Partial bans on smoking in public places fail, only a total tobacco ban works: inferring the causal impact on cigarette sales using an interrupted time series analysis

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Abstract

In January 2006 the Spanish government enacted a tobacco control law which, among other aspects, banned smoking in bars and restaurants, with exceptions depending on the floor space of the premises. This approach became known as the "Spanish Model". In January 2011, further legislation in this area was adopted, removing these exceptions. In this paper, we estimate the effect of these two bans on cigarette sales. We approach this problem using an interrupted time series analysis accounting for potential effects of autocorrelation and seasonality. The data source used was the official data on monthly legal sales of cigarettes in Spain, from January 2000 to December 2015 (excluding Canary Islands and the Autonomous cities of Ceuta and Melilla). The endogenous variable is the log-transformed monthly per-capita manufactured cigarettes plus hand rolling tobacco sales. We use the sum of both types of tobacco products because in recent years it has been observed an increase in the consumption of hand rolling tobacco, indicating a shift from manufactured cigarettes. As control variables we use the weighted average of selling tax burden on cigarettes plus hand rolling tobacco one pack and log-transformed per capita household disposable income at 2000 prices. Total Ban coefficient denote significant change in level in period immediately following intervention initiation with a significant average percent decrease in per-capita tobacco sales of 9.81% (P<0.05, CI=-19.2%; -0.4%). For the control variables, we can say that for an 1 euro increase in tax burden on cigarettes plus hand rolled one pack, we expected about 16.54% of decrease in per-capita tobacco sales (P<0.01, CI=-27.2%; -5.9%). Respect to month variable we can see a peak season in May, June, July, August, September and December related, with and expected mean percent difference in per capita tobacco sales between these months and January (reference) about 25%. In Spain the price differential has always remained above the threshold at which visitors are willing to export the maximum amount allowed under the customs legislation (2 cartons of cigarettes, 400 units maximum per person over 17 years in the case of the UK). An important proportion of cigarette sales in Spain correspond to purchases by non-residents. Finally if we change per capita household disposable income by 1%, we did expect y to change by 0.96% percent (P<0.05, CI=0.16%; 1.98%), holding the other predictor variables constant. Our results indicate that the partial ban was not effective in reducing the number of cigarette packs sold in Spain, but that the total ban contributed significantly to reducing cigarette consumption.

Keywords: Smoking ban, Policy evaluation, Cigarettes, interrupted time series analysis.

Introduction

The banning of smoking in public places is among the most effective public health measures employed in recent years to reduce tobacco consumption in developed countries [1]. Together with economic measures such as punitive taxation and persuasion-based actions derived from theories of behavioural economics, prohibition has proved to be a major instrument in the anti-smoking armoury of increasing numbers of developed countries [2]. Despite low levels of external validity, studies have shown that restrictive policies, based on prohibitions and taxation, are both effective and cost effective [3]. However, the incremental effectiveness of an absolute ban on smoking in public places, compared with a partial ban (usually applied to the workplace and with exceptions) remains unknown. It is no easy task to estimate the effectiveness of such measures because they tend to be approved as part of a broader legislative package, because the data are observational and because appropriate controls, for comparison, are not available.

Spain is an interesting case study because after five years of partial prohibition, a total ban was imposed. On 1 January 2006 a partial ban came into force, under Law 28/2005, and this was extended to become a total ban on 1 January 2011 (Law 42/2010). The Spanish regulation of 2006 was in line with proposals made by the tobacco industry, which hoped it would be extended throughout the EU, which is indicative of the expected effectiveness of partial bans. In addition to the smoking restrictions imposed, the Spanish legislation also affected cigarette pack labelling and packaging, as well as taxation/retail price.

Background to tobacco control legislation in Spain

The regulatory control of tobacco consumption in Spain takes three forms: i) bans on smoking in public places; ii) restrictions on advertising, packaging and labelling; iii) taxation.

i) Law 28/2005 is the primary law governing smoking in public places and tobacco advertising, promotion and sponsorship[4]. It came into force on 1 January 2006. The law banned smoking in all public and work places, with some exceptions in hospitality venues (no ban in premises measuring less than 100 m^2, and "smoking areas" allowed in larger ones). This law was substantially amended by Law 42/2010 (which came into force on 2 January 2011)[5], which mandated a total ban on smoking in indoor public places, indoor workplaces and public transportation.

ii) Royal Decree 1079/2002 is the primary law governing tobacco packaging and labelling. It was amended by Royal Decree 639/2010 (which came into force in April 2010), which mandated picture pack warnings. Penalty provisions for pack warnings are stipulated in the General Health Act and in the Resolution of 19 November 2001, which updated the penalties into euros. Law 28/2005 governed tobacco advertising in general, while Law 7/2010 (which came into force on 1 May 2010) specifically prohibited tobacco advertising in audio-visual forms of communication.

iii) Over the last ten years, the Spanish government has continually increased tobacco taxes. In February 2006, the government decreed a combined minimum of €55 for the sum of specific and ad valorem taxes per 1,000 cigarettes. Subsequently, this minimum was revised several times, to €70 in November 2006, €91.3 in June 2009, €116.90 in December 2010, €119.1 in July 2012) and €138 in July 2013.

The impact of legislation on tobacco consumption, according to three different sources

The best source of disaggregated data on the prevalence of tobacco consumption in Spain is the Spanish National Health Survey (SNHS), which is conducted every three years by the Ministry of Health in collaboration with the National Institute of Statistics (INE) [6]. Unfortunately, the latest data available from this source are for 2011 and are not suitable for measuring the long-term effects of the total ban because at the time of the survey the ban had been in place for only a few months. In 2014 the European Health Interview Survey (EHIS) was conducted with the participation of Spain. This survey replaces the SNHS in 2014 and is based upon small sample than previous SNHS so results comparison should be made with caution.

Successive editions of health surveys have reported a progressive reduction in cigarette consumption. Thus, in 2001, 39.1% of adult men (24.6% of women) smoked daily, see Table 1, while by 2014, this prevalence had fallen to 27.6% for men and 18.6% for women. It should be taken into account that the global prevalence is confounded by the age distribution of the population. Among younger smokers, the prevalence of daily smoking fell from 36.4% to 21.4% for men and from 36.8% to 15.5% for women. At the same time, the percentage of non-smokers among this population rose from 54.55% to 69.6% (men) and from 50.7% to 75% (women). The data presented in Table 1 suggest that the downward trend continued during the years following the 2006 ban, although the proportion of young people who had never smoked increased more quickly, at least among women.

Table 1 *Prevalence of daily smokers and never smoked, 2001-2014. Male and female, total population and those aged 16-24 years*

	Male		*Female*		*Male 16-24 years*		*Female 16-24 years*	
Year	*Daily smokers*	*Never smoked*	*Daily smokers*	*Never smoked*	*Daily smokers*	*Never smoked*	*Daily smokers*	*Never smoked*
2001	*39.1%*	*33.0%*	*24.6%*	*63.2%*	*36.4%*	*54.5%*	*36.8%*	*50.7%*
2003	*34.2%*	*37.8%*	*22.4%*	*64.9%*	*34.8%*	*57.8%*	*31.1%*	*60.4%*
2006	*31.6%*	*36.5%*	*21.5%*	*62.9%*	*25.0%*	*63.6%*	*28.9%*	*60.6%*
2009[a]	*31.2%*	*38.4%*	*21.3%*	*60.1%*	*28.9%*	*60.1%*	*23.5%*	*63.8%*
2011[b]	*27.9%*	*41.9%*	*20.2%*	*64.5%*	*22.5%*	*69.0%*	*21.0%*	*70.9%*
2014[ab]	*27.6%*	*37.4%*	*18.6%*	*60.0%*	*21.4%*	*69.6%*	*15.5%*	*75.0%*

Source: Spanish NHS.

[a] *European Health Survey*

[b] *The age interval is 15-24 years*

An alternative source of information about tobacco consumption is the Household Budget Survey 2006-2014 (HBS), which is conducted by the Spanish Institute of Statistics (INE) [7]. This publication replaced the Continuous Household Budget Survey, which had been conducted from 1997 to 2005. During this period, various methodological improvements took place, such as the change in periodicity (from quarterly to annually). According to these sources, between 2000 and 2005 average annual cigarette consumption by households decreased by 4.7%, but this figure rose slightly from 2006 to 2010 (+ 0.33% average per year). From 2011 to 2015 it fell by an average of 9.5% per year. These sources, therefore, suggest that the partial ban was ineffectual. A disadvantage of these data sources is that they underestimate consumption because they do not include the 'hidden' tobacco consumption by young people, of which their parents are unaware.

The data published by the Spanish NHS and the HBS are obtained by sampling, and so are subject to sampling errors. The third source of data is the sales of cigarettes in Spain (excluding the Canary Islands and the Autonomous cities of Ceuta and Melilla). These figures are published by the Tobacco Market Commission [8] and present several advantages: the data are monthly, more up to date and not derived from sampling, as all sales are registered, for taxation purposes. Among other shortcomings, however, they do not include the sales of smuggled tobacco, but they do include sales to non-resident visitors. In this study, we use the third data source (referring to sales) to

model and draw inferences on the net impact of the partial and total bans imposed on smoking in public places.

Methods

Interrupted time series analysis for the evaluation of population-based interventions

Interrupted time series (ITS) analysis is maybe the strongest quasi-experimental design to assess the impact of an intervention when a randomized controlled trial is not feasible [9]. In an ITS analysis a time series of a particular outcome of interest is used to establish an underlying secular trend, which is interrupted by an intervention at a known point in time. The expected trend in the absence of the intervention is compared to any change occurring in the post-intervention period, given the pre-existing trend. Ordinary least-squares (OLS) regression-based approaches are used to measure statistically the changes in level and slope in the postintervention period compared to the preintervention period. ITS analysis is increasingly being used for the evaluation of public health interventions [10].

Data

The dataset has monthly series of per-capita manufactured cigarettes and hand rolling tobacco sales (packs), from January 2000 to December 2015 (T=192) in Spain (mainland and Balearic Islands), published by the Tobacco Market Commission of Spain and Spanish Tax Agency [8]. Two interventions were sequentially considered: first in January 2006 with the implementation of the tobacco control law 28/2005 (partial smoke-free ban) and later in January 2011 with the implementation of the new tobacco control law 42/2010 (total smoke-free ban).

The endogenous variable is the log-transformed monthly per-capita manufactured cigarettes plus hand rolling tobacco sales. We use the sum of both types of tobacco products because in recent years it has been observed an increase in the consumption of hand rolling tobacco, indicating a shift from manufactured cigarettes [11]. A 30 gr of hand rolling tobacco was considered as the equivalent of one pack of 20 cigarettes. Eight variables were defined as explanatory variables,:

- *Tax-burden -> weighted average selling tax burden on cigarettes plus hand rolling tobacco one pack (Tax_burden);*
- *Month -> is a categorical variable that is code 1 for January, 2 for February, etc.;*

- *Log_hdi -> log-transformed per capita household disposable income at 2000 prices (from Spanish National Accounts compiled by the INE [12]);*

- *T -> is the linear time trend variable since the start of the study;*

- *X28/05 -> is a dummy variable representing the intervention period in January 2006 (code as 0 for pre-tobacco control law 28/2005 or 1 for post-tobacco control law 28/2005);*

- *X42/10 -> is a dummy variable representing the intervention period in January 2011 (code as 0 for pre-tobacco control law 42/2010 or 1 for post-tobacco control law 42/2010);*

- *X28/05_T and X42/10_T -> the interaction terms*

Statistical analyses

Statistical analyses of the effects of an independent variable on a time series are complicated by the dependencies that typically exist within the time series, autocorrelation. Times-series data are typically autocorrelated. The typical consequence of autocorrelations is that estimated standard errors are biased low, leading to an overestimate of the statistical significance of an observed relationship or estimated intervention effect. For this reason, time-series analytic techniques have been developed for transforming the data to remove these dependencies before analysing differences among conditions using the general linear model.

Ordinary least-squares (OLS) regression models with autoregressive error terms are one way of interrupted time series data analysis. Our model assumes the following form:

$$Y_t = \beta_0 + \beta_1 T_t + \beta_2 X_{28/05t} + \beta_3 X_{28/05t} T_t + \beta_4 X_{42/10t} + \beta_5 X_{42/10t} T_t + \beta_{6\ldots} Z_t + \epsilon_t$$

$$\epsilon_t = \rho \epsilon_{t-1} + u_t \qquad |\rho| \leq 1$$

where Y_t is the aggregated outcome variable measured at each monthly-spaced time point t, log-transformed per-capita tobacco sales (in packs), T_t is the linear time trend variable since the start of the study, $X_{28/05t}$ and $X_{42/10t}$ are dummy variables representing the two interventions points that takes value 0 during respectively pre-intervention periods and 1 throughout the post-intervention periods, $X_{28/05}T_t$ and $X_{42/10}T_t$ are interaction terms which starts in the observation period immediately following the start of the interventions and runs sequentially until the last observation, finally $\boldsymbol{Z}_t$ denote the vector of control variables: tax burden on cigarettes plus hand rolled one pack and log-transformed per capita household disposable income. The random error terms follow a first-order autoregressive AR(1) process, if had two lags would be AR(2), etc., ρ is

the autocorrelation parameter, and u_t is the idiosyncratic part of the errors that are independent with a normal distribution and constant variance.

We implement two different estimation procedures. The first estimates the coefficients by OLS with Newey-West variance estimator [13], that produces consistent standard errors when there is autocorrelation in addition to possible heteroskedasticity. The second procedure, Prais-Winsten [14], uses the generalized least-square method to estimate the coefficients in model which the errors are assumed to follow a AR(1) process. We estimated the models in Stata version 13.1 via ordinary least-squares regression [15].

Results

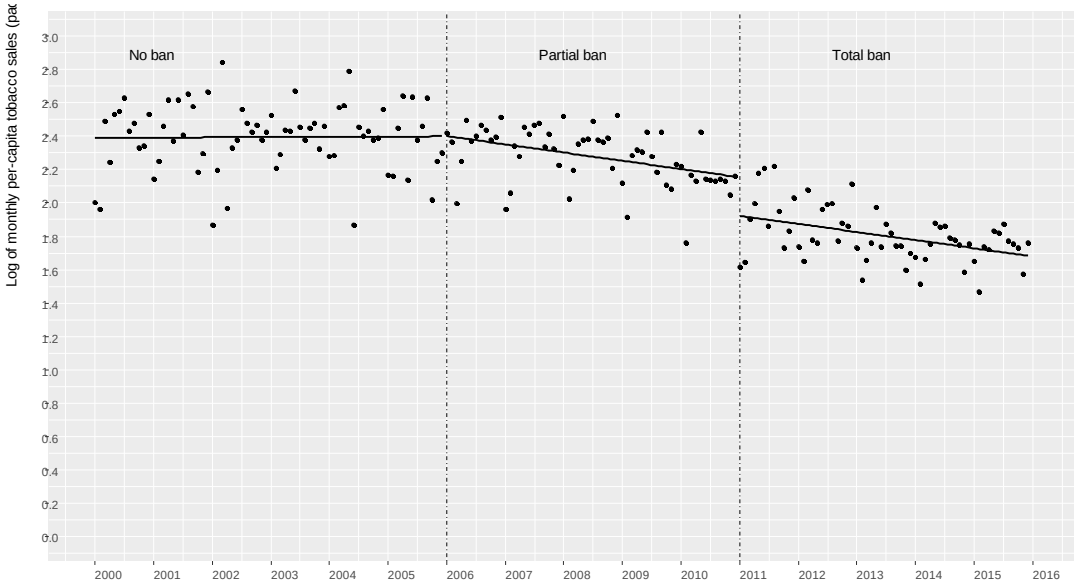
Table 2 shows the estimates of our first ITS model, without control variables only two interventions (28/2005 and 42/2010), using Newey-West standard errors with 1 lag. Figure 1 plot the results.

Table 2. Interrupted time series regression analysis of log-transformed monthly per-capita manufactured cigarettes plus hand rolling tobacco sales, Spain, January 2000 to December 2015: Regression with Newey-West standard errors – lag(1). Model withou control variables.

	Coeficient	*Newey-West Std. Err.*	*[95% Conf. Interval (CI)]*
T	*0.00013*	*0.00124*	*-0.002; 0.003*
X28/05	*0.00100*	*0.06421*	*-0.126; 0.128*
X28/05_T	*-0.00424**	*0.00172*	*-0.008; -0.001*
X42/10	*-0.23139***	*0.06689*	*-0.363; -0.099*
X42/10_T	*0.00007*	*0.00186*	*-0.003; 0.004*
Intercept	*2.39062***	*0.05489*	*2.282; 2.499*
Nº observation = 192			
F (5,186)=106.94		*Prob>F= 0.0000*	

**Statistical significance at 5% level, ** at 1% level*

Figure 1. Observed and extrapolated mean per-capita manufactured cigarettes plus hand rolling tobacco sales. Regression with Newey-West standard errors – lag(1)



As shown, X42/10 coefficient denote significant change in level in period immediately following intervention initiation. In the first month of intervention (tobacco law 42/2010) there appeared to be a significant percent decrease in per-capita tobacco (cigarettes plus hand rolled) sales of 23.14% (P<0.01, CI=-36.3%; -9.9%).

Table 3 presents the estimation results from model with control variables. Only X42/10 coefficient denote significant change in level in period immediately following intervention initiation with a significant average percent decrease in per-capita tobacco (cigarettes plus hand rolled) sales of 9.81% (P<0.05, CI=-19.2%; -0.4%). For the control variables, we can say that for an 1 euro increase in tax burden on cigarettes plus hand rolled one pack, we expected about 16.54% of decrease in per-capita tobacco sales (P<0.01, CI=-27.2%; -5.9%); finally respect to month variable we can see a peak season in May, June, July, August, September and December, with and expected mean percent difference in per capita tobacco sales between these months and January (reference) about 25%, holding the other predictor variables constant.

Table 3. Interrupted time series regression analysis of log-transformed monthly per-capita manufactured cigarettes plus hand rolling tobacco sales, Spain, January 2000 to December 2015: Regression with Newey-West standard errors – lag(1). Model with control variables.

	Coeficient	*Newey-West Std. Err.*	*[95% Conf. Interval (CI)]*
T	*-0.0043**	*0.0026*	*-0.0094; 0.0007*
X28/05	*0.1511**	*0.0818*	*-0.0103; 0.3125*
X28/05_T	*0.0008*	*0.0023*	*-0.0037; 0.0054*
X42/10	*-0.0981***	*0.0475*	*-0.1919; -0.0043*
X42/10_T	*0.0015*	*0.0017*	*-0.0018; 0.0048*
January (ref.)			
February	*-0.0871*	*0.0579*	*-0.2013; 0.0272*
March	*0.1742***	*0.0686*	*0.0387; 0.3096*
April	*0.1597***	*0.0654*	*0.0305; 0.2888*
May	*0.2529****	*0.0647*	*0.1252; 0.3806*
June	*0.2456****	*0.0693*	*0.1089; 0.3823*
July	*0.2591****	*0.0542*	*0.1521; 0.3660*
August	*0.2575****	*0.0551*	*0.1486; 0.3663*
September	*0.2397****	*0.0544*	*0.1323; 0.3471*
October	*0.1425***	*0.0584*	*0.0273; 0.2578*
November	*0.1114***	*0.0519*	*0.0090; 0.2138*
December	*0.2698****	*0.0638*	*0.1438; 0.3958*
Tax-burden	*-0.1654****	*0.0540*	*-0.2720; -0.0589*
Log_hdi	*0.9520**	*0.5449*	*-0.1236; 2.0276*
Intercept	*-6.536***	*5.0023*	*-16.410; 3.3372*
Nº observation = 192			
F (18,173)=127.49		*Prob>F= 0.0000*	

Statistical significance at 10% level, ** at 5% level, and * at 1% level*

To ensure that we estimated a model that accounts for the correct autocorrelation structure, we use the Cumby-Huizinga (CH) test for autocorrelation [16]. The CH test indicate that autocorrelation is present at lag 1 ($P<0.001$), but at no higher lag order (up to the 6 lags tested). Thus, our model specifying should correctly account for this autocorrelation.

An alternative approach of model with control variables using Prais-Winsten AR(1) regression is show in Table 4. These results confirms a significant percent decrease in per-capita tobacco (cigarettes plus hand rolled) sales of 9.41% ($P<0.05$, CI=-18%; -0.81%).

Table 4. Interrupted time series regression analysis of log-transformed monthly per-capita manufactured cigarettes plus hand rolling tobacco sales, Spain, January 2000 to December 2015: Prais-Winsten AR(1) regression. Model with control variables.

	Coeficient	*Semirobust Std. Err.*	*[95% Conf. Interval (CI)]*
T	*-0.0049***	*0.0021*	*-0.0091; -0.0006*
X28/05	*0.1396**	*0.0819*	*-0.0219; 0.3012*
X28/05_T	*-0.0012*	*0.0020*	*-0.0027; 0.0051*
X42/10	*-0.0941***	*0.0436*	*-0.1802; -0.081*
X42/10_T	*0.0018*	*0.0014*	*-0.0010; 0.0045*
January (ref.)			
February	*-0.0876*	*0.0652*	*-0.2163; 0.0412*
March	*0.1740****	*0.0648*	*0.0462; 0.3018*
April	*0.1597***	*0.0633*	*0.0348; 0.2846*
May	*0.2532****	*0.0643*	*0.1263; 0.3801*
June	*0.2461****	*0.0658*	*0.1163; 0.3758*
July	*0.2597****	*0.0532*	*0.1547; 0.3646*
August	*0.2583****	*0.0530*	*0.1540; 0.3626*
September	*0.2407****	*0.0527*	*0.1367; 0.3447*
October	*0.1440***	*0.0559*	*0.0337; 0.2543*
November	*0.1122***	*0.0516*	*0.0104; 0.2141*
December	*0.2748****	*0.0598*	*0.1567; 0.3928*
Tax-burden	*-0.1615****	*0.0526*	*-0.2654; -0.0577*
Log_hdi	*1.0733***	*0.4611*	*0.1631; 1.9835*
Intercept	*-7.6534**	*4.2392*	*-16.021; 0.7137*
rho	*-0.1999*		

Nº observation = 192
F (18,173)=158.26 *Prob>F= 0.0000*
R-squared= 0.8695

Statistical significance at 10% level, ** at 5% level, and * at 1% level*

Discussion

The conclusion to be drawn from our results is that the partial ban imposed was not effective in reducing the number of cigarette packs sold in Spain, while the total ban on smoking in public places contributed significantly to reducing cigarette consumption. These results are not surprising, as they are in line with other sources of information, such as the SNHS and the BHS. An important advantage of our method is that it allows us to examine the short-term impact of the interventions, thanks to the monthly frequency of the data; sales data were modelled, and therefore tobacco consumption by teenagers and young adults living with their parents was included, in contrast to the

statistics reported in the BHS. Although compliance with partial bans is high in the USA, Canada, the UK and Australia [17], in Spain the partial restrictions on smoking imposed in 2006 were not universally respected. According to the Healthcare Barometer 2006 [18] around half of the population perceived that smokers were not respecting the law, which in addition had other shortcomings such as the lack of a plan for evaluation [19]. This might be one of the reasons why the partial ban had no significant effect in Spain, according to our own research and other studies [20]. A cohort study showed that the partial ban of 2006 did not protect the workers of the hospitality sector in Spain [21]. Moreover, according to another study, the tax increase in 2006 did not appear to greatly reduce the prevalence of smoking in Spain [22].

Medical literature has consistently shown that smoking bans have an impact on population health, in terms of reducing the prevalence of heart attacks [23, 24] and improving respiratory health [25-27]. A systematic review of 26 studies quantifying the effects of smoke-free workplaces on smoking by employees in developed countries concluded that "if all workplaces became smoke-free, consumption per capita in the entire population would drop by 4.5% in the United States and 7.6% in the United Kingdom" [28]. Bans seem to be particularly effective in combating smoking uptake by teenagers [29].

References

1. *World Health Organization. WHO report on the global tobacco epidemic, 2015: Raising taxes on tobacco—Executive summary. Available online: http://apps.who.int/iris/bitstream/10665/178577/1/WHO_NMH_PND_15.5_eng.pdf?ua=1&ua=1&ua=1, accessed on Jul 28, 2015.*
2. *Schaap, M. M., Kunst, A. E., Leinsalu, M., Regidor, E., Ekholm, O., Dzurova, D., Helmert, U., Klumbiene, J., Santana, P., Mackenbach, J. P. Effect of nationwide tobacco control policies on smoking cessation in high and low educated groups in 18 European countries. Tob Control 17, 248-255 (2008)*
3. *Ekpu VU, Brown AK. The Economic Impact of Smoking and of Reducing Smoking Prevalence: Review of Evidence. Tob Use Insights 14(8): 1-35 (2015)*
4. *Ley de medidas sanitarias frente al tabaquismo y reguladora de la venta, el suministro, el consumo y la publicidad de los productos del tabaco. L. Nº 28/2005 (26 de diciembre de 2005).*
5. *Ley por la que se modifica la Ley 28/2005, de 26 de diciembre, de medidas sanitarias frente al tabaquismo y reguladora de la venta, el suministro, el consumo y la publicidad de los productos del tabaco. L. Nº 42/2010 (30 de diciembre de 2010).*

6. *Instituto Nacional de Estadística (INE). Encuesta Nacional de Salud 2011-2012. Metodología. Madrid: INE, Ministerio de Sanidad, Servicios Sociales e Igualdad; 2012.*
7. *Instituto Nacional de Estadística (INE). Encuesta de presupuestos familiares 2006-2013. Base 2006. Metodología. Madrid: INE, 2014.*
8. *Comisionado para el Mercado de Tabacos. Ministerio de Hacienda y Administraciones Públicas. Madrid.*
9. *Cochrane Effective Practice and Organisation of Care Review Group. Interrupted time series analyses. 2013. Available at http://epoc.cochrane.org/sites/epoc.cochrane.org/files/uploads/21%20Interrupted%20time%20series%20analyses%202013%2008%2012.pdf. Accessed July 1, 2015.*
10. *Lopez-Bernal J., Cummins S., Gasparrini A. Interrupted time series regression for the evaluation of public health interventions: a tutorial. Int. J. Epidemiol 45(5), 1-8 (2016).*
11. *Fu M, Martínez-Sánchez JM, Cléries R, et al. Opposite trends in the consumption of manufactured and roll-your-own cigarettes in Spain (1991-2020). BMJ Open 4: e006552 (2014)*
12. *Spanish National Statistics Institute (INE). Spanish National Accounts. [online] Available from: http://www.ine.es*
13. *Newey W.K., West, K.D. A Simple, Positive Semi-definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. Econometrica 55 (3): 703-708 (1987).*
14. *Prais S.J., Winsten C.B. Trend estimators and serial correlation. Chicago: Cowles Commission; 1954. (CCDP statistics; no. 383).*
15. *Linden, A. Conducting interrupted time-series analysis for single-and multiple-group comparisons. Stata J. 15, 480–500 (2015).*
16. *Cumby R.E, Huizinga J. Testing the Autocorrelation Structure of Disturbances in Ordinary Least Squares and Instrumental Variables Regressions. Econometrica 60 (1): 185-195 (1992)*
17. *Borland R., Yong H.H., Siahpush M., Hyland A., Campbell S., Hastings G., Cummings K.M., Fong G.T.: Support for and reported compliance with smoke-free restaurants and bars by smokers in four countries: findings from the International Tobacco Control (ITC) Four Country Survey. Tob Control 15, 34-41 (2006)*
18. *Centro de Investigaciones Sociológicas (CIS). Barómetro Sanitario. Available online:http://www.msssi.gob.es/estadEstudios/estadisticas/docs/BS_2006_total_mar.pdf, accessed on Jun, 2015.*
19. *Galan I., López M.J.: Tres años con «Ley de medidas sanitarias frente al tabaquismo»: aire más limpio, pero no lo suficiente. Gac Sanit 23, 87-90 (2009)*
20. *López M.J., Nebot M., Schiaffino A., Pérez-Ríos M., Fu M., Ariza C., Muñoz G., Fernández E.: Two-year impact of the Spanish smoking law on exposure to secondhand smoke: evidence of the failure of the 'Spanish model'. Tob Control 21, 407-411 (2012)*

21. *Fernández E., Fu M., Pascual J.A., López M.J., Pérez-Ríos M., Schiaffino A., Martínez-Sánchez J.M., Ariza C., Saltó E., Nebot M.: Impact of the Spanish smoking law on exposure to second-hand smoke and respiratory health in hospitality workers: a cohort study. PLOS ONE 4, 42-44 (2009)*
22. *Sargent R.P., Shepard R.M., Glantz S.A.: Reduced incidence of admissions for myocardial infarction associated with public smoking ban: before and after study. BMJ 328, 977-980 (2004)*
23. *Cesaroni G., Forastiere F., Agabiti N., Valente P., Zuccaro P. Perucci C.A.: Effect of the Italian smoking ban on population rates of acute coronary events. Circulation 117, 1183-1188 (2008)*
24. *Menzies D., Nair A., Williamson P.A., Schembri S., Al-Khairalla M.Z., Barnes M., Fardon T.C., McFarlane L., Magee G.J., Lipworth B.J.: Respiratory symptoms, pulmonary function, and markers of inflammation among bar workers before and after a legislative ban on smoking in public places. JAMA 296, 1742-1748 (2006)*
25. *Goodman P., Agnew M., McCaffrey M., Paul G., Clancy L.: Effects of the Irish smoking ban on respiratory health of bar workers and air quality in Dublin pubs. Am J Resp Crit Care 175, 840-845 (2007)*
26. *Fichtenberg C.M., GlantzL S.A.: Effect of smoke-free workplaces on smoking behaviour: systematic review. BMJ 325, 188 (2002)*
27. *Wakefield M.A., Chaloupka F.J., Kaufman N.J., Orleans C.T., Barker D.C., Ruel E.E.: Effect of restrictions on smoking at home, at school, and in public places on teenage smoking: cross sectional study. BMJ 321, 333-337 (2000)*
28. *López-Nicolás Á., Cobacho M.B., Fernández E.: The Spanish tobacco tax loopholes and their consequences. Tob Control 22, 21-24 (2013)*