Did the ban on smoking reduce the revenue in pubs and restaurants in Norway?

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ABSTRACT

Objective: After 16 years of exemptions from the ban on indoor smoking in other places of work, Norway became the second country after Ireland to implement a smoke-free regime in pubs and restaurants. This paper evaluates the economic impact on the hospitality sector in a northern region with a cold climate.

Methods: The data consists of bi-monthly observations of revenues in restaurants and pubs starting in January 1999 and ending in August 2007. Auto-regressive integrated moving average (ARIMA) intervention analysis was used to test for possible economic impacts, controlling for variations in temperature.

Results: The ban on smoking did not have a statistically significant effect on revenue in restaurants or on restaurant revenue as a share of personal consumption. There is also no evidence that the ban reduce revenues in bars, but there is some indication that it may have reduced bar revenue as a share of personal consumption.

Conclusion: A large body of research has found no negative economic effect of smoke-free legislation on restaurant and bar sales in the United States, Australia and elsewhere Our study confirms these results in a northern region with a cold climate with respect to restaurants, but the results was more mixed for bars.

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INTRODUCTION

In many countries, the propagation of smoke-free air policies has been slowed by fears that restrictions on smoking may have a negative impact on businesses. The most vigorous debate has revolved around the business activity of pubs and restaurants (1). Debates centre on the potential for lost revenues resulting from smokers visiting these establishments less frequently, cutting their visits shorter and spending less money than they otherwise would if smoking were permitted. An extensive and growing body of literature on the economic impact of smoke-free policies in the hospitality sector shows that smoke-free air policies have no negative economic impact on restaurants, pubs, and other segments of the hospitality industry (2, 3), with the possible exception of gaming establishments (4). However, most of this research has been conducted in regions of the world with a climate less hostile to outdoor smoking than the cold and wet Norwegian climate. In addition, many studies have also been limited to a short time period after the ban. We have examined how the revenues of pubs and restaurants in Norway have been affected by the total ban on indoor smoking.

The ban came into effect on 1 June 2004. The results from a comprehensive evaluation show that the ban was followed by a reduction in airborne nicotine and total dust in pubs and restaurants, and a decline in urinary cotinine levels in non-smoking hospitality workers (5). Service workers were also observed to have increased lung function (6), a decline in respiratory symptoms (7) and better self-reported respiratory health (8). Hospitality workers found a total ban easier to enforce than the previous partial ban (9) and patrons reported better air quality, increased well-being and high and increasing - especially among smokers - support for the ban (10). Despite the potential for bias, population-based consumer surveys showed no significant changes in the frequency of pub/bar and restaurant visits following the implementation of the ban (11).

However, until now no methodologically sound study has been conducted in Norway using valid, reliable measures of business activity covering the period before and after the implementation in order to separate the economic impact of the ban from underlying economic trends, and to allow sufficient time for businesses, smokers, and non-smokers to adapt their behaviour to the policy.

With half of the country situated north of the Arctic Circle and the remaining parts also regularly exposed to cold winters and rainy summers, Norwegian smokers might be expected to be more affected by a ban on indoor smoking than smokers living in more temperate climes. Business owners and hospitality associations therefore expressed concern

when advocates of the ban extrapolated evidence from research conducted in the USA and Australia, and applied it to Norway. With 36% regular smokers (27% daily and 9% occasionally) at the time of implementation, Norway had also higher prevalence of smokers than most countries with such policies. We therefore hypothesised that the ban on smoking at pubs and restaurants would have a larger economic impact in Norway compared to the small or no negative impact that is reported in the scientific literature on the topic.

METHODS

Design

To examine the effect of the ban, we modelled trends in restaurant and bar revenue using a seasonally adjusted and extended ARIMA model with a dummy variable for the ban. The model is extended in the sense that it includes temperature as a variable, while in the standard ARIMA approach only past values of a time series and its disturbances are used to predict its current value. This extension is sometimes called the ARMAX model. By differencing the data (examining changes from time period to time period as opposed to absolute levels) and including lagged variables, the model reduces the problem of trends and time dependencies that exist in time-series data.

Revenues in restaurants and pubs could change for many reasons: higher income, increased population and price changes. Many of these factors could be controlled for by including them in the model, but there is always the problem of leaving out potentially important variables. To reduce the problem of omitted variables, we focused on the ratio of revenues to private consumption. This ratio should go down if the ban had an effect on revenue, but it should not change in response to variables believed to have the same influence on revenue in restaurants/pubs and private consumption. By focusing on the ratio, we eliminated the need to include variables that are common to both series. The approach is similar to the design used by Luk et al. (12).

However, the method above does not adjust for variables that could have a disproportionate influence on revenue in restaurants and pubs compared with revenue in other sectors. For instance, above average temperatures could lead to changes in the consumption pattern and this should to be taken into account before assessing the impact of the ban. For this reason, our model is an extended version of ARIMA in which temperature is allowed as an independent variable in addition to past values of the time series itself. This is an important variable since the summer in which the ban was introduced was colder than normal. Failing to

correct for temperature would mean that the dummy for the ban might include the impact of the cold weather.

We use seasonal differencing to correct for the temporal pattern in restaurant and pub revenues. This implies that we are comparing changes for the same time period in different years. To test the robustness of the results, we also report the results of some alternative specifications. This includes tests without temperature, using different specifications as well as focusing on the revenues directly as opposed to the ratio of revenue to personal consumption. The statistical analysis was performed using Stata v. 10.

Data

The data on revenue from pubs and restaurants and private consumption were obtained from Statistics Norway, which calculates the revenues based on information from the tax authorities which, in turn, receive value added tax (VAT) reports from the hospitality units. Practically all restaurants and pubs are required to report VAT information. For the restaurants, the data consisted of bi-monthly observations beginning in January 1999 and ending in August 2007. The data on revenue in pubs ended on the same date, but began in 2002, as this was the first year for which pub revenue was singled out in the national accounts. The standard consumer price index was applied to adjust revenue and private consumption for changes in the price level.

Information on the average bi-monthly temperature in Oslo was collected from the Norwegian Meteorological Institute. The weather in Oslo is an indicator for the weather of the most densely populated areas of Norway, where most hospitality venues are situated.

As mentioned, the ban on smoking in pubs and restaurants was introduced on the 1st of June 2004, and the dummy variable for the ban was assigned a value of 1 for the post-ban period. Since the smoke-free regime was implemented in the middle of a bi-monthly period, May-June 2004 was assigned a value of 0.5.

RESULTS

The time series of restaurant revenue did not show a large dip after the ban in 2004, but there was a small decrease in restaurant revenue when measured as a percentage of personal consumption (see Figure 1). Real restaurant revenues in 2005 was 2.5% higher than in 2003 while as a percentage of personal consumption it went down from 1.65% to 1.57%. The same pattern was true for revenue in pubs and pubs. In 2005, the year after the ban, pub revenue was 1.2% higher than the year before the ban (2003). Although revenue increased, it did not

increase as much as personal consumption in general, so as a share of consumption pub revenue went down from 0.077% to 0.071%

Figure 1 also reveals that there is a strong seasonal trend in restaurant revenue and that seasonal differencing eliminated the temporal pattern. The autocorrelation diagram of the seasonally differenced data was wave shaped, while the partial autocorrelation showed a significant spike at the first lag. This suggested that a seasonally differenced ARIMA model with one seasonal and two autoregressive terms was a good starting point for testing the effects of the ban (13). Further testing using the Akaike's Information Criterion also indicated that including a seasonally autoregressive term improved the fit. The residuals in this model -- ARIMA (2, 0, 0) $(1, 1, 0)_6$ - showed no remaining significant autocorrelation with a Ljung Box Q(12) statistics of 9.2 (p=0.69). Using this trend structure the analysis reported a statistically insignificant effect of the ban (see Table 1). To interpret the coefficients, it is helpful to recall that the dependent variable is not restaurant revenue directly, but the change in restaurant revenue as measured by its share of personal consumption. Since this is a small number in itself, and the change from time period to time period is even smaller, one would expect the coefficient to be quite small.

Figure 1 Restaurant revenue in Norway, 1999-2007 (overall, as a share of personal consumption and seasonally differenced)

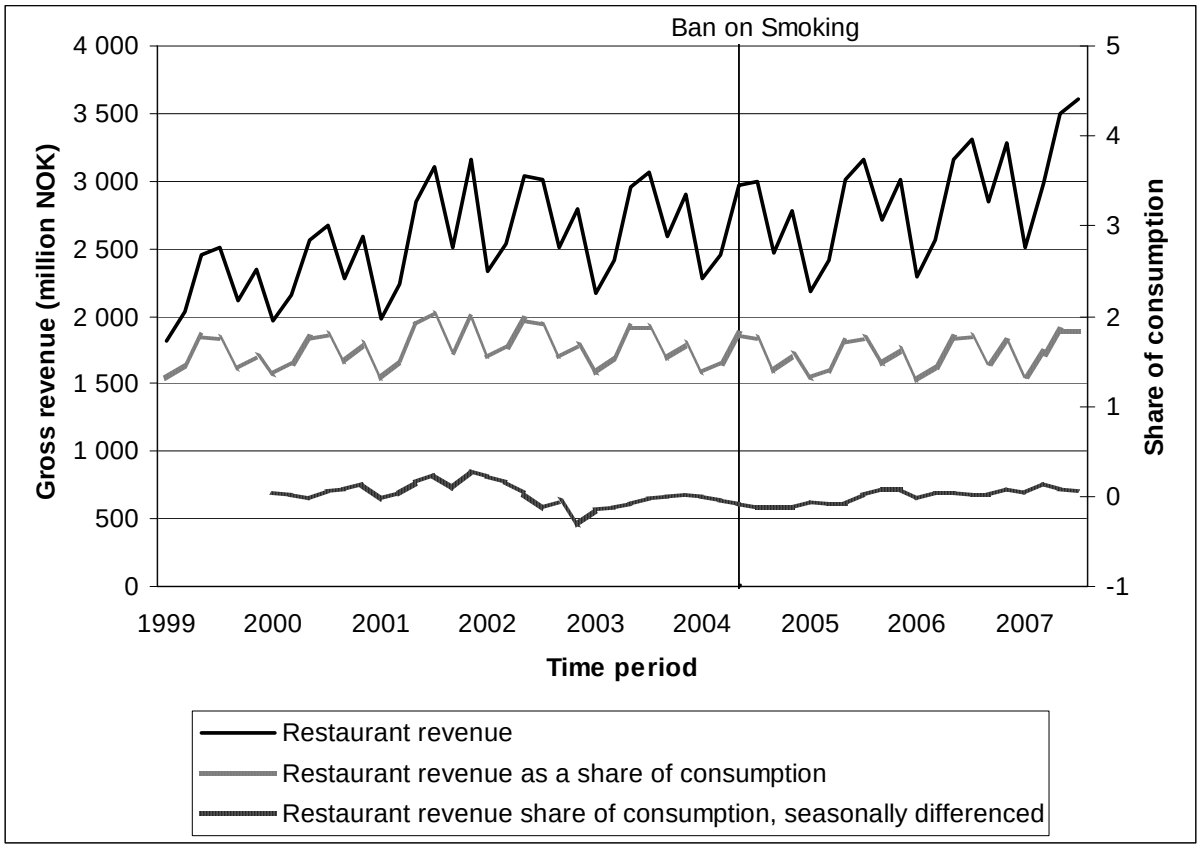


Table 1 Results of ARIMA analysis of the effects of ban on smoking on ratio of restaurant revenue to overall personal consumption

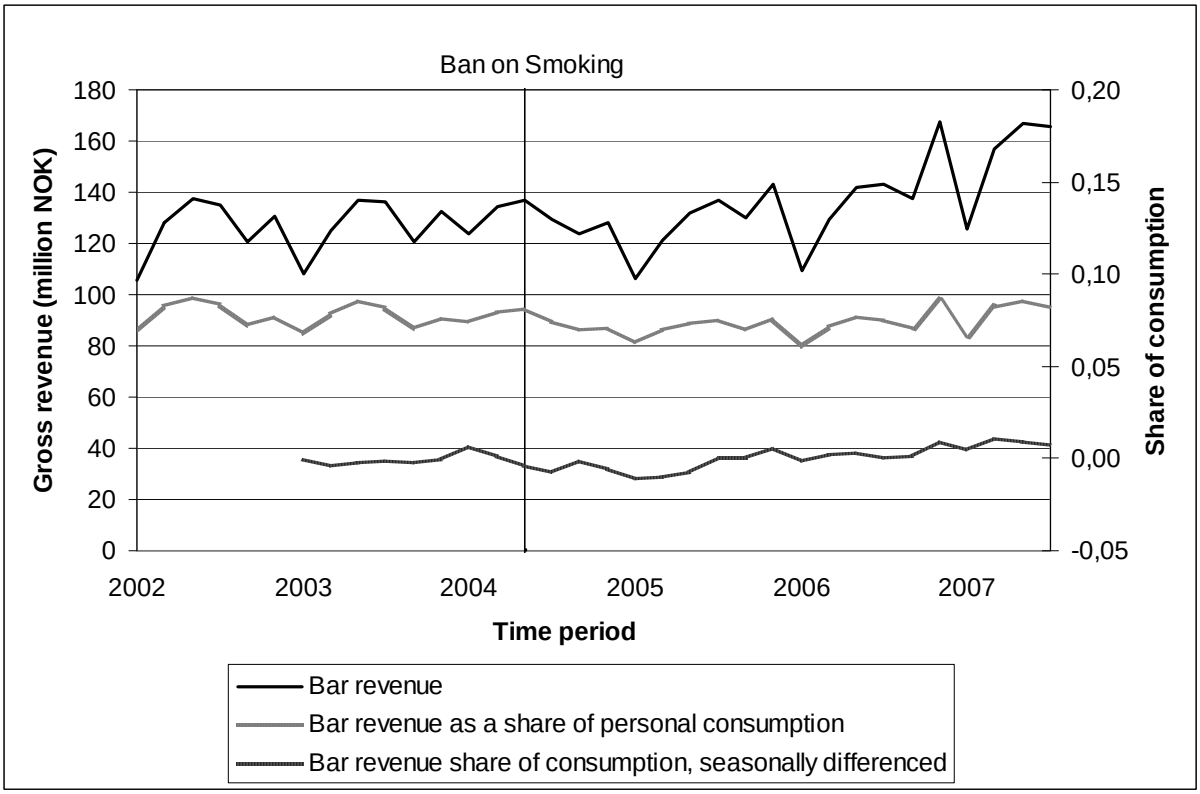
Variable	*Coefficient*	*95% CI*
Ban on smoking	-0.062	(-0.401 to 0.278)
Temperature	0.011	(-0.001 to 0.022)
Constant	0.019	(-0.079 to 0.117)
Autoregressive terms		
Lag1	0.431	(-0.117 to 0.979)
Lag2	0.380	(0.112 to 0.648)
Seasonally autoregressive term		
Lag1	-0.379	(-0.703 to -0.054)

The ratios of revenue in pubs to overall personal consumption also had a seasonal component, but with a different autocorrelation and partial autocorrelation structure compared with restaurant revenue (see Figure 2). The average autocorrelation decayed exponentially and the partial autocorrelation had a spike at lag 1. This indicated that a seasonally differenced ARIMA model with one autoregressive parameter would be a good fit. The diagnostic tests confirmed that this model - ARIMA $(1,0,0)\ (0,1,0)_6$ – passed the standard tests. The Q(12) number was 10.73 (p=0.55) which implies that no additional lags were needed to remove the time trend between the observations. In this model, the dummy for the ban on smoking was negative and statistically significant at the 1% level (see Table 2).

Table 2 Results of ARIMA analysis of the effects of ban on smoking on ratio of pub revenue to overall personal consumption

Variable	*Coefficient*	*95% CI*
Ban on smoking	-0.0089	(- 0.0137 to -0.0042)
Temperature	0.0006	(-0.00003 to 0.0013)
Constant	0.0013	(-0.0016 to 0.0041)
Autoregressive term		
Lag1	0.2545	(-0.3070 to 0.8160)

Figure 2 Bar revenue in Norway, 1999-2007 (overall, as a share of personal consumption and seasonally differenced)



Further tests were carried out to examine the robustness of these results. The constant was removed to see whether underlying trends affected the results. This did not change the statistical significance of any of the results and only moderately reduced the magnitude of the estimated effect of the ban. Next, bi-monthly dummies were added to the model to examine whether results were affected by systematic temporal patterns not captured by the seasonal model. None of these dummies were significant, and adding them had almost no effect on the coefficients and no effect on the statistical significance. The same is true when we add moving average terms or remove temperature from the model. In all of these models, the effect of the ban was negative, never statistically significant for restaurant revenue, but always statistically significant at the 5% level for pub revenue. However, when we analyse revenues alone as opposed to revenue as a share of personal consumption the main result for restaurant revenue stayed the same, with no negative effect of the ban, but this time, the results for pub revenue are changed: the ban on smoking did not have a statistically significant effect on pub revenue. Further tests on the model with pub revenue as the dependent variable also confirmed this. Adding and subtracting autoregressive and moving average terms did not change the statistical insignificance of the ban in these models.

Table 3 Results from different models

Model	*Coefficient on smoking ban dummy*	*Standard error*	*Aiken's Information Criterion (AIC)*
Restaurant revenue			
Benchmark	-0.062	0.173	-101
- removing the constant term	-0.054	0.177	-100
- adding seasonal dummies	-0.060	0.171	-92
- adding moving average term	-0.060	0.164	-99
- removing temperature	-0.085	0.233	-105
- revenue as the dependent variable	-146	183	1840
Pub revenue			
Benchmark	-0.0089*	0.0024	-216
- removing the constant term	-0.0076*	0.0023	-214
- adding seasonal dummies	-0.0090*	0.0032	-208
- adding moving average term	-0.0090*	0.0025	-214
- removing temperature	-0.0099*	0.0033	-233
- revenue as the dependent variable	-18	10	966

* Significant at the 1% level

DISCUSSION

Many previous studies have reported that banning smoking in restaurants and pubs does not have a significant negative economic impact on the hospitality industry. This study reinforces and refines this conclusion in three novel ways. First of all, most studies have not had access to data over a long time period after the ban on smoking was introduced. Some of the studies have had many observations but few have had the opportunity to examine trends for several years after the ban. This leaves the studies open to the charge that they have failed to detect effects because the number of post-ban observations was too small or because the public had not yet adjusted to the new laws. In contrast, this study has used a long time series with data for several years after the ban.

Second, the results show that there was no significant negative result on revenue in restaurants, but the result for pubs are more difficult to interpret. As a share of personal consumption revenues in pubs went down, but in absolute terms revenues increased. This was also reflected in the statistical analysis in which the ban had a statistically significant negative effect on pub revenue when measured as a percentage of personal consumption, but not on pub revenue alone. One interpretation of this pattern is that the ban had an effect in the sense that revenue did not increase as much as much as one might expect given the increase in income and consumption in the same period. This is an important distinction. To have an effect the ban does not need to reduce revenue in absolute terms since other factors changing at the same time – such as income - could increase revenue. All that is needed is that the ban

reduces the growth that the model predicts. The fact that the results changed for pubs, but not restaurants could be partially explained by the fact that Norwegian smokers have been found to patronise pubs more frequently than non-smokers, while the same variations have not been observed in their patronage of restaurants (11). One might argue that an influx of non-smokers to smoke free pubs could make up for the partial loss of smokers (14). This would certainly be true to some extent – and real pub revenues did go up after one year - but the numbers also suggest that this influx was not large enough to make pub revenues grow as a share of overall – smoker and non-smoker - personal consumption.

The distinction between pub and restaurant revenue means that the results do not contradict previous results using the same methodology. For instance Luk et al (12) showed that the ban on smoking did not have a negative effect on revenue but this was for the whole hospitality industry as a whole since "bar and licensed restaurant sales could not be analysed separately." Since annual restaurant revenues are almost 20 times larger than pub revenues in Norway, the results for the restaurants are most important for the industry as a whole. Hence our results are in agreement with Luk et al, but it extends the analysis by examining a sub-sector in which the ban may have had a statistically significant effect. As for the economic importance of this, the size of the coefficient is relatively small, but not so small as to be unimportant. The direct effect of the ban given the size of the coefficient, can be found by calculating the predicted level of pub revenue as a share of personal consumption before and after the ban. The overall share before the ban was 0.077 in 2003 and the size of the coefficient implies that this share would go down by between 5% and 18% after the ban. The actual change between 2003 and 2005 was a reduction of 8%.

Third, the results indicate that it is important to correct for other variables, such as temperature. This variable was weakly significant in both models (at the 10% level) and the coefficients in the models without temperature showed that the model without temperature exaggerated the effect of the ban. Since the ban was introduced during an unusually cold summer, one would expect below average revenues and this change should not be confused with the effects of the ban. Previous research has mainly been conducted in areas with a more temperate climate. Cold climate could affect revenue negatively in the sense that smokers would refrain from visiting pubs and restaurants as they have to step outside to smoke. However, it should be noted that most restaurants adapted to the new legislation by providing blankets, heaters and shelters for smokers (11).

Temperature is also interesting since it might capture trends in the data. Examining the issue more closely, we find that the average temperature does not exhibit a continuous trend

within the time period, but that the average temperature was different in the period before and after 2004. The temperature went from an average of 6.9 C in both 2002 and 2003 to 7.4 C and 7.6 C in 2005 and 2006. This is an interesting shift and it underlines the importance of including temperature in these kinds of analyses.

There are some limitations to the study. First, there are a limited number of observations behind the results for pub revenue. This raises the danger of over-fitting and sensitivity to model specification. However, the statistical tests did not find any such tendencies and the results were stable despite different specifications. Still, there is always the danger of finding false positives because of stochastic fluctuations in the data and given the number of studies showing no effect of the ban the reader should be aware of this possibility.

One might also argue that the result for the restaurants may be economically important even if it is not statistically significant. Statistical tests have an inbuilt asymmetry which makes it hard to establish that there really has been an effect on revenue (15). While this is true, the results show that the ban was not even close to being statistically significant for restaurant revenues.

The statistical analysis focuses on the aggregate long term effects and shifts. Although this is the main aim, it should be noted that the long term effect may be composed of effects of varying strength in the short and long terms. The data on revenues suggest that there was little if any immediate or long term negative impact on restaurant revenue since this grew more in 2005 (3.3%) than in any of the three previous years. Pub revenues are more interesting since this declined by 1% in 2005 and increased by a record 7.8% in 2006. This suggests that there was some immediate negative impact and then a readjustment towards a more natural level. It also suggests that the statistical analysis of revenue alone is correct in finding no long term effect of the ban since the short term negative change was balanced by a positive change the next year.

CONCLUSION

Our results indicate that a total ban on indoor smoking does not harm restaurant revenue directly or as a share of private consumption even in a country known for its harsh climate. Also there was no negative effect on pub revenue, but there was a negative effect on pub revenue as a share of private consumption. This has some implications for authorities in other cold-climate countries that are considering smoke-free hospitality venues. Some smaller sub-sectors might experience a decline, but the hospitality industry on the whole will not experience a statistically significant decline in revenue.

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