Tobacco Consumption Habits in Argentina: Causal Evidence from a New Regulation

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This version: March 2020

Abstract

Modifiable risky behaviors such as smoking tobacco are considered a major determinant of premature death in both developed and developing countries (Blecher, 2008 and Cawley and Ruhm, 2011). This paper examines the effect of non price interventions on smoking habits in the context of Argentina's 2011 national anti smoking law. I interact previous state-level legislation with the national law to identify the effect of tobacco graphic warnings and clean-indoor-air policies on smoking prevalence and average daily cigarette consumption. I find that the probability of being a current smoker decreased by 6.17 percentage points. I also explore whether alcohol and tobacco are consumed as complements or substitutes to assess the side effects of tobacco control policies. I propose a framework to disentangle the effect of place-based bans from the effect of tobacco graphic warnings. I find that TGW play an important role in explaining the increase in the proportion of never smokers. The change in the proportion of current smokers is explained by both components of the policy; roughly 40% can be attributed to place-based bans and spillover effects arising from join implementation of the policies, while the remaining effect can be attributed to tobacco graphic warnings.

Keywords: risky behaviors, tobacco control legislation, event study, developing countries

JEL codes: I12, I18, H75, D12

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I Introduction

Modifiable risky behaviors such as smoking tobacco are considered a major determinant of premature death in both developed and developing countries (Blecher, 2008 and Cawley and Ruhm, 2011). The World Health Organization (WHO) estimates that tobacco use is the leading risk factor in high-income countries, accounting for 18% of deaths.[1] In middle-income countries, tobacco use is the second most important risk factor, responsible for about 11% of deaths. Moreover, 80% of smokers worldwide live in low or middle-income countries. Preventing people from smoking and reducing their exposure to environmental tobacco smoke is a key public health priority of many governments.

Smokers have imperfect information about health risks and side effects associated with their addiction. Smith et al. (2001) estimate that heavy smokers are more optimistic about their self-assessed longevity than their smoking behavior would warrant. Moreover, smokers create a negative spillover on others' health and increase the burden on the health system. Alcaraz et al. (2016) estimate that smoking is responsible for 13.2% of deaths in Argentina with a direct cost equal to 0.75% of GDP or, equivalently, 7.5% of the 2015 federal health budget.

Anti tobacco policies tend to be related to increases in the price of cigarettes through taxation, though a broader set of regulations, including advertising bans, public-smoking bans, and restrictive sales practices, have become increasingly popular (Blecher, 2008). In this paper, I examine the effect of non price interventions on smoking habits. I do so in the context of the most ambitious anti tobacco law passed by the Argentinean federal government in 2011. This law banned smoking in public spaces, including bars and restaurants, and in public and private workplaces. It also regulates packaging design by incorporating tobacco graphic warnings (TGW) about the risks and side effects of tobacco consumption. I use individual-level data on smoking and drinking behavior to study the effect of this non price intervention on consumption habits. I use state-level data on hospitalizations by diagnosis to assess the impact of the law on health outcomes. My identification strategy relies on state-level differences in the strength of regulation on tobacco products before the national law was passed.

By 2016, at least 105 had begun requiring graphic warnings to be printed on packages.[2] Well-designed package warnings are a highly cost-effective means for increasing awareness of smoking's effects health.[3] Tobacco packages reach a one-pack-per-day smoker is potentially exposed to graphic warnings up to 20 times a day (Hammond, 2011). Measuring the effectiveness of this type of advertising, however, has relied on respondents' answers to questions about the TGW in experimental contexts. The measures considered include desire to quit, knowledge of

[1] WHO, 2009

[2] Canadian Cancer Society, 2016

[3] Guidelines to implement Article 11 (packaging and labeling) adopted under the WHO Framework Convention on Tobacco Control (FCTC)

tobacco's health risks and ability to recall the messages. Although these measures may predict future behavior, research based on actual consumption behavior is limited (Azagba and Sharaf, 2012). This paper contributes to this strand of the literature by presenting evidence from individual-level data on tobacco consumption before and after the incorporation of TGW.

A number of studies have examined the impact of smoking restrictions on cigarette demand in the United States and elsewhere (see Chaloupka and Warner (2000) and Carpenter et al. (2011) for a review of these studies). Restrictions on smoking in public places and private workplaces have been found to reduce both smoking prevalence and average daily cigarette consumption. The literature has heavily relied on sales data to estimate the impact of these policies (Abadie et al., 2010 and Yurekli and Zhang, 2000). In this paper, I provide empirical evidence on the effectiveness of smoking restrictions and their effects on health outcomes in the context of developing countries using individual-level data. I leverage the individual-level data to characterize the marginal individual affected by the policy and document the heterogeneity on chances in consumption behavior and how this translate to health outcomes.

The question of whether alcohol and tobacco are complements or substitutes is crucial for determining the side effects of tobacco control policies. If cigarettes and alcohol are substitutes, policies implemented to reduce smoking may create adverse health effects due to increases in alcohol consumption. Empirical research has addressed this issue by estimating demand systems for alcohol and tobacco and subsequently calculating cross-price effects. Tauchmann et al. (2013) using German survey data and an instrumental-variable strategy, estimate that a reduction in tobacco consumption results in a moderate reduction in alcohol consumption. Using individual-level data from the Behavioral Risk Factor Surveillance System, Decker and Schwartz (2000) suggest that higher cigarette prices tend to decrease smoking participation but increase drinking. Shrestha (2018) studies the effect of increases in cigarette prices following the Master Settlement Agreement[4] in 1998, on alcohol consumption among 18-to-24-year-olds and finds a substitution relationship between alcohol and cigarettes. This paper contributes to this strand of the literature by documenting the effects of a non price variation in the costs of smoking on abusive consumption of alcoholic beverages.

I find three key results. First, the anti tobacco regulation effectively reduced smoking; the probability of being a current smoker decreased by 6.17 percentage points in the people aged 18 to 65, relative to a prevalence of 28.25% in 2011, a sharp 22% reduction. Also, I document that the cumulative distribution of daily cigarettes smoked has shifted to the right, i.e. it is now less likely that smokers consume fewer than 15 cigarettes per day. Thus the reduced probabil-

[4]The Master Settlement Agreement (MSA) was an agreement whereby forty-six states and the four largest tobacco companies resolved these states' legal claims against these cigarette manufacturers for smoking-related expenses incurred via their Medicaid programs. The original settlement called for payment of roughly $200 billion over a twenty-five year period. (Levy and Meara, 2006) estimate that the MSA led to a roughly forty-five cent increase in cigarette price.

ity of being a current smoker is, at least partially, driven by quitters whose consumption was less than a pack per day. Second, I find that the new tobacco regulation induced a decrease in abusive consumption of beer (3 percentage points), wine (2.74 percentage points) and binge drinking (5.44 percentage points). The direction of these changes is consistent with a complementary relationship when it comes to consumption of these pairs of goods, e.g., tobacco and alcohol. Nonetheless, tobacco and spirits have a substitution relationship on consumption, pointing to an unintended negative effect of the tobacco regulation. Third, the law's effects on extensive and intensive margins are reflected in better health outcomes. The rate of hospital discharges due to diagnoses of chronic obstructive pulmonary disease (COPD) decreased in the short run; in the three years after the law was passed, the decrease was 13% relative to the 2011 level. Also, the rate of hospital discharges caused by lung cancer diagnosis decreased in the short run; by 2015, the hospitalization rate due to lung cancer diagnosis has decreased 15% relative to the 2011 level.

The implementation of the 2011 Argentina's policy features a common characteristic across countries; the government implemented two anti tobacco policies at the same time, i.e., the clean-indoor-air policy and the incorporation of TGW. Many countries implement anti tobacco policies simultaneously, e.g., in 2001, the Canadian Federal Tobacco Control Strategy proposed raising tobacco taxes, in addition to the incorporation of TGW (Health Canada, 2002).[5] However, the question of whether the joint implementation is more effective than implementing single policies remains unanswered. In this context, policy-relevant parameters are the effects of each policy as well as the effect of the bundle policy. I propose a framework to disentangle the effect of place-based bans from the effect of tobacco graphic warnings. To identify the effect of the place-based bans exclusively, I compare early adopters of place-based bans with late adopters. I find that TGW play an important role in explaining the increase in the proportion of never smokers. The change in the proportion of current smokers is explained by both components of the policy; roughly 40% can be attributed to place based bans and spillover effects arising from join implementation of the policies, while the remaining effect can be attributed to tobacco graphic warnings .

The rest of this paper is structured as follows. Section II presents background information on tobacco regulation in Argentina. Section III describes the data. Section IV presents the research design and my empirical strategy. Section V presents the main effects of the national

[5]In January 2001, Canada became the first county in the world to introduce pictorial warning messages on cigarette packs (Azagba and Sharaf, 2012). Begging in April 2001 the federal government implemented a sequence of tax hikes. The excise tax was first raised to $10.99 per carton in May 2001, and then to $12.62 by the end of 2001. In mid-2002, the federal tax was further raised to $13.86 per carton and then to $15.85 in July 2002 (Gabler and Katz, 2010). Other examples of joint implementation of policies are: Taiwan Tobacco Hazards Prevention Amendment Act in 2009 extended smoke-free areas to almost all enclosed workplaces and public places, added graphic health warnings to cigarette packages and banned tobacco advertisement, promotion, and sponsorship (for details see, Chang et al. (2010)); Spain's anti smoking law in 2011 banned smoking on hospitality venues and selected outdoor areas (for details see, Sureda et al. (2014)).

regulation on extensive and intensive margin outcomes; and how these effects vary across populations. Section VI studies the interaction between the non price variation in the cost of smoking and abusive alcohol consumption. Section VII examines effects on health outcomes highly correlated with smoking, e.g. COPD, asthma and lung cancer. Section VIII discusses the mechanisms through which the law operated. Section IX presents robustness checks and section IX concludes.

II Non price Regulation and the Argentinean National Law

Restrictions on smoking in public places and private worksites impose additional costs on smokers by forcing them outdoors to smoke, raising the time and discomfort associated with smoking. Similarly, limits on youth access to tobacco may raise the time and potential legal costs associated with smoking by minors, while new information on the health consequences of tobacco use can raise the perceived long-term costs of smoking.

Bernheim and Rangel (2004) model of addiction places a high value on policies that improve opportunities for self-regulation and identifies a central role for "cognitive" policies, including the suppression of certain environmental cues (e.g., through limitations on advertising), and the dissemination of counter cues (e.g., graphic warnings). The literature on economics of smoking has identified four direct mechanisms through which cigarette advertising and promotion could affect cigarette consumption: (1) it can entice children and young adults to experiment with smoking and to initiate regular smoking; (2) it can reduce current smokers' willingness to quit smoking; (3) it can serve as a cue or stimulus that leads to increased daily cigarette consumption; and (4) it can induce former smokers to resume their habit by reinforcing the attractions of smoking (Chaloupka and Warner, 2000).

Argentina's 2011 policy builds on the rationale of non price policies to increase the cost of smoking and reduce the exposure of smokers to cues. The national law has three main components (i) it bans smoking in public spaces, such as restaurants, bars, educational institutions, and public and private work sites (ii) it bans sales in schools, hospitals, public buildings, and transport means; and (iii) it regulates advertising of tobacco products and mandates the incorporation of TGW.

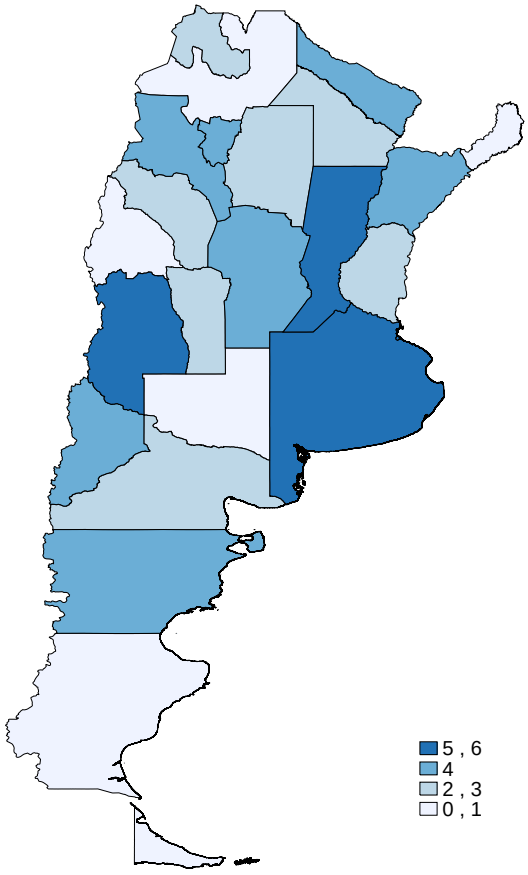
Tobacco packages expose a one-pack-per-day smoker to graphic warnings as many as to 20 times a day (Hammond, 2011). The TGW consists of short messages about smoking's health consequences and side effects displayed with a shocking picture on one side of the package (see figure A.1 in the appendix for examples). Images are designed by the National Department of Health and are updated once every year and a half in order to attenuate potential wear-out effects of graphic warnings. After the law was approved, producers had up to six months to incorporate the designs on their packages. I observe individual smoking habits approximately

a year after TGW fist began appearing in packaging.

Argentina is a federal country; as in the US, states have *some* autonomy to implement different regulations. However, states do not have control over cigarette prices, and taxation of tobacco-related products is exclusive to the national government. Though each state has the autonomy to regulate smoking and access to tobacco products. I collected state-level legislation data and constructed a legislation index following Laugesen and Meads (1991). To this end, I read and coded 49 laws for the 23 Argentinean states and the capital city. The legislation index is discrete and bounded on a scale 0 to 7 that summarizes the state of the legislation in a given year. The data construction section in the appendix A.ii provides details on the criteria and definitions I used. The index allows for a convenient summary of the regulatory apparatus, but its weakness is that unit increases do not reflect a specific change in regulation. A value of 0 indicates that a given state has only banned cigarette sales to minors. A value of 1 indicates that the state has also banned consumption in public means of transportation. A value of 2 indicates that a state has banned consumption in educational and health institutions or that a state has banned some type of advertising, e.g., event sponsorship. Each subsequent unit increase indicates a tightening in the regulation. A value of 7 is reached by all states in 2011 when the national law was passed. Figure 1 shows the regional variation on regulation using the legislation index in 2009.

I exploit this regional variation to identify the causal effect of the national policy. Once the law passed, every state experienced a tightened regulation. Put another way, the source of variation that identifies the effect of non price policies is the interaction between the state-level legislation and the national law. Before 2011, no state had legislation as strict as the new national law, which introduce TGW to Argentina. States that regulated advertising before the law, banned only sports sponsorship and advertising on radio or television at certain times of the day. In states where the previous legislation was as strong as the national law regarding consumption and sales, the main change was the introduction of TGW.

Figure 1: Legislation Index in 2009



Notes: The legislation index summarizes the strength of regulations at the state level; higher index values (darker shades) indicate stricter regulation while lighter shades indicate more lenient regulation. See Appendix A.ii for details about the construction of the legislation index.

I observe neither national nor state-level enforcement efforts directly, e.g., data on government expenditure on screening producers or collection of fines from violators; however, I observed exposure to environmental tobacco smoke. I use this data as an indirect measure of compliance with the law. Figure A.2 presents the evolution of exposure to environmental tobacco smoke at the state level for 2005, 2009, and 2013; lighter shades correspond to smaller exposure. Exposure to environmental tobacco smoke is a self-reported measure; every surveyed individual was asked if people regularly smoke around them in closed venues such as office, school, and home. Thus, the survey measures the percentage of individuals exposed to environmental tobacco smoke in any indoor environment. This percentage decreased by 13 percentage points on average between 2009 and 2013. This value includes states that had their own clean-indoor-air policy before 2011. If the sample of states is restricted to those without strict clean-indoor-air policies, [6] the reduction in the percentage of individuals exposed to en-

[6]Specifically, I consider only states with legislation index less than 3 in 2009. The reason for this threshold will become clear in the empirical strategy section.

vironment tobacco smoke equals 16 percentage points. These figures suggest compliance with the national law at the state level, with the caveat that I do not control for previous trends in exposure.

III Data

Data on consumption of tobacco and alcohol come from two nation wide surveys: the National Survey on Risk Factors (ENFR) and the National Survey on Prevalence of Consumption of Psychoactive Substances (EnPreCoSP). These surveys provide cross-sectional data with state-level coverage for 2008, 2009, 2011 , and 2013.[7] The surveys were conducted at the household level, though the questions about substance consumption were answered by a randomly selected member of the household. This individual needed to be between 18 and 65 to participate in the survey. Thus, I observe individual consumption of tobacco and alcohol and individual characteristics, e.g., age, level of education, marital status, and employment status. I do not observe income at the individual level, but I create proxy for this variable using household income quintile.[8]

I consider an individual to be a current smoker if she has ever smoked more than 100 cigarettes or if at the moment of the survey she smokes every day or some days. Individuals who have smoked a few times in their life and for whom smoking has not turned into an addiction are not considered smokers. My definition is close to the one used by Carpenter et al. (2011) with Canadian data. In particular, they defined as current smokers those individuals who reported smoking cigarettes daily or occasionally. This definition might entail a limitation on the analysis because *social smokers* might not be classified as smokers[9] and the law could potentially impact their consumption, since restaurants and bars are where these individuals are most likely to smoke.

The consumption of tobacco and alcohol are self-reported, which raises the concern of measurement error present in the independent variable. The coefficient of interest can be consistently estimated by OLS despite this problem (see, for instance, Angrist and Krueger, 1999). If the source of measurement error is under-reporting of consumption, the estimates presented in this paper can be interpreted as a lower bound for the true coefficient. Under-reporting of consumption might arise for two reasons, first some smokers deny their habit when surveyed; second, smokers might not correctly report how much they smoke. I leverage data on sales to

[7] The EnPreCoSP was conducted in 2018 but access to individual-level data was restricted until the end of 2019 and is not included in this project.

[8] During the period under study, the Argentinean economy experienced high inflation, the lack of reliability on official estimates of the Consumer Price Index (for a discussion see, Cavallo, 2013) challenges the use of nominal income, and the construction of its constant-price analog. Thus, I use household income quintiles, computed using the distribution of income, constructed each year from household employment surveys.

[9] For example, if the individual smokes in social events only and does not hit the threshold of 100 cigarettes, she is not considered a smoker.

construct an additional estimate of consumption. Table A1 presents comparisons on aggregate consumption from sales to survey data as well as percentage changes. Survey data mirrors the main trends in consumption shown in sales data, the figures are in line with under-reporting of consumption; importantly, under-reporting is stable across the years: survey data captures about 58% of consumption relative to sales data.

Data on health outcomes come from the Argentinean National Center for Health Statistics.[10] Upon a patient's visit to a hospital, the admissions area must fill a *Statistical Hospitalization Report* with the patient's basic demographic information. Once the patient is examined, the report is updated with the main diagnosis, secondary diagnosis, surgeries and other medical interventions and type of discharge (medical discharge, voluntary discharge, relocation of the patient or death). Diagnoses are classified following the International Statistical Classification of Diseases and Related Health Problems (tenth revision). *I use tabulations of discharge data at the state level by age group and gender for 81 different diagnoses. That is, using hospital discharge data combined with population data, I can assess how prevalent certain pathologies are among the population before and after the national law was passed.*

Table 1: Descriptive Statistics by Smoker Status and Year

	2008	2009	2011	2013
Panel A: Current smokers				
Percentage	30.37	29.92	28.25	27.58
Average age	37	38	38	38
Female	25.96	25.24	23.06	23.07
Male	35.31	35.12	33.59	32.34
Young (<25 years old)	31.2	29.25	26.95	27.77
Less than high school	33.22	33.19	31.92	32.42
Married or cohabitant	29.43	29.26	27.29	26.46
Single	31.15	30.01	27.7	27.82
Employed	32.63	32.07	30.26	29.74
Unemployed	39.88	33.92	36.97	34.91
Age at first smoke	17	17	17	17
Income category				
Lowest quintile	31.29	34.04	28.66	29.42
Second quintile	30.8	32.08	28.72	29.64
Third quintile	31.7	28.81	30.72	28.58
Fourth quintile	30.21	29.15	28.13	26.78
Highest quintile	30.73	28.65	24.97	22.65

(Continued)

[10] In Spanish, Direccion de Estadisticas e Informacion de Salud (DEIS). This agency is analogous to the U.S. National Center for Health Statistics.

Table 1: Descriptive Statistics by Smoker Status and Year *(continued)*

	2008	2009	2011	2013
Panel B: Never smokers				
Percentage	50.75	54.36	54.08	55.34
Average age	37	38	37	37
Female	58.31	60.12	61.29	62.51
Male	42.7	47.91	46.05	47.98
Young (<25 years old)	56.14	60.13	62.95	62.72
Less than high school	51.68	50.67	52.22	52.23
Married or cohabitant	49.05	52.65	51.53	53.51
Single	55.94	59.47	61.25	60.66
Employed	46.62	51.52	51.04	52.73
Unemployed	55.13	47.06	53.84	49.82
Income category				
Lowest quintile	51.49	55.71	52.75	55.52
Second quintile	53.25	56.01	53.42	56.39
Third quintile	49.77	54.07	56.17	53.59
Fourth quintile	48.39	54.16	53.83	53.87
Highest quintile	50.65	48.86	50.18	54.45

Notes: This table presents summary statistics of consumption of tobacco. Panel A: Current smokers are individuals who have smoked more than 100 cigarettes and currently smoke every day or some days. Panel B: Never smokers are individuals who have never smoked or have smoked fewer than 100 cigarettes. For variables other than age, each value indicates the percentage of current and never smokers for a particular subpopulation and year.

Table 1 presents descriptive statistics for the population of current smokers (panel A) and the population of never smokers (panel B). Summary statistics for alcohol consumption among smokers are presented in section VI. Summary statistics from hospital discharges tabulations are presented in section VII.

The average smoker in the sample is 37 years old and started smoking at the age of 17. Between 2008 and 2013, the proportion of smokers dropped 2.79 percentage points while the proportion of never smokers rose 4.59 percentage points. Women were less like to smoke than men: the population of female smokers is 10 percentage points smaller than the population of male smokers, a gap that is stable throughout my study period.[11] Among young people, smoking is as prevalent as in the general population. However, between 2008 and 2013 the percentage of young smokers was 3.5 percentage points greater than the national average.

In 2008, there were no sharp differences in the distribution of smokers by income category; the percentage of smokers in each quintile was around 30%. In 2013, however, the percentage of

[11]Pregnancy status is not observed from the smoking consumption surveys. Since women are recommended to stop smoking during pregnancy, one would be concerned that an increase in fertility could exacerbate the reduction in the proportion of smokers. The fertility rate for 2008 is 2.40 births per woman, and it declined to 2.34 births per woman by 2013.

smokers in the highest quintile of income distribution is 7.13 percentage points smaller than the percentage of smokers in the lowest quintile, suggesting that there was an unequal reduction in smoking across income levels. The population of never smokers decreased across income levels by about 4 percentage points. These two facts combined provide preliminary evidence that individuals in the highest-income households are better at quitting smoking than individuals in lower-income households, though both groups were equally effective in avoiding the take-up of this addiction.

IV Empirical Strategy

My identification strategy relies on state-level differences in the strength of regulations on tobacco products before the national law was passed. I interact previous state-level legislation with the national law to identify the effect of bans on advertising and the implementation of clean-indoor-air policies by the national government. Figure 1 depicts the regional variation across states in 2009 using the legislation index. This index summarizes all relevant regulations at the state level; higher values (darker shades on the map) indicate stricter regulation. No clear geographic pattern emerges on the leniency of the state laws before the national regulation.

The ideal research design would define the intensity of treatment Z as the difference between the value of the legislation index for state s, and the year 2009 denoted by L_s and the maximum value of the index $\bar{L}$ in 2011, i.e. $Z = \bar{L} - L_s$. This variable ranges from 1 to 7, where 7 indicates that the national law shifts the state of regulation from very permissive (e.g., only sales to minors were banned) to very restrictive (see section II for a detailed description of the policy put in place). The number of states and years observed is relatively small, which limits the implementation of this design. Hence, I define the treatment as a dichotomous variable, $Treat_s$, that equals 1 if the legislation index for state s is less than or equal to 3 before 2011. [12] After 2011, all states *are treated* thus $Treat_s$ equals 1 for all states s. I estimate the causal effect of the national regulation via the following regression:

$$y_i = \sum_{\tau=-2}^{1} \delta_\tau \left[\text{Treat}_s \cdot (\text{Years after treat} = \tau)\right] + \beta' X_{is} + \Gamma' X_{st} + \alpha_s + \alpha_t + \varepsilon_i \tag{1}$$

where s denotes the state where individual i is observed at period t, y_i is the outcome of interest, X_{is} is a vector of control variables that comprise individual-level characteristics, e.g., age, gender, educational attainment. X_{st} is a vector of control variables that comprise state-time varying controls: private employment and population. The variable $Years\ after\ treat = \tau$ is equal to the difference between the calendar year and the year in which the national law

[12] I present estimates of the main results defining $Treat_s = 1$ if the legislation index is strictly less than 3 in the robustness checks section (see section IX) .

was passed. States fixed effects (α_s) control for variation in outcomes across states that is constant over time. Time fixed effects (α_t) control for variation in outcomes over time that is common across all states. The variable ε_i is an individual error term. Standard errors are block-bootstrapped at the state-level with 200 replications.[13]

Each δ_τ coefficient captures the effect of the national law τ years after the implementation. The omitted coefficient is $\delta_{\tau=0}$, which corresponds to the year of the treatment. The outcome of interest corresponds to the probability of never smokers and the probability of current smokers for measures of extensive margin; the probability of smoking a given number of cigarettes in the last month conditional on being a smoker as a measure of intensive margin, and abusive-alcohol consumption. Equation 1 is estimated using OLS. Thus, the coefficients are the percentage-point change in the relevant outcome.

The source of variation used to identify the causal effect of non price policies is the interaction between the state-level legislation and the national law. Hence, estimates are to be interpreted as the causal effect of the change in regulation, where regulation represents a bundle of non price policies implemented simultaneously. These effects are estimates of the existence of a national regulation but not on the enforcement of such law. That is, I observe neither national nor state-level enforcement efforts directly. Differential enforcement efforts can constitute a threat to identification if states more concerned about the harmful effects of smoking devote more resources to law enforcement and this additional effort differs across comparison and treated states. In particular, if all states with legislation index greater than 3, the comparison states, devote more effort than more lenient states, the treated states, the estimates would represent a lower bound for the effect of the national policy. If the direction of the selection is the opposite, i.e. if more lenient states devote more resources to law enforcement, the estimates would represent an upper bound for the effect of the national policy. In the context of the tobacco regulation considered in this paper, the most likely type of selection is the first one. Thus, if states exert different levels of effort, the estimates presented in this paper constitute a lower bound of the parameter of interest. In section VIII I show that under the parallel trends assumption and homogeneous and additive treatment effect, I can disentangle the effect of place-based bans from the effect of tobacco graphic warnings.

IV.i Balance Test on Observable Characteristics

The identifying assumption is that comparison states were on the same trend as treated states; that is, in absence of the national legislation, those states where the legislation index is

[13] Using cluster-robust standard errors permit both error heteroskedasticity and flexible error correlation within clusters. With a small number of clusters the cluster-robust standard errors are downward biased (Cameron et al., 2008), block-bootstrap procedures yield more accurate cluster-robust inference when there are few clusters. Block-bootstrap standard-errors estimates maintain the autocorrelation structure within groups, states in this specific application, by keeping observations that belong to the same group together in a"block," as it samples groups instead of observations.

greater than 3 would have been on the same trend as more lenient states. I provide evidence to support this claim next. First, I test whether individuals in treated and comparison states were statistically indistinguishable in terms of their observed characteristics in 2008 and 2009.[14] Second, I present evidence to support the assumption of parallel trends in the consumption of tobacco between comparison and treated states. Testing this assumption amounts to a test of whether $\delta_{\tau=-2}$ and $\delta_{\tau=-1}$ are statistically indistinguishable from zero. These estimates are presented in Tables 3 and 4.

Balancing test results are presented in Table 2. The estimated differences indicate that individuals are statistically indistinguishable in terms of gender, age, marital status, employment status, and educational attainment. I find evidence that on average individuals in comparison sates are poorer than individuals in treated states. The proportion of households in the second quintile is bigger in comparison states, while the proportion of households in the third and fourth quintiles is smaller in comparison states. To account for this difference in observable characteristics, I include controls for household income in every specification, as well as the other individual characteristics presented in Table 2.

[14] I present pooled results only. Conclusions on balance on observable characteristics do not change when the analysis is done by year.

Table 2: Pre Policy Balance on Individual Characteristics

	Control	Treatment	Difference
Average age	37.74	37.70	0.05
	(13.49)	(13.32)	(0.46)
Male	0.49	0.49	0.01
	(0.50)	(0.50)	(0.02)
Young (< 25 years old)	0.24	0.23	0.00
	(0.43)	(0.42)	(0.01)
Married or cohabitant	0.57	0.59	-0.02
	(0.49)	(0.49)	(0.01)
Employed	0.70	0.70	0.00
	(0.46)	(0.46)	(0.01)
Educational level			
Elementary school drop-out	0.08	0.08	0.00
	(0.26)	(0.26)	(0.01)
Elementary school	0.20	0.20	0.00
	(0.39)	(0.39)	(0.01)
High school drop-out	0.19	0.20	-0.01
	(0.39)	(0.40)	(0.01)
High school	0.23	0.24	-0.01
	(0.42)	(0.43)	(0.01)
College drop-out	0.14	0.13	0.01
	(0.34)	(0.34)	(0.01)
College	0.15	0.14	0.01
	(0.35)	(0.34)	(0.01)
Income category			
Lowest quintile	0.13	0.14	-0.01
	(0.32)	(0.32)	(0.01)
Second quintile	0.35	0.24	0.11***
	(0.47)	(0.42)	(0.01)
Third quintile	0.20	0.23	-0.03***
	(0.40)	(0.42)	(0.01)
Fourth quintile	0.18	0.26	-0.08***
	(0.38)	(0.43)	(0.02)
Highest quintile	0.14	0.14	0.00
	(0.32)	(0.31)	(0.01)
Observations	23,830	36,619	60,449
Number of states	11	13	24

Notes: This table presents the mean and standard deviation of individual characteristics for comparison and treated states in columns 1 and 2. Column 3 presents estimated coefficients and standard errors from an OLS regression of the mean difference. Estimates use pooled data from national surveys on tobacco use for 2008 and 2009. The lowest quintile corresponds to the lowest 20% of households in the income distribution. Analogously, the highest quintile corresponds to the highest 20% of households in the income distribution. *** $p<0.01$, ** $p<0.05$, * $p<0.10$

V Effects of the 2011 National Law

In this section, I examine the effects of the bans on consumption and the regulation of advertising Argentinean Federal government in 2011 on (i) extensive margin outcomes, (ii) intensive margin outcomes, and (iii) heterogeneous effects.

V.i Extensive Margin Outcomes

A reduction in the number of current smokers can be explained by an increase in the number of former smokers or a decrease in the number of new consumers. To explore these two channels; in Table 3, I present results on the probability of being a never smoker and the probability of being a current smoker. The estimates suggest that the national law was effective in reducing smoke initiation and in helping people to stop smoking. The comparison and treated states were on similar trends regarding cigarette consumption before the national law was passed. The estimates for $\delta_{\tau=-2}$ and $\delta_{\tau=-1}$ correspond to the coefficients for 2008 and 2009, respectively and these estimates are not statistically distinguishable from zero.

The probability of being a never smoker increased by 4.34 percentage points, relative to the average of 46.08% in 2011, a roughly 10% increase in this outcome. This effect is driven by individuals who were on the margin between smoking and not smoking and decided not to smoke. The probability of being a current smoker decreased by 6.17 percentage points, relative to the average of 28.25% in 2011, a sharp 22% reduction. This effect is driven by former smokers and potential smokers who have not taken up smoking. Thus, the estimated effect is a weighted average of the treatment effect for these two groups, where the weights are a function of the proportion of each group in the population. [15]

[15] To compute these weights, I need data about the number of quitters. I observe a measure of intention to quit, but its use entails two main challenges: (i) intention to quit might be an expression of purpose but not an actual behavior of individuals and (ii) many smokers report that they have tried to quit at least once. For example, in 2009, 82% of current smokers reported that they have tried to quit smoking at least once in their lives. Hence, intention to quit is a noisy measure of quitters and does not provide a useful variation to identify the share of quitters in the population.

Table 3: Effects on Extensive Margin Outcomes

Probability of	Never smokers (1)	Current smokers (2)
2008	-0.0054	-0.0056
	[0.0147]	[0.0104]
2009	-0.0155	-0.0076
	[0.0162]	[0.0087]
2013	0.0434	-0.0617
	[0.0175]**	[0.0103]***
Mean dep. var. in 2011	0.4608	0.2825
Observations	153,093	153,093
R-squared	0.0329	0.0259
Correctly predicted	0.5536	0.6881
Individual controls	Yes	Yes
State $\times$ time controls	Yes	Yes
State FE	Yes	Yes
Time FE	Yes	Yes

Notes: The omitted category corresponds to 2011, the year the federal law was passed. Treatment is a dichotomous variable, $Treat_s$, that equals one if the legislation index for state s in moment t is less than or equal to 3 before 2011. After 2011, all states *are treated* thus $Treat_s$ equals one for all states s after 2011 Individual controls include age, gender, educational attainment, employment status and income category of the household. State $\times$ time controls include total private employment and total population. Standard errors in squared brackets are block-bootstrapped at the state-level with 200 replications. *** p<0.01, ** p<0.05, * p<0.10

V.ii Intensive Margin Outcomes

In this section, I study whether the policy affects the intensive margin of cigarette consumption, i.e., I ask whether there is a reduction in the number of daily cigarettes smoked in the last month. I use data on self-reported smoking intensity in the last month. A challenge I faced in this exercise is that smokers tend to report factors of five when asked about their daily consumption. One reason for this rounding is that cigarettes are sold in boxes of 10 or 20 as single-unit sales are illegal. To overcome this limitation, I discretize the number of cigarettes, i.e., I generate bins (b) of consumption in five-unit increments up to 20, and 10-units increments for higher quantities,[16] e.g. b_1 is a dummy variable such that $b_1 = 1\, if\ number\ of\ cigarettes\ smoked\ \in (0,5]$.

As the new legislation increases awareness of the side effects of smoking, smokers might (i)

[16]The intervals are open to the left: (0,5] (5, 10] (10, 15] (15, 20] (20, 30] (30,40] and (40,50]. In table 4; I present the proportion of smokers for each bin in 2011. I did not include smokers who report smoking more than 50 cigarettes a day, they represent the 3% of the sample in 2011. Note that the shares of smokers in each bin add up and that the coefficients for each year add up to zero since they represent the changes in accumulated mass in the distribution of smoked cigarettes.

no change their behavior, (ii) reduce their consumption without quitting smoking, (iii) effectively quit smoking [17] or (iv) increase their consumption. Thus, two opposite effects are taking place at the intensive margin; I consider two extreme scenarios to illustrate this. First, assume that the intervention is effective and it induces smokers to reduce their consumption but not quit smoking, i.e. the effect operates entirely through channel (ii). The cumulative distribution of smoked cigarettes would then shift to the left; since the proportion of individuals in the "low" bins would increase.

Second, assume that some smokers quit smoking and some of them do not change their behavior, i.e. the effect operates entirely through channel (iii). The change in the cumulative distribution of smoked cigarettes would thus depend on the composition of the group of quitters. If quitters come from the group of smokers with relatively low consumption, the cumulative distribution of smoked cigarettes would shift to the right, as the proportion of individuals in the "low" bins would decrease.

Which direction dominates in the intensive margin is an empirical question that I address next. To study how the law shifted the distribution of cigarettes smoked, I estimate equation (1) using as the dependent variable an indicator for daily number of cigarettes in bin b. The estimated coefficients are the percentage change in the probability of observing average daily consumption in bin b.

I find evidence that the distribution of daily cigarettes smoked shifts to the right, i.e. it is more likely that smokers consume more than 15 cigarettes per day and less likely that they consume fewer than 15 cigarettes per day. The proportion of smokers who consume between zero and five cigarettes per day decreases by 16 percentage points. This result suggests that the pool of smokers is more negatively selected. Hence, the reduction in the probability of being a current smoker is partially driven by quitters whose consumption was less than five cigarettes per day. [18]

[17] Some smokers might attempt to quit but fail; I can not speak to this mechanism from the survey data used in this paper.

[18] About 93% of the consumers have consumption in the first 4 bins, i.e. up to a pack per day. Thus, capturing effects for bins above 20 cigarettes requires a bigger sample or sizable effects to avoid power-related limitations.

Table 4: Effects on Intensive Margin Outcomes

Cigarettes smoked	(0,5] (1)	(5, 10] (2)	(10, 15] (3)	(15, 20] (4)	(20, 30] (5)	(30 , 40] (6)	(40 , 50] (7)
2008	-0.0201	0.0225	-0.0006	0.0003	0.0015	-0.0042	0.0006
	[0.0293]	[0.0161]	[0.0085]	[0.0143]	[0.0077]	[0.0064]	[0.0009]
2009	-0.0052	0.0603	0.0008	-0.0379	-0.0097	-0.0101	0.0018
	[0.0276]	[0.0227]	[0.0092]	[0.0201]*	[0.0047]*	[0.0052]*	[0.0018]
2013	-0.1652	0.0584	0.0102	0.0786	0.0216	-0.0035	-0.0001
	[0.0295]***	[0.0141]*	[0.0087]*	[0.0150]***	[0.0050]	[0.0035]*	[0.0009]
Mean dep. var. in 2011	0.3500	0.2708	0.0966	0.2143	0.0385	0.0272	0.0024
Observations	40,651	40,651	40,651	40,651	40,651	40,651	40,651
R-squared	0.0716	0.0108	0.0071	0.0324	0.0138	0.0181	0.0017
Correctly predicted	0.6242	0.6949	0.8627	0.7526	0.9077	0.9181	0.9398
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State × time controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The omitted category corresponds to 2011, the year the federal law was passed. Treatment as a dichotomous variable, $Treat_s$, that equals one if the legislation index for state s in moment t is less than or equal to 3 before 2011. After 2011, all states *are treated* thus $Treat_s$ equals one for all states s after 2011 Individual controls include age, gender, educational attainment, employment status and income category of the household. State × time controls include total private employment and total population. Standard errors in squared brackets are block-bootstrapped at the state-level with 200 replications. *** p<0.01, ** p<0.05, * p<0.10

V.iii Heterogeneous Effects

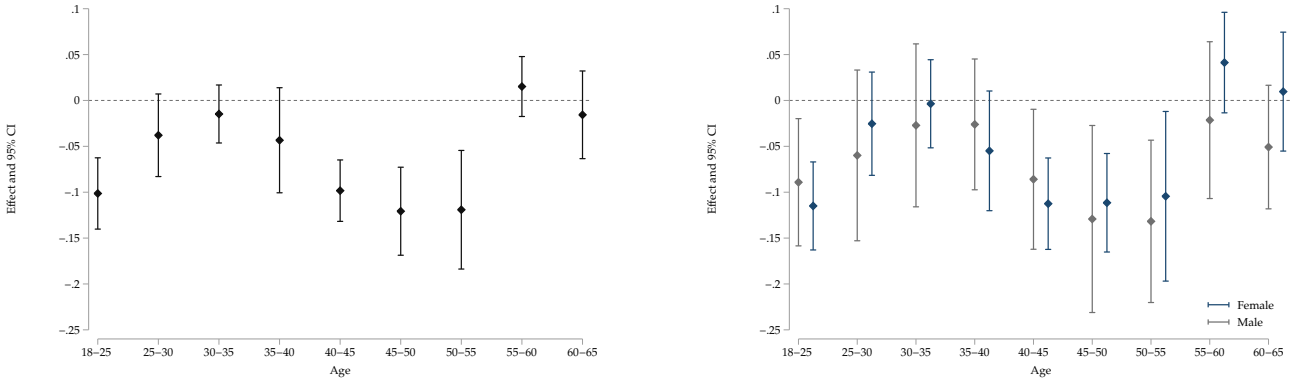
Do the effects of stricter restrictions on tobacco consumption vary across populations? I address this question by analyzing the effects of the 2011 law on the probability of being a current smoker across populations. I estimate equation (1) restricting the sample by age group, gender, educational attainment, and household income. Figures 2 and 3 plot the estimates of the causal effect of the national law, i.e., the estimates for $\delta_{\tau=1}$ in equation (1) and the corresponding symmetric percentile-t confidence intervals. [19] Tables A2, A3, A4, and A5 complement these figures and present estimates of the remaining coefficients included in equation (1).

The estimated effects on the probability of being a current smoker by age show an inverted-U shape pattern for ages 18 to 55 (panel (a), figure 2). I estimate the effects by age groups, the

[19] Symmetric percentile-t confidence interval are construct as follows: define $\hat{\delta}_\tau$ as the point estimate of the parameter δ_τ, obtained employing OLS on equation (1), define $\hat{\delta}_\tau^{(b)}$ as the estimate of δ_τ from the bootstrap sample b. Then, the estimated confidence interval with confidence level α is: $\widehat{CI}_{boot} = [\hat{\delta}_\tau - \text{sd}(\hat{\delta}_\tau^{(b)}) \times q^*(1-\alpha/2), \hat{\delta}_\tau + \text{sd}(\hat{\delta}_\tau^{(b)}) \times q^*(1-\alpha/2)]$, where $q^*(1-\alpha/2)$ is estimated from a bootstrap simulation by sorting the bootstrap t-statistics and taking the $(1-\alpha)$ percentile. Symmetric percentile-t confidence intervals have the advantage of being centered in the point estimate of the coefficient of interest, whereas the confidence interval $\hat{CI}_E = [q^*(\alpha/2), q^*(1-\alpha/2)]$ proposed by Efron (1979) and widely used in the empirical practice, works poorly when the sample distribution of $\hat{\delta}_\tau$ is not symmetric about δ_τ (Hansen, 2018).

youngest group observed comprises individuals aged 18 to 25; each subsequent group is defined by a five-year increment, and intervals are closed to the left. Effects are statistically different from zero for individuals aged 18 to 25, and for individuals aged 35 to 55. This inverted-U shape is consistent with an increase in "never takers" among the youngest adults accompanied by an increase in former smokers among adults aged 40 to 55. In 2013, the percentage of never smokers aged 18 to 25 was 66.54%, whereas this figure for adults aged 50 to 55 was 46.89%, a 20-point difference. At the same time, the percentage of current smokers was comparable among these two age groups, 26.66% , and 28.81% respectively. Thus, the group of younger non smokers had a higher share of never smokers, while the group of older non smokers had a higher share of former smokers.

Figure 2: Heterogeneous Extensive Margin Effects



(a) By age

(b) By age and gender

Notes: This figure presents point estimates and symmetric percentile-t confidence intervals (see footnote 19) of the causal effect of the national regulation on the probability of being a smoker in 2013 by subgroups. Estimates are constructed using a probability linear model (see equation 1) standard errors are block-bootstrapped at the state-level with 200 replications. Panel (a) presents results by age group and panel (b) presents results by age group interacted with gender. A complete set of results is presented in tables A2 and A3.

Adults aged 55 to 65 did not respond to the increase in the cost of smoking induced by the national law. The effect is statistically not different from zero, both for the entire population and for the subgroups by gender. One potential explanation is their average consumption. If the average consumption of this group is lower than the consumption of their younger counterparts, we might not observe extensive margin effects, i.e. these smokers do not quit but are better at controlling their consumption.

I find no conclusive evidence to support the hypothesis of low consumption among the elderly. I use data on average daily consumption of smokers to construct the cumulative distribution function of cigarettes per day (see figure A.3) and explore this hypothesis. At the

threshold of 20 cigarettes per day consumption exhibits an age-sorting pattern as the cumulative distribution function (CDF) of older groups dominate the CDF of younger groups at this point and to its right. This sorting is less clear for lower levels of consumption.

I also explore an alternative explanation for the behavior of the elderly, as people might find quitting more difficult the older they are and the longer they have been addicted to nicotine. The length of addiction mechanically increases as consumers age if they do not intend to quit. Using intention-to-quit data I find that 67% of smokers aged 50 to 55 have intended to quit smoking while only 60% of smokers aged between 55 and 60 have intended to quit. Hence, the hypothesis of *discouraged smokers* is a plausible explanation to the null effects estimated for these groups.

As documented in table 1, women are less likely to smoke than men. In panel (b) of Figure 2, I explore whether the inverted-U pattern by age differs by gender. I estimate effects by age and gender and test the null hypothesis that the effect on women of a given age is equal to the effect on men of the same age group, i.e. $H_0 : \delta_{Female,\tau=1} = \delta_{Male,\tau=1}$. I do not find evidence to reject this hypothesis for any age group (see Table A3 for the respective p-value). These results indicate that although women are less likely to smoke, they are equally responsive to increases in the cost of smoking induced by the national law.

The relationship between education and health behaviors, known as the education gradient; relates years of schooling and health behavior. Cutler and Lleras-Muney (2010) use data for the United States and the United Kingdom to document that each year of education is associated with a 3 percentage-point lower probability of smoking. A college graduate is 12 percentage points less likely to smoke than a high school graduate. Given that smoking is associated with a six-year shorter life expectancy (Cutler et al., 2002), this difference is immense. Following Cutler and Lleras-Muney (2010) approach, I estimate that the probability of smoking is negatively associated with education in my sample. Each additional year of education is associated with a 1.06 percentage point lower probability of smoking.[20] The smaller correlation indicates that smoking habits in developing countries are less linked to educational attainment, as the average rates of consumption are comparable across groups.[21]

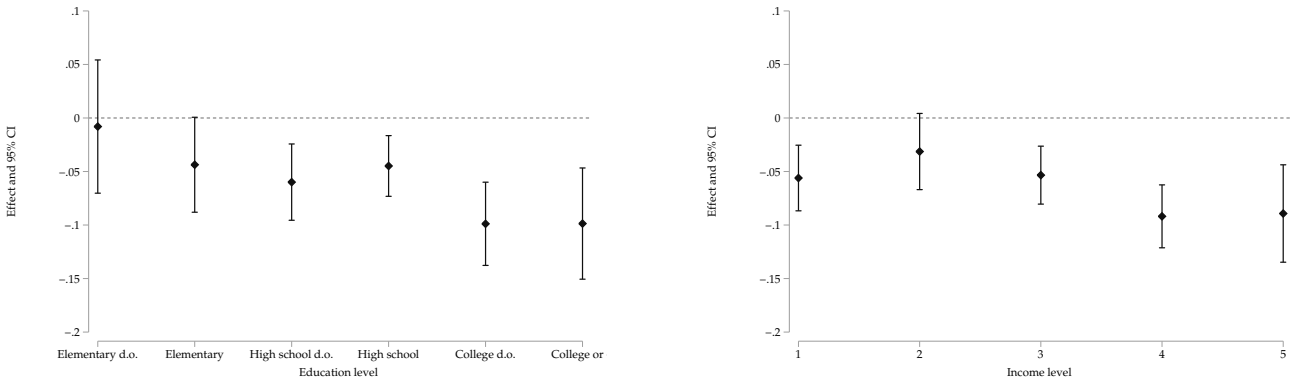
More educated individuals have been more responsive to the law, see panel (a) in Figure 3. Since the law's introduction, an elementary school graduate is 4.37 percentage points less likely to be a current smoker, while a college graduate is 9.86 percentage points less likely to

[20] I run the following regression: $y_i = \beta_0 + \beta_1 EDUC_i + \Gamma' X_{is} + \alpha_s + \varepsilon_i$, where X_{is} is a vector of control variables that includes individual-level characteristics and α_s are state-level fixed effects to control for variation in outcomes across states that is constant over time. The estimate of β_1 is -0.0105 (0.0007) in 2008. Estimates for other years before the implementation of the national regulation are similar. This result should be interpreted as a simple correlation between the probability of smoking and educational attainment. Since I do not observe exact years of education, I convert the educational level observed to years of education using average school duration and rates of completion.

[21] Average rates of consumption for 2011 are reported in A4

be a current smoker. High-school completion is associated with an extra 5-percentage-point decrease in the probability of being a current smoker. Changes in the extensive margin can be explained, as argued before, by "never takers" of smoking as well as quitters. Consistently with the hypothesis of quitters, Cutler and Lleras-Muney (2010) find that better educated people are more successful at quitting smoking than less educated people, not because they try to quit more frequently or use different methods, but because they are more successful when they do try.

Figure 3: Heterogeneous Extensive Margin Effects



(a) By educational attainment

(b) By income level

Notes: This figure presents point estimates and symmetric percentile-t confidence intervals (see footnote 19) of the causal effect of the national regulation on the probability of being a smoker in 2013 by subgroups. Estimates are constructed using a probability linear model (see equation 1). Standard errors are block-bootstrapped at the state-level with 200 replications. Panel (a) presents results by educational attainment and panel (b) presents results by household income ranking. d.o. stands for drop-out. The 1^{st} quintile corresponds to the lowest 20% households in the income distribution. Analogously, the 5^{th} quitile corresponds to the highest 20 % households in the income distribution. A complete set of results is presented in tables A4 and A5.

Cigarette taxes would be regressive with respect to income if poorer and richer consumers smoked at the same rate. This regressive effect is exacerbated when smoking prevalence is inversely related to income. Policies that change the costs of smoking but not the monetary price of cigarettes have the comparative advantage of not increasing the burden of consumption on poorer smokers. Bernheim and Rangel (2005) model of addiction explicitly cautions against strategies that tend to magnify economic burdens on those who become addicted, and underscores the benefits of policies that reduce these burdens. I explore heterogeneous effects by income in Panel (b) of Figure 3. In line with the previous findings on the education gradient, I document that individuals in richer households were more responsive to the new regulation. An individual who belongs to the highest income quintile was 8.92 percentage points less likely to be a smoker after national law was introduced. This change is 3 percentage points higher in absolute values than the change for the lowest income quintile (a 5.61 percentage points de-

crease). Hence, the policy does not entail a regressive component, e.g. an increase in prices via taxation, but the benefits are higher for higher-income individuals.

VI Alcohol Consumption

The question of whether alcohol and tobacco are consumed as complements or substitutes is crucial for determining the side-effects of tobacco control policies. Under the hypothesis that they are substitute goods, an effective anti smoking policy would backfire leading to an increase in alcohol consumption, *all else equal*. Conversely, under the hypothesis that they are complementary goods, an effective anti smoking policy would lead to a decrease in alcohol consumption.

Tauchmann et al. (2013) have empirically addressed this issue. Using German survey data and an instrumental-variable strategy, they estimate that a reduction in tobacco consumption results in a moderate reduction in alcohol consumption. Decker and Schwartz (2000) use individual-level data from the Behavioral Risk Factor Surveillance System to investigate cigarette and alcohol consumption in the United States, estimating both own and cross-price elasticities. Their results suggest that higher cigarette prices tend to decrease smoking but increase drinking. Shrestha (2018) studies the effect of increases in cigarette prices following the Master Settlement Agreement in 1998, on alcohol consumption among 18-to-24-year-olds and finds a substitution relationship between alcohol and cigarettes, concentrated among the heaviest drinkers. Argentina's 2011 law builds on the rationale of using non price policies to increase the cost of smoking and reduce the exposure of smokers to cues. In this paper, I exploit state-level variation in the leniency of tobacco regulation and the interaction with national legislation to identify the effect of an increase in the cost of smoking on abusive consumption of alcoholic beverages.

The outcomes studied in this section, extreme examples of alcohol consumption, are constructed as follows: an indicator for heavy drinking of beer, an indicator for heavy drinking of wine, an indicator for heavy drinking of spirits, and an indicator for binge drinking. Heavy drinking or alcohol abuse is defined as a function of consumption per day: eight or more drinks of beer, five or more drinks of wine and three or more drinks of spirits. [22] Binge drinking is defined as consuming five or more drinks during a single occasion in the past 30 days, either over the weekend or during a weekday. The sample is restricted to current smokers who have reported drinking alcohol in the last month. I also present results on alcohol consumption during the last month to characterize the frequency of this behavior.

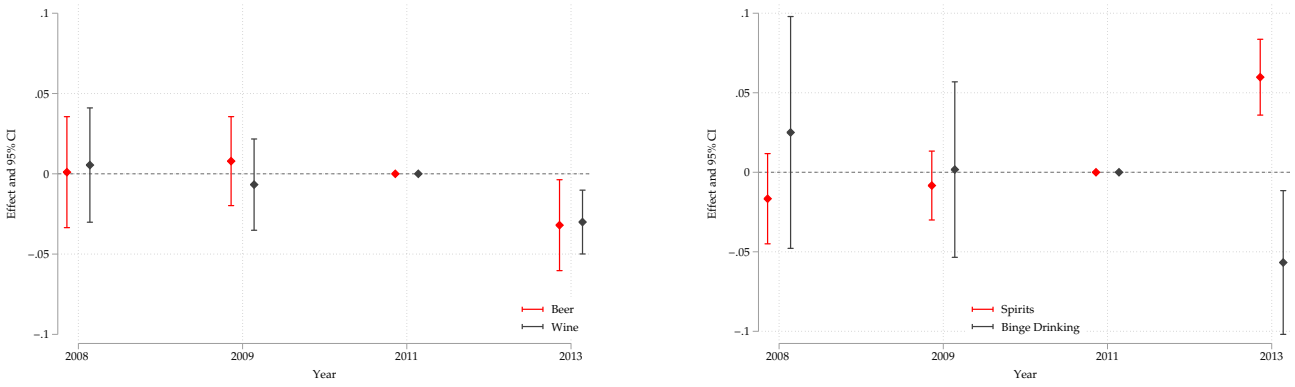
To study whether cigarrettes ad alcohol are substitutes or complements, I estimate equation (1) using a Probit model. To make it easier to interpret and compare with coefficients reported

[22] Spirits include vodka, gin, tequila, rum, and whisky.

in the rest of the paper, Figure 4 reports estimates of the marginal effects and Appendix Table A6 presents the estimates of the (raw) coefficients and the marginal effects. Marginal effects can be interpret as the percentage point change in the relevant outcome relative to the average level of such outcome. Standard errors are clustered at the state level.

The estimated coefficients for 2008 and 2009 are statistically indistinguishable from zero; they correspond to estimates of parameters $\delta_{\tau=-2}$ and $\delta_{\tau=-1}$ in equation (1). The null effects in the pre treatment period provide evidence supporting the identifying assumption of parallel trends in the consumption of alcoholic beverages between comparison and treated states.

Figure 4: Effects on risky consumption of alcoholic beverages



(a) Beer and wine

(b) Spirits and binge drinking

Notes: This figure presents estimates of the marginal effect and confidence intervals of the 2011 national law on the probability of abusive consumption of beer, wine, and spirits, and binge drinking; across smokers. Abusive consumption thresholds are specific to the beverage, see the main text for details. Binge drinking is defined as consuming five or more drinks during a single occasion in the past 30 days, either over the weekend or during a weekday. Estimates are constructed using a probit model (see equation 1). Standard errors are clustered at the state level. The complete results are presented in Table A6.

I find evidence that tobacco and abusive wine (and tobacco and abusive beer) consumption have a complementary relationship. Tobacco consumption and binge drinking also change in a direction that suggests a complementary relationship. However, tobacco and spirits have a substitution relationship. I document that a decrease in state leniency on tobacco regulation, effectively reduced smoking and induced a decrease in abusive consumption of beer (3.20 percentage points), and wine (3.00 percentage points), and in binge drinking (5.67 percentage points). Consumption of spirits increased 5.98 percentage points after the stricter regulations on tobacco consumption and advertising when into effect. The average level of abusive consumption of spirits in 2011 was 3.18%, thus the estimated effect suggests a huge increase in this risky behavior. Hence, an unintended effect of the tobacco regulation was an increase in abusive consumption of spirits.

Why are spirits substitutes with smoking while wine and beer are complements? One po-

tential explanation is that smokers who drink spirits are different than the rest of smokers who abuse alcohol, at least on observable demographic characteristics. To illustrate this, I present conditional sample means of observable characteristics in Appendix Table (A7). Smokers who abuse spirits are more likely to be single young people (less than 25 years) and are more educated and wealthy than those who abuse other drinks. Thus, the difference in sign of the elasticity could be attributable to young people substituting outside smoking by inside drinking in bars and pubs. This seems to be specially true for young men, the policy effect on spirits consumption is three times larger for men than for women.

Do the effects of anti smoking policies on alcohol consumption vary across populations? First, I test whether these effects are different among women and men. Women are less likely to smoke than men, though both groups are responsive to the national law as documented in the previous section. At the same time, women are less likely to be heavy drinkers. By 2011, the percentage of women who smoked and heavily drunk beer (4.61%) was 10 percentage points smaller than the percentage of men reporting this risky behavior (14.12%). Heavy drinking of wine also differs among women and men (12-percentage-points difference) and so does the prevalence of binge drinking (21-percentage-points difference). In table 5, I present estimates of the effects of anti smoking policies on alcohol separately for women and men, and I test if these are statistically different from each other. I do not find evidence to reject the hypothesis that the policy effect on beer and wine consumption are statistically different for men and women. I do find evidence that the policy effects on alcohol abuse is bigger for men and statistically different than the effect for women. Both of them are statistically different from zero.

Table 5: Effects on consumption of alcoholic beverages by gender among smokers

Dependent variable	Alcohol consumption (1)	Beer abuse (2)	Wine abuse (3)	Spirits (4)	Binge drinking (5)
2013					
Female	0.0100	-0.0225***	-0.0127	0.0261***	-0.0120**
	(0.0170)	(0.0058)	(0.0111)	(0.0075)	(0.0234)
Male	0.0097	-0.0341	-0.0334*	0.0786***	-0.0722**
	(0.0201)	(0.0237)	(0.0194)	(0.0188)	(0.0299)
$H_0 : \delta_{Female} = \delta_{Male}$	0.0001	0.0000	0.0000	0.0000	0.000
Mean dep. var. in 2011					
Female	0.6191	0.0461	0.0497	0.0297	0.2108
Male	0.7864	0.1399	0.1671	0.0328	0.432
Observations					
Female	12,471	7,994	7,994	7,994	7,994
Male	16,920	13,567	13,567	13,567	13,567
Correctly Predicted					
Female	0.6304	0.6304	0.6304	0.6304	0.6304
Male	??	0.8265	0.8301	0.9178	0.6014
Individual controls	Yes	Yes	Yes	Yes	Yes
State $\times$ time controls	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

Notes: This table presents estimates of the causal effect of the national law on alcohol consumption behavior across smokers by gender, a complete set of results is presented in table [add ref]. The omitted category corresponds to 2011, the year the federal law was passed. Abusive consumption thresholds are specific to the alcohol beverage, see the main text for details. Binge drinking is defined as consuming 5 or more drinks during a single occasion in the last 30 days, either during the weekend or during a week day. Treatment is a binary variable that takes the value of 1 if the legislation index for state s in moment t is less than or equal to 3 before 2011 and for every state s after 2011. Standard errors are clustered at the state level and the number of states is 24. *** p<0.01, ** p<0.05, * p<0.10

VII Health Outcomes

In this section, I ask whether the effects on extensive-margin outcomes, i.e. a reduction in the probability of being a current smoker by 6.17 percentage points and the increase in the probability of being a never smoker (4.34 percentage points) are in turn reflected in better health outcomes in the short run. I collected data on the number of hospital discharges reported, by cause of diagnose, at the age, gender, and state level from 2008 to 2015. Each hospital or health care institution member of the public health system [23] is mandated to report the number of discharges to the Direction of Statistics and Information on Health[24] which tabulates this information and constructs health indicators, such as mortality and fertility rates.

Though smoking can potentially damage nearly every part of the human body, I limited

[23] Institutions comprise national hospitals, state hospitals, and regional hospitals.
[24] Direccion de Estaditicas e Informacion de la Salud (DEIS)

the analysis to those health outcomes that exhibit a high correlation with smoking behavior. Smoking can cause lung disease by damaging the airways and the small air sacs (alveoli) found in the lungs. Cigarette smoking causes most cases of lung cancer. Lung diseases caused by smoking include COPD, which includes emphysema and chronic bronchitis. Estimates from the U.S. by the Department of Health and Human Services[25] indicate that smoking causes about 90% of all lung cancer deaths, and 80% of all deaths from COPD. Alcaraz et al. (2016) estimate that in 2015 in Argentina, cigarette smoking caused 75% of COPD deaths and 82% of lung cancer deaths, while 33% of other cancers could be attributed to cigarette smoking.

I estimate the causal effects of the clean-indoor-air policy and the introduction of TGW via the following equation, which I run over the sample of treated and comparison states for the period 2008-2015 by cause of discharge c.

$$y_{st} = \sum_{\tau=-3}^{4} \delta_\tau \left[\text{Treat}_s \cdot (\text{Years after treat} = \tau)\right] + \Gamma' X_{st} + \alpha_s + \varepsilon_{st} \tag{2}$$

where s denotes the state and t denotes the calendar year, y_{st} is the outcome of interest, X_{st} is a vector of control variables that comprise state-level characteristics. The variable $Years\ after\ treat = \tau$ is equal to the difference between the calendar year and the year the national law was passed. State fixed effects control for variation in outcomes across states that is constant over time. This analysis is performed at the state-time level, in contrast to the previous analysis that relies on individual-level data. Standard errors are robust to heteroskedasticity.[26] The outcomes of interest are defined as the ratio between the number of cases with diagnoses cause c and the total population of state s in year t times 1,000, which I call *ratio of hospital discharges* for the rest of the paper. The coefficients can be interpreted as a change in the ratio of hospital discharges for cause c when the legislation was tightened. Hospital discharge ratios are examined for two diagnoses, COPD and lung cancer, [27] for entire the population and by age group.

[25] See DHS, *The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General.*

[26] I refrain from using clustered standard errors at the state level because the number of observations within each cluster is small,i.e., there are eight observations per state.

[27] In this paper, lung cancer is used to refer to malignant tumor of the respiratory system since is the most popular of such diseases.

Table 6: Effect on the Ratio of Hospital Discharges by Cause

Cause	COPD (1)	Lung Cancer* (2)
2008	0.0146	0.0265*
	(0.0639)	(0.0156)
2009	0.0450	0.0234
	(0.0818)	(0.0225)
2010	0.0570	0.0282*
	(0.0683)	(0.0134)
2012	-0.1229**	-0.0029
	(0.0573)	(0.0100)
2013	-0.1052*	0.0028
	(0.0624)	(0.0097)
2014	-0.1358**	-0.0112
	(0.0596)	(0.0088)
2015	-0.0400	-0.0284**
	(0.0737)	(0.0113)
Mean dep. var. in 2011	0.7453	0.1313
Observations	192	192
R-squared	0.738	0.700
State x time controls	Yes	Yes
State FE	Yes	Yes
Time FE	No	No

Notes: The omitted category corresponds to 2011, the year the national law was passed. Treatment is defined as a dichotomous variable, $Treat_s$, that equals 1 if the legislation index for state s in moment t is less than or equal to 3 before 2011. After 2011, all states *are treated* thus $Treat_s$ equals 1 for all states s after 2011. State $\times$ time controls include total private employment. Standard errors are robust to heteroskedasticity. COPD stands for chronic obstructive pulmonary disease. * Lung cancer refers to malignant tumors in the respiratory system. *** p<0.01, ** p<0.05, * p<0.10

These results show that the effects on extensive and intensive margins are reflected in better health outcomes. The rate of hospital discharges due to a diagnoses of COPD decreased in the short run; in the three years after the national law was passed, this decrease was 13% relative to the 2011 level. Also, the rate of hospital discharges due to lung cancer diagnosis had decreased in the short run; by 2015 the hospitalization rate due to lung cancer diagnosis had decreased in 15% relative to the 2011 level.

I examine hospitalization rates by age category; my preliminary results appear in Appendix Tables A8 and A9. The main take-away is that those age groups that have shown a bigger reduction in smoking also accrue more health benefits. Put another way, the inverted U-shape documented from the extensive margin outcomes is reflected in the health outcome results. People aged 40 to 55 benefited from lower hospitalization rates after the national law was passed.

VIII Bans or Tobacco Graphic Warnings: what works best?

The implementation of the 2011 Argentina's policy features a common characteristic across countries; the government implemented two anti tobacco policies at the same time, i.e., the clean-indoor-air policy and the incorporation of TGW. Many countries implement anti tobacco policies simultaneously, e.g., in 2001, the Canadian Federal Tobacco Control Strategy proposed raising tobacco taxes, in addition to the incorporation of TGW (Health Canada, 2002).[28] However, the question of whether the joint implementation is more effective than implementing single policies remains unanswered. In this context, policy-relevant parameters are the effects of each policy as well as the effect of the bundle policy.

The joint implementation setting poses two empirical challenges to the identification. The first challenge originates in the core of joint implementation; policies are implemented at the same time or within a short period which limits the opportunity to exploit either regional or temporal variation. The second challenge refers to the presence of spillover effects or complementarities between policies. Complementarities arise as policies provide incentives towards the same goal; deter individuals from smoking. The rationale of the joint implementation is to maximize the potential of each policy, i.e. the government's prior is that the combination of policies should *at least* be as effective as the individual or sequential implementation. In this section, I proposed a framework to disentangle the effect of place-based bans from the effect of tobacco graphic warnings.

Let the parameter δ be the causal effect of the national regulation identified of the comparison of lenient and strict states under the parallel trend assumption. Define two groups of states, those states who have implemented place-based bans before 2011, the early adopters of place-based bans, and those states with no (or very lenient) place-based bans before 2011, these are the late adopters states. I show in Appendix A.viii, that this parameter can be written as a linear combination of the effects of each branch of the policy and the spillover effects:

$$\delta = \delta^{TGW} + \omega_2 \, \delta^{bans} + \omega_2 \, f(\delta^{TGW}, \delta^{bans}) \tag{3}$$

Where δ^{bans} is the causal effect of the place-based policy on the outcome of interest, δ^{TGW} is

[28] In January 2001, Canada became the first county in the world to introduce pictorial warning messages on cigarette packs (Azagba and Sharaf, 2012). Begging in April 2001 the federal government implemented a sequence of tax hikes. The excise tax was first raised to $10.99 per carton in May 2001, and then to $12.62 by the end of 2001. In mid-2002, the federal tax was further raised to $13.86 per carton and then to $15.85 in July 2002 (Gabler and Katz, 2010). Other examples of joint implementation of policies are: Taiwan Tobacco Hazards Prevention Amendment Act in 2009 extended smoke-free areas to almost all enclosed workplaces and public places, added graphic health warnings to cigarette packages and banned tobacco advertisement, promotion, and sponsorship (for details see, Chang et al. (2010)); Spain's anti smoking law in 2011 banned smoking on hospitality venues and selected outdoor areas (for details see, Sureda et al. (2014)).

the causal effect of the tobacco graphic warnings on the outcome of interest, ω_2 is the proportion of states that have not implemented a place-based ban before the national regulation and $f(\delta^{TGW},\delta^{bans})$ is the spillover effect of implementing the policies jointly.

Can the effect of place-based policies be told apart from the effect of tobacco graphic warnings? I exploit the comparison of early adopters of place-based bans with late adopters to identify the effect of place-based policies. Under the assumption that the early adopter are a good comparison for late adopters, the causal effect of place-based bans could be estimated via the following regression:

$$y_i = \sum_{\tau=-2}^{1} \tilde{\delta}_{\tau}^{bans} \left[\text{Bans}_s \cdot (\text{Years after treat} = \tau)\right] + \beta' X_{is} + \Gamma' X_{st} + \alpha_s + \alpha_t + \varphi_i \tag{4}$$

Where I use the notation $\tilde{\delta}^{bans} = \delta^{bans} + f(\delta^{bans},\delta^{tgw})$ to emphasize that the parameter being estimated is the effect of bans plus the potential spillover due to join implementation. $Bans$ is a dummy variable that equals 1 if the state s is a late-adopter of place-based bans. The estimate of $\tilde{\delta}^{bans}$ provides an upper bound estimation of δ^{bans}.

Under the assumption that effects of bans and tobacco graphic warnings are constant across states and time and allowing for a spillover effect when these policies are jointly implemented, the effect of tobacco graphic warnings can be infer from the following relation [29]:

$$\delta = \delta^{TGW} + \omega_2 \tilde{\delta}^{bans} \tag{5}$$

I can use the estimates of δ and $\tilde{\delta}^{bans}$ to construct estimates of the effect of tobacco graphic warnings. I present the results of this exercise in the next table.

Table 7: Mechanisms: Bans and Tobacco Graphic Warnings

Parameter	δ	$\tilde{\delta}^{bans}$	δ^{tgw}
Probability of never smoker	0.0434	0.00546	0.04067
	[0.0175]**	[0.0220]	[0.0207]*
Probability of current smokers	-0.0617	-0.04635	-0.038525
	[0.0103]***	[0.0080]***	[0.0102]***

Notes: This table presents point estimates of the effects of the federal law, the effects of place-based bans, and the incorporation of tobacco graphic warnings following the decomposition proposed in equation (5). Standard errors are block-bootstrapped at the state-level with 200 replications. *** p<0.01, ** p<0.05, * p<0.10

[29] I present the proof in appendix A.viii

IX Robustness Checks

IX.i Definition of the treatment

My identification strategy relies on state-level differences in the strength of regulations on tobacco products before the national law was passed. I define the treatment as a dichotomous variable, $Treat_s$, that equals 1 if the legislation index for state s is less than or equal to 3 before 2011. In this section, I present the main results of my analysis using an alternative definition. I define the treatment as a dichotomous variable that equal 1 if the legislation index for state s is strictly less than 3 before 2011. This change implies that the pool of states used as controls are stricter states.

Table A10 presents balancing test results. As in the main analysis, estimated differences indicate that individuals are statistically indistinguishable in terms of gender, age, marital status, employment status, and educational attainment. I find evidence that on average individuals in comparison sates are poorer than individuals in treated states.

I reproduce results for the extensive margin in Table 8. The estimates of the coefficients for 2008 and 2009 are not statistically distinguishable from zero, meaning that the comparison and treated states were on similar trends regarding cigarette consumption before the national law was passed. I find that results on the probability of being a never smoker and the probability of being a current smoker are smaller in absolute value and still significantly different from zero under the more strict definition of treatment. This is the direction that we expect given the change in the composition of the comparison group: as more strict states are used as comparison, the changes induced by the 2011 law are smaller.

Table 8: Effects on Extensive Margin Outcomes

Probability of	Never smokers	Current smokers
	(1)	(2)
2008	-0.0205	-0.0055
	[0.0149]	[0.0120]
2009	-0.0238	-0.0138
	[0.0165]	[0.0099]
2013	0.0402	-0.0594
	[0.0187]**	[0.0100]***
Mean dep. var. in 2011	0.4608	0.2825
Observations	153,093	153,093
R-squared	0.0328	0.0259
Correctly predicted	0.5536	0.6881
Individual controls	Yes	Yes
State $\times$ time controls	Yes	Yes
State FE	Yes	Yes
Time FE	Yes	Yes

Notes: The omitted category corresponds to 2011, the year the federal law was passed. Treatment as a dichotomous variable, $Treat_s$, that equals one if the legislation index for state s in moment t is strictly less than 3 before 2011. After 2011, all states *are treated* thus $Treat_s$ equals one for all states s after 2011. Individual controls include age, gender, educational attainment, employment status and income category of the household. State $\times$ time controls include total private employment and total population. Standard errors in squared brackets are block-bootstrapped at the state-level with 200 replications. *** p<0.01, ** p<0.05, * p<0.10

I present results for the intensive margin in Table 9. The estimated coefficients are the percentage change in the probability of observing average daily consumption in bin b. I find evidence that the distribution of daily cigarettes smoked shifts to the right, i.e. it is more likely that smokers consume more than 15 cigarettes per day and less likely that they consume fewer than 15 cigarettes per day. The proportion of smokers who consume between zero and five cigarettes per day decreases by 23 percentage points. This estimate is slightly greater than the one found with the original treatment definition. This result suggests that as more strict states are used as comparison, the pool of smokers is more negatively selected.

Table 9: Effects on Intensive Margin Outcomes

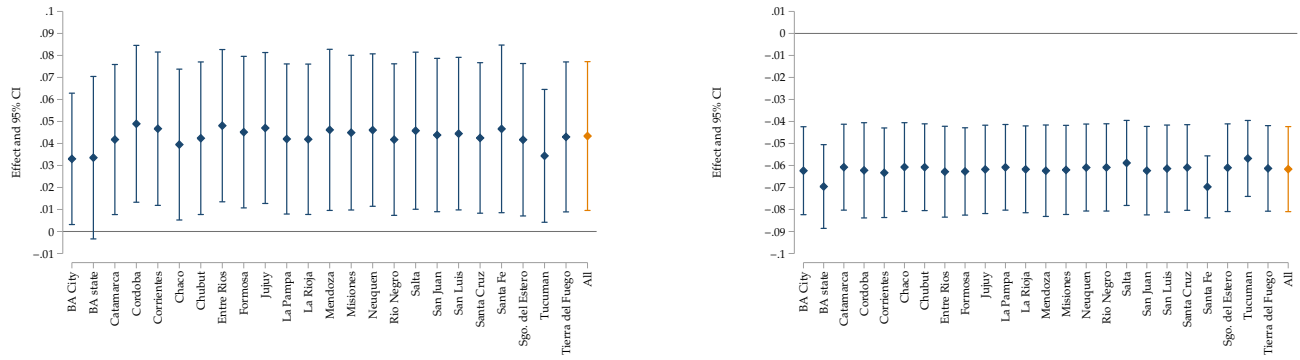
Cigarettes smoked	(0,5]	(5, 10]	(10, 15]	(15, 20]	(20, 30]	(30 , 40]	(40 , 50]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2008	0.0017	0.0237	-0.0033	0.0084	0.0051	-0.0100	0.0010
	(0.0317)	(0.0185)	(0.0104)	(0.0123)	(0.0067)	(0.0062)	(0.0011)
2009	-0.0839**	0.0394*	0.0020	-0.0182	-0.0111***	-0.0097*	0.0008
	(0.0370)	(0.0201)	(0.0056)	(0.0150)	(0.0035)	(0.0054)	(0.0014)
2013	-0.2335***	-0.0224	-0.0147**	0.0110	0.0073	-0.0073**	-0.0003
	(0.0233)	(0.0159)	(0.0069)	(0.0144)	(0.0045)	(0.0034)	(0.0007)
Mean dep. var. in 2011	0.3397	0.2628	0.0937	0.2080	0.0374	0.0265	0.0024
Observations	45,585	45,585	45,585	45,585	45,585	45,585	45,585
R-squared	0.0797	0.0114	0.0069	0.0257	0.0108	0.0170	0.0014
Correctly predicted	0.8013	0.7775	0.7333	0.7634	0.7211	0.7182	0.7123
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State $\times$ time controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The omitted category corresponds to 2011, the year the federal law was passed. Treatment is a dichotomous variable, $Treat_s$, that equals one if the legislation index for state s in moment t is strictly less than 3 before 2011. After 2011, all states *are treated* thus $Treat_s$ equals one for all states s after 2011 Individual controls include age, gender, educational attainment, employment status and income category of the household. State $\times$ time controls include total private employment and total population. Standard errors in squared brackets are block-bootstrapped at the state-level with 200 replications. *** p<0.01, ** p<0.05, * p<0.10

IX.ii Removing One State at a Time

Are the policy's effects driven by one particular state? I address this question by performing a very simple exercise: I estimate the effect on extensive margin outcomes in a sub-sample of states where I exclude one state at a time. I present the results of this exercise in Figure 5, the category "All" replicates the effects discussed in section V.i. This figure presents estimates of the marginal effect and confidence intervals of the 2011 national law on the probability never smokers (panel a) and never smokers (panel b). I find evidence that point estimates are robust to the exclusion of one state from the sample, although there is some evidence that the state of Buenos Aires (the biggest state in terms of population) might drive the effect on never smokers. The 95% confidence interval includes the zero when the state of Buenos Aires is excluded, nonetheless, the point estimates are very close to the ones find when every state is included. To alleviate this concern, I use weighted OLS in all the regressions presented so far so that estimates are representative at the country level.

Figure 5: Extensive Margin Outcomes



(a) Never Smokers

(b) Current Smokers

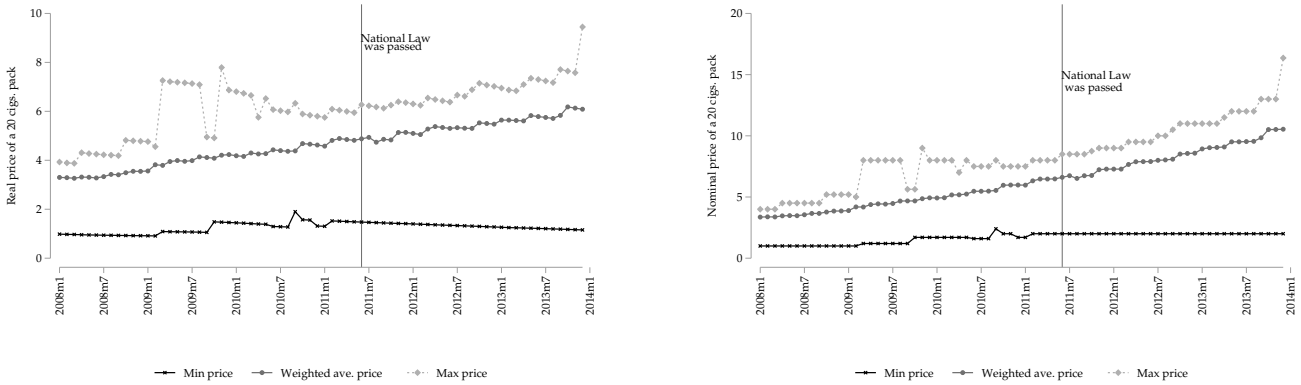
Notes: This figure presents estimates of the marginal effect and confidence intervals of the 2011 national law on the probability never smokers (panel a) and never smokers (panel b). Treatment is a dichotomous variable, $Treat_s$, that equals one if the legislation index for state s in moment t is less than or equal to 3 before 2011. After 2011, all states *are treated* thus $Treat_s$ equals one for all states s after 2011. Individual controls include age, gender, educational attainment, employment status and income category of the household. The category "All" replicates the effects in the main body, see table 3. State $\times$ time controls include total private employment and total population. Standard errors are clustered at the state-level.

IX.iii Prices and Industry

Did the 2011 policy change prices of cigarettes? I use data on prices to address this question. The Ministry of Agriculture follows the sales of cigarettes at the national level, they provide information on sales by price range. I focus on three price ranges: the minimum price paid (by consumers) in the cigarette market, the average price paid and the highest price paid. Data is at the price-range month level so I can closely follow the evolution around the dates of the change in the regulation. Figure 6 presents time series of real and nominal prices. I use the price index constructed by Cavallo, 2013).[30] There is no evidence of sharp changes in the price of the cheapest cigarette box. I look at the minimum price because smokers could *easily* substitute among brands to avoid price changes in the more expensive brands. This substitution patterns are a very interesting per se and a potential mechanism through which the law operated but I can not speak to this mechanisms with the data that I have.

[30]During the period under study, the Argentinean economy experienced high inflation, the lack of reliability on official estimates of the Consumer Price Index (for a discussion see, Cavallo, 2013) challenges the use of the official Consumer Price Index series.

Figure 6: Evolution of cigarettes' price



(a) Real prices

(b) Nominal prices

Notes: This figure presents time series of real and nominal prices faced by consumers divide in three price-ranges: the minimum price, the average price and the highest price. I use the price index constructed by Cavallo, 2013) to deflate prices. Data is at the price-monthly level and comes from price series constructed by the Ministry of Agriculture.

X Conclusion

Preventing people from smoking and reducing their exposure to environmental tobacco smoke is a key public health priority of many governments. Bernheim and Rangel (2004) model of addiction places a high value on policies that improve opportunities for self-regulation and identifies a central role for "cognitive" policies, including the suppression of certain environmental cues (e.g., through limitations on advertising), and the dissemination of counter cues. Through the lens of this model, public-place smoking restrictions and regulation of advertising, especially tobacco graphic warnings, are promising policies for decreasing smoking prevalence. This research helps to broaden our understanding of the effectiveness of such policies in developing countries and supports the effectiveness of these policies as suggested by Bernheim and Rangel (2005).

I interact previous state-level legislation with the national law to identify the effect of bans on advertising and the implementation of clean-indoor-air policies by the national government. The probability of being a never smoker increased by 4.34 percentage points, relative to the average of 46.08% in 2011, a roughly 10% increase in this outcome. This effect is driven by potential smokers who decided not to smoke. The probability of being a current smoker decreased by 6.17 percentage points, relative to the average of 28.25% in 2011. Intensive margin results suggest that the distribution of daily cigarettes smoked shifted to the right, i.e. it became more likely that smokers would consume more than 15 cigarettes per day and less likely that they would consume fewer than 15 cigarettes per day. Thus, the pool of smokers is more

negatively selected and the reduction in the probability of being a current smoker is partially driven by quitters whose consumption was less than a pack per day.

Policies implemented to deter smoking might affect alcohol consumption, depending on the complementary or substitutability between these goods. This paper finds evidence that tobacco and abusive wine (and tobacco and abusive beer) consumption have a complementary relationship. Tobacco consumption and binge drinking also change in a direction that suggests a complementary relationship. However, tobacco and spirits have a substitution relationship on consumption, pointing to a unintended negative effect of the anti-tobacco policy.

Finally, the probability of being a current smoker shows an inverted-U shape pattern for ages 18 to 55, consistent with a decrease in youth initiation of tobacco use and an increase in former smokers among adults aged 35 to 55. Also, adults aged 55 to 65, were less likely to intend to quit smoking and did not respond to the increase in the cost of smoking induced by the national law. Though the national law was effective in reducing consumption, it might have also increased health inequality. I find that completion of high school is associated with an extra 5 percentage points decrease in the probability of being a current smoker and that people in richer households were less likely to be a smoker after the introduction of the national law. Hence, though the policy does not entail a regressive component, e.g., as an increase in prices via taxation, the benefits are higher for higher-income individuals.

This paper provides a detailed characterization of people affected by the anti smoking regulation. It also warns about potential side effects of this policy. This draft presents a short analysis of the impact of this policy on health outcomes to address the question of whether the extensive margin outcomes are in turn reflected in better health outcomes in the short run. My results are preliminary and in future versions of this paper I hope to extended tehm to (i) other relevant outcomes such as asthma, and (ii) a deeper analysis of the age-gradient.

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A Appendix

A.i Tobacco Graphic Warnings

Figure A.1: Examples of law-regulated packaging.

Notes: This figure provides an example of the Tobacco Graphic Warnings printed on cigarette boxes. Big font messages: (i) smoking reduces years of life, (ii) smoking causes cancer, (iii) smoking might cause leg amputation, (iv) pregnant women who smoke harm her child (v) smoking causes death by suffocation. Small font messages: (i) tobacco drives half of smoker's deaths, (ii) every cigarette poisons you, (iii) smoking causes gangrene, (iv) every cigarette damages your respiratory capacity.

A.ii Legislation Index Construction

Argentina has 23 states and one federal district.[31] Each state has the autonomy to dictate laws in their territory as long as these laws are not contrary to the federal laws. Broadly speaking, taxes on tobacco-related products is done at the national level but non price related policies have been put in place at the regional level before the law 26,687 was passed.

I coded a total of 47 regional laws and two national laws. The three main categories that composed the index are: tobacco advertising, sells, and consumption. Each category is further divided into sub-categories, to allow for a better understanding of the regulation and to be able to assess the importance of each particular aspect of the law. The subcategories were defined following González-Rozada (2006) report on the status of tobacco legislation in Argentina.

The advertising category includes the next sub-categories: publicity, advertising in radio, in television, to a certain audience, regulation on the content of advertising, events sponsoring, brand stretching, inclusion and size of TGW and inclusion of contact information about anti-smoking public services. Sells category includes the next sub-categories [32] sells to under 18 years old individuals, elementary school, high school, education institutions in general, hospitals or health institutions, government buildings, public transportation means and sells

[31] I will refer to this administrative unit as another state since the distinction between state and federal district is not relevant for this paper.

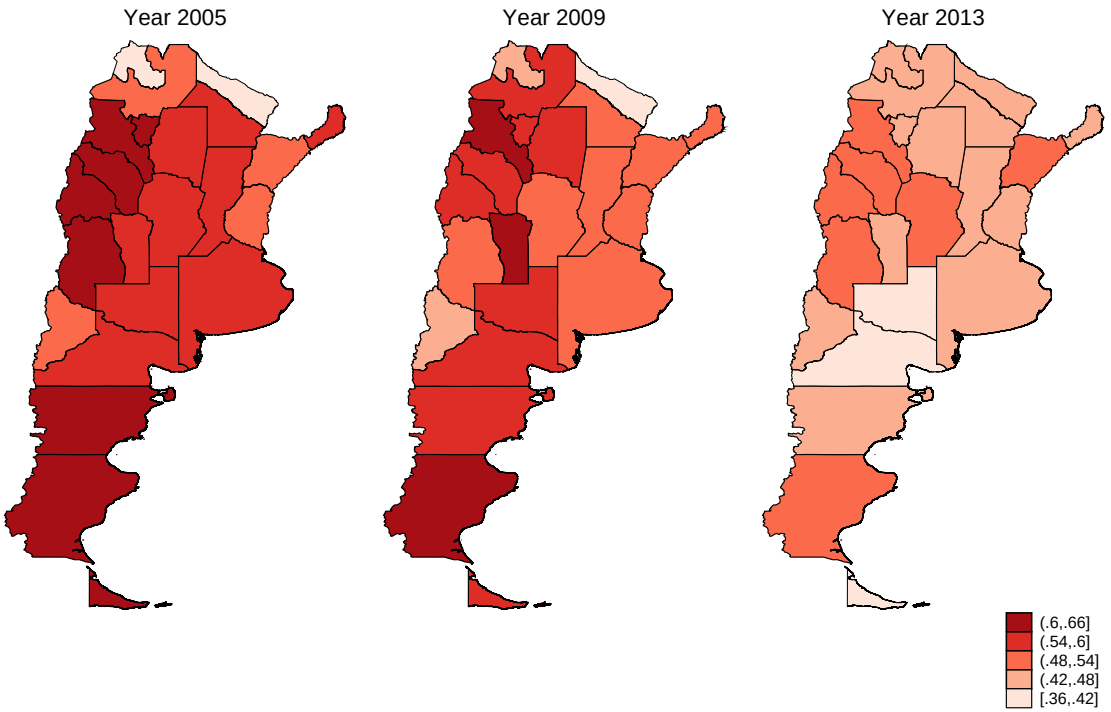
[32] All of them are defined as bans on sells in the described venue or establishment

by the unit. Finally, the consumption category includes the following sub-categories: government buildings, workplaces, health institutions, elementary schools, high schools, universities, public transportation means, restaurants, bars, entertainment centers.

To construct the legislation index I summarize the previous categories. The advertising category is summarized by a dummy that takes the value of 1 if the state has passed some regulation regarding advertising. Sells category is restricted to bans in sells to underage individuals. Consumption sub-categories are group regarding similarities of the environments: public means of transportation, educational institutions, health institutions, and restaurants, bars and other entertainment places together. Thus, the maximum value the index can take before the implementation of the national law is 6. I define strict states as those with an index strictly greater than 3.

A.iii Evidence on law enforcement

Figure A.2: Exposure to Environmental Tobacco Smoke



Notes: Exposure to Environmental Tobacco Smoke is a self-reported measure. Each individual is asked if people regularly smoke around them in close venues such as: office, school, home. Thus, it measures the percentage of individuals expose to Environmental Tobacco Smoke in any indoor environment.

A.iv Consumption trends and sales trends

Table A1: Evolution of Consumption

	Sales data		Survey data	
Year	Consumption	Percent change	Consumption	Percent change
2008	181.06		106.75	
2009$^{(a)}$	177.64	-1.89%	103.42	-3.11%
2010	174.86			
2011$^{(b)}$	182.65	1.40%	105.84	1.16%
2012	178.36			
2013$^{(b)}$	174.07	-2.38%	99.39	-3.09%

Notes: Consumption measures are expressed in millions of 20 cigarettes packages a month. Sales data is collected by the Ministry of Agriculture, time series are expressed in 20 cigarettes packages in a year, I converted them in monthly figures. Consumption from survey data is computed based on average consumption per day multiply by 30. Smokers are also asked how many days they smoke per month, though this variable has many missing values. Summary statistics indicates that 62% of smokers smoke every day, this is the modal frequency. Percent changes are: (a) relative to the previous calendar year; (b) relative to the $n-2$ year.

A.v Heterogeneous effects

Table A2: Probability of being a current smoker by age group

Age:	18-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2008	0.0009	-0.0252	-0.0363	-0.0212	0.0125	-0.0253	0.0074	0.0177	0.0365
	[0.0293]	[0.0267]	[0.0235]	[0.0319]	[0.0303]	[0.0267]	[0.0257]	[0.0179]	[0.0201]
2009	0.0038	0.0089	-0.0209	-0.0363	-0.0216	0.0163	-0.0227	-0.0038	-0.0088
	[0.0157]	[0.0225]	[0.0212]	[0.0224]	[0.0166]	[0.0249]	[0.0302]	[0.0201]	[0.0158]
2013	-0.1014	-0.0379	-0.0148	-0.0434	-0.0983	-0.1207	-0.1191	0.0152	-0.0156
	[0.0307]***	[0.0251]	[0.0200]	[0.0217]	[0.0163]***	[0.0250]****	[0.0275]***	[0.212]	[0.0187]
Mean dep. var. in 2011	0.27	0.31	0.29	0.29	0.26	0.30	0.32	0.27	0.23
Observations	24,822	19,409	20,329	18,804	16,121	14,205	13,576	11,992	13,835
R-squared	0.0497	0.0278	0.0377	0.0341	0.0348	0.0247	0.0253	0.0232	0.0240
Correctly predicted	0.6899	0.6604	0.6564	0.7059	0.5085	0.6758	0.6591	0.7331	0.8005
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State $\times$ time controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

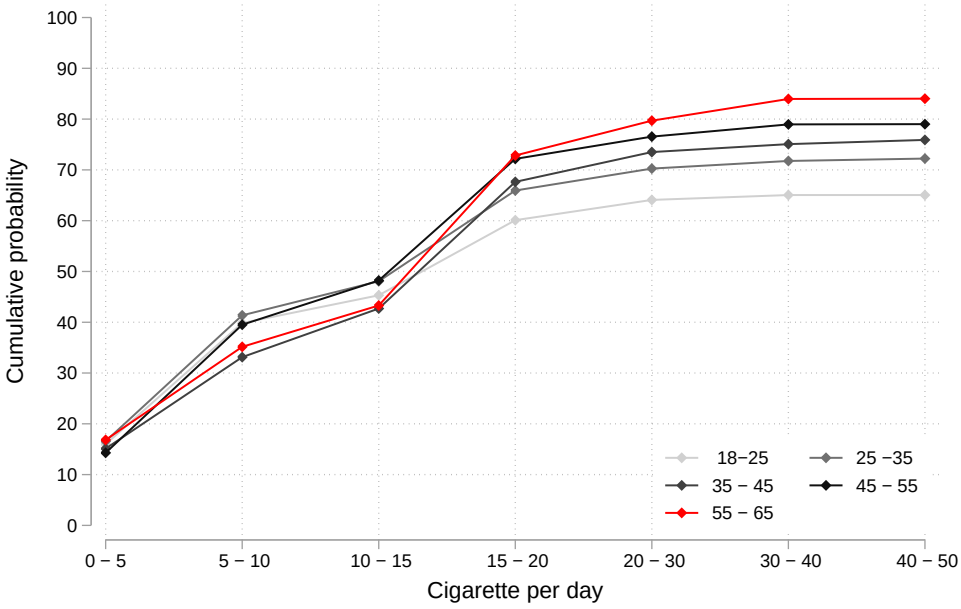
Notes: The omitted category corresponds to 2011, the year the federal law was passed. Treatment is defined as a dichotomous variable, $Treat_s$, that equals one if the legislation index for state s in moment t is less than or equal to 3 before 2011. After 2011, all states *are treated* thus $Treat_s$ equals one for all states s after 2011. Individual controls include age, gender, educational attainment, employment status and income category of the household. State $\times$ time controls include total private employment and total population. Standard errors in parentheses are clustered at the state-level and the number of states is 24. Standard errors in squared brackets are block-bootstrapped at the state-level with 200 replications. *** p<0.01, ** p<0.05, * p<0.10

Table A3: Probability of being a current smoker by age group and gender

Age:	18-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2008									
Female	-0.0448	-0.0507	-0.0252	-0.0123	-0.0247	-0.0055	-0.0322	-0.0174	0.0612
	[0.0338]	[0.0296]	[0.0212]	[0.0455]	[0.0375]	[0.0341]	[0.0433]	[0.0359]	[0.0356]
Male	0.0485	0.0146	-0.0442	-0.0204	0.0560	-0.0446	0.0423	0.0510	0.0035
	[0.0359]	[0.0316]	[0.0406]	[0.0341]	[0.04145]	[0.0499]	[0.0671]	[0.0342]	[0.0379]
2009									
Female	0.0142	-0.0257	-0.0111	-0.0047	-0.0068	-0.0330	-0.0276	-0.0362	0.0153
	[0.0257]	[0.03212]	[0.0367]	[0.225]	[0.0218]	[0.0359]	[0.0414]	[0.0294]	[0.0266]
Male	-0.0056	0.0422	-0.0312	-0.0669	-0.0338	0.0680	-0.0238	0.0220	-0.0391
	[0.0247]	[0.0329]	[0.0315]	[0.0363]	[0.0344]	[0.0306]	[0.0327]	[0.0274]	[0.0272]
2013									
Female	-0.1150	-0.0253	-0.0036	-0.0549	-0.1125	-0.1115	-0.1044	0.0413	0.0096
	[0.0252]***	[0.0381]	[0.0386]	[0.0266]	[0.0259]***	[0.0308]***	[0.0401]***	[0.0343]	[0.0283]
Male	-0.0891	-0.0599	-0.0271	-0.0261	-0.0859	-0.1292	-0.1318	-0.0215	-0.0508
	[0.0510]***	[0.0384]	[0.0342]	[0.0282]	[0.0324]***	[0.0473]***	[0.0304]***	[0.0437]	[0.0348]
$H_0 : \delta_{FEMALE} = \delta_{MALE}$	.432	.1235	.6888	.9247	.5955	.9301	.9443	.8385	.3941
Mean dep. var. in 2011									
Female	0.27	0.31	0.29	0.29	0.26	0.30	0.32	0.27	0.23
Male	0.33	0.36	0.36	0.35	0.32	0.35	0.37	0.30	0.25
Observations									
Female	13,107	10,700	11,360	10,451	8,859	7,666	7,464	6,697	8,193
Male	11,715	8,709	8,969	8,353	7,262	6,539	6,112	5,295	5,642
Correctly Predicted									
Female	0.7467	0.7163	0.7162	0.7691	0.5735	0.7051	0.6879	0.7688	0.8351
Male	0.6317	0.5235	0.5972	0.6281	0.4677	0.6400	0.6307	0.6871	0.7359
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State $\times$ time controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The omitted category corresponds to 2011, the year the federal law was passed. Treatment is defined as a dichotomous variable, $Treat_s$, that equals one if the legislation index for state s in moment t is less than or equal to 3 before 2011. After 2011, all states *are treated* thus $Treat_s$ equals one for all states s after 2011. Individual controls include age, gender, educational attainment, employment status and income category of the household. State $\times$ time controls include total private employment and total population. Standard errors in squared brackets are block-bootstrapped at the state-level with 200 replications. *** p<0.01, ** p<0.05, * p<0.10

Figure A.3: CDF of daily consumption by age group



Notes: Cumulative Distribution Function (CDF) of reported daily consumption of cigarettes in the last month by age group. Smokers tend to report factor of 5 integers when asked about their daily consumption. To overcome this rounding, I discretize the number of cigarettes, I construct open-to-the-left intervals of consumption: [0,5] (5, 10] (10, 15] (15, 20] (20, 30] (30,40] and (40,50]. For each interval, I compute the percentage of smokers of a given age that report a daily consumption in the interval values.

Table A4: Probability of being a current smoker by educational attainment

Educational level:	Elementary d/o	Elementary	HS d/o	HS	College d/o	College +
	(1)	(2)	(3)	(4)	(5)	(6)
2008	-0.0312	-0.0310	0.0030	0.0336	0.0036	-0.0093
	[0.4700]	[0.0175]	[0.0272]	[0.0212]	[0.0260]	[0.0238]
2009	-0.0630	0.0093	-0.0177	-0.0141	0.0049	0.0167
	[0.0210]***	[0.0170]	[0.0139]	[0.0179]	[0.0220]	[0.0223]
2013	-0.0080	-0.0437	-0.0599	-0.0448	-0.0989	-0.0986
	[0.0361]	[0.0185]*	[0.0216]***	[0.0303]***	[0.0296]***	[0.0193]***
Mean dep. var. in 2011	0.31	0.30	0.35	0.28	0.24	0.228
Observations	12,261	30,388	27,877	35,538	21,195	23,811
R-squared	0.0713	0.0434	0.0258	0.0217	0.0199	0.0134
Correctly predicted	0.5073	0.6906	0.6370	0.6173	0.7181	0.7607
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
State $\times$ time controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The omitted category corresponds to 2011, the year the federal law was passed. Treatment is defined as a dichotomous variable, $Treat_s$, that equals one if the legislation index for state s in moment t is less than or equal to 3 before 2011. After 2011, all states *are treated* thus $Treat_s$ equals one for all states s after 2011. Individual controls include age, gender, educational attainment, employment status and income category of the household. State $\times$ time controls include total private employment and total population. HS stands for High School and d/o stands for drop-out. Standard errors in squared brackets are block-bootstrapped at the state-level with 200 replications. *** p<0.01, ** p<0.05, * p<0.10

Table A5: Probability of being a current smoker by income

Income category	1^{st} quintile (1)	2^{nd} quintile (2)	3^{rd} quintile (3)	4^{th} quintile (4)	5^{th} quintile (5)
2008	-0.0239	-0.0288	-0.0080	0.0282	-0.0028
	[0.0246]	[0.0241]	[0.0201]	[0.0195]	[0.0318]
2009	-0.0433	-0.0513	0.0297	0.0093	-0.0213
	[0.0211]	[0.0216]**	[0.0200]	[0.0146]	[0.0404]
2013	-0.0561	-0.0313	-0.0534	-0.0919	-0.0892
	[0.0135]***	[0.0187]*	[0.0137]***	[0.0183]***	[0.0207]***
Mean dep. var. in 2011	0.29	0.29	0.31	0.28	0.25
Observations	23,427	33,418	32,291	37,006	16,507
R-squared	0.0530	0.0291	0.0248	0.0231	0.0217
Correctly predicted	0.6846	0.7049	0.7032	0.7057	0.7023
Individual controls	Yes	Yes	Yes	Yes	Yes
State $\times$ time controls	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

Notes: The 1^{st} quintile corresponds to the lowest 20 percent households in the income distribution. Analogously, the 5^{th} quitile corresponds to the highest 20 percent households in the income distribution. The omitted category corresponds to 2011, the year the federal law was passed. Treatment is defined as a dichotomous variable, $Treat_s$, that equals one if the legislation index for state s in moment t is less than or equal to 3 before 2011. After 2011, all states *are treated* thus $Treat_s$ equals one for all states s after 2011. Individual controls include age, gender, educational attainment, employment status and income category of the household. State $\times$ time controls include total private employment and total population. Standard errors in squared brackets are block-bootstrapped at the state-level with 200 replications. *** p<0.01, ** p<0.05, * p<0.10

A.vi Alcohol Consumption

Table A6: Probability of risky alcohol consumption - Estimates from the Probit model

Dependent variable	Alcohol consumption	Beer abuse	Wine abuse	Spirits	Binge drinking
	(1)	(2)	(3)	(4)	(5)
2008	-0.0845	-0.0085	0.0132	-0.2020	0.0534
	(0.0591)	(0.1297)	(0.1108)	(0.1645)	(0.1109)
2009	0.0091	0.0342	-0.0807	-0.1013	-0.0277
	(0.0741)	(0.0985)	(0.0901)	(0.1329)	(0.0816)
2013	0.0288	-0.2256**	-0.1527**	0.6968***	-0.1526**
	(0.0355)	(0.1079)	(0.0556)	(0.1553)	(0.0730)
Marginal Effects (at means)					
2008	-0.0268	-0.0011	0.0021	-0.0171	0.0179
	0.0187	0.0162	0.0174	0.0139	0.0373
2009	0.0029	0.0043	-0.0127	-0.0086	-0.0093
	0.0235	0.0123	0.0142	0.0111	0.0274
2013	0.0091	-0.0282**	-0.0241**	0.0589***	-0.0512**
	0.0113	(0.0133)	0.0089	0.0117	0.0246
Mean dep. var. in 2011	0.7232	0.1095	0.1291	0.0318	0.3605
Observations	29,391	21,561	21,561	21,561	21,561
Pseudo R-squared	0.0534	0.1768	0.1035	0.1613	0.1054
Correctly predicted	0.9816	0.8605	0.8663	0.9258	0.6909
Individual controls	Yes	Yes	Yes	Yes	Yes
State $\times$ time controls	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

Notes: The omitted category corresponds to 2011, the year the federal law was passed. Treatment is defined as a dichotomous variable, $Treat_s$, that equals one if the legislation index for state s in moment t is less than or equal to 3 before 2011. After 2011, all states *are treated* thus $Treat_s$ equals one for all states s after 2011. The sample is restricted to current smokers who have reported drinking alcohol in the last month. Individual controls include age, gender, educational attainment, employment status and income category of the household. State $\times$ time controls include total private employment and total population. Standard errors in parentheses are clustered at the state-level and the number of states is 24. *** p<0.01, ** p<0.05, * p<0.10

Table A7: Demographic Characteristics of Smokers by Alcohol Beverages

	Abusive consumption			Binge drinking
	Beer	Wine	Spirits	
Female	0.14	0.13	0.30	0.19
	(0.01)	(0.01)	(0.04)	(0.01)
Young (<25 years old)	0.45	0.29	0.61	0.35
	(0.02)	(0.02)	(0.04)	(0.01)
Less than high school	0.53	0.61	0.44	0.53
	(0.02)	(0.02)	(0.04)	(0.01)
Single	0.54	0.36	0.74	0.48
	(0.02)	(0.02)	(0.03)	(0.01)
High income hh	0.06	0.03	0.09	0.07
	(0.01)	(0.01)	(0.02)	(0.01)
Population share	0.12	0.13	0.03	0.38

A.vii Health outcomes

COPD

Table A8: Effect on the ratio of hospital discharges by age

Age:	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2008	0.0148	0.0565	0.0268	0.0463	0.0551**	0.0998**	0.1246**	0.0890	0.2829*	0.1586
	(0.0207)	(0.0369)	(0.0268)	(0.0306)	(0.0225)	(0.0332)	(0.0598)	(0.1015)	(0.1481)	(0.1759)
2009	0.0229	0.0741**	0.0466**	0.0335	0.0383	0.0664	0.2336***	0.1700*	0.1876	0.0399
	(0.0340)	(0.0349)	(0.0226)	(0.0253)	(0.0327)	(0.0548)	(0.0467)	(0.1024)	(0.1406)	(0.1642)
2010	0.0601**	0.0324	0.0259	0.0393	0.0731**	0.0045	0.1453**	0.0758	0.4212**	0.4147*
	(0.0261)	(0.0211)	(0.0172)	(0.0240)	(0.0319)	(0.0460)	(0.0477)	(0.0717)	(0.1480)	(0.2440)
2012	0.0141	0.0047	0.0224	0.0176	-0.0133	-0.0095	-0.0225	-0.1671**	0.0203	-0.1288
	(0.0191)	(0.0200)	(0.0248)	(0.0226)	(0.0187)	(0.0288)	(0.0287)	(0.0578)	(0.0983)	(0.1058)
2013	0.0049	0.0068	0.0128	0.0264	0.0108	0.0004	0.0163	-0.0825*	0.0230	0.0544
	(0.0149)	(0.0158)	(0.0178)	(0.0267)	(0.0230)	(0.0223)	(0.0344)	(0.0491)	(0.0775)	(0.1199)
2014	0.0113	-0.0031	-0.0103	0.0106	-0.0053	-0.0141	0.0055	-0.1846***	-0.0532	-0.1287
	(0.0165)	(0.0185)	(0.0174)	(0.0200)	(0.0192)	(0.0283)	(0.0385)	(0.0514)	(0.0836)	(0.1045)
2015	0.0061	-0.0023	-0.0079	0.0090	-0.0081	0.0091	-0.0244	-0.0802	0.0815	-0.0808
	(0.0163)	(0.0152)	(0.0162)	(0.0237)	(0.0146)	(0.0340)	(0.0335)	(0.0655)	(0.1211)	(0.0980)
Mean dep. var in 2011	0.1158	0.1052	0.1184	0.1233	0.1482	0.2294	0.3242	0.6813	1.0632	1.5516
Observations	192	192	192	192	192	192	192	192	192	192
R - squared	0.756	0.719	0.779	0.691	0.770	0.609	0.657	0.546	0.490	0.630
State x time controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No

Notes: The omitted category corresponds to 2011, the year the federal law was passed. Treatment is defined as a dichotomous variable, $Treat_s$, that equals one if the legislation index for state s in moment t is less than or equal to 3 before 2011. After 2011, all states *are treated* thus $Treat_s$ equals one for all states s after 2011. State $\times$ time controls include total private employment. Standard errors are clustered at the state-level and the number of states is 24. COPD stands for Chronic Obstructive Pulmonary Disease. *** p<0.01, ** p<0.05, * p<0.10

Lung Cancer

Table A9: Effect on the ratio of hospital discharges by age

Age:	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2008	0.0021	0.0565	0.0268	0.0463	0.0551**	0.0998**	0.1246**	0.0890	0.2829*	0.1586
	(0.0030)	(0.0369)	(0.0268)	(0.0306)	(0.0225)	(0.0332)	(0.0598)	(0.1015)	(0.1481)	(0.1759)
2009	0.0003	0.0741**	0.0466**	0.0335	0.0383	0.0664	0.2336***	0.1700*	0.1876	0.0399
	(0.0026)	(0.0349)	(0.0226)	(0.0253)	(0.0327)	(0.0548)	(0.0467)	(0.1024)	(0.1406)	(0.1642)
2010	-0.0004	0.0324	0.0259	0.0393	0.0731**	0.0045	0.1453**	0.0758	0.4212**	0.4147*
	(0.0022)	(0.0211)	(0.0172)	(0.0240)	(0.0319)	(0.0460)	(0.0477)	(0.0717)	(0.1480)	(0.2440)
2012	0.0075*	0.0047	0.0224	0.0176	-0.0133	-0.0095	-0.0225	-0.1671**	0.0203	-0.1288
	(0.0043)	(0.0200)	(0.0248)	(0.0226)	(0.0187)	(0.0288)	(0.0287)	(0.0578)	(0.0983)	(0.1058)
2013	0.0031	0.0068	0.0128	0.0264	0.0108	0.0004	0.0163	-0.0825*	0.0230	0.0544
	(0.0021)	(0.0158)	(0.0178)	(0.0267)	(0.0230)	(0.0223)	(0.0344)	(0.0491)	(0.0775)	(0.1199)
2014	0.0012	-0.0031	-0.0103	0.0106	-0.0053	-0.0141	0.0055	-0.1846***	-0.0532	-0.1287
	(0.0021)	(0.0185)	(0.0174)	(0.0200)	(0.0192)	(0.0283)	(0.0385)	(0.0514)	(0.0836)	(0.1045)
2015	0.0034	-0.0023	-0.0079	0.0090	-0.0081	0.0091	-0.0244	-0.0802	0.0815	-0.0808
	(0.0031)	(0.0152)	(0.0162)	(0.0237)	(0.0146)	(0.0340)	(0.0335)	(0.0655)	(0.1211)	(0.0980)
Mean dep. var in 2011	0.0040	0.0032	0.0082	0.0168	0.0313	0.0685	0.1888	0.2706	0.5170	0.7187
Observations	192	192	192	192	192	192	192	192	192	192
R-squared	0.239	0.719	0.779	0.691	0.770	0.609	0.657	0.546	0.490	0.630
State x time controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	No	No	No	No	No	No	No

Notes: The omitted category corresponds to 2011, the year the federal law was passed. Treatment is defined as a dichotomous variable, $Treat_s$, that equals one if the legislation index for state s in moment t is less than or equal to 3 before 2011. After 2011, all states *are treated* thus $Treat_s$ equals one for all states s after 2011. State $\times$ time controls include total private employment. Standard errors are clustered at the state-level and the number of states is 24. Lung cancer is approximate by the cause "malignant tumors in the respiratory system". *** p<0.01, ** p<0.05, * p<0.10

A.viii Appendix to what works best

In this section I present a framework for identification of the effects of each policy branch. The identification assumption put in place is that; conditional on state and time fixed effects, more lenient and more strict states would have followed the same trend in the absence of the 2011's federal policy. Define y_{0i} as the smoking status of individual i in state s in absence of the federal policy and let y_{1i} be the smoking status of individual i in state s if the federal policy is implemented . In absence of this policy, smoking outcomes can be written as the sum of a state effect that is fixed over time and a year effect that is common to all states. The conditional mean function is restricted in a particular way, under the assumption that the effect of the policy is constant across states and time: [33]

$$E\left[y_{0i}|s,t\right] = \alpha_s + \alpha_t$$
$$E\left[y_{1i}|s,t\right] = E\left[y_{0i}|s,t\right] + \delta$$

The parameter δ is the causal effect of the national regulation. I argue that this effect is a linear combination of the effects of each branch of the policy. To see this, define S_1 as the subset of states that have implemented place-based bans before the national implementation and S_2 as the subset of states that have not implemented such bans. The counterfactual outcomes for each subset of states show that some states *have already been treated*:

$$S_1 \quad \text{states:} \quad E\left[y_{0i}|s \in S_1,t\right] = \alpha_s + \alpha_t + \delta^{bans}$$
$$S_2 \quad \text{states:} \quad E\left[y_{0i}|s \in S_2,t\right] = \alpha_s + \alpha_t$$

Under the assumption that the effects of each policy branch are additive, and allowing for the presence of spillover effects among the clean-indoor-air policy and the TGW when they are jointly implemented, the outcomes if the implementation happens are:

$$S_1 \quad \text{states:} \quad E\left[y_{1i}|s \in S_1,t\right] = E\left[y_{0i}|s \in S_1,t\right] + \delta^{tgw}$$
$$S_2 \quad \text{states:} \quad E\left[y_{1i}|s \in S_2,t\right] = E\left[y_{0i}|s \in S_2,t\right] + \delta^{bans} + \delta^{tgw} + f(\delta^{bans},\delta^{tgw})$$

Where δ^{bans} is the causal effect of the place-based policy on the outcome of interest, δ^{TGW} is the causal effect of the tobacco graphic warnings, and $f(\delta^{TGW},\delta^{bans})$ is the spillover effect of implementing the policies jointly. Then, the effect of the federal policy can be written as a

[33] I implicitly condition on covariates in the next derivations, I omit this conditioning to ease on notation.

function of the effect of each branch of the policy:

$$\begin{aligned}\delta =& E\left[y_{1i}|s,t\right] - E\left[y_{0i}|s,t\right] \\ =& E\left[y_{1i}|s \in S_1,t\right] P(s \in S_1) - E\left[y_{0i}|s \in S_1,t\right] P(s \in S_1) + E\left[y_{1i}|s \in S_2,t\right] P(s \in S_2) \\ & - E\left[y_{0i}|s \in S_2,t\right] P(s \in S_2)\end{aligned}$$

Let $P(s \in S_1) = \omega_1$ and $P(s \in S_2) = \omega_2$ thus :

$$\begin{aligned}\delta =& \omega_1 \left[E\left[y_{0i}|s \in S_1,t\right] + \delta^{tgw}\right] - \omega_1 E\left[y_{0i}|s \in S_1,t\right] \\ & + \omega_2 \left[E\left[y_{0i}|s \in S_2,t\right] + \delta^{bans} + \delta^{tgw} + f(\delta^{bans},\delta^{tgw})\right] - \omega_2 E\left[y_{0i}|s \in S_2,t\right] \\ =& \delta^{tgw} + \omega_2 \delta^{bans} + \omega_2 f(\delta^{bans},\delta^{tgw})\end{aligned}$$

Where ω_2 can be estimated as the proportion of states that have not implemented a place-based ban before the national regulation. Alternatively, ω_1 is the proportion of states that have implemented a place-based ban before the national regulation. Can the effect of place-based policies be told apart from the effect of tobacco graphic warnings? The effect of place-based bans is identified by the comparison of early adopters of place-based bans with late adopters. Early adopters imposed place-based bans before 2011, while late adopters imposed place-based bans once the 2011 national law was passed. Using the previous results:

$$\begin{aligned}\delta^{bans} + f(\delta^{bans},\delta^{tgw}) &= \left\{E\left[y_{1i}|s \in S_2,t\right] - E\left[y_{0i}|s \in S_2,t\right]\right\} - \left\{E\left[y_{1i}|s \in S_1,t\right] - E\left[y_{0i}|s \in S_1,t\right]\right\} \\ \tilde{\delta}^{bans} &= \left\{E\left[y_{1i}|s \in S_2,t\right] - E\left[y_{0i}|s \in S_2,t\right]\right\} - \left\{E\left[y_{1i}|s \in S_1,t\right] - E\left[y_{0i}|s \in S_1,t\right]\right\}\end{aligned}$$

Where I have defined $\tilde{\delta}^{bans} = \delta^{bans} + f(\delta^{bans},\delta^{tgw})$.
The effect of the national policy can be now written in terms of $\tilde{\delta}^{bans}$:

$$\begin{aligned}\delta =& \delta^{tgw} + \omega_2 \left[\delta^{bans} + f(\delta^{bans},\delta^{tgw})\right] \\ \delta =& \delta^{tgw} + \omega_2 \tilde{\delta}^{bans}\end{aligned}$$

Where δ, ω_2 and $\tilde{\delta}^{bans}$ can be estimated. That is, I can use the estimates of δ and $\tilde{\delta}^{bans}$ to construct estimates of the effect of tobacco graphic warnings. The running equation to estimate δ is (1), replicated here omitting individual and state-time varying control variables to ease exposition:

$$y_i = \sum_{\tau=-2}^{1} \delta_\tau \left[\text{Treat}_s \cdot (\text{Years after treat} = \tau)\right] + \alpha_s + \alpha_t + \varepsilon_i$$

Next, the proportion of states that have not implemented a place-based ban before the national regulation is observed in the data: $\omega_2 = P(s \in S_2)$ and can be estimated as the number of states that are late-adopters of clean-indoor-air bans relative to the total number of states. Finally, the running equation to estimate $\delta^{bans} + f(\delta^{bans}, \delta^{tgw})$ is:

$$y_i = \gamma_0 + \gamma_1 \times 1\{Year = 2013\} + \gamma_2 \times 1\{s \in S_2\} + \tilde{\delta}^{bans} 1\{Year = 2013\ , s \in S_2\} + u_i$$

This regression can be augmented by leads and lags of relative treatment time in an event-study framework:

$$y_i = \sum_{\tau=-2}^{1} \tilde{\delta}_{\tau}^{bans} \left[\text{Bans}_s \cdot (\text{Years after treat} = \tau)\right] + \alpha_s + \alpha_t + u_i \tag{6}$$

Where $Bans$ is a dummy variable that equals 1 if the state s is a late-adopter of place-based bans.

A.ix Robustness-checks

A.ix.1 Balance test on observable characteristics

The following table presents the mean and standard deviation of individual characteristics for comparison and treated states when treatment is defined as a dichotomous variable that equal 1 if the legislation index for state s is strictly less to 3 before 2011. Estimates use pooled data from national surveys on tobacco use for 2008 and 2009.

Table A10: Pre Policy Balance Individual Characteristics

	Control	Treatment	Difference
Average age	37.66	37.71	-0.05
	(13.47)	(13.31)	(0.42)
Male	0.49	0.49	0.01
	(0.50)	(0.50)	(0.02)
Young (< 25 years old)	0.24	0.23	0.01
	(0.43)	(0.42)	(0.01)
Married or cohabitant	0.57	0.59	-0.01
	(0.49)	(0.49)	(0.02)
Employed	0.70	0.70	0.00
	(0.46)	(0.46)	(0.02)
Educational level			
Elemetary school drop out	0.08	0.08	0.01
	(0.27)	(0.26)	(0.01)
Elemetary school	0.20	0.19	0.01
	(0.40)	(0.39)	(0.01)
High school drop out	0.19	0.20	-0.01
	(0.39)	(0.40)	(0.01)
High school	0.23	0.24	-0.01
	(0.42)	(0.43)	(0.02)
College drop out	0.14	0.13	0.00
	(0.34)	(0.34)	(0.01)
College	0.14	0.14	0
	(0.35)	(0.34)	(0.01)
Income category			
First quintile	0.15	0.13	0.02***
	(0.34)	(0.32)	(0.01)
Second quintile	0.35	0.23	0.12***
	(0.47)	(0.41)	(0.01)
Third quintile	0.20	0.23	-0.03***
	(0.40)	(0.42)	(0.01)
Forth quintile	0.17	0.27	-0.09***
	(0.38)	(0.43)	(0.01)
Fifth quintile	0.13	0.14	-0.01
	(0.32)	(0.32)	(0.01)
Observations	27,348	33,101	60,449
Number of states	15	9	24

Notes: This table presents the mean and standard deviation of individual characteristics for comparison and treated states in columns 1 and 2. Column 3 presents estimated coefficients and standard errors from an OLS regression of the mean difference. Estimates use pooled data from national surveys on tobacco use for 2008 and 2009. The lowest quintile corresponds to the lowest 20% of households in the income distribution. Analogously, the highest quintile corresponds to the highest 20% of households in the income distribution. *** $p<0.01$, ** $p<0.05$, * $p<0.10$