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The economic impact of smoke-free laws on sales in bars and restaurants in Argentina

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Summary We studied the impact of the recent smoke-free laws on the sales in bars and restaurants, in the city of Buenos Aires and in three provinces of Argentina. Using a quasi-experimental design and a difference-in-differences estimation procedure we found that the smoke-free laws did not have a statistically significant negative effect on sales in bars and restaurants in the city of Buenos Aires and in the provinces of Córdoba, Santa Fe and Tucumán. Moreover, in the case of Buenos Aires, the smoke-free legislation could have induced an increase in the sales in bars and restaurants.
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Introduction

In developed countries smoke-free or clean indoor air laws have been applied widely since the mid eighties mainly due to increasing scientific evidence that secondhand tobacco smoke is hazardous to nonsmokers' health [1]. Since these findings were well accepted by the public, as reflected in many public-opinion surveys [2], an increasing number of communities began to apply smoke-free laws. Moreover, there is a large and growing literature reporting that smoke-free laws have no negative effects, or even positive ones on revenues and employment in restaurants and bars [3] and on tourism and hotel revenues [4,5]. Despite this scientific evidence, implementation of smoke-free bar and restaurant laws always produces an initial rejection by tobacco industry-sponsored research and the owners of bars and restaurants in the cities where the laws are applied. The main allegation refers to the potential economic losses induced by a decline in sales due to the smoke-free laws. It is very common to read opinions in tobacco industry-sponsored research and in the press, such as ''the tobacco industry has claimed that smoke-free bar laws caused bar revenues to decline by 30%'' [6] even when there is no empirical evidence to back up such a claim.

The history of smoke-free legislation in developing countries is much more recent. In South America by the end of 2006 only one country, Uruguay,

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and one city and three provinces of Argentina had applied smoke-free laws [7]. Trying to pass such laws produced negative reactions by the tobacco industry and by the owners of bars and restaurants using the same arguments mentioned for developed countries. For example, the recent implementation of smoke-free laws in the city of Buenos Aires (Argentina) was vigorously opposed by the owners of bars and restaurants using the same argument about the expected economic losses when applying these laws. National newspapers reflected some of these opinions. The president of the Association of Hotels, Restaurants and Bars was quoted in the newspaper ''El Clarín'', saying that in the city of Buenos Aires, after the implementation of the smoke-free law, sales in restaurant and bars will decline around 25% [8]. Owners of bars and restaurants were quoted in the same newspaper [9] saying that sales declined fifty percent since the implementation of the smoke-free law. However, contrary to what is observed in developed countries, the empirical evidence about the economic effects of smoke-free laws is very thin. There is only one unpublished study for Uruguay, by Ramos and Curti, on the effects of smoke-free laws on taxable sales in bars and restaurants.

The main objective of this paper is to contribute to the literature by analyzing, in a scientific way, the economic effects of the smoke-free laws on taxable sales in bars and restaurants in Argentina. The implementation of smoke-free laws in this country has advanced recently at provincial and municipal levels. At the end of 2006, the city of Buenos Aires and three provinces, Córdoba, Santa Fe and Tucumán applied smoke-free laws. The first province of Argentina that implemented smoke-free legislation was Santa Fe through law 12,432 in November 2005. This law banned smoking not only in bars and restaurants but also in any building depending on the provincial government and also in public and private transportation. Next in order were the provinces of Córdoba and Tucumán. The implementation of the smoke-free legislation in Córdoba (law 9133) began in June 2006; while in Tucumán (law 7575) began in July of the same year. Finally, in the city of Buenos Aires, smoke-free legislation (law 1799) was applied in October 2006. This law allowed bars and restaurants of more than one hundred squared meters to divide the place physically into two sections (smoking and nonsmoking) but in practice almost all restaurants opted to be smoke-free.

Using a quasi-experimental design and the estimation procedure of difference-in-differences we examined whether these smoke-free laws affected sales in bars and restaurants in the city of Buenos Aires and in the provinces of Córdoba, Santa Fe and Tucumán.

Methodology

The usual way to analyze the impact of a public policy like the one we set out to study is to use the Before—After methodology. This method consists in comparing, in our case, the average real taxable sales before and after the implementation of the smoke-free law. The difference between those averages is the economic impact of the smoke-free legislation on the taxable sales in bars and restaurants. The problem with this methodology is that it implicitly assumes that the average real sales in bars and restaurants before the smoke-free legislation should be equal to the average real sales in bars and restaurants after the law, had the city decided not to apply it. In other words, before the application of the smoke-free legislation there are two potential outcomes: average real sales in bars and restaurants after the city's decision to apply the smoke-free law and average real sales after the city's decision not to apply the law. The actual effect of the smoke-free legislation is computed as the difference between those two averages. The problem is that one of those averages is not observed. That is, with legislation in place, we observe only the average real sales in bars and restaurants after the city applies the smoke-free law. The average real sales after the city's decision not to apply the law are not observed. The Before—After study estimates this unobserved average using the average real sales in bars and restaurants in the city *before* the law was applied, with the implicit assumption that the average real sales *before* the law was applied are equal to the average real sales in bars and restaurants should the city decide not to apply the law.

Of course, this is not necessarily true. For example, in the case of an economic decline, real wages fall implying that average real sales in bars and restaurants decrease over time. In this economic context it is possible that the smoke-free legislation has a null or positive effect on the average real sales in bars and restaurants but smaller in magnitude than the negative effect implied by the real wages falling. Therefore, if we use the Before—After methodology to measure the impact of the smoke-free legislation on real sales in bars and restaurants, we will obtain a negative effect. However, this is not the actual impact of the smoke-free law. If this is the case, the Before—After method will be capturing not only the effect of

the smoke-free legislation but also any other effect, such as the one due to the economic decline in the example, that induces differences between the unobserved average real sales in bars and restaurants and its estimation using the average real sales in bars and restaurants *before* the law is applied.

From this discussion it should be clear that in order to estimate correctly the effect of the smoke-free legislation we have to be able to distinguish which impact is due to the legislation and which one is not. The standard procedure is to use a quasi experimental design and the estimation procedure of difference-in-differences [10,11]. This methodology identifies the actual impact of the smoke-free law by comparing the average real sales in bars and restaurants of two groups. A treatment group that includes the city or province that applied the smoke-free law, and a control group that includes cities or provinces where the smoke-free legislation was not applied. For the procedure, denote the period before by t, and the period after the smoke-free legislation is applied in city or province j by $t + h$ ($h > 0$). First, the average real sales in bars and restaurants in city j before the smoke-free law is applied is computed and called $MRS(j,t)$. Second, the average real sales in bars and restaurants in city j in period $t + h$ is computed and called $MRS(j, t + h)$. Assuming that city A applies the smoke-free law, then the effect of the smoke-free legislation is computed as

$$\text{Impact}(j = A) = [MRS(j = A, t + h) - MRS(j = A, t)]$$
$$- [MRS(k \neq A, t + h) - MRS(k \neq A, t)],$$
$$\text{for all } k.$$

where, Impact$(j = A)$ is the effect on real sales in bars and restaurants of the smoke-free legislation in city A. The above formula eliminates any common effects on real sales in bars and restaurants of the treatment and control groups between t and $t + h$.

If the only effect on real sales in bars and restaurants between t and $t + h$ is a negative one induced by real wages falling, then the difference between $MRS(j, t + h) - MRS(j, t)$ captures this potential effect not only for the city applying the smoke-free legislation (A) but also for cities where the smoke-free law was not applied ($j \neq A$). Therefore, the above equation results in an impact equal to zero, reflecting correctly the null effect of the smoke-free legislation implementation on real sales in bars and restaurants of city A. If besides the effect on real sales in bars and restaurants due to the decline in real wages, the implementation of the smoke-free legislation in city A has a po-

sitive effect on real sales in bars and restaurants in the city, then, the first part of the equation above, $MRS(j = A, t + h) - MRS(j = A, t)$, captures this positive effect implying that Impact$(j = A) > 0$. Again, the difference-in-differences approach correctly captures the actual effect of the implementation of the smoke-free legislation on real sales in bars and restaurants in city A.

The difference-in-differences model can be specified as a two-way fixed effect linear regression model:

$$y_{jt} = \alpha I_{jt} + \beta x_{jt} + \lambda_t + \mu_j + \varepsilon_{jt} \qquad (1)$$

where y_{jt} is the outcome of interest, in this case the real sales in bars and restaurants for city j in period t; I_{jt} is an indicator variable that takes on the value one if city j applied the smoke-free legislation in period t; x_{jt} is a vector of exogenous variables, λ_t is a time effect; μ_j is a city fixed effect; and ε_{jt} is the error term. The coefficient α measures the effect of the smoke-free legislation on sales in bars and restaurants in city j. A null (positive/negative) value for α indicates that the smoke-free legislation had a null (positive/negative) effect on real sales in bars and restaurants.

To see the relationship between α and Impact $(j = A)$ defined above, the simplest case, where we have two time periods and there are no exogenous variables, $t = 1, 2$ is considered. City A applying the smoke-free law in period 2 constitutes the treatment group and the rest of the cities, not applying smoke-free laws constitute the control group (B). Assuming there are no exogenous variables, in this context, Eq. (1) above reduces to

$$y_{jt} = \beta_0 + \beta_1 dA + \beta_2 dt2 + \alpha dA \times dt2 + \varepsilon_{jt} \qquad (2)$$

where $dt2$ denotes a dummy variable for the second (post application of the smoke-free law) time period capturing aggregate factors affecting y_{jt} over time in the same way for both groups (λ_t above in the general case (1)). dA is a dummy variable adopting the value one for city A and zero otherwise. The presence of dA by itself captures potential differences between the control and treatment group before the application of the smoke-free law (μ_j above in (1)). With these definitions, $dA \times dt2$ is equal to I_{jt} in (1).

The OLS estimator of α ($\hat{\alpha}$) has the following interpretation. Let $\bar{y}_{B,1}$ be the sample average of y for the control group in time period 1 and let $\bar{y}_{B,2}$ be the sample average of y for the control group in the second period. Defining $\bar{y}_{A,1}$ and $\bar{y}_{A,2}$ similarly for city A.

Then $\hat{\alpha}$ can be expressed as

$$\hat{\alpha} = (\bar{y}_{A,2} - \bar{y}_{A,1}) - (\bar{y}_{B,2} - \bar{y}_{B,1})$$

This estimator is exactly the same estimator called Impact($j = A$) above. In most applications, additional covariates appear in (2) accounting for the potentially different characteristics within groups in the two time periods [12].

Data

We used time series data, from January 2005 to February 2007, of overall taxable sales (in argentine pesos) in bars and restaurants not only for the three provinces and the city of Buenos Aires, where the smoke-free legislation was applied, but also for nineteen other provinces where the smoke ban was not applied. The monthly sales variable was the outcome used to analyze the impact of the smoke-free legislation. Consumer price index (CPI) was used to transform the sales data in real terms and the number of monthly restaurants in the sample was used to obtain average real sales per restaurant. We used aggregate real wages series in each province/city to control for macroeconomic trends in our regressions below. The source of the taxable sales was the Federal Administration of Public Revenues (AFIP). The real wage series was obtained from the National Economic Ministry and the CPI series from the National Institute of Statistics and Census (INDEC). Using these variables we generated four panel datasets. The first one included average real taxable sales bars and restaurants and real wages for the city of Buenos Aires (treatment city) and the provinces of Buenos Aires, Catamarca, Chaco, Chubut, Corrientes, Entre Ríos, Formosa, Jujuy, La Pampa, La Rioja, Mendoza, Misiones, Neuquen, Río Negro, Salta, San Juan, San Luis, Santa Cruz and Santiago del Estero, which formed our control group. The second panel dataset included the same variables but for Córdoba (treatment province) and the nineteen provinces in the control group. The third panel dataset included the variables for Santa Fe (treatment province) and the nineteen provinces in the control group. Finally, the fourth panel dataset included the variables for Tucumán (treatment province) and the nineteen provinces in the control group. Each dataset comprised 20 communities and had 26 monthly observations (for each variable and for each community) yielding a total number of 520 observations. We estimated the model in Eq. (1) for each one of the datasets obtaining four estimations of α.

Results

Table 1 shows the estimation results for the city of Buenos Aires and the three Provinces, Córdoba,

Table 1 Economic impact of the smoke-free laws on sales in bars and restaurants

Dependent variable: real sales by restaurant	Buenos Aires		Córdoba		Santa Fe		Tucumán	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
I_{jt}	822.5634 (294.1774)***	549.8387 (327.9611)*	249.9568 (153.4233)	0.6724 (127.5441)	145.0596 (146.4611)	-145.1387 (160.4511)	379.7598 (147.9502)**	185.4113 (182.6721)
% Change	9.96	6.66					10.38	
Real wages		3.1487 (0.5479)***		3.2741 (0.5624)***		3.1811 (0.5657)***		3.1144 (0.5629)***
Fixed effects by province	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects by period	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Seasonal dummy variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average real sales by restaurant	8255	8255	4068	4068	3346	3346	3657	3657
Observations	520	520	520	520	520	520	520	520
R-squared	0.86	0.87	0.81	0.83	0.81	0.83	0.80	0.83

Notes: Robust standard errors in parentheses. Statistical significance: *significant at 10%, **significant at 5%, ***significant at 1%. Average real sales by restaurant were computed over the period before the implementation of the smoke-free laws. The % change was computed over this average.

Santa Fe and Tucumán, that applied smoke-free legislation. For each case the table shows two regression estimates. A base regression (column 1) without exogenous variables and another regression that used the real wages series to control for macroeconomic trends in the control and treatment groups (column 2). Both specifications include a full set of temporal dummy variables that captured any non observable time variable effect common to both groups along with seasonal dummy variables capturing potential seasonal effects and a full set of cross section effects capturing any time invariant non observable differences between the treatment and control groups. We computed robust standard errors to address potential heteroskedasticity and autocorrelation in the disturbances of the model. The first row of the table shows, for each panel dataset, the estimation of the parameter α that measures the impact of the smoke-free laws on real sales in bars and restaurants.
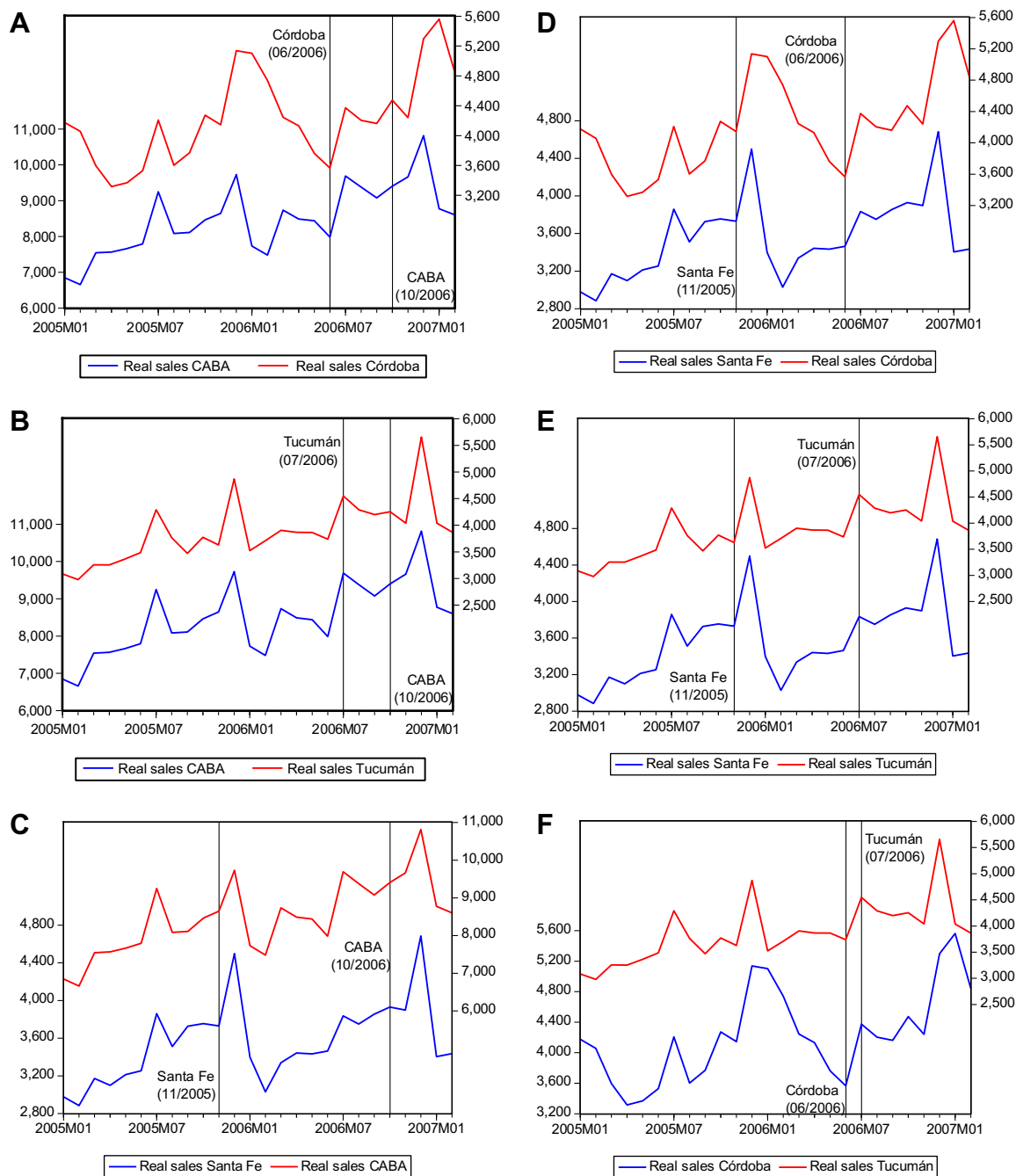

Figure 1 The effects of smoke-free laws on real sales in bars and restaurants using an interrupted time series design.

As can be seen in the case of the city of Buenos Aires, the estimation of α is positive and statistically significant in both regressions (at 1% and 10%, respectively) indicating that, contrary to the opinions pointed out in the introduction, the implementation of the smoke-free legislation has had a statistically significant positive effect on real sales in bars and restaurants of the city. This increment in real sales was on average between 6.7% and 10%.

In the case of Córdoba, even when the estimation of α is positive in both regressions it is not statistically significant implying that the smoke-free legislation had no negative effects on real sales in bars and restaurants in the province. Similar evidence was obtained for the province of Santa Fe where the estimation of α was also not statistically significant. Therefore it seems that the implementation of the smoke-free law in Santa Fe had no negative effects on real sales in bars and restaurants either.

The last two columns of Table 1 show the case of Tucumán. The estimation of the impact of the smoke-free legislation on real sales in bars and restaurants was positive and statistically significant in the base regression case but not statistically significant when we controlled for the macroeconomic trends in the province. The positive impact of the smoke-free legislation on real sales in bars and restaurants, as measured by the base regression was around 10%.

To complement these results we used an interrupted time series design [13] adding switching replications. Since our four treatment communities applied the smoke-free legislation at different times in an alternating sequence such that: when one community applied the law the others served as controls and when the control communities later applied the smoking ban, the original community then served as a continued-treatment control. In this setting if the smoke-free law had a negative effect on sales we should observe a decrease in the real sales in bars and restaurants in the treatment community, compared with the sales in the control group, after the implementation of the smoke-free law and the replication of this effect later on after the original control community implemented the smoke-free law. Moreover, if the smoke-free law had a negative effect on sales in a particular community we should have observed a decrease in the real sales in bars and restaurants in that community, compared with the sales in each one of the other (control) communities, after the implementation of the law.

The six panels in Fig. 1 show this quasi-experimental interrupted time series design. As can be seen in the figure, the application of the smoke-free law did not appear to have a negative effect on sales in bars and restaurants. This is consistent with the econometric evidence presented above.

On the other hand, it seems that the application of the smoke-free law could have had a positive effect on real sales in bars and restaurants in the city of Buenos Aires (CABA). In the month following the application of the smoke-free law there was an increase in the real sales of the bars and restaurants of the city of Buenos Aires compared with the real sales in bars and restaurants of Córdoba (Panel A), Tucumán (Panel B) and Santa Fe (Panel C). This evidence is in line with the baseline regression for the city of Buenos Aires analyzed above. In all other cases plotted in Fig. 1, the application of the smoke-free law did not appear to have a negative effect on sales in bars and restaurants neither in Córdoba nor in Santa Fe and Tucumán.

Conclusion

Contrary to allegations of the tobacco industry and the owners of bars and restaurants, that smoke-free laws had reduced their sales, the econometric evidence presented in this paper shows that these laws did not have a statistically significant negative effect on the sales in bars and restaurants in the city of Buenos Aires and the provinces of Córdoba, Santa Fe and Tucumán. Moreover, in the case of Buenos Aires, the smoke-free legislation could have induced an increase in sales in bars and restaurants. Having empirical evidence of the economic impact of the smoke-free legislation in these communities is very important not only to address the arguments of opponents to the legislation but also to provide empirical scientific evidence for those other provinces of Argentina that are engaged in passing laws to ban smoking and are facing the same allegations. Legislators and government officials of those provinces can use this empirical evidence to promote the implementation of smoke-free laws to protect the health of patrons and employees in bars and restaurants. Moreover, our finding that smoke-free laws did not have a statistically significant negative effect on the sales in bars and restaurants in the four communities of Argentina is in line with the majority of the evidence from developed countries. This result debunks another usual argument made by the opponents to smoke-free laws in less developed countries, namely that only in developed countries smoke-free laws have no economic effect.

Acknowledgements

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