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TRADE-OFF BETWEEN OBESITY AND TOBACCO CONSUMPTION: EVIDENCE FROM ARGENTINA

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ABSTRACT

Recent evidence suggests that obesity and tobacco prevalence rates are moving in opposite direction. This study examines the causal relationship between these variables in Argentina. The effects of tobacco consumption on body weight are estimated by using instrumental variables to address endogeneity problems. To this end, the entry into force of provincial laws on tobacco control at different times is exploited. Our results show that smoking has a negative impact on three weight measures (BMI, weight in kilograms, obesity rate). This finding suggests that anti-smoking measures should be complemented with nutritional controls and the promotion of physical activity.

JEL classification: I12; I18; C26.
Keywords: obesity, tobacco consumption, health, Argentina..

RESUMEN

La evidencia reciente sugiere que la obesidad y la tasa de prevalencia del tabaco se mueven en direcciones opuestas. Este trabajo examina la relación causal entre dichas variables en Argentina. Los efectos del consumo de tabaco en el peso corporal son estimados utilizando variables instrumentales para lidiar con problemas de endogeneidad. Con este fin, el trabajo toma provecho de leyes provinciales para el control del tabaco que fueron aplicadas en diferentes períodos temporales. Nuestros resultados muestran que fumar tiene un impacto negativo en tres medidas de peso corporal (BMI, peso en kilogramos, tasa de obesidad). Estos hallazgos sugieren que las reglamentaciones contra el tabaco deben ser complementadas con controles nutricionales y promoción de la actividad física.

Clasificación JEL: I12; I18; C26.
Palabras clave: obesidad, consumo de tabaco, salud, Argentina

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TRADE-OFF BETWEEN OBESITY AND TOBACCO CONSUMPTION: EVIDENCE FROM ARGENTINA[1]

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I. Introduction

The World Health Organization (WHO) considers tobacco use and obesity as two major risk factors contributing to costly chronic conditions. Nearly 22% of the world's population aged 15 years and over are smokers, meanwhile 39% of adults aged 18 years and over are overweight and 13% are obese (WHO, 2016). More than six million people die each year from tobacco use and exposure to tobacco smoke and an estimated of 2.8 million deaths per year are attributable to obesity (WHO, 2017a, 2017b).

Tobacco causes serious cardiovascular and respiratory diseases including coronary heart disease and is a leading cause of cancer and death from cancer. Tobacco consumption causes cancer of lung, larynx, mouth, esophagus, throat, bladder, kidney, liver, stomach, pancreas, colon and rectum, cervix, and acute myeloid leukemia (NIH, 2017). The WHO (2019) estimates that total economic cost of smoking (including health expenditures and productivity losses) is

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roughly 1.4 trillion US dollars per year, an amount equivalent in magnitude to 1.8% of the world's annual gross domestic product (GDP).

Overweight and obesity are significant risk factors for noncommunicable diseases such as cardiovascular diseases (e.g., heart disease and stroke), type II diabetes and hypertension, musculoskeletal disorders (specially osteoarthritis), and some cancers, including endometrial, breast, ovarian, prostate, liver, gallbladder, kidney, and colon (WHO, 2018). They also impose a large economic burden on the individual, families and nations as result of lower productivity at work, working days lost, disability and early death (Tremmel, Gerdtham, Nilsson, & Saha, 2017). Dobbs et al. (2014) estimate the global economic impact from obesity is around 2.0 trillion US dollars, or 2.8% of world's GDP.

In Argentina, 25.1% of people 18 years and older smoke and 20.5% are obese (ENFR 2013). According to Rubinstein et al. (2010), tobacco use in Argentina is accountable for 16.1% of years of life lost (YLL) and 16.6% of potential years of life lost (PYLL), while overweight and obesity are responsible for 13.8% and 15.1%, respectively. Furthermore, the authors indicate that the cost in terms of YLL was equivalent to at least 180 million US dollars in 2007, attributing similar shares to smoking and obesity.

Since the mid-20th century, the main concern of health practitioners and economists has been developing measures to reduce both the demand and the supply of tobacco products. Effective strategies have been implemented globally to reverse the positive trend in the prevalence of smokers. Simultaneously, a rapidly increasing prevalence of overweight and obesity that might undermine the health advances of tobacco control policies has been observed worldwide. If these trends continue, obesity will overtake smoking as the biggest preventable cause of non-communicable diseases in the future.[5]

In view of these facts, many researchers have begun to question if smoking status and body weight are interrelated. Health and economics studies have reached conflicting results, suggesting that the relationship between tobacco and obesity is complex. Some studies have suggested that cigarette consumption and obesity are inversely related (Baum, 2009; Chou, Grossman, & Saffer, 2004; Courtemanche, Tchernis, & Ukert, 2018; Dare, Mackay, & Pell, 2015;

[5] In a recent study, the International Agency for Research on Cancer reports that overweight and obesity could contribute to more United Kingdom cancer cases than smoking in the foreseeable future (CRUK, 2018).

Fang, Ali, & Rizzo, 2009; Jiménez-Martín, Todeschini, & Labeaga, 2010; Lara & Serio, 2012; Nie, Leon, Sánchez, & Sousa-Poza, 2018; Pieroni & Salmasi, 2016; Rashad, 2006; Sen, Entezarkheir, & Wilson, 2010, among others). A few studies have found that reduced smoking leads to a lower body mass index (BMI) (Cawley, Markowitz, & Tauras, 2004; Duncan et al., 2010; Fulkerson & French, 2003; Gruber & Frakes, 2006; Rees & Sabia, 2010). Wehby, Murray, Wilcox, and Lie (2012) find heterogeneous effects by using a categorical BMI and genetic instrumental variables. Other researchers suggest reverse causality, namely that individuals choose to smoke in order to lose or control weight (Chiolero, Faeh, Paccaud, & Cornuz, 2008; Courtemanche, 2009). If smoking status and body weight are interrelated in any sense, as suggested by these studies, then tobacco control policies might have an unintended consequence on overweight and obesity that should be addressed.

The potential trade-off between these two public health concerns would mitigate the net social benefits of tobacco control policies because of the economic and social costs of obesity.[6]

This study examines the effects of smoking on body weight measures (such as weight in kilograms, BMI, obesity). It aims to contribute to the literature by offering evidence for Argentina, using the three waves of Encuesta Nacional de Factores de Riesgo (ENFR, National Risk Factor Survey). The use of Argentine data is attractive for many reasons. First, obesity and tobacco trends are similar to those observed in developed countries; in particular, the prevalence rate of tobacco consumption is decreasing, whereas those of overweight and obesity are increasing. Second, it is possible to exploit the differences in the scope and entry into force of state regulations and laws regarding tobacco use. Finally, this study would have important implications for public policies due to the scarce research on the causal relationship between tobacco and obesity in developing countries. Findings in favor to a causal relationship between smoking and obesity and the magnitude of the effect will improve the design of public policies aimed at reducing the prevalence of both risk factors and mitigating their negative economic impacts.

The remainder of this paper is organized as follows. Section 2 summarizes

[6] However, both targets could be simultaneously achieved if anti-tobacco campaigns reduce smoking and obesity rates, challenging the principles of Tinbergen (Tinbergen, 1955) and Theil (Theil, 1961).

the economic literature linking tobacco to body weight. Section 3 describes the data used in the empirical analysis. Section 4 explains the methodology and empirical strategy adopted. The results are presented in Section 5. Section 6 discusses policy implications and Section 7 concludes.

II. Background

In the past three decades, several authors have studied the relationship between tobacco consumption and body weight. Health researchers have found that tobacco consumption may decrease body weight "by altering insulin homeostasis, lipoprotein lipase activity, the activity of the sympathetic nervous system, physical activities and the preferences in food consumption" (Baum & Chou, 2011). Conversely, quitting smoking may induce smokers to increase caloric intake because of "the need to put something in their mouth to replace cigarettes," a phenomenon known as "oral fixation" (Courtemanche, 2009).

The medical and clinical literature has generally asserted that smoking decreases weight, while quitting smoking leads to weight gain (Basterra-Gortari et al., 2010; Chiolero et al., 2008; Dare et al., 2015; Robertson, McGee, & Hancox, 2014; Tian, Venn, Otahal, & Gall, 2015; Williamson et al., 1991). Similarly, economists' studies such as Baum (2009); Baum and Chou (2011); Chou et al. (2004); Courtemanche et al. (2018); Fang et al. (2009); Pieroni and Salmasi (2016); Rashad (2006); Sen et al. (2010); Wehby et al. (2012) also analyze the relationship between smoking and obesity.

Baum (2009); Baum and Chou (2011); Chou et al. (2004); Rashad (2006); Sen et al. (2010) find that the increase in the real cost of cigarettes due to tobacco control policies has had a positive effect on obesity.[7] In particular, Chou et al. (2004) study the determinants of BMI clustering by state and year, controlling for an individual's characteristics (e.g., age, race, household income, year of formal education, hours of work), alcohol and tobacco prices, as well as the number of fast food and full service restaurants and their prices. Their results indicate a positive association between the real price of cigarettes and weight, but no clear pattern in the effect of clean indoor laws in the United States is found.

[7] The real cost of smoking includes the "money price of cigarettes, the diffusion of information concerning the harmful effects of smoking, and the enactment of state statutes that restrict smoking in public places and in the workplace" (Chou et al., 2004).

The study of Rashad (2006) is similar to the analysis of Chou et al. (2004) but she adds caloric intake adjusted by activity level as an explanatory variable. Her estimates indicate that caloric intake and cigarette tax have important effects on determining obesity, but these effects lose significance when she takes endogeneity into account.

Baum (2009) uses the same data and similar specifications to those used by Chou et al. (2004), Rashad (2006), and Gruber and Frakes (2006), showing that the results are sensitive to the measures of cigarettes used (taxes or monetary prices) and the analytical approach. His results evidence that higher cigarette taxes and monetary prices significantly increase BMI when more complete controls are added for correlation with state-specific time trends.

Fang et al. (2009) re-examine this relationship by using data from China, the largest consumer and manufacturer of tobacco in the world, based on an instrumental variable estimation and quantile regression analyses. They find a moderate negative and significant relationship between cigarette smoking and BMI. Furthermore, they show that the association between smoking and BMI is weak among high-BMI subjects, but considerably stronger among subjects in the healthy weight range.

Jiménez-Martín et al. (2010) evaluate the impact of tobacco control policies on the body weight of US adults. They construct a synthetic panel that allows them to control unobserved heterogeneity and use the exogenous changes in taxes and clean indoor laws to instrument the decision of quitting smoking. Their findings suggest that a 10% reduction in smoking consumption leads to an average weight gain of 1 to 1.3 kilograms, assuming constant height. They estimate that the implicit elasticity of giving up smoking to the probability of becoming obese is 0.58. Finally, by using data from the Department of Health and Human Services on the average healthcare cost for the obese and smokers, they conclude that reducing tobacco consumption by 1% produces a positive net benefit. Courtemanche et al. (2018) find a similar relation by using data from the Lung Health Study, a randomized trial of smoking cessation treatments. They use an instrumental variable approach and estimate that people who quit smoking gain around 1.8–1.9 BMI units in the long run. Sen et al. (2010) exploit the differences between Canadian provinces to estimate the effects of cigarette taxes on smoking and obesity, using aggregate region- and individual-level health data. As in the preceding research, they find a positive correlation between larger

tobacco taxes and obesity. Pieroni and Salmasi (2016) also study the causal relationship between quitting smoking and body weight, finding a positive effect of quitting smoking on weight changes. Moreover, the effects increase in the highest quantiles.

Baum and Chou (2011), by using the Oaxaca–Blinder decomposition technique, find that cigarette consumption explains around 2% of the increase in body weight measures, while other co-factors explain less. Nie et al. (2018) also perform a micro-decomposition by using data from Cuba. They find that a significant part is attributable to changes in risky behavior such as smoking.

Other studies such as those conducted by Gruber and Frakes (2006) and Courtemanche (2009) obtain the contrary results, namely that higher taxes and prices are associated with reductions in body weight. Gruber and Frakes (2006) find that increases in excise tax on tobacco reduce BMI and obesity in the long run, while Courtemanche (2009) provides evidence that the effects of giving up smoking on exercise and food consumption might explain the results obtained.

Wehby et al. (2012) exploit data from a population-level study of oral clefts in Norway between 1966 and 2001, from which they obtain DNA samples from parents and their live-born infants, and evaluate the effects of the number of cigarettes smoked by the mother in the year before becoming pregnant on BMI before pregnancy, using genetic variables as instruments. Their results show that tobacco consumption has heterogeneous effects on BMI, with smoking increasing BMI at low/moderate levels and decreasing BMI at high levels. They also find that smoking reduces the probability of being underweight, increases the probability of being overweight, and might reduce the probability of being obese.

Other researchers have addressed these relations from the hypothesis of reverse causality, namely the effects of body weight on smoking initiation and on the intensity of cigarette consumption. Cawley et al. (2004) and Rees and Sabia (2010) find evidence supporting this hypothesis. Fulkerson and French (2003) conclude that adolescents (mainly girls) are more likely to smoke to achieve weight loss or control regardless of gender, race, and ethnicity. In addition, they assert that heavy smokers, smokers who perceive themselves as overweight, and those who are weight-conscious report cigarettes to be a weight loss or control method.

Cawley et al. (2004) examine the role of body weight, as an objective

measure, and body image, as a subjective measure, in determining adolescent smoking initiation. They report that the probability of smoking initiation is higher among girls trying to lose weight and those overweight. Such results are not observed for boys. Meanwhile, Duncan et al. (2010) find that overweight or obese young women are more likely to become regular smokers than those underweight or normal weight.

However, research that addresses obesity and smoking simultaneously is scarce in Argentina. Marchionni, Caporale, Conconi, and Porto (2011) and Montero and Castillo (2009) analyze obesity as a noncommunicable disease risk factor. Temporelli and Viego (2010) examine the socioeconomic determinants of overweight and obesity by using a spatial econometric model, regardless of the relationship between body weight and tobacco consumption. Lara and Serio (2012) examine the obesity demographic and socioeconomic factors, among the smoking habit, and find an inverse correlation between body weight and tobacco consumption.

III. Data

This study uses a panel dataset for the 24 provinces of Argentina (23 provinces and Ciudad Autónoma de Buenos Aires, CABA) for 2005, 2009, and 2013. The main source of data is the Encuesta Nacional de Factores de Riesgo (ENFR) which covers people of 18 years and more, resident in places of 5,000 and more habitants, with national, regional, and provincial representation. This survey provides self reported information about socio-economics characteristics and the health risk factors of noncommunicable diseases and another health data such as weight in kilograms and height in meters and centimeters, which allows us to calculate body weight indicators as well as the prevalence rates of smokers at the provincial level.

The study also uses provincial data on gross domestic product from Porto, Porto, and Garbero (2016) and Garbero (2016) and population by province data from the Instituto Nacional de Estadisticas y Censos (INDEC).[8]

For this research, three provincial indicators of body weight are defined as follows: average weight in kilograms, average BMI (defined as the ratio of

[8] Data on gross domestic product are in constant 2010 prices, while per capita household income are in constant 2005 prices. Both measures are in local currencies.

weight in kilograms to the square of height in meters), and the prevalence rate of obesity. An obese person is defined as one who presents a BMI equal to or greater than 30 (WHO, 2016).

Before 2011,many Argentinian provinces introduced anti-tobacco laws and regulations within the scope of their competence to make up for the deficit of national tobacco control legislation. These norms provide for protection from exposure to tobacco smoke in indoor workplaces, public transport, indoor public places and other public places. In 2011, Argentina enforce the Law 26687 of Tobacco Control based on the recommendations of the WHO Framework Convention on Tobacco Control (WHO FCTC), although it is one of the few countries in the world that has not yet ratified the international agreement. The measures proposed in this law are used to reduce the prevalence of tobacco use and exposure to tobacco smoke. Among the Law 26687's tobacco control provisions are those that reduce the demand for tobacco (as price and tax measures; protection to exposure to tobacco smoke; regulations of the contents and disclosures of tobacco products; packaging and labelling of tobacco products; education, communication, training and public awareness; tobacco advertising, promotion and sponsorship; and demand reduction measures concerning tobacco dependence and cessation), as well as others that reduce tobacco availability and supply such as prohibit the sale to and by minors and eliminate all forms of illicit trade in tobacco products.

We use the differences in the scope and entry into force of provincial tobacco control bans to complete the dataset with an index of regulations on tobacco consumption at the provincial level with a sanction date from 1993, using data from "Atlas Federal de Legislación Sanitaria" of Argentina, Ministerio de Salud de la Nación (Appendix I documents the time when each legislation was enforced). As Jiménez-Martín et al. (2010) and Chriqui, Frosh, Fues, el Arculli, and Stillman (2002) indicate, the index has to consider provincial laws or regulations that affected the capacity of consumers to smoke in their daily activities, this is especially the case when smoking is banned in enclosed spaces.

The Legislation Index is constructed by using six categories based on enclosed spaces: public sector (e.g., government offices), public transportation (e.g., urban bus, short-distance bus, long-distance bus), educational facilities, recreational public places (e.g., theaters), hospitals, and private offices and places (e.g., restaurants). Each category takes 1 when a total smoking ban exists, 0.5

when a partial ban exists, and 0 otherwise.[9] The Index is thus coded from 0 to 6, with 0 meaning that the province has no smoking ban in place and 6 meaning that smoking is banned in all six enclosed spaces.

Two additional variables are constructed as alternatives for the Legislation Index. First, the Weak Legislative Dummy takes 1 if there is a ban in at least one of the six categories and 0 if the regulation allows smoking in the six categories. The second variable, or the Strong Legislative Dummy, takes 1 when smoking is banned in the six categories at the same time and 0 otherwise. Table A.1 shows the provincial legislation used to create the indices.

Table 1 presents a descriptive analysis of the main provincial variables for 2005, 2009, and 2013. A descriptive analysis by gender is presented in Appendix II. Argentine people have started to become more aware of cigarette damage over time. The percentage of smokers decreased by 5 percentage points (p.p.) between 2005 and 2013, while the percentage of people who had never smoked increased by 4.4 p.p. However, there was no noticeable change in the number of cigarettes consumed per day. A higher percentage of smokers are men and they smoke almost two cigarettes more per day than women (see Appendix II).

At the same time, average weight, average BMI, and the obesity prevalence rate increased in the period, with higher values for men. The consumption of alcohol rate also shows higher values over time (48% in 2005 vs. 81% in 2013). On the other hand, two-thirds of the sample consume fruits and vegetables at least five days per week but increases have been small since 2005. The percentage of the sample that practices sports and physical activities decreased by 7 p.p. in 2005–2013. This tendency to do less physical exercise is the same between genders.

Considering socioeconomic status, both average per capita household income and the percentage of the sample with a higher level of education increased. Although per capita household income is higher for men, fewer men have completed college than women. Furthermore, in 2013, 54% of women have completed high school or a higher level compared with 44% for men. Finally, provinces present higher GDP and have cut public health expenditure (as a percentage of total public expenditure) by half.

[9] For example, Law 5537 states a total smoking ban for exhibitions and museums but does not include another recreational spaces as restaurants.

Table 1: Argentine descriptive statistics: 2005, 2009, and 2013.

Variables	2005	2009	2013
Never smoked	45.79	46.74	50.22
Ex-smoker	24.08	25.70	24.68
Smoker	30.13	27.57	25.10
Number of cigarettes consumed	9.74	10.06	9.94
Weight	71.24	72.77	74.04
BMI	25.57	26.04	26.52
Obesity	15.68	18.08	20.53
Consumption of alcohol	48.52	77.96	81.07
Consumption of fruit and vegetables	66.37	66.38	66.70
Sports and other activities	52.17	43.72	44.86
Health insurance	62.70	68.45	98.92
Married	57.53	56.41	54.56
Per capita household income	277	812	2,331
Incomplete elementary school	16.62	13.65	11.35
Complete elementary school	24.17	21.99	20.56
Incomplete high school	18.45	18.80	19.08
Complete high school	17.76	20.85	23.00
Incomplete college	12.86	12.61	13.04
Complete college	10.14	12.11	12.97
Public health expenditure (% total expenditure)	15.21	16.22	8.96
GDP	22,788	47,230	61,841

Source: Own elaboration based on ENFR, INDEC, Porto et al. (2016), and Garbero (2016).

IV. Methodology

IV.1 The model

The relation between tobacco consumption and body weight is analyzed by estimating the following equation:

$$Y_{j,t} = \alpha + X'_{j,t}\beta + S_{j,t}\theta + \eta_j + u_{j,t}, \quad (1)$$

where j is the Argentine province and t indicates time. $Y_{j,t}$ is the average of a

body weight indicator from province j at time t. We consider three dependent variables: the logarithm of the average body weight in kilograms of the residents of province j, the average BMI of province j (logarithm), and the obesity rate of province j. $S_{j,t}$ is the smoking rate of province j at time t.[10] $X'_{j,t}$ is a $1\text{x}k$ vector of the control variables at provinces level including number of habitants by province, GDP, percentage of the population with higher education, percentage of men, percentage that is married, percentage of occupied, percentage of the population that consume fruits and vegetables five or more times a week, alcohol consumption rate, and percentage that performs high physical activity.[11] η_j are the fixed effects (FE) of provinces and $u_{j,t}$ is the error term.

The estimation of Equation 1 might suffer from the endogeneity problem because of reverse causality and selection bias. In regard to reverse causality, smoking diminishes anxiety, leading to less caloric intake and thereby weight loss. On the contrary, one reason for not quitting smoking cigarettes is the subsequent possible gain weight. In addition, some people who want to lose weight will start smoking. Thus, we also proposed the following equation:

$$S_{j,t} = \gamma + X'_{j,t}\phi + Y_{j,t}\psi + \lambda_j + \varepsilon_{j,t}, \tag{2}$$

where λ_j are fixed effects (FE) by provinces and $\varepsilon_{j,t}$ is the error term.

Reverse causality bias comes up through the error term of Equation 1. This error term is not independent because it is correlated with the smoker variable $S_{j,t}$.

Selection bias could also arise in the estimations. The smoking rate and body weight of people could be affected by the same unobserved factors. Therefore, if these endogeneity problems are not taken into account and the parameters of the model are estimated by using ordinary least squares, they will be biased and inconsistent. A within estimator is unsuitable because some of these unobservable variables might change over time (e.g., social culture, health

[10] An alternative is to explore the effects of quitting smoking on body weight. Unfortunately, our data do not provide adequate information on the time at which a person stops smoking.

[11] Consumption of alcohol is used as control by Williamson et al. (1991), Chou et al. (2004), Fang et al. (2009), Basterra-Gortari et al. (2010), Duncan et al. (2010), Jiménez-Martín et al. (2010), Dare et al. (2015) and Nie et al. (2018). Consumption of fruits and vegetables is used by Courtemanche (2009). Williamson et al. (1991), Rashad (2006), Courtemanche (2009), Fang et al. (2009), Basterra-Gortari et al. (2010), Jiménez-Martín et al. (2010), Baum and Chou (2011), Dare et al. (2015) and Pieroni and Salmasi (2016) use physical activity as control.

education, healthy and unhealthy behaviors). These problems led us to propose the following empirical strategy to estimate Equation 1.

IV.2 Emirical strategy

To identify the causal effect of smoking on body weight, we propose estimating Equation 1 with instrumental variables. Usually, in the literature tobacco taxes and prices are the most used instruments (Chou et al., 2004; Gruber & Frakes, 2006; Jiménez-Martín et al., 2010; Rashad, 2006, among others). However, in Argentina tobacco taxes are national, so they do not vary through provinces. On the other hand, tobacco prices show differences between provinces but this information is not available. Thus, our strategy is to consider smoking bans in enclosed spaces in Argentinian anti-tobacco laws as an instrument.

Argentinian anti-tobacco laws are an exogenous variation of the smoking prevalence rate, which affects people's body weight. Moreover, this anti-tobacco laws are not correlated with other characteristics associated with body weight. These features make bans in enclosed spaces in anti-tobacco laws a good instrument.

Studies in Argentina have used similar empirical strategies. For example, Alzúa, Gasparini, and Haimovich (2015) and Alzúa and Velázquez (2017) employ an education reform law (*Ley de Reforma Educativa*) as an instrumental variable to analyze the effect of education on the labor market and fertility rate, respectively. Here, as in the above studies, the temporal variability of legislation is exploited.

In June 2011, the Argentine Law 26.687 of Tobacco Control was sanctioned and implemented. This law takes into account the World Health Organization Framework Convention on Tobacco Control and prohibits smoking in enclosed spaces. However, each Argentinian province either could accept or not the national law or create its own law. Moreover, before 2011 some provinces already had anti-tobacco legislation at the provincial level. Table A.1 shows the province's anti-tobacco legislation. In 2005, only six of the 14 provinces that had legislation, banned smoking in enclosed spaces. In 2009, this number rose to 18. By 2013, most provinces had banned smoking in enclosed spaces (except for Misiones and Jujuy).

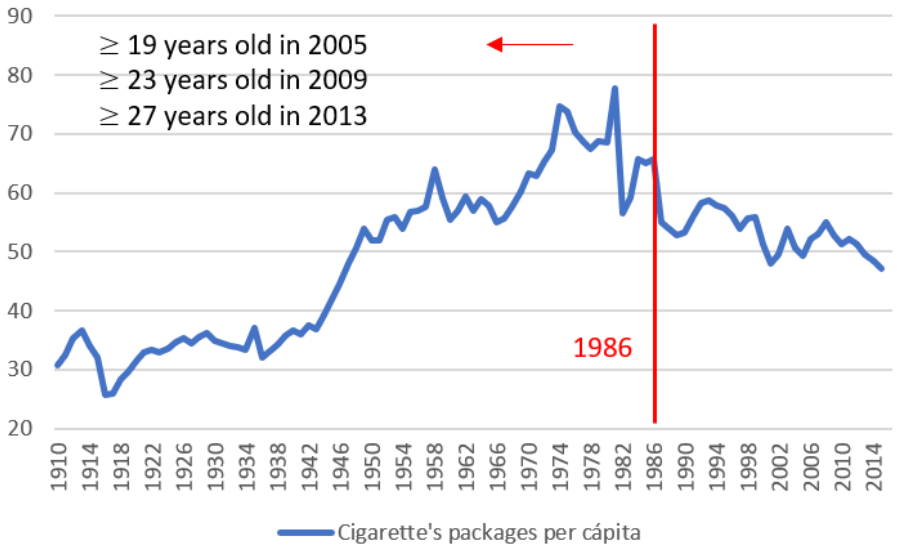
We consider the Legislative Index to be an instrument. As we mentioned above, this index includes six categories. In addition, a robust analysis is conducted by using two alternative instruments, namely the Weak Legislation Dummy and the Strong Legislation Dummy. An additional approach could be to use each category as an instrument, i.e., six instruments, but they perform as weak instruments. Thus, we follow the usual empirical strategy that is to combine them.[12]

Moreover, we would not expect that the legislation affects individuals in the same way. Evidence show that people has different tobacco consumption patterns depending on their born age. This is related to their health risk perceptions in regard to cigarettes due to the context where they were born. In the last 40 years, the consumption of tobacco in Argentina change showing a significant decreasing trend (see Figure 1). The change in this trend was carried out in a period where was a growing evidence of the harmful effects of smoking on people's health. Similar occurs in United States of America with a window of ten-twenty years before (CDC, 1999). If we analize the trend of cigarrette's packages sales, it is possible to identify the year 1986 as the one where the Law 23.344 enforced the inclusion of the legend "Smoking is harmful for health" ("El Fumar es perjudicial para la Salud") in cigarettes packages. Although this law was ineffective and was not sufficient to eliminate smoking, it is the result of a change in the trend of cigarette consumption and health perceptions related to tobacco use. Thus, we exploit this change of trend dividing our sample between individuals that born before and after 1986. Hence, we would expect that the laws of enclosed spaces will have a lower impact on those born after 1986.

We also perform a robustness check considering other years such as 1974, 1976, 1978, 1980, 1982, 1984 as turning points (see Figure D.1 in Appendix IV). In almost all cases we find the same negative relationship between tobacco and weight that in 1986, but only are significant in the '80s. Moreover, for women, the effects are significant only in 1986.

[12] See Cameron and Trivedi (2005), page 110.

Figure 1: Cigarette packages sales in Argentina



Source: Ministerio de Agroindustria, Argentina.

In this case, our instrument would vary by province and by year of birth (those who born in 1986 and before 1986 and those who born after 1986). The sample will have 144 observations (24 provinces x two birth year status x three years of panel data). By this way the number of clusters is 48, surpassing the rule of thumb of 42 clusters suggested by Angrist and Pischke (2008) in order to avoid bias for few clusters. Equation 1 is replaced by the following,

$$Y_{j,b,t} = \alpha + X'_{j,b,t}\beta + S_{j,b,t}\theta + \eta_j + u_{j,b,t}, \tag{3}$$

where b is the year of birth before and after 1986.

A reduced form can be derived by substituting the first-stage equation into the causal relation of interest (Equation 3), obtaining Equation 4. We will estimate this Equation 4 by OLS.

$$Y_{j,b,t} = \zeta + I_{j,b,t}\vartheta + X'_{j,b,t}\delta + \varrho_j + \nu_{j,b,t}, \tag{4}$$

where I is the instrument variable.

Further, the ban on smoking in enclosed spaces, whether public or private, might affect employed and unemployed/inactive people differently. We assume that an employed person is more likely to spend time in an office, building, or workplace considered to be an enclosed space. Hence, this person is more likely to be exposed to the effects of the law than others who do not spend time in enclosed spaces. Meanwhile, an unemployed or inactive person could smoke in a private space such as his/her house or in an open area, and thus not be exposed to the anti-tobacco legislation. Thus, we would expect that the laws of enclosed spaces have a lower impact on unemployed and inactive persons than on employed ones. As another robustness exercise, we decide to vary our instrument by province and by employment status. To exploit this variation, the sample is divided into cohorts according to employment status: employed and unemployed/inactive. Ultimately, the sample has 144 observations (24 provinces x two employment status x three years of panel data). In this case, the Equation 1 is

$$Y_{j,o,t} = \alpha + X'_{j,o,t}\beta + S_{j,o,t}\theta + \eta_j + u_{j,o,t}, \quad (5)$$

where o is the employment status cohort.

The parameters are estimated by using two-stage least squares. First, Equation 2 is estimated including the instrumental variable as a regressor to explore the change in the smoking rate due to the implementation of the anti-tobacco law. The smoking rate is predicted and used to estimate Equations 3 and 5. Thus, we find the effect of the smoking rate on body weight, BMI, and the obesity rate at the province level.

The instrument has to be a good instrument to estimate the real causal effect of tobacco consumption on body weight, $\hat{\theta}$. A good instrument has to be highly correlated with the endogenous variable (i.e., smoking rate) and the exclusion restriction has to be satisfied (i.e., the instrument is not correlated with body weight).

Probably, if smoking is banned in enclosed spaces, the legislation will be correlated with the cigarette consumption rate. As already mentioned, the anti-tobacco legislation also is not likely to be related to people's body weight in kilograms, BMI, or obesity rate. Thus, the exclusion restriction would be

satisfied. Nonetheless, if the law generates some kind of anxiety or stress on citizens, then the restriction would not be satisfied. As Argentine legislation does not include large fines or penalties for tobacco smokers, we expect that it does not affect people's anxiety or change their alimentary behavior. The instrument validity would be threatened too if the legislation is an institutional response to the changing of the social valuation of a healthy life. In this case, the social valuation could both affect body weight and encourage governments to implement anti-smoking laws.

It could be expected that the citizens of most developed provinces would be more aware of the risk of tobacco and would demand stronger anti-tobacco laws. We also would expect that citizens that carry a healthy life would demand more anti-tobacco laws. So, in these cases the instruments would not be valid because the application of anti-tobacco laws is correlated with the unobservable health commitment of a province.

We test the exogeneity of the instruments using regressional analysis approach following Galiani, Gertler, and Schargrodsky (2005). The specifications include a set of economic and development variables (GDP, employment rate, and high skills rate) and a set of proxy variables of healthy life (smoking rate, consumption of fruit and vegetables rate, consumption of alcohol rate, and practice physical activity rate). The Table C.5 in the Appendix III show that smoking rate is not correlated with anti-tobacco laws, as we expect. Moreover, we find that none of the healthy life variables are statistically significant.

While the results discussed above suggest that the current smoking rate is uncorrelated with the anti-tobacco legislation, the length of time required since the decision to legislate is made until the legislation is enacted might be important, thus we propose an alternative specification where the regressors are lagged (Table C.6). We find that even in this case, the lagged smoking rate is not correlated with the legislation. These results provide evidence that the decision to legislate anti-tobacco laws was not made in response to Argentinian cultural and health commitment. A possible reason for this legislation to emerge could be the exogenous international shock: the MPOWER program. In 2008, the WHO introduces the MPOWER measures to reverse the tobacco epidemic. We would expect that the WHO program led to the rise of provincial anti-tobacco laws.

Furthermore, an estimation problem could arise due to migration patterns

across provinces. The provincial legislation could incentive citizens to move to another province that does not have anti-tobacco law. However, the survey does not allow to identify these migration patterns. Nevertheless, in Argentina the cost of moving is large, we would expect that the cost of relocation does not offset the prohibition of smoke in enclosed spaces.

In addition, we divide the sample by gender to capture differences in smoking patterns and causes (Chu, 2014; Chung, Lim, & Lee, 2010; Hersch, 1996; Keyes, March, Link, Chilcoat, & Susser, 2013; Kilic & Ozturk, 2014; Lundborg & Andersson, 2008). This strategy also allows us to generate more observations.

Finally, the proposed model is estimated following the fixed effects with an instrumental variable (FE-IV). However, the estimations by FE are also performed.

V. Results

V.1 Effects of the tobacco legislation reforms on obesity

Table 2 presents estimations of the reduced form (Equation 4) of the effect of the legislation reform on body weight. As can be observed, the legislation has a statistically significant positive effect on body weight variables for all specifications. The results are robust to the addition of economic and development variables as healthy life variables. A stronger legislative index increases body weights measures. For example, an increase of one unit (which means that legislation bans an additional enclosed space) increased on average the BMI and the weight in kilograms by 0.4%. Regard to the obesity rate, legislation increases obesity rate on 0.008 p.p. When dummy instrument variables are used, we also find positive and statistically significant effects.

Table 3 includes the effects of tobacco legislation on body weight by gender. In all cases, the effect is positive and statistically significant. Moreover, males show higher coefficients than women. These estimations are relevant because we find a significant relation between tobacco legislation and body weight, which probably will suggest that there exists a relationship to explore. If we do not find a significant relation, it will probably suggest that there is no such relationship (Angrist & Krueger, 2001).

Reduced form estimates indicate that implementation of tobacco legislation

Table 2: Effects of the tobacco legislation reforms on body weight (reduced form regressions). OLS estimates of Equation 4. Sample divided by cohort according to year of birth.

VARIABLES	**FE**	**FE**	**FE**	**FE**	**FE**	**FE**
	(1.1)	**(1.2)**	**(2.1)**	**(2.2)**	**(3.1)**	**(3.2)**
Panel A- BMI (log)						
Total	**0.009**	**0.004**	**0.042**	**0.017**	**0.042**	**0.016**
Anti-tobacco law	(0.001)***	(0.001)***	(0.003)***	(0.006)***	(0.003)***	(0.005)***
Panel B- Weight in kilogramos (log)						
Total	**0.009**	**0.004**	**0.044**	**0.016**	**0.043**	**0.017**
Anti-tobacco law	(0.000)***	(0.001)***	(0.002)***	(0.006)***	(0.002)***	(0.005)***
Panel C- Obesity						
Total	**0.012**	**0.008**	**0.059**	**0.034**	**0.060**	**0.034**
Anti-tobacco law	(0.001)***	(0.002)***	(0.008)***	(0.010)***	(0.006)***	(0.008)***
Controls	NO	YES	NO	YES	NO	YES
Anti-tobacco law variable used (instrument)	Legislative Index	Legislative Index	Strong legislative dummy	Strong legislative dummy	Weak legislative dummy	Weak legislative dummy
Observations	144	144	144	144	144	144
Id	48	48	48	48	48	48
Power calculations	0.9	A-0.85; B-0.89; C-0.99	0.9	A-0.68; B-0.64; C-0.96	0.9	A-0.64; B-0.73; C-0.97

Note: Robust standard errors grouped by cluster by year of birth and province in parentheses. *** significant at 1%, ** significant at 5%, * significant at 12%. The percentage of the population with higher education, the percentage of men, the PBG, the percentage of the population that consumes fruits and vegetables five or more times a week, the percentage that are married and the percentage that performs high physical activity are included as controls.

Table 3: Heterogeneous effects of the tobacco legislation reforms on body weight (reduced form regressions) by gender. OLS estimates of Equation 4. Sample divided by cohort according to year of birth and gender.

VARIABLES	**FE**	**FE**	**FE**	**FE**	**FE**	**FE**
	(1.1)	**(1.2)**	**(2.1)**	**(2.2)**	**(3.1)**	**(3.2)**
Panel A- BMI (log)						
Total	**0.009**	**0.003**	**0.042**	**0.017**	**0.043**	**0.014**
Anti-tobacco law	(0.001)***	(0.001)***	(0.003)***	(0.005)***	(0.003)***	(0.005)***
Females	**0.009**	**0.003**	**0.042**	**0.015**	**0.045**	**0.012**
Anti-tobacco law	(0.001)***	(0.001)**	(0.004)***	(0.007)**	(0.004)***	(0.008)
Males	**0.008**	**0.004**	**0.043**	**0.020**	**0.040**	**0.015**
Anti-tobacco law	(0.001)***	(0.002)**	(0.004)***	(0.008)**	(0.004)***	(0.009)*
Panel B- Weight in kilogramos (log)						
Total	**0.009**	**0.004**	**0.044**	**0.018**	**0.045**	**0.018**
Anti-tobacco law	(0.000)***	(0.001)***	(0.003)***	(0.005)***	(0.002)***	(0.005)***
Females	**0.009**	**0.003**	**0.043**	**0.015**	**0.046**	**0.014**
Anti-tobacco law	(0.001)***	(0.002)**	(0.004)***	(0.007)**	(0.003)***	(0.008)
Males	**0.009**	**0.004**	**0.045**	**0.019**	**0.043**	**0.017**
Anti-tobacco law	(0.001)***	(0.001)***	(0.004)***	(0.007)***	(0.003)***	(0.007)**
Panel C- Obesity						
Total	**0.012**	**0.008**	**0.059**	**0.037**	**0.060**	**0.036**
Anti-tobacco law	(0.001)***	(0.001)***	(0.007)***	(0.008)***	(0.005)***	(0.007)***
Females	**0.011**	**0.007**	**0.048**	**0.025**	**0.052**	**0.029**
Anti-tobacco law	(0.001)***	(0.002)***	(0.008)***	(0.010)**	(0.005)***	(0.009)***
Males	**0.014**	**0.009**	**0.070**	**0.049**	**0.068**	**0.041**
Anti-tobacco law	(0.002)***	(0.003)***	(0.010)***	(0.013)***	(0.009)***	(0.013)***
Controls	NO	YES	NO	YES	NO	YES
Anti-tobacco law variable used (instrument)	Legislative Index	Legislative Index	Strong legislative dummy	Strong legislative dummy	Weak legislative dummy	Weak legislative dummy
Observations	288	288	288	288	288	288
Females	144	144	144	144	144	144
Males	144	144	144	144	144	144
Id	96	96	96	96	96	96
Females	48	48	48	48	48	48
Males	48	48	48	48	48	48

Note: Robust standard errors grouped by cluster by year of birth, gender and province in parentheses. *** significant at 1%, ** significant at 5%, * significant at 12%. Number of habitants by province, GDP, percentage of the population with higher education, percentage of men, percentage that is married, percentage of occupied, percentage of the population that consume fruit and vegetables five or more times a week, alcohol consumption, and percentage that performs high physical activity are included as controls.

reforms is relevant to explain the average body weight of the population. The causal relationship of interest may be hard to identify from these estimations. For that reason, in the next section, we present our two stage least square analysis.

V.2 Effects of the tobacco legislation reforms on smoking

The Legislation Index must influence the smoking rate to be a valid instrument. This is explored by using Equation 2. The results are presented in the Appendix III in Tables C.1 and C.2 for the sample divided by the year of birth of the cohorts and in the Tables C.3 and C.4 are the results for the sample divided by the employment status.

The results show that the Legislation Index decreases the smoking rate in the provinces. These results are robust to the addition of covariates (percentage of the population with higher education, percentage of men, GDP, percentage of the population that consumes fruits and vegetables five or more times a week, percentage that is married, and percentage that performs high physical activity) and the coefficients do not change qualitatively. There is also a negative relationship when the two legislative dummies are used.

The F-statistic on the excluded instrument is above the rule of thumb value of 10 in the majority of the cases (see Table 4). Moreover, when additional controls are included, the F-statistic for excluded variable verifies the rule of thumb, for the Strong Legislative Dummy.

The results for the sample divided by year of birth and gender cohorts (Table C.2) are similar from the previous case. The three variables of the anti-tobacco legislation have a negative impact on the smoking rate in the provinces. The smoking rate decreases to a greater extent as a consequence of the anti-smoking laws than the rates for women. Again, the F-statistic on the excluded instrument is above 10 for unconditional estimations and for the Strong Legislative Dummy with and without covariates (see Table 5).

The same behavoir is shown when the sample is divided by employment status cohort (Table C.3) and when it is divided by employment status and gender cohort (Table C.4).

To sum up, the first-stage estimates indicate that the tobacco legislation reforms have a negative impact on the smoking rate. Considering that the legislative reforms are unlikely to be affected by the weight variables and that

they affected the smoking rate by province, it can be thought that they are good instruments, specially, the Strong Legislative Dummy. In the cases where the F-statistic on the excluded instrument is less than 10 might the instrument be weak, and this could affect the second-stage results.

V.3 Effects of smoking on obesity

Table 4 presents the results of smoking on BMI (Panel A), weight in kilograms (Panel B), and obesity (Panel C) in provinces in Argentina, using the sample divided based on the year of birth. Columns (1.1) and (1.2) show the FE estimates and Columns (2.1) and (2.2) present the FE-IV estimates, using the Legislative Index as the instrumental variable. Columns (3.1) to (4.2) presents the results using the Strong Legislative Dummy and Weak Legislative Dummy as the instrument.

From the FE-IV estimates, we find that a 10 p.p. increase in the smoking rate decreases BMI by 6% when the Legislative Index is used. This result is robust to the various instruments, and the magnitude of the coefficient varies slightly. An increase of 10 p.p. in the smoking rate decreases BMI by 4% using the Strong Legislative Dummy and by 6% with the Weak Legislative Dummy.

Regarding weight in kilograms, the coefficients are negative, statistically significant and presents similar magnitude than BMI. Increasing by 10 p.p. the percentage of smokers reduces average weight by 6% when the Legislative Index (Column (2.2)) is used as instrument. With the alternative instruments, an increase in 10 p.p. of the percentage of smoker decreases average weight by 4% and 7%; respectively (see Columns (3.2) and (4.2) of Panel B in Table 4).

Finally, the obesity rate is also negatively affected by the percentage of smokers in the province with statistically significant coefficients. In all cases, the results are lower than those found for BMI and weight in kilograms. Increasing by 10 p.p. the percentage of smokers reduces obesity rate by 0.1 p.p. implementing the Legislative Index (Column (2.2) of Panel C), by 0.08 p.p. using the Strong Legislative Dummy (Column (3.2) of Panel C), and by 0.1 p.p. using the Weak Legislative Dummy (Column (4.2) of Panel C).

Our results suggest that a 10 p.p. decrease in the smoking rate increases the average BMI to a value that characterizes population as pre-obese (BMI between 25 and 29.9). The same decrease in the smoking rates also implies an increase

of 5 kilograms on average weight and an increase of at least 1.9 million of obese people, according to the data of ENFR 2013.

In all cases, the magnitude of the coefficients of the FE-IV estimates is larger than the coefficients estimated by FE, indicating that the bias when estimating by the latter is positive and that the coefficients decrease by including the additional controls. The errors are robust and grouped by cluster according to province and year of birth. The cluster total is 48, surpassing the 42 suggested by Angrist and Pischke (2008).

Table 4: Effects of smoking on body weight. Sample divided by cohort according to year of birth.

VARIABLES	**FE**	**FE**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**
	(1.1)	**(1.2)**	**(2.1)**	**(2.2)**	**(3.1)**	**(3.2)**	**(4.1)**	**(4.2)**
Panel A- BMI (log)								
Total	**-0.003**	**-0.002**	**-0.009**	**-0.006**	**-0.008**	**-0.004**	**-0.010**	**-0.006**
Smoker	(0.001)***	(0.001)**	(0.001)***	(0.002)***	(0.001)***	(0.001)***	(0.001)***	(0.003)**
Panel B- Weight in kilogramos (log)								
Total	**-0.002**	**-0.002**	**-0.010**	**-0.006**	**-0.008**	**-0.004**	**-0.010**	**-0.007**
Smoker	(0.001)**	(0.001)**	(0.001)***	(0.002)**	(0.001)***	(0.001)***	(0.001)***	(0.004)*
Panel C- Obesity								
Total	**-0.003**	**-0.002**	**-0.013**	**-0.012**	**-0.011**	**-0.008**	**-0.014**	**-0.014**
Smoker	(0.001)***	(0.001)**	(0.002)***	(0.004)***	(0.002)***	(0.003)***	(0.003)***	(0.007)*
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Instruments			Legislative Index	Legislative Index	Strong legislative dummy	Strong legislative dummy	Weak legislative dummy	Weak legislative dummy
Observations	144	144	144	144	144	144	144	144
Id	48	48	48	48	48	48	48	48
F-statistics for excluded variable			70.97	7.34	89.57	16.95	59.08	3.66

Note: Robust standard errors grouped by cluster by year of birth and province in parentheses. *** significant at 1%, ** significant at 5%, * significant at 12%. Number of habitants by province, GDP, percentage of the population with higher education, percentage of men, percentage that is married, percentage of occupied, percentage of the population that consume fruit and vegetables five or more times a week, alcohol consumption, and percentage that performs high physical activity are included as controls.

We also performed the estimations by dividing the sample according to the year of birth and gender cohorts. Table 5 presents the effects of smoking on BMI (Panel A), weight in kilograms (Panel B), and obesity (Panel C). Columns

(1) and (2) present the FE estimates and Columns (3) and (4) present the FE-IV estimations using the different instruments.

The percentage of smokers in the province has a negative impact of BMI, average weight, and the obesity rate. In the FE-IV estimates, increasing the percentage of smokers by 10 p.p. reduces BMI by 4%, average weight by 5%, and the obesity rate by 0.09 p.p. Once again, the results are robust to the instruments. Table 5 shows that in the case of the Strong Legislative Dummy, the effects of a 10 p.p. increase in the smoking rate are 3%, 3%, and 0.07 p.p., respectively. With the weak instrument, negative impacts for increasing the smoker rate by 10 p.p. are also obtained: 4% for BMI, 5% for average weight, and 0.09 p.p. for the obesity rate.

The sign and significance of the coefficients are retained to understand differences by gender. In general, the effects are greater in women but they are not always statistically significant. In the case of men, statistical significance is maintained at 1% in all regressions.

Again, lower coefficients are found when estimating by FE and by including additional controls. In this case, robust standard errors are grouped by province, year of birth, and gender.

In summary, the smoking rate decreases average body weight, average BMI, and the probability of being obese, showing the trade-off between tobacco and obesity. Our findings concurring with those of Baum (2009); Baum and Chou (2011); Chou et al. (2004); Jiménez-Martín et al. (2010); Rashad (2006); Sen et al. (2010), among others. These results are robust to the different tests carried out: the use of different instruments, the incorporation of controls, and the use of alternative samples.

Our estimated effects are similar in magnitude to those obtained by Courtemanche et al. (2018) and larger than those estimated by Jiménez-Martín et al. (2010). Courtemanche et al. (2018) find that quitting smoking leads to an average weight gain of 1.5-1.7 BMI units, or 5 kilograms at the average height in the short-run and an average weight gain of around 6 kilograms at the average height in the long run, as well. Jiménez-Martín et al. (2010) estimate that a 10% decrease in the incidence of tobacco use leads to an increase of almost 1.4 kilograms in the weight of the average cohort. Baum and Chou (2011) indicate that the reduction in tobacco consumption explains less than 2% of the increase in weight measures. All of them use data from United States of America.

Table 5: Heterogeneous effects of smoking on body weight by gender. Sample divided by year of birth and gender.

VARIABLES	**FE**	**FE**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**
	(1.1)	**(1.2)**	**(2.1)**	**(2.2)**	**(3.1)**	**(3.2)**	**(4.1)**	**(4.2)**
Panel A- BMI (log)								
Total	**-0.002**	**-0.002**	**-0.009**	**-0.004**	**-0.008**	**-0.003**	**-0.010**	**-0.004**
Smoker	(0.001)***	(0.000)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.002)***	(0.001)**
Females	**-0.002**	**-0.001**	**-0.011**	**-0.005**	**-0.008**	**-0.003**	**-0.013**	**-0.006**
Smoker	(0.001)***	(0.000)**	(0.002)***	(0.003)	(0.002)***	(0.001)*	(0.004)***	(0.006)
Males	**-0.002**	**-0.002**	**-0.008**	**-0.003**	**-0.008**	**-0.003**	**-0.008**	**-0.003**
Smoker	(0.001)**	(0.000)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)**
Panel B- Weight in kilogramos (log)								
Total	**-0.002**	**-0.001**	**-0.010**	**-0.005**	**-0.008**	**-0.003**	**-0.011**	**-0.005**
Smoker	(0.001)**	(0.000)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.002)***	(0.002)**
Females	**-0.001**	**-0.000**	**-0.011**	**-0.005**	**-0.008**	**-0.003**	**-0.013**	**-0.006**
Smoker	(0.001)	(0.000)	(0.002)***	(0.004)	(0.001)***	(0.002)*	(0.004)***	(0.006)
Males	**-0.002**	**-0.002**	**-0.009**	**-0.003**	**-0.008**	**-0.003**	**-0.009**	**-0.003**
Smoker	(0.001)**	(0.000)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Panel C- Obesity								
Total	**-0.002**	**-0.002**	**-0.013**	**-0.009**	**-0.011**	**-0.007**	**-0.014**	**-0.009**
Smoker	(0.001)***	(0.001)***	(0.002)***	(0.003)***	(0.002)***	(0.002)***	(0.002)***	(0.003)***
Females	**-0.001**	**0.000**	**-0.013**	**-0.010**	**-0.009**	**-0.005**	**-0.015**	**-0.013**
Smoker	(0.001)	(0.000)	(0.003)***	(0.005)*	(0.002)***	(0.002)*	(0.005)***	(0.011)
Males	**-0.003**	**-0.003**	**-0.014**	**-0.007**	**-0.012**	**-0.008**	**-0.014**	**-0.007**
Smoker	(0.001)***	(0.001)***	(0.003)***	(0.002)***	(0.003)***	(0.003)***	(0.003)***	(0.002)***
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Instruments			Legislative Index	Legislative Index	Strong legislative dummy	Strong legislative dummy	Weak legislative dummy	Weak legislative dummy
Observations	288	288	288	288	288	288	288	288
Females	144	144	144	144	144	144	144	144
Males	144	144	144	144	144	144	144	144
Id	96	96	96	96	96	96	96	96
Females	48	48	48	48	48	48	48	48
Males	48	48	48	48	48	48	48	48
Test F for excluded variable			70.67	12.66	87.65	23.25	48.33	8.11
Females			24.01	5.67	35.84	15.62	13.98	1.94
Males			52.07	8.35	53.77	10.81	44.92	6.76

Note: Robust standard errors grouped by cluster by year of birth, gender and province in parentheses. *** significant at 1%, ** significant at 5%, * significant at 12%. Number of habitants by province, GDP, percentage of the population with higher education, percentage of men, percentage that is married, percentage of occupied, percentage of the population that consume fruit and vegetables five or more times a week, alcohol consumption, and percentage that performs high physical activity are included as controls.

We also computed heterogeneous effects by employment status dividing the sample according to the year of birth and employment status. Table 6 presents the effects of smoking on BMI, weight in kilograms, and obesity. The results show that the percentage of smokers in the province has a negative impact on BMI, average weight, and the obesity rate regardless of status. The sign and significance of the coefficients show differences by employment status. Particularly, we note in the case of the Strong Legislative Dummy, the effects are greater for employed than unemployed or inactive. For employed, an increase of 10 p.p. in the smoking rate, reduces weight in kilograms in 4-8 %, meanwhile, for unemployed these effects are 2-7 %. Also, an increase of 10 p.p. in the smoking rate, reduces the probability of being obese in 0.08-0.11 p.p. for employed and 0.05-0.10 p.p. for unemployed or inactive.

V.4 Robustness exercise

In this section a robustness exercise is carried out to test the effects of smoking on body weight. For this reason, the same previous estimates are performed but on the sample divided based on the employment status cohorts. Table 7 presents the results of smoking on BMI (Panel A), weight in kilograms (Panel B), and obesity (Panel C) in Argentina's provinces.

The results show that the signs of the coefficients are maintained and their magnitudes vary slightly. An increases of 10 p.p. in the smoking rate decreases BMI by 4% using the Legislative Index. The effect is negative but is not statistically significant for alternative instruments.

In the case of weight in kilograms, increasing by 10 p.p. the percentage of smokers reduces average weight by5% when the Legislative Index is used (Column (2.2) of Panel B), decreases average weight by 4% using the Strong Legislative Dummy (Columns (3.2) of Panel B) and by 5% using the Weak Legislative Dummy (Columns (4.2) of Panel B).

Finally, the percentage of smokers in the province also has a negative effect on obesity rate with statistically significant coefficients. Increasing by 10 p.p. the percentage of smokers reduces obesity rate by 0.07 p.p. implementing the Legislative Index (Column (2.2) of Panel C). The effects are not statistically significant for the alternative instruments when the control variables are included.

Table 6: Heterogeneous effects of smoking on body weight by employment status. Sample divided by year of birth and employment status.

VARIABLES	**FE**	**FE**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**
	(1.1)	**(1.2)**	**(2.1)**	**(2.2)**	**(3.1)**	**(3.2)**	**(4.1)**	**(4.2)**
Panel A- BMI (log)								
Total	**-0.002**	**-0.001**	**-0.010**	**-0.004**	**-0.008**	**-0.003**	**-0.011**	**-0.004**
Smoker	(0.001)***	(0.000)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.002)***	(0.002)*
Employed	**-0.002**	**-0.001**	**-0.008**	**-0.004**	**-0.007**	**-0.004**	**-0.008**	**-0.004**
Smoker	(0.001)**	(0.000)*	(0.001)***	(0.002)*	(0.001)***	(0.002)**	(0.001)***	(0.003)
Unemployed or inactive	**-0.003**	**-0.001**	**-0.012**	**-0.004**	**-0.008**	**-0.003**	**-0.015**	**-0.006**
Smoker	(0.001)***	(0.001)**	(0.003)***	(0.003)	(0.002)***	(0.002)	(0.005)***	(0.008)
Panel B- Weight in kilogramos (log)								
Total	**-0.002**	**-0.001**	**-0.010**	**-0.004**	**-0.008**	**-0.003**	**-0.011**	**-0.004**
Smoker	(0.001)***	(0.000)***	(0.001)***	(0.002)**	(0.001)***	(0.001)***	(0.002)***	(0.002)*
Employed	**-0.001**	**-0.001**	**-0.009**	**-0.004**	**-0.008**	**-0.004**	**-0.009**	**-0.003**
Smoker	(0.001)**	(0.000)**	(0.001)***	(0.002)*	(0.001)***	(0.002)**	(0.001)***	(0.003)
Unemployed or inactive	**-0.002**	**-0.001**	**-0.012**	**-0.003**	**-0.007**	**-0.002**	**-0.015**	**-0.005**
Smoker	(0.001)***	(0.001)*	(0.003)***	(0.004)	(0.002)***	(0.002)	(0.005)***	(0.009)
Panel C- Obesity								
Total	**-0.002**	**-0.001**	**-0.014**	**-0.009**	**-0.010**	**-0.007**	**-0.015**	**-0.011**
Smoker	(0.000)***	(0.000)**	(0.002)***	(0.003)***	(0.002)***	(0.002)***	(0.003)***	(0.005)**
Employed	**-0.002**	**-0.001**	**-0.012**	**-0.011**	**-0.011**	**-0.008**	**-0.012**	**-0.012**
Smoker	(0.001)***	(0.001)	(0.001)***	(0.005)**	(0.002)***	(0.003)***	(0.001)***	(0.008)
Unemployed or inactive	**-0.003**	**-0.002**	**-0.015**	**-0.010**	**-0.010**	**-0.005**	**-0.019**	**-0.018**
Smoker	(0.001)***	(0.001)**	(0.005)***	(0.006)*	(0.003)***	(0.003)*	(0.007)**	(0.018)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Instruments			Legislative Index	Legislative Index	Strong legislative dummy	Strong legislative dummy	Weak legislative dummy	Weak legislative dummy
Observations	288	288	288	288	288	288	288	288
Employed	144	144	144	144	144	144	144	144
Unemployed or inactive	144	144	144	144	144	144	144	144
Id	96	96	96	96	96	96	96	96
Employed	48	48	48	48	48	48	48	48
Unemployed or inactive	48	48	48	48	48	48	48	48
Test F for excluded variable			71.38	11.92	108.49	25.57	49.58	6.06
Employed			99.78	3.72	174.69	9.55	114.66	1.99
Unemployed or inactive			18.34	5.44	33.84	10.63	10.11	1.11

Note: Robust standard errors grouped by cluster by year of birth, employment status, and province in parentheses. *** significant at 1%, ** significant at 5%, * significant at 12%. Number of habitants by province, GDP, percentage of the population with higher education, percentage of men, percentage that is married, percentage of occupied, percentage of the population that consume fruit and vegetables five or more times a week, alcohol consumption, and percentage that performs high physical activity are included as controls.

As before, the magnitude of the coefficients of the FE-IV estimates is larger than the coefficients estimated by FE, indicating that the bias when estimating by the latter is positive and that the coefficients decrease by including the additional controls. The errors are robust and grouped by cluster according to province and the employment status cohort and the cluster total is 48.

Table 7: Effects of smoking on body weight. Sample divided by cohorts according to employment status.

VARIABLES	**FE**	**FE**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**
	(1.1)	**(1.2)**	**(2.1)**	**(2.2)**	**(3.1)**	**(3.2)**	**(4.1)**	**(4.2)**
Panel A- BMI (log)								
Total	**-0.003**	**-0.001**	**-0.006**	**-0.004**	**-0.005**	**-0.003**	**-0.007**	**-0.004**
Smoker	(0.001)***	(0.001)	(0.001)***	(0.002)**	(0.001)***	(0.002)	(0.001)***	(0.002)
Panel B- Weight in kilogramos (log)								
Total	**-0.003**	**-0.001**	**-0.007**	**-0.005**	**-0.006**	**-0.004**	**-0.008**	**-0.005**
Smoker	(0.001)***	(0.000)**	(0.001)***	(0.002)**	(0.001)***	(0.002)**	(0.001)***	(0.003)*
Panel C- Obesity								
Total	**-0.004**	**-0.001**	**-0.010**	**-0.007**	**-0.007**	**-0.006**	**-0.010**	**-0.006**
Smoker	(0.001)***	(0.001)	(0.002)***	(0.003)*	(0.002)***	(0.004)	(0.002)***	(0.004)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Instruments			Legislative Index	Legislative Index	Strong legislative dummy	Strong legislative dummy	Weak legislative dummy	Weak legislative dummy
Observations	144	144	144	144	144	144	144	144
Id	48	48	48	48	48	48	48	48
F-statistics for excluded variable			62.37	10.39	89.78	12.43	55.26	5.55

Note: Robust standard errors grouped by cluster by employment status and province in parentheses. *** significant at 1%, ** significant at 5%, * significant at 12%. Number of habitants by province, GDP, percentage of the population with higher education, percentage of men, percentage that is married, percentage of occupied, percentage of the population that consume fruit and vegetables five or more times a week, alcohol consumption, and percentage that performs high physical activity are included as controls.

Table 8 presents the effects of smoking on BMI (Panel A), weight in kilograms (Panel B), and obesity (Panel C) when the estimations are performed by dividing the sample according to employment status and gender cohorts. Columns (1.1) and (1.2) present the FE estimates and Columns (2.1) to (4.2)

present the FE-IV estimations using the different instruments.

The results also support the hypothesis that there is an trade off between the rate of smokers and the level of obesity in the Argentina's provinces. An increase in the smoking rate reduces the BMI, average weight, and the obesity rate.

In the FE-IV estimates, increasing the percentage of smokers by 10 p.p. reduces BMI by 4%, average weight by5%, and the obesity rate by 0.06 p.p. The results are robust to the instruments: in the case of the Strong Legislative Dummy, the effects of a 10 p.p. increase in the smoking rate are 3%, 4%, and 0.05 p.p., respectively, and using the weak instrument, the negative impact for increasing the smoker rate by 10 p.p. is 7% for average weight, and there are not statistical significance for BMI and obesity rate. The magnitudes of the coefficients vary slightly to those obtained when the sample is split according to year of birth and gender cohorts.

Regarding to the differences by gender, the coefficients are greater for the woman but not statistically significant when the control variables are considered.

In these estimations, robust standard errors are grouped by province, employment status and gender.

The robustness analysis performed shows that the negative impact of smoking on body weight indicators is maintained using an alternative estimation strategy and varying the instruments used.

VI. Policy implications

A large body of the literature documents the complexity of the relationship between tobacco smoking and obesity. As a consequence, there is no single policy recommendation, and the way in which to reduce both unhealthy behaviors deserves high priority in health economics research.

In the past half-century, the main public health concern had been cigarette consumption and how to reduce its prevalence rate, without taking into account the collateral effects on other health variables. Recent studies have provided credible evidence on the effects of quitting smoking on body weight and on the associated health problems. As a result, the trade-off between obesity and tobacco has been questioned.

Rubinstein et al. (2010) assert that more than 70% of the 600,000 YLL and almost 400,000 PYLL in Argentina concerned with cardiovascular

Table 8: Heterogeneous effects of smoking on body weight by gender. Sample divided by employment status and gender.

VARIABLES	**FE**	**FE**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**
	(1.1)	**(1.2)**	**(2.1)**	**(2.2)**	**(3.1)**	**(3.2)**	**(4.1)**	**(4.2)**
Panel A- BMI (log)								
Total	**-0.002**	**-0.001**	**-0.006**	**-0.004**	**-0.005**	**-0.003**	**-0.007**	**-0.004**
Smoker	(0.000)***	(0.000)**	(0.001)***	(0.002)**	(0.001)***	(0.001)*	(0.001)***	(0.003)
Females	**-0.002**	**0.000**	**-0.007**	**-0.004**	**-0.004**	**-0.002**	**-0.008**	**-0.005**
Smoker	(0.001)***	(0.001)	(0.002)***	(0.004)	(0.001)***	(0.002)	(0.003)***	(0.007)
Males	**-0.002**	**-0.001**	**-0.006**	**-0.004**	**-0.006**	**-0.004**	**-0.006**	**-0.004**
Smoker	(0.000)***	(0.000)***	(0.001)***	(0.002)**	(0.002)***	(0.002)*	(0.001)***	(0.003)
Panel B- Weight in kilogramos (log)								
Total	**-0.002**	**-0.001**	**-0.007**	**-0.005**	**-0.006**	**-0.004**	**-0.008**	**-0.007**
Smoker	(0.000)***	(0.000)***	(0.001)***	(0.002)***	(0.001)***	(0.002)**	(0.002)***	(0.003)*
Females	**-0.003**	**-0.001**	**-0.008**	**-0.006**	**-0.005**	**-0.003**	**-0.009**	**-0.009**
Smoker	(0.001)***	(0.001)	(0.002)***	(0.004)	(0.001)***	(0.003)	(0.003)***	(0.009)
Males	**-0.002**	**-0.001**	**-0.007**	**-0.005**	**-0.006**	**-0.005**	**-0.007**	**-0.006**
Smoker	(0.000)***	(0.000)***	(0.001)***	(0.002)**	(0.002)***	(0.002)**	(0.002)***	(0.003)*
Panel C- Obesity								
Total	**-0.002**	**-0.001**	**-0.009**	**-0.006**	**-0.007**	**-0.005**	**-0.010**	**-0.006**
Smoker	(0.001)***	(0.001)	(0.002)***	(0.003)**	(0.002)***	(0.003)*	(0.002)***	(0.004)
Females	**-0.002**	**0.000**	**-0.008**	**-0.006**	**-0.005**	**-0.004**	**-0.009**	**-0.007**
Smoker	(0.001)**	(0.001)	(0.002)***	(0.005)	(0.002)**	(0.004)	(0.003)***	(0.010)
Males	**-0.003**	**-0.001**	**-0.011**	**-0.006**	**-0.009**	**-0.006**	**-0.011**	**-0.005**
Smoker	(0.001)***	(0.001)*	(0.003)***	(0.004)	(0.003)***	(0.004)	(0.003)***	(0.005)
Controls	NO	YES	NO	YES	NO	YES	NO	YES
Instruments			Legislative Index	Legislative Index	Strong legislative dummy	Strong legislative dummy	Weak legislative dummy	Weak legislative dummy
Observations	288	288	288	288	288	288	288	288
Females	144	144	144	144	144	144	144	144
Males	144	144	144	144	144	144	144	144
Id	96	96	96	96	96	96	96	96
Females	48	48	48	48	48	48	48	48
Males	48	48	48	48	48	48	48	48
Test F for excluded variable			49.17	13.13	45.43	15.14	34.45	5.52
Females			17.44	4.24	22.18	6.31	11.04	1.13
Males			38.55	7.38	23.67	6.76	32.29	3.57

Note: Robust standard errors grouped by cluster by employment status, gender and province in parentheses. *** significant at 1%, ** significant at 5%, * significant at 12%. Number of habitants by province, GDP, percentage of the population with higher education, percentage of men, percentage that is married, percentage of occupied, percentage of the population that consume fruit and vegetables five or more times a week, alcohol consumption, and percentage that performs high physical activity are included as controls.

disease are attributable to modifiable risk factors (i.e., they could be avoided). Tobacco smoking is accountable for 16.1% of YLL and 16.6% of PYLL, while overweight and obesity are responsible for 13.8% and 15.1%, respectively. These authors estimate that in 2007, hospitalization costs owing to cardiovascular disease were nearly 520 million US dollars, attributing similar shares to smoking and obesity, 17.3% and 17.1%, respectively. Further, Rubinstein et al. (2010) only examine direct medical hospitalization costs; therefore, they may have underestimated the social costs of these pathologies, making it imperative to study the causal relationships and calculate the social and economic costs of both epidemics.

The results of this research and those conducted by Baum (2009); Baum and Chou (2011); Chou et al. (2004); Courtemanche et al. (2018); Fang et al. (2009); Pieroni and Salmasi (2016); Rashad (2006); Sen et al. (2010); Wehby et al. (2012), among others, highlight that smoking is negatively associated with body weight. If this is the case, tobacco control policies have been an unforeseen contributor to escalating obesity rates, with one unhealthy behavior being replaced by another. Our results suggest that a decrease of 10 p.p. in the smoking rate, the average BMI approaches obesity; the average weight increases by 5 kilograms and the number of obese people rise by 1.9 million. These results do not imply in any way that anti-tobacco campaigns are not beneficial for health, only that their impact on body weight variables should be taken into account.

Assuming that societies prefer a healthy environment, health authorities need to include new policy instruments to control obesity and overweight, as the principles of Tinbergen (1955) and Theil (1961) assert. In other words, tobacco control policies should be complemented by campaigns that encourage the consumption of healthy food and performance of physical exercise as well as information on the negative effects of obesity on health.

VII. Conclusion

Different countries have implemented anti-tobacco policy measures such as limiting tobacco consumption, levying tax rates on tobacco products, and providing information on tobacco's effects on health. Several studies have explored the effect of quitting smoking or reducing tobacco consumption on body weight, BMI, overweight, and obesity. While the results are mixed and the

evidence is inconclusive, the literature highlights the relevance of anti-tobacco campaigns and policies with nutrition campaigns.

This article contributes to the previous literature in different ways. First, it studies the relationship between tobacco and body weight in Argentina, where 25.1% of people 18 years and older smoke and 20.5% are obese (ENFR 2013). Furthermore, tobacco use in Argentina is accountable for 16.1% of years of life lost (YLL) and 16.6% of potential years of life lost (PYLL), while overweight and obesity are responsible for 13.8% and 15.1%, respectively. Secondly, it provides empirical evidence for a Latin American country using information based on microdata. Finally, it presents a methodology that allows estimating the causal effect of smoking on different body weight variables.

The effects of smoking on body weight, BMI, and obesity are analyzed by exploiting the variation in the time of the implementation of regional anti-tobacco laws in Argentina focus on bans in enclosed spaces as an empirical strategy. This is a large-scale natural experiment. The National Tobacco Control Law 26687 was implemented in June 2011, although each province could adhere to the national legislation or legislate its own anti-tobacco rules. These province and time variations and the specific legislation on enclosed spaces allow us to use the legislation as a good instrument. The legislation only has an impact on people's weight through the smoking rate.

The results show a negative impact of smoking rates on different indicators of body weight: average body weight in kilograms, BMI, and the obesity rate of the population. Moreover, the results suggest that the estimation bias underestimates the effect of the smoking rate on the weight variables. The conclusions are similar if we conduct our analysis by gender. The results are also robust to different specifications, instrumental variables, and samples.

The findings provide evidence of the importance that anti-tobacco campaigns take into account the possible effects they may have on people's weight, since quitting smoking without an adequate nutritional program could lead to an unhealthy weight. Multidisciplinary teams that consider all the consequences of quitting smoking are thus needed.

Although the results are consistent with the literature, more studies are still needed. There is evidence of a higher burden of the obesity phenomenon in Argentina, which makes it important to advance our understanding of the causal relationships among socioeconomic variables, smoking, and obesity. New

insights would allow us to formulate efficient and egalitarian social policies aiming to reduce both obesity rates and smoking rates.

This is the first exploratory study for Argentina. A deep analysis of the relationship between stopping smoking and obesity is needed, estimating the causal effect of quitting smoking on body weight at the individual level. In this case, endogeneity problems are also present, and thus an empirical strategy that can solve these problems is needed as well. We leave this to future research.

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A. Argentinian anti-tobacco legislation

Table A.1: Anti-tobacco legislation by province.

Province/ Year	Does it have legislation?	Law	Legislative index	Weak legislative Index	Strong legislative Index
CABA					
2005	X	Law 1799	0	0	0
2009	X	Law 2837	5	1	0
2013	X	Law 3718	5	1	0
Buenos Aires					
2005		Law 13894	0	0	0
2009	X	Decree 1626	5	1	0
2013	X	Law 14381	5.5	1	0
Catamarca					
2005		Law 5223	0	0	0
2009	X	Decree 777	6	1	1
2013	X		6	1	1
Córdoba					
2005	X	Law 9113	0	0	0
2009	X	Law 10026	0	0	0
2013	X		6	1	1
Corrientes					
2005	X	Law 5537	4.5	1	0
2009	X	Law 5793	4.5	1	0
2013	X		4.5	1	0
Chaco					
2005	X	Law 3515	3	1	0
2009	X	Law 7055	3	1	0
2013	X		6	1	1
Chubut					
2005	X	Law 3775	2	1	0
2009	X	I-452	2	1	0
2013	X		6	1	1
Entre Ríos					
2005		Law 9862	0	0	0
2009	X	Res. 1322	3.5	1	0
2013	X		3.5	1	0
Formosa					
2005	X	Law 1187	5	1	0
2009	X	Law 1574	5	1	0
2013	X		6	1	1
Jujuy					
2005			0	0	0
2009			0	0	0
2013			0	0	0
La Pampa					
2005		Law 2563	0	0	0
2009		Law 2701	0	0	0
2013	X		6	1	1
La Rioja					
2005	X	Law 8870	0	0	0
2009	X	Law 9066	6	1	1
2013	X		6	1	1

Table 1 (cont.): Anti-tobacco Legislation by province.

Province/ Year	Does it have legislation?	Law	Legislative index	Weak legislative Index	Strong legislative Index
Mendoza					
2005		Law 6898	0	0	0
2009	X	Law 7790	4.5	1	0
2013	X	Law 8382	6	1	1
Misiones					
2005		Law 1794	0	0	0
2009		(year 2016)	0	0	0
2013			0	0	0
Neuquén					
2005		Decree 2276	0	0	0
2009	X	Law 2572	6	1	1
2013	X	Law 2738	6	1	1
Río Negro					
2005	X	Law 4714	0	0	0
2009	X		4.5	1	0
2013	X		6	1	1
Salta					
2005		Law 7631	0	0	0
2009			0	0	0
2013	X		3.5	1	0
San Juan					
2005	X	Law 7595	0	0	0
2009	X	Law 8406	2.5	1	0
2013	X		2.5	1	0
San Luis					
2005	X	Decree 206	4	1	0
2009	X	Law III-0723	4	1	0
2013	X	Law IX-0326	6	1	1
Santa Cruz					
2005		Law 3329	0	0	0
2009	X	Law 3366	4.5	1	0
2013	X		4.5	1	0
Santa Fé					
2005	X	Decree 2759	0	0	0
2009	X	Law 12432	3.5	1	0
2013	X		3.5	1	0
Santiago del Estero					
2005	X	Decree 1555	0	0	0
2009	X	Law 6962	0	0	0
2013	X		5.5	1	0
Tierra del Fuego					
2005	X	Decree 3234	2	1	0
2009	X	Law 175	2	1	0
2013	X		2	1	0
Tucumán					
2005	X	Decree 59	0	0	0
2009	X	Law 7575	6	1	1
2013	X	Law 8894	6	1	1

Source: Own elaboration based on "Atlas Federal de Legislación Sanitaria," Argentina, Ministerio de Salud de la Nación.

B. Argentinine descriptive statistics

Table B.1: Descriptive statistics by gender: 2005, 2009, and 2013.

	Male			Female		
	2005	**2009**	**2013**	**2005**	**2009**	**2013**
Never smoked	36.92	37.61	42.99	54.66	55.86	57.44
Ex-smoker	28.61	30.24	27.84	19.55	21.16	21.53
Smoker	34.47	32.15	29.17	25.79	22.98	21.03
Number of cigarettes consumed	10.91	11.37	10.85	8.57	8.75	9.04
Weight	77.21	78.84	80.17	65.27	66.70	67.90
BMI	26.06	26.52	26.97	25.08	25.57	26.07
Obesity	16.02	18.52	21.23	15.33	17.65	19.82
Consumption of alcohol	62.99	86.61	87.79	34.05	69.31	74.36
Consumption of fruit and vegetables	62.57	62.66	62.97	70.17	70.10	70.44
Sports and other activities	54.65	46.74	47.95	49.68	40.69	41.77
Health insurance	62.76	67.15	98.92	62.64	69.74	98.92
Married	59.36	56.75	55.00	55.70	56.07	54.13
Per capita household income	289	824	2,381	265	799	2,282
Incomplete elementary school	17.03	14.66	12.60	16.21	12.63	10.10
Complete elementary school	24.54	23.07	22.10	23.81	20.90	19.03
Incomplete high school	20.06	20.86	21.16	16.84	16.74	17.00
Complete high school	16.85	19.92	21.62	18.66	21.78	24.37
Incomplete college	13.79	12.52	13.28	11.94	12.69	12.80
Complete college	7.73	8.97	9.24	12.54	15.26	16.69

Source: Own elaboration based on ENFR, INDEC.

C. IV First stage

Table C.1: Effects of the tobacco legislation reforms on smoking according to year of birth. IV First Stage.

Variable	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**
	(1.1)	**(1.2)**	**(2.1)**	**(2.2)**	**(3.1)**	**(3.2)**
Anti-tobacco law	-0.924	-0.691	-5.530	-4.384	-4.225	-2.537
	(0.110)***	(0.255)***	(0.584)***	(1.065)***	(0.550)***	(1.326)*
Controls	NO	YES	NO	YES	NO	YES
Instruments	Legislative Index	Legislative Index	Strong legislative dummy	Strong legislative dummy	Weak legislative dummy	Weak legislative dummy
Observations	144	144	144	144	144	144
Number of id	48	48	48	48	48	48
Partial R-squared	0.096	0.228	0.092	0.240	0.071	0.210

Note: Robust standard errors grouped by cluster by year of birth and province in parentheses. *** significant at 1%, ** significant at 5%, * significant at 12%. Number of habitants by province, GDP, percentage of the population with higher education, percentage of men, percentage that is married, percentage of occupied, percentage of the population that consume fruit and vegetables five or more times a week, alcohol consumption, and percentage that performs high physical activity are included as controls.

Table C.2: Effects of the tobacco legislation reforms on smoking according to year of birth and gender. IV First Stage.

Variable	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**
	(1.1)	**(1.2)**	**(2.1)**	**(2.2)**	**(3.1)**	**(3.2)**
Total	-0.919	-0.902	-5.527	-5.188	-4.192	-3.827
Anti-tobacco law	(0.109)***	(0.253)***	(0.590)***	(1.076)***	(0.603)***	(1.344)***
Females	-0.816	-0.649	-5.340	-5.455	-3.510	-2.144
Anti-tobacco law	(0.167)***	(0.273)**	(0.892)***	(1.380)***	(0.939)***	(1.538)
Males	-1.022	-1.259	-5.714	-5.892	-4.873	-5.987
Anti-tobacco law	(0.142)***	(0.436)***	(0.779)***	(1.792)***	(0.727)***	(2.303)**
Controls	NO	YES	NO	YES	NO	YES
Instruments	Legislative Index	Legislative Index	Strong legislative dummy	Strong legislative dummy	Weak legislative dummy	Weak legislative dummy
Observations	288	288	288	288	288	288
Females	144	144	144	144	144	144
Males	144	144	144	144	144	144
Id	96	96	96	96	96	96
Females	48	48	48	48	48	48
Males	48	48	48	48	48	48
Partial R-squared	0.051	0.125	0.049	0.128	0.037	0.113
Females	0.051	0.238	0.058	0.267	0.033	0.226
Males	0.052	0.167	0.043	0.148	0.042	0.155

Note: Robust standard errors grouped by cluster by year of birth, gender and province in parentheses. *** significant at 1%, ** significant at 5%, * significant at 12%. Number of habitants by province, GDP, percentage of the population with higher education, percentage of men, percentage that is married, percentage of occupied, percentage of the population that consume fruit and vegetables five or more times a week, alcohol consumption, and percentage that performs high physical activity are included as controls.

Table C.3: Effects of the tobacco legislation reforms on smoking according to employment status. IV First Stage. Robustness check.

Variable	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**
	(1.1)	**(1.2)**	**(2.1)**	**(2.2)**	**(3.1)**	**(3.2)**
Anti-tobacco law	-0.867	-0.474	-5.209	-2.671	-3.946	-1.897
	(0.110)***	(0.147)***	(0.550)***	(0.758)***	(0.531)***	(0.805)**
Controls	NO	YES	NO	YES	NO	YES
Instruments	Legislative Index	Legislative Index	Strong legislative dummy	Strong legislative dummy	Weak legislative dummy	Weak legislative dummy
Observations	144	144	144	144	144	144
Number of id	48	48	48	48	48	48
Partial R-squared	0.175	0.421	0.168	0.420	0.129	0.404

Note: Robust standard errors grouped by cluster by employment status and province in parentheses. *** significant at 1%, ** significant at 5%, * significant at 12%. Number of habitants by province, GDP, percentage of the population with higher education, percentage of men, percentage that is married, percentage of occupied, percentage of the population that consume fruit and vegetables five or more times a week, alcohol consumption, and percentage that performs high physical activity are included as controls.

Table C.4: Effects of the tobacco legislation reforms on smoking according to employment status and gender. IV First Stage. Robustness check.

Variable	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**	**FE-IV**
	(1.1)	**(1.2)**	**(2.1)**	**(2.2)**	**(3.1)**	**(3.2)**
Total	-0.862	-0.520	-5.258	-3.334	-3.896	-1.953
Anti-tobacco law	(0.123)***	(0.144)***	(0.780)***	(0.857)***	(0.664)***	(0.831)**
Females	-0.848	-0.424	-5.626	-3.387	-3.747	-1.239
Anti-tobacco law	(0.203)***	(0.206)**	(1.195)***	(1.348)**	(1.128)***	(1.167)
Males	-0.876	-0.547	-4.890	-3.073	-4.044	-2.136
Anti-tobacco law	(0.141)***	(0.201)***	(1.005)***	(1.182)**	(0.712)***	(1.131)*
Controls	NO	YES	NO	YES	NO	YES
Instruments	Legislative Index	Legislative Index	Strong legislative dummy	Strong legislative dummy	Weak legislative dummy	Weak legislative dummy
Observations	288	288	288	288	288	288
Females	144	144	144	144	144	144
Males	144	144	144	144	144	144
Id	96	96	96	96	96	96
Females	48	48	48	48	48	48
Males	48	48	48	48	48	48
Partial R-squared	0.115	0.243	0.114	0.251	0.083	0.227
Females	0.135	0.376	0.158	0.398	0.093	0.360
Males	0.101	0.195	0.084	0.196	0.076	0.182

Note: Robust standard errors grouped by cluster by employment status, gender and province in parentheses. *** significant at 1%, ** significant at 5%, * significant at 12%.

Table C.5: Test for the exogeneity of the intruments.

VARIABLE	**Legislative Index**	**Strong legislative dummy**	**Strong legislative dummy**
Smoker	0.011	-0.003	0.004
	(0.032)	(0.004)	(0.006)
GDP	0.000	-0.000	0.000
	(0.000)	(0.000)**	(0.000)
Consumption of fruits and vegetables	0.008	0.002	0.002
	(0.022)	(0.004)	(0.004)
Sports and others activities	0.026	0.003	0.004
	(0.021)	(0.004)	(0.004)
Consumption of alcohol	-0.012	0.003	-0.002
	(0.019)	(0.003)	(0.004)
Employment rate	-9.468	-0.979	-1.769
	(1.883)***	(0.320)***	(0.380)***
High skill	-0.026	-0.004	-0.004
	(0.031)	(0.004)	(0.006)
Constant	3.976	0.281	0.763
	(2.417)	(0.400)	(0.446)*
Observations	***144***	***144***	***144***
R-squared	***0.453***	***0.286***	***0.420***
Id	***48***	***48***	***48***

Note: Robust standard errors grouped by cluster by year of birth and province in parentheses. *** significant at 1%, ** significant at 5%, * significant at 12%.

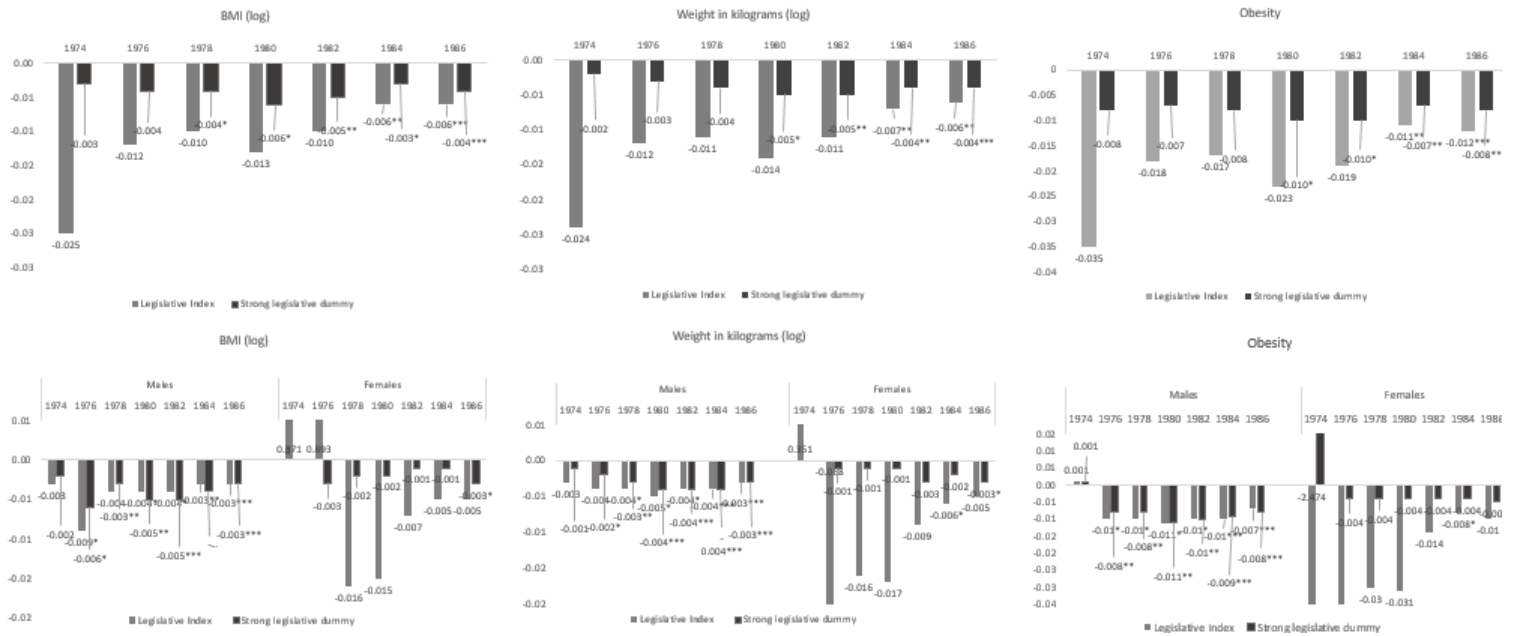
Table C.6: Test for exogeneity of the instruments. Lagged model

VARIABLE	**Legislative Index**	**Strong legislative dummy**	**Strong legislative dummy**
Smoker (lagged one period)	-0.024	-0.001	-0.005
	(0.025)	(0.006)	(0.004)
GDP (lagged one period)	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Consumption of fruits and vegetables (lagged one period)	-0.003	0.001	0.001
	(0.034)	(0.007)	(0.005)
Sports and others activities (lagged one period)	0.009	-0.002	0.003
	(0.013)	(0.004)	(0.003)
Consumption of alcohol (lagged one period)	0.003	0.001	0.001
	(0.017)	(0.005)	(0.003)
Employment rate (lagged one period)	-3.852	-0.958	-0.356
	(1.659)**	(0.469)**	(0.272)
High skill (lagged one period)	0.022	0.001	0.005
	(0.028)	(0.006)	(0.005)
Constant	4.347	0.784	0.353
	(3.439)	(0.750)	(0.512)
Observations	**96**	**96**	**96**
R-squared	**0.241**	**0.248**	**0.142**
Id	**48**	**48**	**48**

Note: Robust standard errors grouped by cluster by employment status and province in parentheses. *** significant at 1%, ** significant at 5%, * significant at 12%. Number of habitants by province, GDP, percentage of the population with higher education, percentage of men, percentage that is married, percentage of occupied, percentage of the population that consume fruit and vegetables five or more times a week, alcohol consumption, and percentage that performs high physical activity are included as controls.

D. Robust check

Figure D.1: Robust check using several years



Note: *** significant at 1%, ** significant at 5%, * significant at 12%.