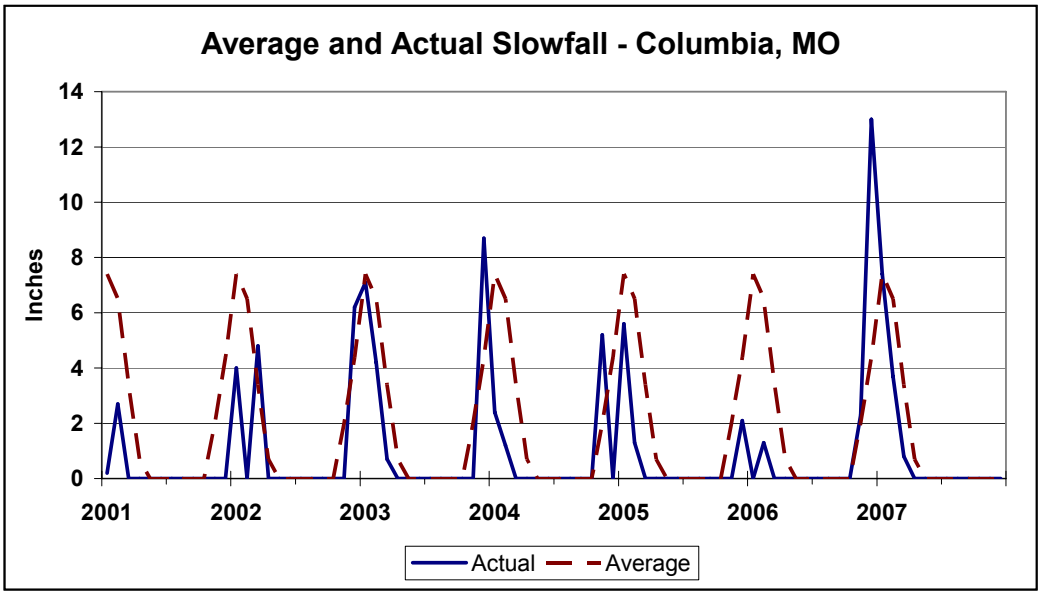
[9] The 2008 budget report for the city of Columbia also indicates that dining and entertainment sectors are lagging the rest of the local economy: "General retail sales remain steady, however the current trend indicates the home improvement/construction and dining and entertainment sectors are declining."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

Controlling for weather

Another factor that can be particularly important for revenues at bars and restaurants (for obvious reasons) is inclement weather.[10] The winter of 2006-2007 in Columbia was, in fact, unusually severe.

Figure 4 shows the average monthly snowfall for Columbia compared with actual snowfall over the sample period. The winter of 2006-2007 clearly represents a departure from average weather conditions.[11] The relatively mild winter of 2005-2006 might also help explain the surge in dining tax revenues during that earlier period.

Figure 4:



Source: National Oceanic and Atmospheric Administration

Regressions (3a) and (3b) add this consideration to the analysis, introducing a variable that is equal to the difference between actual and average snowfall, in inches. The coefficient on

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

[11] Average snowfall is calculated for the period 1971-2000 (NOAA).

this snowfall variable is of the expected sign, and it is statistically significant. The point estimate indicates that one inch of snowfall in excess of the average tends to lower sales tax revenues by 0.3 to 0.4 percent for the month. The addition of the snowfall variable improves the overall fit of the model, but it has little impact on the significance of the smoking-ban dummy variable. Estimates of an independent downturn in bar and restaurant revenues beginning in January 2007 remain highly significant, measuring approximately 5 percent.

A Specification/Robustness Test

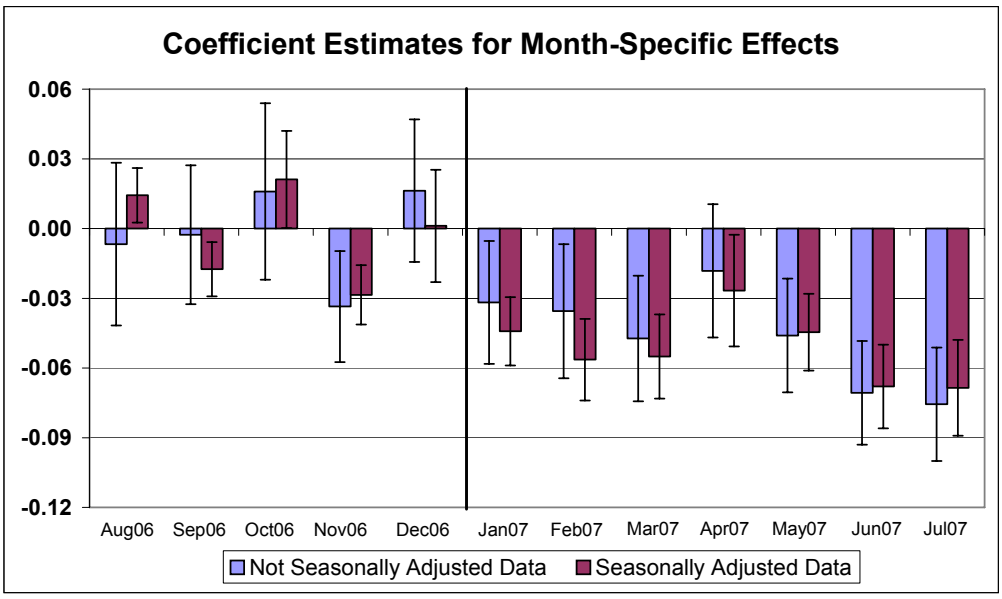
The association of the smoking ban dummy variable with the Columbia Smoke-Free Ordinance relies on the timing of its adoption. It is possible for a dummy variable to indicate statistically significant effects, even if the restaurant sales slowdown began either before or after the implementation of the smoking ban. To test whether the dummy variable is accurately identifying the effects of the smoking ban and not an independent, unidentified factor, the regression specifications in (3a) and (3b) were re-estimated using month-specific factors for the last 12 months of the sample period (instead of the smoking-ban dummy variable).[12]

The coefficient estimates for the month-specific factors (along with two standard-error confidence intervals) are illustrated in Figure 5. These estimates can be considered as monthly deviations in revenues from predictions of the estimated model (which includes trends, seasonality, business conditions, and weather). For the last 5 months of 2006, the month-specific factors show no clear, consistent pattern. Both the seasonally adjusted and non-seasonally adjusted specifications show that November was a significantly bad month for restaurant sales. For August, October, and December, however, the monthly effects are estimated to be positive (although not, in most cases, significant). A log-likelihood ratio test for the joint redundancy of

[12] That is, monthly effects are identified using dummy variables that take on the value one in a particular month and zero in all other months.

these five month-specific variables indicates that the null hypothesis of redundancy cannot be rejected at any reasonable level of statistical significance.[13]

Figure 5:



The month-specific effects for the first seven months of 2007, on the other hand, are uniformly negative. Only one monthly estimate (April 2007) is not significantly different from zero (at the 95% level)—and only for the non-seasonally adjusted specification. The average values for these seven monthly effects are 0.046 (non-seasonally adjusted) and 0.052 (seasonally adjusted). Again, the estimates indicate an average loss of about 5 percent. A log likelihood ratio test easily rejects the null hypothesis that these seven monthly variables are redundant to the regression.[14]

These results suggest that January 2007 does, indeed, represent a break-point in the data series on bar and restaurant sales tax revenues.

[13] The p-values are 0.437 for the non-seasonally adjusted specification and 0.319 for the seasonally adjusted version of the model.

[14] The p-values are 0.004 for the non-seasonally adjusted specification and 0.003 for the seasonally adjusted version of the model.

Discussion and Conclusions

The results reported in this paper indicate that there have been statistically significant losses to bar and restaurant sales tax revenues since the implementation of the Columbia Smoke-Free Ordinance in January 2007. After accounting for trends, seasonality, an overall downturn in retail sales, and an unusually harsh winter, there remains a 5 percent loss in dining tax revenues associated with the smoking ban.

These findings are, of course, preliminary. With only seven months of data since the implementation of the smoke-free ordinance, any conclusion about the impact of the smoking ban should be considered tentative. The downturn in bar and restaurant business in Columbia may be associated with some other factor that has not been considered in this analysis. It is impossible, at this point, to draw any inference about long-run effects. Nevertheless, the finding of a downturn in revenues is robust to model specification and its timing corresponds to the implementation of the smoking ban.

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

One interesting feature of the Columbia experience is the response of restaurant owners to the patio exemption. According to *The Columbia Missourian*, owners of at least two bars are building or planning outdoor patio expansions. One owner was quoted as saying "You have to have a patio to survive."[15] The expenses associated with these renovations may help offset

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

losses in sales revenue of these establishments, but they also represent *profit* losses above and beyond the measured declines in revenues.

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

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Table 1: Regression Results

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Smoking Ban	-0.0540***	-0.0557***	-0.0475***	-0.0491***	-0.0472***	-0.0522***
	(0.0163)	(0.0141)	(0.0113)	(0.0092)	(0.0117)	(0.0079)
Constant	11.7745***	11.7110***	6.8094***	6.9951***	7.6587***	7.7872***
	(0.0119)	(0.0078)	(1.3101)	(1.2950)	(1.3393)	(1.3039)
Time Trend	0.0058***	0.0058***	0.0044***	0.0044***	0.0046***	0.0047***
	(0.0002)	(0.0002)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Non-Dining Tax Revenues			0.3503***	0.3387***	0.2905***	0.2815***
			(0.0923)	(0.0930)	(0.0945)	(0.0936)
Snowfall					-0.0044***	-0.0031***
					(0.0015)	(0.0012)
AR(1) coefficient	0.2694*	0.2461*	0.1533	0.0992	0.1277	0.0781
	(0.1427)	(0.1380)	(0.1301)	(0.1295)	(0.1321)	(0.1407)
Seasonally Adjusted Data	No	Yes	No	Yes	No	Yes
Seasonal Dummy Variables	Yes	No	Yes	No	Yes	No
Adjusted R^2	0.9682	0.9679	0.9729	0.9724	0.9760	0.9751

Notes:

(1) *, **, and *** denote significance at 0.90, 0.95, and 0.99, respectively.

(2) The dependent variable for all equations is the log of dining-sector tax revenue. Regressions labeled (a) use data that are not seasonally adjusted, while those labeled (b) use data that are adjusted using the Census X12 ARIMA procedure.