CESifo WORKING PAPERS

9587
2022

Original Version: February 2022
This Version: January 2023

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Joan Costa-Font, Luca Salmasi, Sarah Zaccagni

CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
Editor: Clemens Fuest
https://www.cesifo.org/en/wp
An electronic version of the paper may be downloaded
· from the SSRN website: www.SSRN.com
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CESifo *Working Paper No. 9587*

More than a Ban on Smoking? Behavioural Spillovers of Smoking Bans in the Workplace

Abstract

We study whether workplace smoking bans (WSBs), in addition to influencing smoking cessation, exert behavioural spillover effects on (i) a set of health behaviours, and (ii) on individuals not directly affected by the bans. So far we know little about WSBs as most of the evidence refers to smoking bans in public places. Drawing upon quasi-experimental variation from Russia, which introduced a WSB (in addition to a ban on smoking in public places), and adopting a difference-in-differences (DiD) strategy, which compares employed individuals (exposed to the work and public place ban) to unemployed individuals (exposed only to the ban in public places), we document three sets of findings. First, WSBs increase smoking cessation by 2.9 percentage points (pp) among men. Second, we find that quitters are less likely to use alcohol (6.7 pp reduction among men and 3.5 pp among women), and to reduce their alcohol consumption (10 percent among men). Finally, WSBs are found to influence the health behaviour of those not directly affected by the reform, such as never smokers. Our findings are consistent with a model of joint formation of health behaviours, and suggest the need to account for a wider set of spillover effects when estimating the welfare effect of WSBs.

JEL-Codes: I180, H750, L510.

Keywords: joint formation of behaviours, workplace smoking bans, behavioural spillovers, smoking, drinking, physical activity, healthy identity, Russia.

Joan Costa-Font
Department of Health Policy
London School of Economics and Political Science
London / United Kingdom
j.costa-font@lse.ac.uk

Luca Salmasi
Department of Economics and Finance
Catholic University Rome / Italy
luca.salmasi@unicatt.it

*Sarah Zaccagni**
Department of Economics
University of Copenhagen / Denmark
Sarah.Zaccagni@econ.ku.dk

*corresponding author

January 7, 2023
We are grateful to Laura Derksen, Gregor Pfeifer, Erdal Tekin, and seminar participants at the 11th Workshop on the Economics of Risky Behavior for their valuable comments. The activities of CEBI are financed by the Danish National Research Foundation, Grant DNRF134.

1 Introduction

Although canonical demand for health models conceptualise health behaviours as resulting from an individual evaluation of their costs and benefits (Grossman et al. 1983), limited research has been conducted to determine whether individuals evaluate each health behaviour independently or whether a change in one specific behaviour modifies the costs of engaging in other related behaviours. When behaviours are jointly formed, or when different related behaviours feed a common identity (e.g., a health related identity), a change in one specific behaviour can exert spillover effects on other behaviours (Truelove et al. 2014).

This paper specifically tests for the presence of behavioural spillovers in health behaviours by examining whether an intervention that attempts to change a specifically targeted health behaviour at work (smoking cessation) alters other non-targeted behaviours (physical activity or alcohol use). Similarly, we examine whether such interventions modify the behaviour of non-targeted individuals (non-smokers). The existence of behavioural spillovers has important implications for the evaluation of the welfare effects of policy interventions, as they suggest that evaluation should consider general equilibrium effects above and beyond the targeted behaviours.

To date, the tobacco epidemic is responsible for the death of more than 8 million people a year around the world. More than 7 million of those deaths are the result of direct tobacco use while around 1.2 million are the result of non-smokers being exposed to second-hand smoke.[1]

Both workplace and public place smoking bans (WSBs and PPSBs, respectively), along with bans on tobacco advertising, take a prominent role among the policies that govern-

[1] Link: WHO 2021

ments have articulated to discourage individuals from smoking. However, the evaluation of such smoking bans has so far devoted limited attention to the spillover effects they might produce both on other health behaviours and on other subjects not originally targeted by government regulations.

So far, most of the literature has considered the effect of smoking bans in public places (Carpenter et al. 2011, Adda & Cornaglia 2010*b*, Jones et al. 2015, Rong 2017, Anger et al. 2011), while fewer studies have focused on the effects of bans in the workplace (Evans et al. (1999), Carpenter (2009), Fichtenberg & Glantz (2000)). This is important as WSBs can influence smoking for longer times every day than bans in public places; hence, they might result in an additional effect in changing behaviours compared to PPSBs.

We study evidence of a WSB in Russia. More specifically, we document that the WSB has effects beyond the targeted health behaviours (smoking), and among non-targeted individuals. We exploit the introduction of a WSB in 2013, as part of the tobacco control law in Russia, which banned smoking in all workplaces from 2013, and in public places from 2014. We leverage in such time difference to identify causal effects using a difference-in-difference (DiD) strategy. More specifically, we compare employed individuals, exposed to both bans, to unemployed individuals, considering potential selection into employment.

Our estimates suggest that the introduction of the WSB reduced the extensive margin of smoking behaviour by 2.9 percentage points among men, while no significant effects are found among women. However, when we look at the intensive margin, we do not find any significant change in the number of cigarettes smoked daily.[2] Consistently with evidence of spillover effects, we estimate a significant reduction in the number of alcohol users. However, the size of the effect on the extensive margin of alcohol use differs by gender,

[2]Throughout the paper, we consider the effect on both extensive margins, defined as the probability of adopting a certain behaviour (e.g., prevalence of smoking), and intensive margins, defined as the quantity consumed by those who adopt that behaviour (e.g., consumption of cigarettes).

being a decrease of 6.7 and 3.5 percentage points for men and women respectively. When we focus on the intensive margin, we find a decrease in alcohol consumption of about 10%, but only among men. However, we do not find any significant effect of the WSB on physical activity. Next, given that the proportion of people who stop drinking alcohol is higher than the proportion of people who quit smoking, we examine whether the WSB has an effect on people who are not directly affected by the ban (e.g., never smokers and those who used to smoke before the ban and kept smoking after it). Consistent with the hypothesis of behavioural spillovers on non-targeted individuals, we document evidence of a significant reduction in alcohol use among never smokers that were indirectly exposed to the effects of the WSB by living with other household members who quit smoking after the ban.

We contribute to the body of knowledge about the effectiveness of smoking bans. The literature on the economics of smoking is broad (see a comprehensive overview provided by Chaloupka & Warner (2000)), and includes studies that have investigated, amongst others, the effects of price changes induced by excise taxes (Wasserman et al. (1991), Becker & Murphy. (1994); Yurekli & Zhang (2000), Tauras (2006), Carpenter & Cook (2008); Hansen et al. (2017)), the impact of legal restrictions on access to tobacco products (Chaloupka & Grossman (1996), Gruber & Zinman (2001), Kvasnicka (2010)), or the effects of public smoking bans on the exposure of non-smokers to second-hand smoke (Jiménez-Ruiz et al. (2008), Carpenter (2009), Adda & Cornaglia (2010*a*)). A few studies are more closely related to our research and investigate the effects of workplace smoking bans. For instance, Evans et al. (1999) find that WSBs in the U.S. significantly reduced smoking prevalence and daily tobacco consumption among those directly exposed to the restrictions compared to workers subject to minimal or no restrictions. In addition, no evidence of displacement of home smoking is reported by Carpenter et al. (2011). A review by Fichtenberg & Glantz (2000) concludes that workplace smoking restrictions were effective in reducing cigarette consumption and smoking prevalence. More recently, Adda & Cornaglia (2010*b*), Jones et al. (2015), Rong (2017) find no effect while Anger et al. (2011) find some heterogeneous effects across individuals depending on the intensity of the exposure to the ban and Boes et al. (2015) detect some temporal effects.

However, work in this area remains inconclusive and has focused mainly on the U.S. This study draws on novel evidence from Russia. Evidence from Russia is particularly relevant given that smoking prevalence is among the highest in the European Region (almost 40% of individuals smoked in 2010), and significantly higher than in the U.S.[3] Men exhibit an even higher prevalence (60%), while the prevalence for women is significantly smaller (20%) but showed a dramatic increase in the years before 2000 (Lunze & Migliorini 2013). The gap is also significant if we look at alcohol consumption: the annual per capita consumption in 2013 was around 13.5[4] liters in Russia, while in the U.S. it was around 8.8[5]. Hence, Russia appears to be an important country for examining the effect of smoking bans on smoking and other health behaviours.

Our second contribution is to offer evidence of the effect of smoking bans on other health behaviours and its subsequent social multiplier effects (Cutler & Lleras-Muney 2010). The novely of our work lies in that, if spillovers are generalised, previous estimates suggesting a small correlation between health behaviours (Cutler & Glaeser 2005) might underestimate the effect of smoking bans. An alternative explanation lies in the presence of "complementary behaviours" or even "identity shifts" (Akerlof & Kranton 2000), and

[3]In 2013, the smoking prevalence in the U.S. was 17.8%. Data from "Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, CDC."

[4]https://lenta.ru/news/2013/10/17/alcohol/.

[5]https://www.statista.com/statistics/1081880/us-alcohol-consumption-per-person-per-year/.

hence, whether individuals modify their behaviour, aspiring to keep some consistency between their actions and their identities. Truelove et al. (2014) argue that when people think about goals abstractly, they tend to act consistently with past behaviour.

Most of the literature that investigates spillovers of tobacco policies focuses on the effect on drinking behaviour (Adams & Cotti (2008), Picone et al. (2004), Koksal & Wohlgenant (2016), Burton (2020)) and has not reached unambiguous conclusions.[6] We draw on the same identification strategy and exploit the ban in the workplace to estimate the effect of the WSB on smoking, alcohol consumption, and physical activity. Finally, in addition to exploring the effects on other behaviours, we examine the effect of the WSB on different target groups. The existence of behavioural spillovers among social ties has important implications for the evaluation of the benefits of health interventions. Fletcher & Marksteiner (2017) have recently documented the first evidence of causal spillovers of health behaviors between spouses and Powell et al. (2005) reported that peer effects play a significant role in youth smoking decisions. In line with the results of Pfeifer et al. (2020), we find that smoking bans spill over to the treated persons household.

The remainder of the paper is organised as follows. The next section reports a brief summary of the status of the literature on health behaviours and behavioural spillovers. Section 3 provides a description of the data and outlines the empirical strategy. Section 4 displays the baseline estimates, and section 5 the spillover effects on other individuals. Section 6 is devoted to the robustness checks of our estimates. A final section concludes.

[6] These papers mainly examine the effects of PPSBs in bars and restaurants, since those are the places where alcohol is mostly consumed.

2 Behavioural Spillovers and Explanations

2.1 Behavioural Spillovers

Behavioural spillovers emerge when changes in one behaviour give rise to changes in other behaviours. They can be driven by compensatory beliefs in the search for consistency in behaviour. If individuals expect to attain a specific abstract goal of "being healthy", a change in a reference health behaviour, such as smoking, might trigger the adoption of changes in other behaviours. Some authors coin this effect as the "foot in the door" effect (Bénabou & Tirole 2011). Indeed, health identity gives rise to expectations of action, i.e., "behavioural standards" for individuals to follow, so that incoherence between expected and actual behaviours produce negative evaluative emotions (Stryker & Burke 2000), or negative effects on self-image (Bénabou & Tirole 2011). In contrast, identity-congruent behaviours give rise to positive emotions. In some studies in the health realm, identity has been shown to influence exercise (Anderson et al. 1998) as well as smoking and drinking (Storer et al. 1997).

Testing the effect of such spillovers requires either a careful experimental design or a quasi-natural experiment, such as a policy intervention targeting one behaviour and then having the ability to examine the effects of the intervention on other behaviours (Thomas et al. 2016, Truelove et al. 2014). Similarly, identity can explain spillovers to individuals that have not engaged in a specific behaviour, such as smoking, but for whom not engaging in such behaviour is regarded as a signal of healthy behaviour. Hence, smoking bans can signal that the 'healthiness' of someone's behaviour is based on something more than just not smoking, as smoking in the workplace is no longer an individual choice.

2.2 Substitution and complementarity of health behaviours

Whether or not and how a change in a reference behaviour influences other healthy behaviours depends on whether such changes in behaviour are substitute or complementary in a specific environment. For instance, if behaviours are substitutes, the presence of behavioural spillovers might give rise to "licensing effects" (e.g., drink more, exercise less), which means that individuals adjust other behaviour as a result of changing some specifically targeted behaviour (smoking). Such negative spillover effects have been identified in environmental decision-making (Nilsson et al. 2017) to explain the extent to which individuals engage in compensating behaviours (e.g., recycling) to reduce their feelings of guilt that result from engaging in non-environmentally friendly behaviours (e.g., driving). The latter set of behavioural processes are generally labelled "compensatory beliefs" that explain, in the nutrition domain, dieters' inconsistent behaviours when their behavioural goals (e.g., healthy eating) conflict with other goals (e.g., experiencing pleasure from food).

Consistent with a hypothesis of substitution, Gruber & Frakes (2006) find evidence of an effect of cigarette taxes on body weight, implying that reduced smoking leads to lower body weights, and similar effects are found in other studies (Baum 2009, Liu et al. 2010, Wildman & Hollingsworth 2012, Pieroni & Salmasi 2015). However, more recent studies that revisit such effects find no evidence of a link between smoking and obesity (Nonnemaker et al. 2009) or heterogeneous effects (Wehby & Courtemanche 2012, Wehby et al. 2012). In contrast, other studies document evidence of complementary behaviours. For instance, using a first difference model, French et al. (2010) find that increasing frequency and intensity of alcohol use is associated with statistically significant yet quantitatively small weight gain. One explanation for this result lies in the existing complementarities between health behaviours (Dragone et al. 2016). Some studies have already shown that drinking complement smoking behaviour (Dee (1999), Picone et al. (2004), Yörük & Yörük (2011), Crost & Guerrero (2012), Pieroni, Lanari & Salmasi (2013), Businelle et al. (2013), Picone & Sloan (2003)).

Among the others, Pieroni, Chiavarini, Minelli & Salmasi (2013) find that the percentage of habitual drinkers of alcoholic beverages who typically consumed outside the home decreased after the ban, which is consistent with a complementary effect of alcohol intake on smoking. However, they measured the effect of smoking bans in bars and restaurants, which may be different from that of smoking bans in the workplace, on measures of drinking participation outside the home. In addition, their identification strategy relies on cross-sectional data where the year immediately before the introduction of the smoking ban was not available, casting doubts on the robustness of their estimated causal effects. Picone et al. (2004) exploit the introduction of smoking bans in the US, but focus on older individuals.

Finally, Courtemanche (2009) examines other health behaviours influenced by smoking: physical activity and food consumption (number of grams of fat consumed per day; the number of times that fruit and vegetables are consumed per week). An explanation of these results is that individuals who are exogenously induced to smoke less (or quit altogether) may experience a renewed sense of interest in their health, such as a healthier diet and exercise. In addition, people who are able to overcome their smoking addiction may gain self-confidence and develop healthier habits (Sweet 2000). However, their evidence does not result from a causal quasi-experimental research design.

3 Data and Empirical Strategy

3.1 Data

We use data from the Russian Longitudinal Monitoring Survey (RLMS),[7] which is an ongoing longitudinal survey, with the first wave in 1994. The survey collects information on a wide range of individual and household characteristics including detailed expenditure data and information about individual activities and health for household members aged 14 and older.

Our sample includes individuals over the age of 18 and under 65 from 2010 to 2014. We exclude individuals over 65 as it is the common retirement age, and hence WSBs would not typically affect them, as discussed in the next section. We use employment status to classify individuals into treatment and control groups. In addition, we examine the period after 2010 to avoid our estimates capturing the effects of a minimum price for alcoholic beverages that was introduced in 2009,[8] and we end in 2014 as the prices of alcoholic beverages were cut considerably in 2015 to disincentivize illegal consumption of alcohol, which became extremely commonplace among Russian drinkers due to the continual increases in prices after 2009. Such sudden variations in alcohol prices can influence both smoking and other health behaviours beyond the introduction of smoking bans and for this reason, we decided to focus on a period of time where prices did not show important discontinuities.

We present descriptive evidence of price variations for tobacco products and alcoholic drinks in Figures 2-3.[9]

[7]Source: Russia Longitudinal Monitoring survey, the RLMS-HSE survey is conducted by the Higher School of Economics, National Research University in collaboration with the Carolina Population Center, University of North Carolina and the Institute of Sociology, Russian Academy of Sciences. (RLMS-HSE websites: http://www.cpc.unc.edu/projects/rlms-hse, http://www.hse.ru/org/hse/rlms)

[8]In addition, in 2010, the Higher School of Economics (HSE) began to fund the RLMS. Supplementary funding came from the University of North Carolina, leading to a significant increase in the sample size.

[9]We proxy prices by means of unit values that have been extensively employed in the literature, though this also embeds

Figures 2-3 show the variation in relative prices of cigarettes and alcoholic drinks in Russia from 2000 to 2017. Looking at cigarette prices, we can see that they have been constantly rising since 2010, due to an additional measure to reduce smoking. The increasing trend in cigarette prices could additionally lead to a reduction in smoking habits beyond the effect of smoking bans, but if taxes affect both treated and controls equally, our DiD strategy is justified. Indeed, the sudden increase in cigarette prices could represent a threat to our estimates if the demand of unemployed individuals is less elastic than the demand of employed individuals. However, it must be noted that: (i) the increase in prices starts in 2009, whereas we can observe a decrease in smoking participation only after the introduction of smoking bans in 2013, (ii) in section 6 we check the robustness of our results to the inclusion of unit values of alcohol and tobacco in the model.

Looking at relative prices for alcoholic beverages, we can observe two years, i.e., 2009 and 2015, where prices either increased or fell suddenly.[10] Since such sudden variations in alcohol prices could impact drinking behaviours beyond the indirect effect of smoking bans, we only include the years between 2010 and 2014, where alcohol prices remained stable. Finally, descriptive statistics for other variables of interest in our analysis are shown in Table A.1.

an average quality choice component. Unit values are estimated as the ratio between household expenditure and quantity purchased for a specific item. In addition, we obtain relative unit values by dividing absolute unit values by the unit value of total expenditure. Information about household expenditure and quantity purchased for a wide range of durable and non-durable items is provided by the RLMS survey on household expenditure for the years 2001 to 2017. This survey allows us to link information about smoking and other health behaviours to information on expenditure and quantity purchased at the household level.

[10] On 1 January 2010, the order nr. 17 of the Federal authority for the control of the alcohol market, dated 30 November 2009, set a minimum price of 89 roubles (about 1.50 US dollars) for a half-litre bottle of vodka in Russia. The price of vodka was subsequently increased during the following years, reaching 220 roubles (about 3 US dollars), until 2015 when it was cut by 16% as a way of reducing illegal drinking.

3.2 Empirical Strategy

Our empirical strategy aims to estimate the effect of anti-smoking legislation on smoking and other health behaviours, such as drinking habits and physical exercise. We exploit the introduction of a comprehensive tobacco control law in Russia in 2013. The policy was implemented to reduce tobacco use among Russians by: (i) banning smoking in public places including workplaces (WSB), housing block stairwells, buses and commuter trains and within 15 metres of train stations and airports; and (ii) requiring graphic health warnings on cigarette packs and prohibiting advertising and promotion of tobacco products and sponsorships by tobaco companies. One interesting feature of this legislation is that, although it has been in force since the 1st of June 2013, the ban on smoking in restaurants, hotels and trains came into effect on the 1st of June 2014. One could exploit the differential implementation of bans to estimate their impact on smoking and other health behaviours, but the simple pre-post comparison may lead to biased estimates. There may be other factors, such as changes in cigarette and alcohol prices, or the introduction of graphic health warnings that varyied after 2013, that are responsible for changes in smoking and other behaviours.

In order to identify the effect and account for these confounding factors, we propose a DiD strategy that exploits both the differential implementation of smoking bans and the fact that not all smokers in the population were exposed to the same level of restrictions. We can identify a first period, including the years before 2013, when no regulation of smoking was in place, a second period from 2013 to 2014, when the first part of the law banning smoking in workplaces - excluding bars, restaurants and trains - was implemented, and a third period, after 2014, when the ban in public places was also implemented. In addition, we know that not all smokers were equally exposed to smoking bans. In fact, employed individuals were first exposed to bans in workplaces and then also to bans in public places, whereas unemployed individuals were exposed only to bans in public places after 2014. Defining the former as the treatment group and the latter as a control group and exploiting the different types and timings of smoking bans introduced in Russia after 2013 allows us to estimate the effect of workplace smoking bans on smoking and other health behaviours. Figure 1 shows the timeline of the implementation of smoking bans in Russia and how the employed and unemployed are affected in each period of time. In the first part of the chart neither employed nor unemployed individuals were affected, while after 2013 employed individuals are exposed to smoking bans in workplaces (WP). After 2014, employed individuals are exposed to both bans in workplaces and public places (WP + PP), whereas unemployed individuals are only exposed to bans in public places. In each period we can calculate the difference between the average health behaviours of employed and unemployed individuals and between employed individuals before and after the implementation of each smoking ban, which corresponds to a DiD estimator that estimates the effect of smoking bans in workplaces.

Formally, the DiD estimator can be expressed using the following formulation:

$$Y_{it} = \alpha_1 T_{it} \times post_t + \sum_{j=1}^{J} \alpha_j X_{it} + l_i + m_t + \epsilon_{it}, \qquad (1)$$

where Y_{it} describes our outcomes of interest and measures: (i) smoking status, in terms of participation ($S_{it} = 1$ if individual i at time t smokes) and intensity (S_{it} = average number of cigarettes smoked daily by individual i at time t); (ii) drinking behaviour, defined as alcohol participation ($Y_{it} = 1$ if individual i at time t had at least one alcoholic drink during the last month), and alcohol consumption (Y_{it} = the natural logarithm grams consumed daily for individual i at time t), noting that can distinguish consumption of wine, beer and spirits to account for possible heterogeneous effects on these categories; (iii) participation in physical activity ($Y_{it} = 1$ if individual i at time t participated in any physical activity during the last 12 months), and intensity (Y_{it} = number of sessions per month or minutes per session of physical activity for individual i at time t). $T_{it} \times post_t$ identifies the effect of the treatment, taking the value of 1 for employed individuals after 2013 and 0 for either employed individuals before 2013 or for unemployed individuals whose employment status never changed before or after 2013. In this specification we include individual (l_i) and time specific fixed effects (m_t) and a vector of covariates at the individual level, X_{it}. For detailed descriptive statistics, see Table A.1. The main effect of interest is α_1, which is the coefficient that captures the causal effect of T_{it} on Y_{it}.

Nonetheless, for our estimates to be valid we must be able to prove that the introduction of smoking bans did not affect the probability of employment. Given that the possibility of WSB sorting individuals into employment poses a threat to identification, we only include individuals in our analysis who report being always in employment; thus defining both an unbalanced and a balanced sample of individuals. The latter sample is used to ensure that individuals do not modify their employment status between interviews.

As expected, we rely on the common trend assumption to ensure identification of causal effects.[11] We test this assumption estimating the following equation:

$$Y_{it} = \gamma_1 + \sum_{j=2}^{J} \eta_j (Lag_j)_{it} + \sum_{k=1}^{K} \mu_k (Lead_k)_{it} + \lambda_i + \psi_t + \xi_{it}. \tag{2}$$

From Equation 2, we can estimate a case-event study where η_j and μ_k are parameters associated with lags and leads, defined as in Clarke & Schythe (2020), and can

[11]In other words, if there were not a smoking ban after 2013, health behaviours for employed individuals would have faced the same change as health behaviours of unemployed ones.

be interpreted as post-ban and anticipatory effects, respectively. λ_i and ψ_t represent individual-specific and year fixed effects. The common trend assumption can be tested by proving that the coefficients of leads are not significantly different from zero, in which case we can conclude that treated and control individuals have the same pre-ban behaviour with respect to health behaviours. Moreover, we can use post-treatment coefficients (i.e., lags) to see whether the effect grows or fades as time passes.

4 Results

4.1 The panel case-event study

Figures 4-6 displays the lags and leads for the main health behaviours of interest estimated from equation 2. Figure 4 reveals that the pre-trend assumption is met for smoking participation since all lead coefficients are not statistically different from 0, but we do observe a decrease in the probability of smoking after 2013 for employed men only, but not for employed women. No significant differences are found in the number of cigarettes smoked. Similarly, Figure 5, indicates the common trend assumption is not violated. After 2013, employed men experience a decrease in the probability of drinking, especially driven by a change in the consumption of beer and spirits. The same does not occur for women. We find similar results for alcohol consumption, measured by the grams of alcohol consumed monthly. Indeed, Figure 5 shows that, among men, time leads are not significantly different from zero, implying that the common trend assumption holds also for these outcomes. In addition, we find evidence of a decrease in alcohol consumption, which is driven by a decrease in wine consumption.[12] Figure 6 shows the case-event

[12] In contrast, the common trend assumption is not met among women except for the grams of spirits consumed, where we also observe a significant decrease after 2013.

study for physical activity. From these graphs, we observe that there is evidence of a common trend before 2013 for both men and women, and we find evidence of a significant increase in the probability of participating in exercise for both men and women, but not for other variables measuring physical activity intensity. Yet, given that the common trend assumptions are generally met, with the exception of womens drinking habits, the discussion now shifts to the main findings from equation 1.

4.2 Main estimates

4.2.1 Effect on Smoking Behaviour

Tables 1-4 contain the main DiD estimation results. These estimations are retrieved from an unbalanced panel.[13] We report the results separately for men and women. The main outcomes of interest are smoking behaviour, number of cigarettes, drinking participation, drinking consumption, exercising, and intensity of physical activity. While the first of these is the main target of the smoking ban, the others show the spillover effects of the ban on other health behaviours, which is the main contribution of this paper.

Estimates suggest significant reduction in the probability of smoking among men. Table 1 (column 1), suggests that the WSB significantly reduces the percentage of smokers by 2.9 percentage points, out of an average percentage of 57.4% male smokers. We find no effect on women, whose average percentage smoking prevalence is already significantly lower (18.3%). Table 1 (column 2) shows that no effect is reported on the average number of cigarettes either for men (17.5) or for women (11.9). We also test if the WSB has a different impact on heavy and light smokers, defined by number of cigarettes. Yet, as Table C.17 shows, we find no significant difference on the number of cigarettes. Overall,

[13]There are approximately 50,000 observations in the sample, and in each regression, the following control variables are included: gender, age, age squared, education and marital status. See Tables C.1-C.4 in Appendix C for estimations on the balanced panel.

the WSB reduces smoking participation among men though it does not alter the number of cigarettes smoked by those who continue to smoke.

4.2.2 Effect on Other Health Behaviours

In Tables 2-4 we display the results of the spillover effects of the WSB on other health behaviours. More specifically, we test whether a compensatory mechanism (licensing effect) is triggered whereby individuals who quit an unhealthy behaviour engage in another one. Alternatively, it might well be that WSB give rise to a complementary effect increasing the awareness of the welfare effects of a healthy lifestyle. Table 2 shows the estimated coefficients of the WSB on the use of various types of alcoholic beverages. We find that the WSB decreases alcohol use by 6.7 percentage points, out of 49% of men were drinkers, and by 3.5 percentage points, out of 39% of women were drinkers. Focusing on drinking categories (columns 2-4), we find significant and negative effects of the WSB on beer and spirits consumption, and no effect on wine, for both men and women. Estimates suggest that the negative impact of the WSB on drinking is driven by reduced beer drinking. The effect on drinking is confirmed if we look at alcohol consumption, as displayed in Table 3), measured by average grams of alcohol consumed. More specifically, column 1 shows that the smoking ban reduces the grams of alcohol consumed per capita by 10.4%. Yet, the specific effect on each type of alcoholic beverage is not precisely estimated given the small number of observations available.

When we adjust inference for multiple hypothesis testing, we find that the Romano-Wolf p-values confirm the significance of the results on the main outcomes (Table C.18).

Table 4 shows estimates of WSB when participation in or intensity of physical activity are considered as outcomes. The main estimates show no effect of the smoking ban on participation in physical activity, on the number of sessions per week or on the minutes per session of physical activity. We find a significant effect when we look specifically at spillovers inside the household, which are presented in Section 5.

4.3 Heterogeneous effects

WSB may have different effects according to some observable characteristics of respondents, like age, education, status of residency, and family type. Older individuals may be less likely to quit because they present higher levels of addiction with respect to younger individuals; highly educated individuals are more likely to understand the benefits of quitting, and individuals living in cities are more exposed to bans in the workplace because they are more likely to work in closed spaces. Finally, people who are married or live together are less likely to quit than singles, divorced and not married.

Heterogeneous effects are shown in Figures B.1-B.3. In each figure we report heterogeneous effects on four categories (age, education, status of residency, and family type) for a set of outcomes (smoking, drinking, physical activity). The figures report the effects separately for men and women. Next, we consider spatial heterogeneity and heterogeneous effects by civil status.[14]

The estimates suggest that the positive effect of the WSB in reducing the incidence of smoking is evenly spread among age groups. Figure B.1 shows that the WSB has no significant additional effect on people older than 30, it reduces the percentage of smokers among individuals younger than 30 by 0.0328 percentage points. Among the oldest age

[14] We split the sample in three age subgroups, namely individuals aged 18 to 29 years, 30 to 49 years and 50 to 64 years. The reference age is 18-29 and the coefficients plotted in Figures B.1-B.3 represent the additional effect of belonging to one of the other age groups with respect to the reference age group. Similarly, we consider a number of education groups where the reference group is those people who have only completed primary school. The other educational groups are completion of secondary school, vocational school, university, and postgraduate education. The reference category for spatial heterogeneity is people who live in a regional centre. Other categories are the following: towns, villages and rural areas. As for the civil status, we distinguish between single people, people who are married or live together (family type I), and those who are divorced and not remarried, widower or widow, or married but not living together (family type II).

group, the WSB does not reduce the percentage of smokers, but it decreases the number of cigarettes per capita (-1.13 cigarettes in the age class 50-65 for men). No effect on smoking behaviour is reported for women, confirming the null effect already reported in the main estimates.

Looking at other heterogeneity dimensions, we observe that the effect of the WSB is homogeneous across education and that it reduces the percentage of smokers, among those who live in a town. We do not observe remarkable heterogeneous effects for the number of cigarettes smoked irrespectively of gender and family size.

Figure B.2 reports the effect of the WSB on drinking behaviour. When we look at age heterogeneity, we find a higher reduction in drinking among men among the oldest age group (-5.34 percentage points in the age group 50-65). More specifically, the WSB decreases the share of beer drinkers, consistently with previous estimates. The graph on the far right displays higher effects of WSB on alcohol consumption among younger women. This is true for wine and beer, while no effect is reported for spirits. The result for the youngest age individuals is suggestive of an effect of the WSB on habits among less experienced individuals. Yet, we find no obvious effects across levels of education.

The effect of the WSB on drinking behavior is different among women, and specifically highly-educated women are less likely to drink wine as a consequence of the WSB (-1.58 percentage points). When we examine heterogeneous effects across space and civil status, we find that the WSB decreases drinkers in urban areas. The WSB does not have an additional effect among partnered individuals. As reported in Section 5, we find significant spillover effects among household members (not necessarily partners) who are not directly targeted by the ban but live with someone who quit smoking after its introduction.

Figure B.2 displays evidence of heterogeneity across education groups. In particular, higher educated males reduce their intake of wine after the WSB, and higher educated women drink less beer. Whilst living in an urban area decreases the likelihood of drinking beer, individuals in urban areas exhibit a higher beer consumption. Finally, we examine the effect of WSB on physical activity (Table B.3), and suggest a higher increase in the probability of exercising among males with postgraduate education. Males living alone after the WSB exercise significantly more times than individuals of any other civil status.

Thus far, our estimates on smoking and alcohol use suggest that the effect of the WSB is heterogeneous by gender and educational attainment. In particular, the WSB seems to encourage males with a high education to behave in a more virtuous way.

5 Spillover effects on quitters and on other household members

Our baseline estimates suggest that the effect of the WSB leads to larger changes in drinking than in smoking behaviours. Tables 1 and 2, suggest that smoking declines by 2.9 percentage points among men, whereas drinking participation decreases by 6.7 and 3.5 percentage points among men and women, respectively. This result can be explained by the presence of spillover effects on the drinking behaviours of peers of individuals reacting to the workplace ban. In other words, smoking bans influence alcohol use of the peers of those who quit smoking after a WSB.[15] However, we define individuals as 'potentially' indirectly treated if they live in the same household as compliers and can either be: (i) never smokers or (ii) current smokers, and we estimate the variation in drinking and physical activity for these individuals and also for compliers compared to

[15] Unfortunately, we do not have information about respondents' peers from the RLMS, and the only analysis we can carry out in this context is within the household.

that of individuals not living with a complier. We use the following equation:

$$Y_{it}^{g} = \iota_1 T_{it}^{g} \times post_t + \sum_{j=1}^{J} \iota_j X_{it} + l_i + m_t + \epsilon_{it} \qquad (3)$$

where Y_{it}^{g} describes our outcomes of interest about drinking and physical activity already described in previous sections. T_{it}^{g}, with $g = 1, 2, 3$, identifies individuals who are either: (i) compliers (those who quit after the ban), or (ii) never smokers, and (iii) current smokers living in the same household with at least one complier. T_{it}^{g} is 0 for individuals not living with a complier. If the behavioural spillover hypothesis is true, we should identify that: (i) compliers should have larger variations in terms of other health behaviours than non-compliers, and (ii) non-compliers living in the same household as at least one complier should change their health behaviours as well.

Figure 7 displays the results from this analysis. In the first two graphs of the figure, we find that the effect of the smoking ban on the percentage of people who drink alcohol is driven by the effect on compliers, among both men and women. This is particularly true for beer and spirits (5^{th} to 7^{th} graphs), which are the two products on which the main estimates showed the greatest effect.

However, we find a reduction in beer drinking for women who never smoked, and a reduction in spirits drinking among men and women who never smoked. These individuals were only exposed to the ban because they live in the same household as a complier.

Looking at grams of alcohol, the figure reveals an interesting result on drinking consumption. Never smokers men who live with a complier decrease the grams of wine consumed. It is therefore plausible that the WSB not only affects drinking in targeted individuals but also wine consumption of people cohabiting with individuals who have managed to quit smoking after the WSB. Finally, we examine the effect of the WSB on participation in and intensity of physical activity (15^{th} to 20^{th} graphs). In contrast to the main estimates, here we find a positive significant impact on compliers as well as a positive impact on subjects who do not smoke but live with a complier among men. The significant effect is on the probability of exercising, while no effect is detected for the frequency and the length of their exercise sessions. What we can conclude from Figure 7 is that limiting the analysis of the effects of smoking bans to the individuals directly targeted underestimates the effect of the WSB. Furthermore, it is worth noting that our estimates are a lower bound of the effect because our analysis is limited to peers within the same household as compliers, so ignores all the other individuals in the same social network as compliers who are potentially indirectly affected by the ban.

6 Robustness

In this section, we document the results of a battery of robustness checks to test the sensitivity of our results with respect to the definition of the sample or the inclusion of key variables in the model.

6.1 Balanced Sample

First, we check the robustness of our results restricted to the balanced sample. The unbalanced sample might contain some individuals who might have changed their employment status when not interviewed. When we only consider individuals in the balanced sample we find that the magnitudes of the effects of the WSB on smoking are larger than the effects in the unbalanced sample (column 1, Table C.1). The coefficients of drinking participation (Table C.2) are consistent with those obtained for the unbalanced sample in terms of direction and significance: the magnitude is slightly greater for all of them except for drinking among male respondents. However, estimates on the balanced sample do not reveal any effect on grams of alcohol consumed (Table C.3). This might be due to measurement errors. Consistent with our baseline results, we do not find any significant effects on other outcomes (i.e., physical activity, sessions per week, and minutes per session of exercising).

Second, we test whether our results change when we exclude individuals that start smoking during the period. In the main estimates, the reduction in the percentage of smokers may in fact be due to a reduction in the number of people who start smoking or to a reduction in people who smoked only at the beginning of the WSB. By reducing the sample to quitters, the results reported in Tables C.5 - C.8 are aligned with those of the main estimation. That is, we find a significant negative effect of the WSB on smoking and drinking participation and, consistently, no effects on drinking consumption and physical activity.

6.2 Different specifications

Third, we have checked whether our results change if we include regional linear trends in the model, see Tables C.9 - C.12. This should allow us to account for possible trends at the regional level that could affect the outcomes (i.e., variations in prices and other unobservables). The main results on smoking and drinking behaviours are robust to the inclusion of regional trends and the reduction in the quantity of alcohol consumed is also confirmed (column 1, Table C.11).

Fourth, we provide evidence of how robust our results are to the inclusion of unit values of alcohol and tobacco in the model. This allows us to check whether the results could be biased due to changes in relative prices rather than the effect of the ban, see Tables C.13 - C.16.

6.3 Exposure to the Treatment

Finally, we test whether the WSB exerts heterogeneous effects based on the number of hours worked and the frequency of eating in a restaurant or at home. First, we check whether individuals were more likely to work more than eight hours a day and to eat out after the introduction of the smoking ban for the treated group (Figure D.1 in Appendix D). Once we show this, we test whether the introduction of the WSB exerted a larger effect among those more exposed to it, and show that treated individuals exposed to the ban for longer hours have the strongest decrease in smoking (Figure D.2) and alcohol consumption (Figure D.3). Eating out reduces the effect of the WSB on drinking (Figure D.3): this is consistent with the fact that eating out offers people an incentive to drink alcohol, which counterbalances the reduction obtained by the ban.

As a final check, in Figure D.4 we checked that the trend of the probability of being employed (for men and women) has not been affected by the WSB: this is particularly important to support our identification strategy in which the employment status determines the treatment and control groups. In addition, we checked the same on two placebo outcomes (Figure D.5): the probability of being single, the tobacco unit value, and the alcohol unit value.

7 Conclusion

Although work based smoking bans (WSB) have been introduced in several countries to encourage smoking cessation, they can have spillover effects on other health behaviors and outcomes. We document that a WSB not only discourages smoking but can also give rise to behavioural spillovers by modifying other behaviours, such as alcohol use and physical activity. Furthermore, we document evidence of spillovers beyond targeted groups, as non-smokers and current smokers who live with a quitter are likely to change their health behaviours too.

Our estimates draw on a major smoking ban introduced between 2013 and 2014 in Russia, a country where about half of the population smokes. We find robust evidence that the WSB reduces smoking among men in 2.9 percentage points. In contrast to previous studies, we only find an effect on the extensive margin. Indeed, both Evans et al. (1999) and Fichtenberg & Glantz (2000) report a reduction in the prevalence of smoking after the introduction of WSBs in the United States, Australia, Canada, and Germany, ranging from 3.8 to 5 %. We find that the WSB reduces use of alcohol among quitters (6.7 percentage point reduction among men and 3.5 percentage point among women), as well as their alcohol consumption (by 10 percent among men). In contrast, we do not observe any direct effect on the individual physical activity. Our estimates are consistent with evidence in the literature, suggesting that smoking bans influence alcohol use, but the majority of them draw from evidence of bans in public places[16]. It is important to note that these results are relevant for policy as they suggest that studies that estimate the effects of smoking bans on smoking alone are likely to underestimate the health-related effects as they tend to disregard the presence of behavioural spillovers that alter healthy identities. This evidence can be explained by either changes in health-related

[16] Adams & Cotti (2008) observe an increase in fatal accidents involving alcohol following bans on smoking in bars, but Bernat et al. (2013) documents no evidence of smoke free laws on alcohol-related car crash fatalities. Among studies that focus on expenditure and consumption, Pryce (2019) documents evidence that smoking bans in the UK decrease alcohol expenditure, in pubs and restaurants, and especially amongst smoking households. Picone et al. (2004) report a reduction in alcohol consumption among females after the introduction of smoking bans in the US, Koksal & Wohlgenant (2016) distinguish between alcohol consumption at home and in restaurants, finding a reduction of the former and an increase of the latter. In addition, we find that smoking bans affect individuals who are unaffected by the reform, namely never smokers or smokers who do not quit but live in a household with other smokers.

identities (which are adjusted after marginal changes in the acceptability of related health behaviours), or licensing effects. More specifically, they point towards a joint formation of healthy behaviours.

Finally, it is worth noting that smoking bans might exhibit heterogeneous effects, and differ depending on the smoking and drinking culture. Moreover, WSB are likely to exert different effects than other bans.

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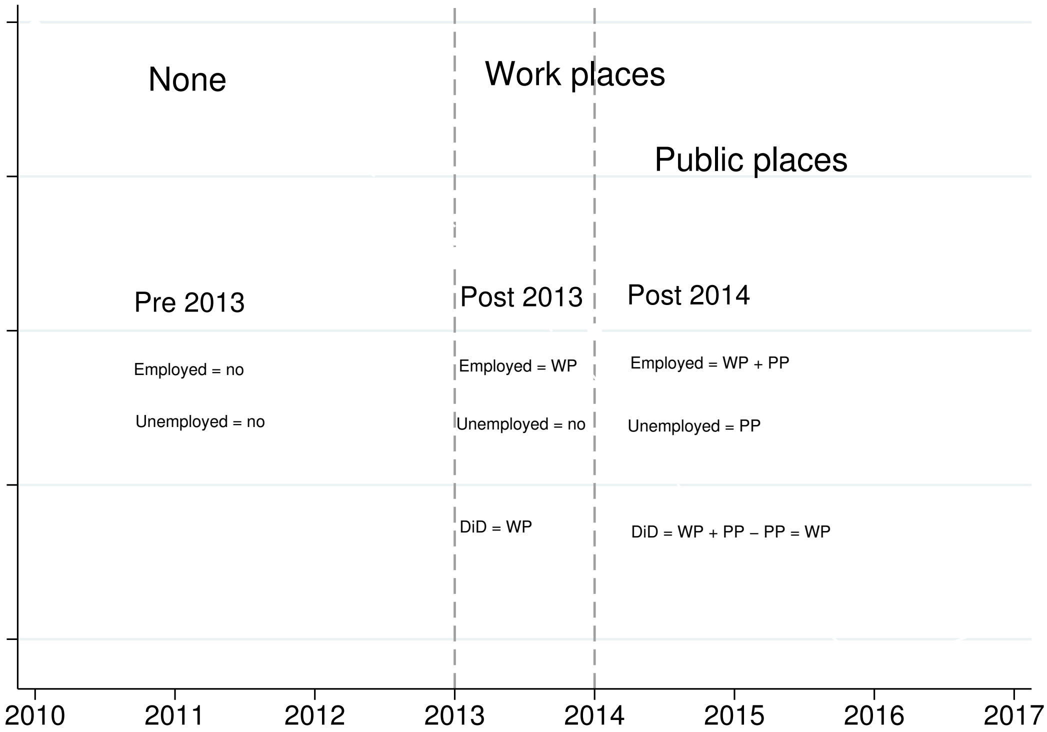
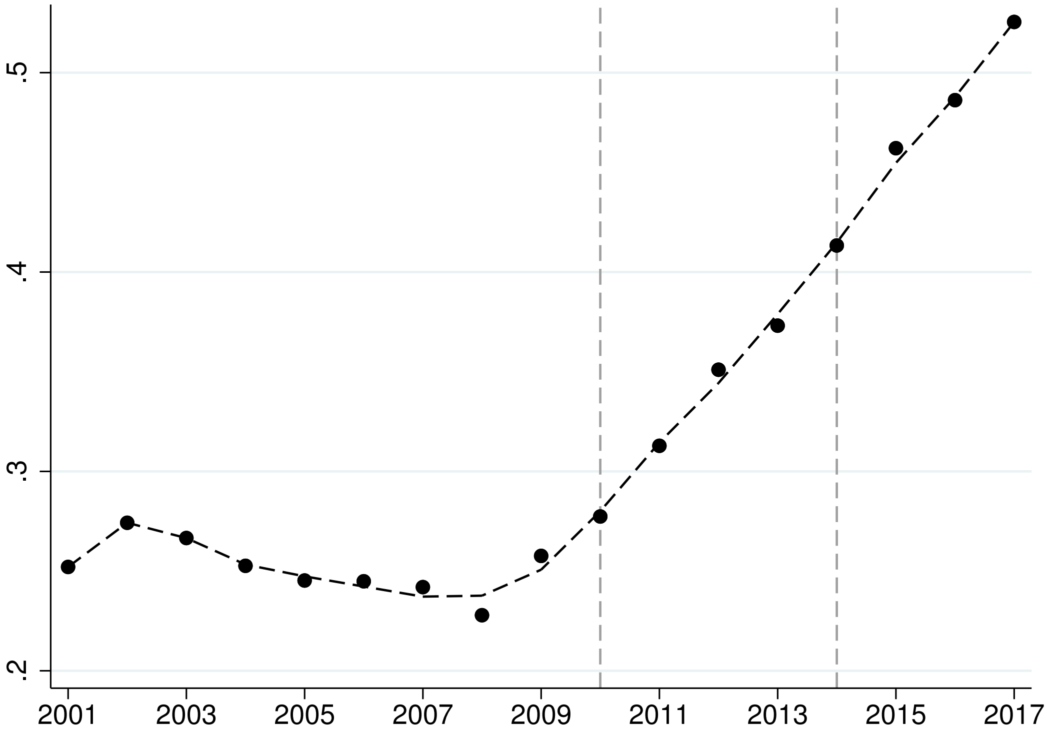


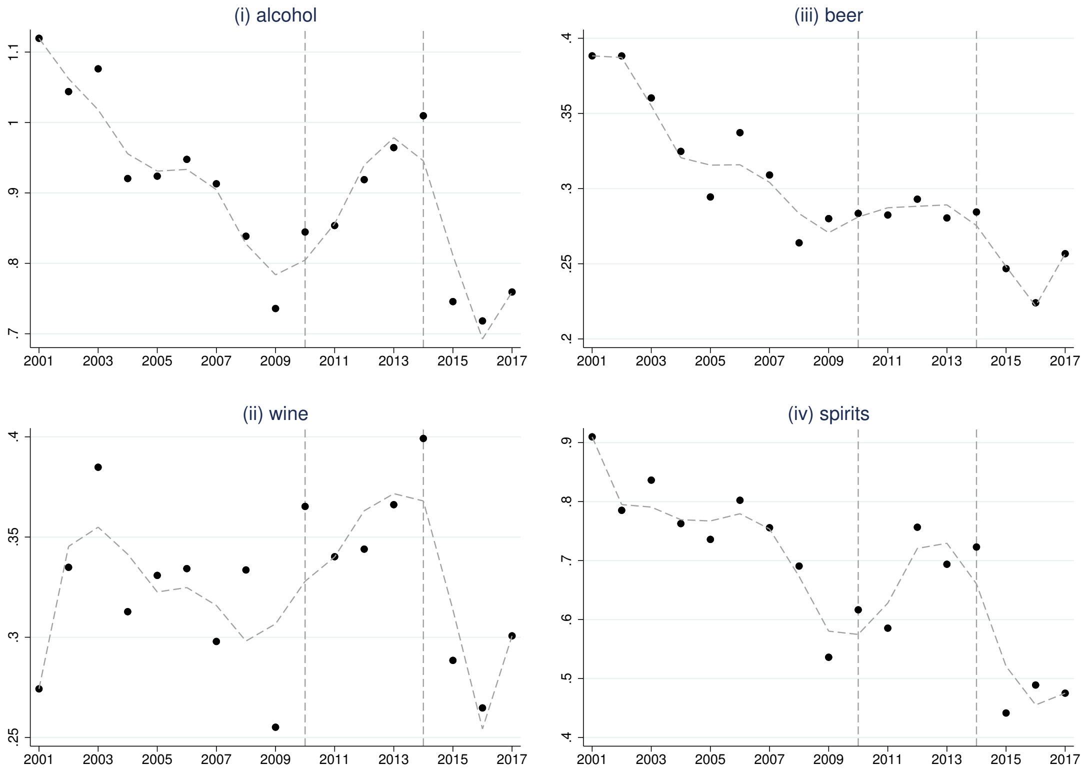
Notes: The figure plots the timeline of the implementation of smoking bans in Russia and how the employed and unemployed are affected in each period of time.

Figure 1: Timeline of the implementation of smoking bans.



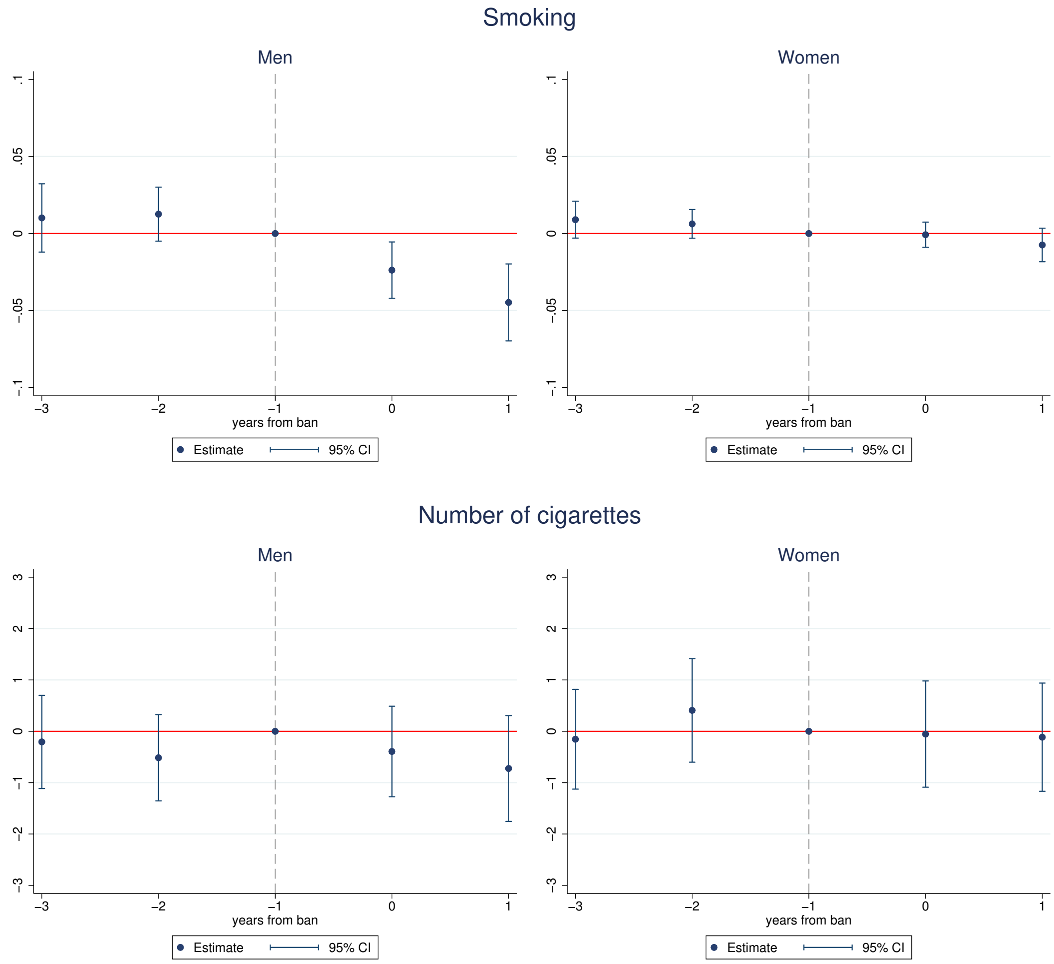
Notes: The figure plots year-specific average values for the unit value for tobacco products divided by the unit value for all goods. Unit values are obtained from the Survey on Household Expenditures, which is part of the RLMS, The data from the survey allow us to calculate unit values for a wide range of products at the household level as the ratio between household expenditure and quantity.

Figure 2: Time trends for relative price of cigarettes.



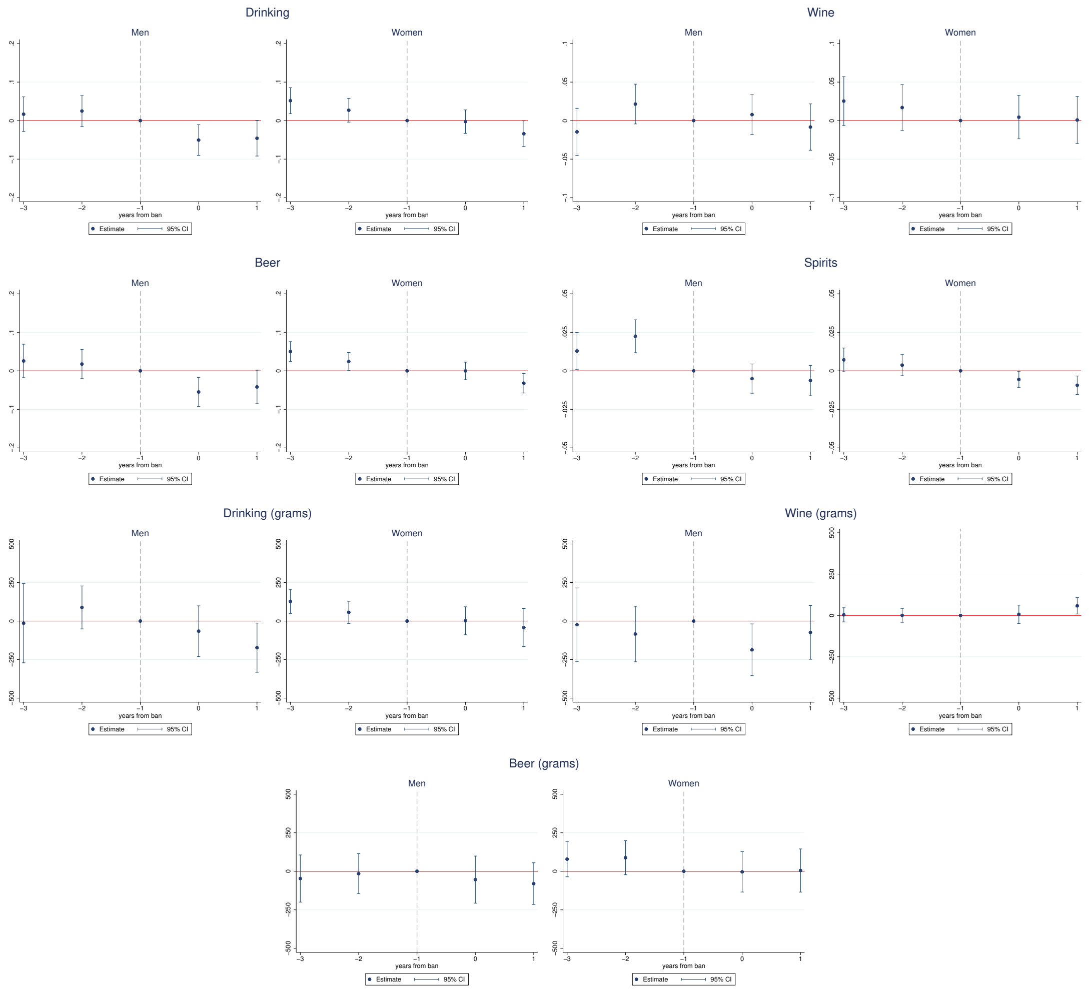
Notes: The figure plots year-specific average values for the unit value for beer, wine and spirits divided by the unit value for all goods. Unit values are obtained from the Survey on Household Expenditures, which is part of the RLMS. The data from the survey allow us to calculate unit values for a wide range of product, at the household level as the ratio between household expenditure and quantity.

Figure 3: Time trends for relative prices of (i) alcohol, (ii) wine, (iii) beer and (iv) spirits.



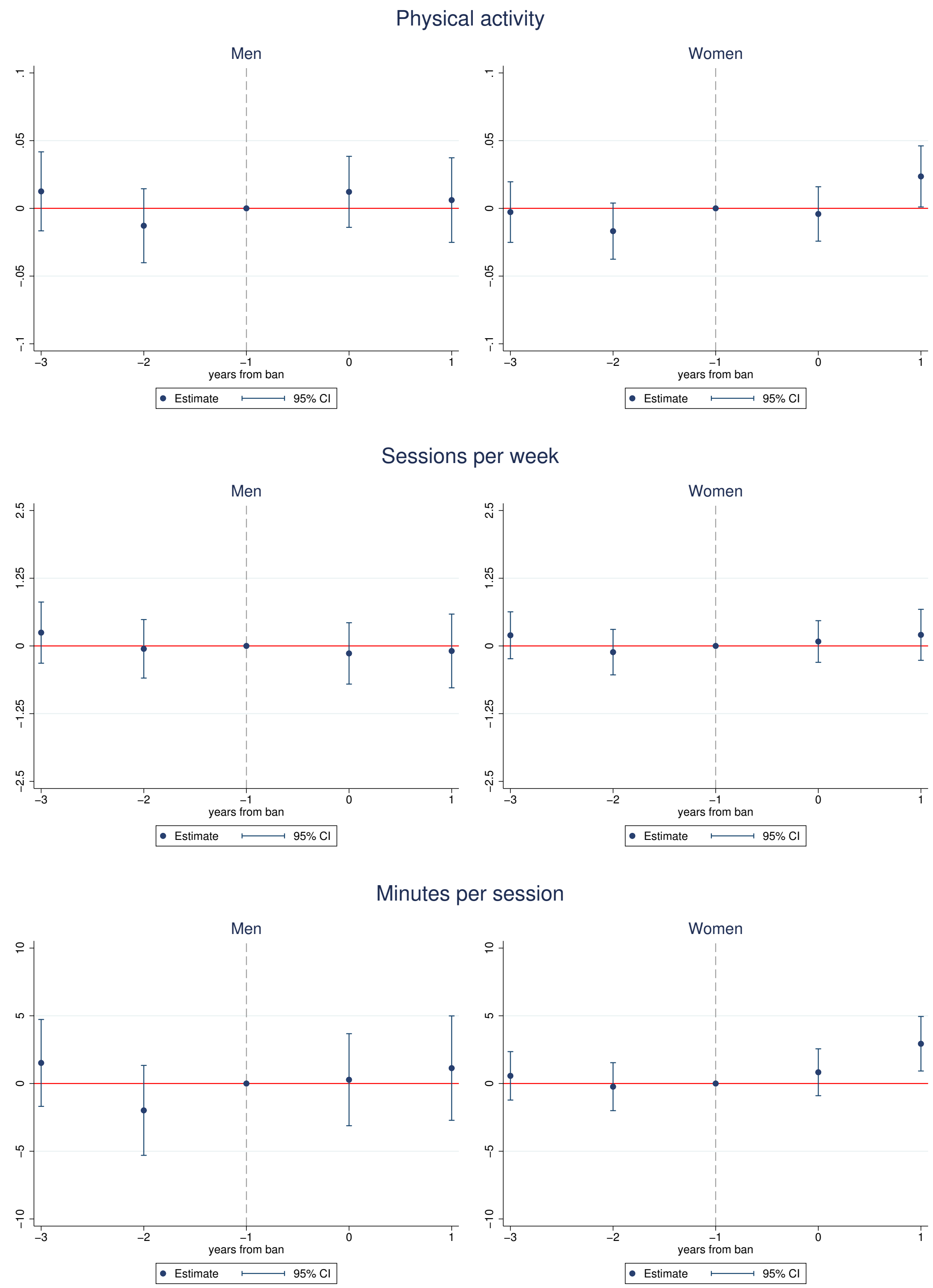
Notes: The figure plots lags and leads for the main health behaviours estimated from equation 2. The dots represent point estimates, and vertical bars represent 95% confidence intervals. The year 2012 was chosen as the reference year.

Figure 4: Event study: smoking and number of cigarettes



Notes: The figure plots lags and leads for the main health behaviours estimated from equation 2. The dots represent point estimates and vertical bars represent 95% confidence intervals. The year 2012 was chosen as the reference year.

Figure 5: Event study: drinking participation and consumption.



Notes: The figure plots lags and leads for the main health behaviours estimated from equation 2. Spirits consumption is omitted: too few observations. The dots represent point estimates and vertical bars represent 95% confidence intervals. The year 2012 was chosen as the reference year.

Figure 6: Event study: Physical activity

Table 1: Effect of smoking bans on smoking behaviour.

	Smoker	Number of cigarettes
	Men	
	(1)	(2)
SB_{WP}	-0.0291**	-0.3650
	(0.012)	(0.359)
Constant	0.3265	3.3550
	(0.229)	(7.226)
Mean of Y	0.574	17.54
SD of Y	0.494	8.078
Observations	23,014	12,666
Number of clusters	8,345	5,087
	Women	
SB_{WP}	-0.0014	-0.2903
	(0.005)	(0.397)
Constant	0.4118	14.3074
	(0.259)	(12.331)
Mean of Y	0.183	11.86
SD of Y	0.386	6.651
Observations	26,246	4,579
Number of clusters	9,182	1,955

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on smoking participation and consumption. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1*

Table 2: Effect of smoking bans on drinking participation.

	Drinking	Wine	Beer	Spirits
		Men		
	(1)	(2)	(3)	(4)
SB_{WP}	-0.0673***	-0.0059	-0.0659***	-0.0156***
	(0.016)	(0.010)	(0.015)	(0.004)
Constant	-0.0154	-0.5063	0.4396	0.0840
	(0.491)	(0.336)	(0.411)	(0.107)
Mean of Y	0.490	0.104	0.441	0.00895
SD of Y	0.500	0.306	0.497	0.0942
Observations	22,906	22,996	22,928	23,021
Number of clusters	8,327	8,342	8,332	8,347
		Women		
SB_{WP}	-0.0346***	-0.0068	-0.0340***	-0.0121***
	(0.012)	(0.011)	(0.009)	(0.003)
Constant	-0.7203*	-1.5846***	1.0866***	-0.1232
	(0.435)	(0.460)	(0.393)	(0.081)
Mean of Y	0.387	0.254	0.200	0.00756
SD of Y	0.487	0.435	0.400	0.0866
Observations	26,191	26,226	26,224	26,257
Number of clusters	9,177	9,179	9,181	9,187

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on drinking participation and consumption for the following categories: all, wine, beer and spirits. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 3: Effect of smoking bans on drinking consumption.

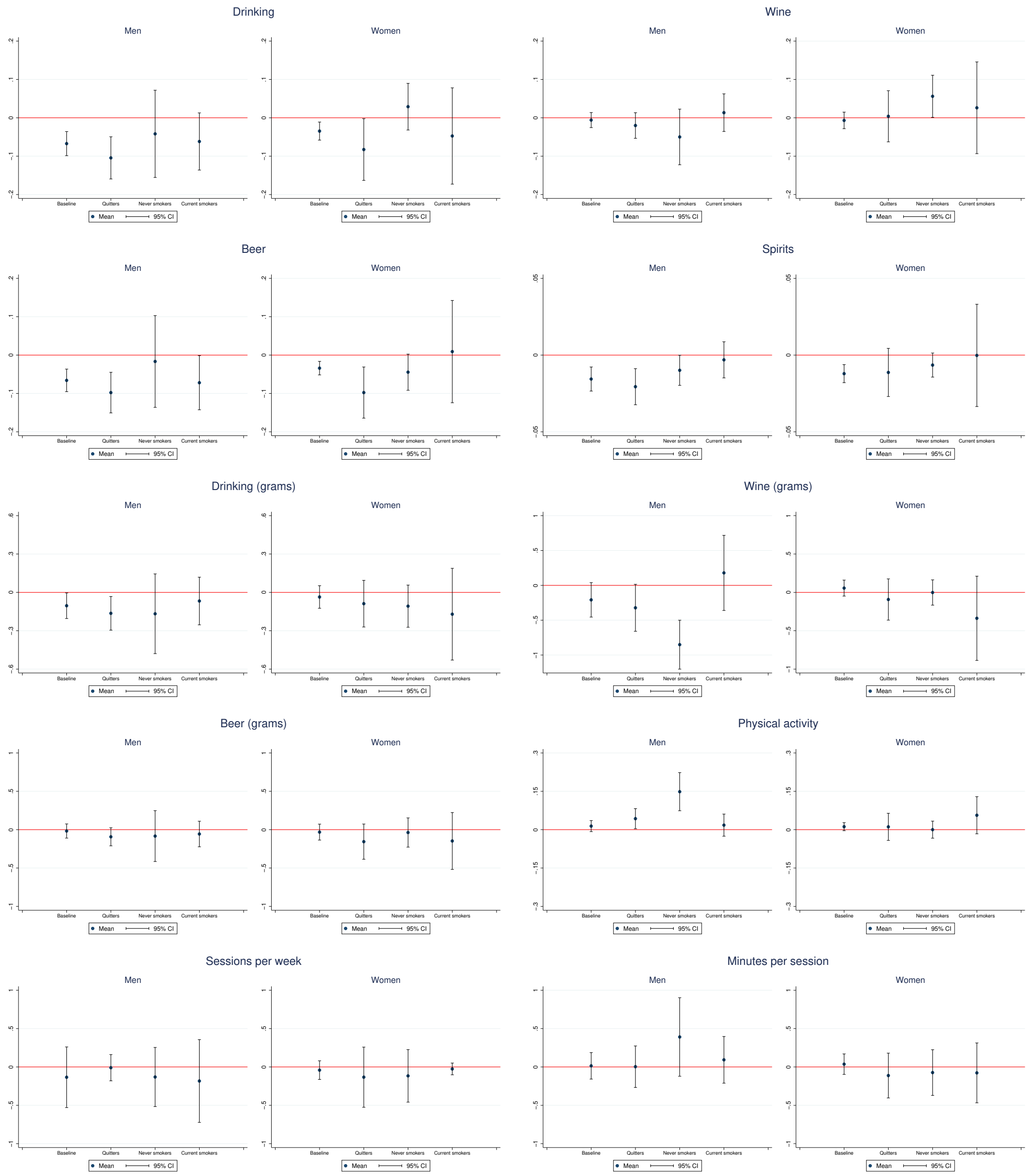
	Drinking (grams)	Wine (grams)	Beer (grams)
		Men	
	(1)	(2)	(3)
SB_{WP}	-0.1044**	-0.2081*	-0.0176
	(0.051)	(0.126)	(0.047)
Constant	5.5393***	10.4127***	5.1195***
	(0.962)	(3.169)	(1.008)
Mean of Y	6.720	5.735	6.765
SD of Y	0.708	0.696	0.602
Observations	11,432	2,454	10,303
Number of clusters	5,436	1,743	4,991
		Women	
SB_{WP}	-0.0360	0.0559	-0.0317
	(0.045)	(0.053)	(0.053)
Constant	5.0087***	2.7467*	4.9163***
	(1.366)	(1.430)	(1.729)
Mean of Y	5.978	5.457	6.314
SD of Y	0.832	0.613	0.628
Observations	10,061	6,882	4,894
Number of clusters	5,140	4,022	2,807

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on drinking consumption for the following categories: all, wine, and beer. Spirits consumption is omitted: too few observations. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 4: Effect of smoking bans on physical activity.

	Physical activity	Sessions/week	Minutes/session
		Men	
	(1)	(2)	(3)
SB_{WP}	0.0140	-0.1243	0.0145
	(0.011)	(0.113)	(0.088)
Constant	0.3373	-1.0405	5.8073***
	(0.365)	(2.288)	(2.141)
Mean of Y	0.136	2.284	4.243
SD of Y	0.342	0.808	0.746
Observations	23,022	3,139	3,150
Number of clusters	8,345	1,979	1,983
		Women	
SB_{WP}	0.0117	-0.0713	0.0363
	(0.008)	(0.098)	(0.068)
Constant	0.1491	-0.9012	1.7063
	(0.261)	(2.810)	(2.130)
Mean of Y	0.122	2.321	3.994
SD of Y	0.328	0.781	0.723
Observations	26,247	3,295	3,307
Number of clusters	9,182	2,083	2,090

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on participation in and intensity of physical activity - number of sessions and sessions per week. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*



Notes: The figure plots estimates from equation 3 of spillover effects, of the workplace smoking ban on drinking participation and consumption, and on physical activity on: (i) compliers with the WSBs, and (ii) household members living with a complier. We excluded the graph on consumption of spirits due to lack of observations. Spirits consumption is omitted: too few observations.

Figure 7: Drinking: spillover effects on quitters and on other never and current smokers' household members

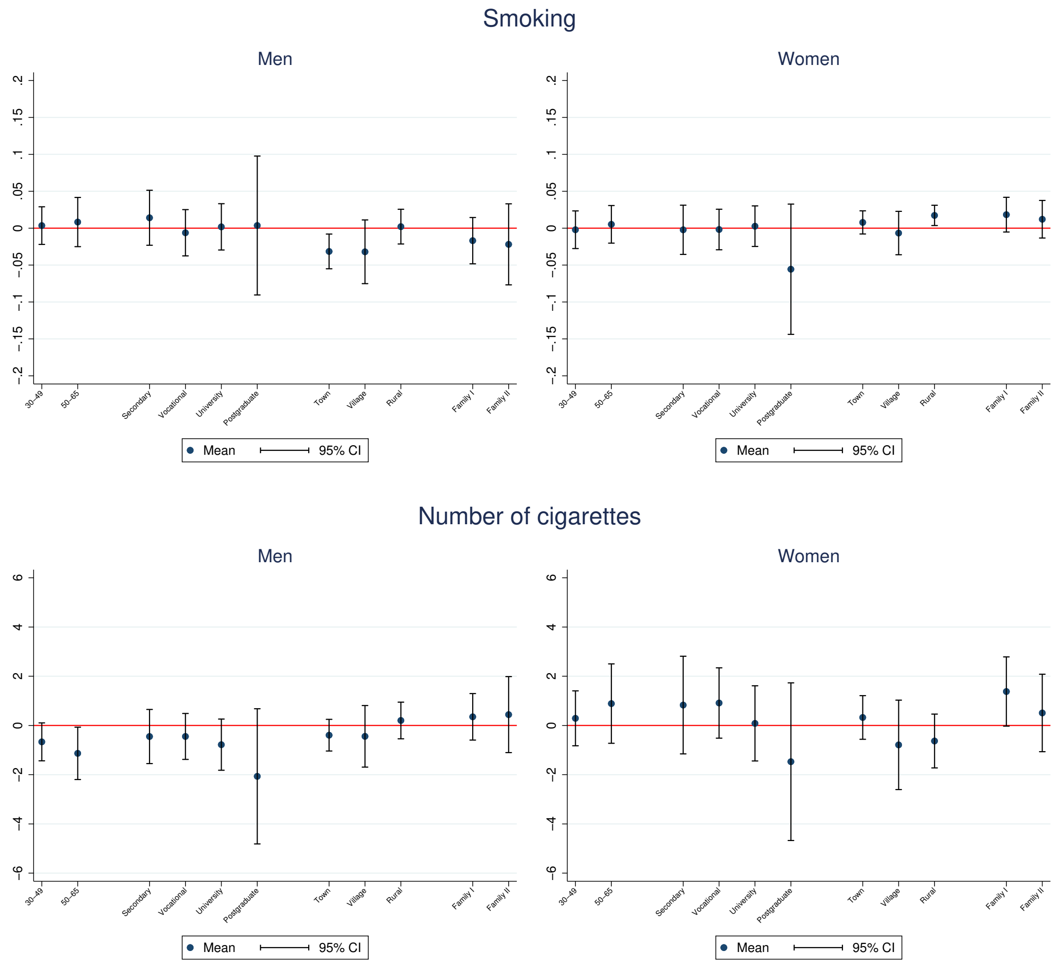
Appendix A

Table A.1: Descriptive statistics.

Variable	Modality	Obs	%	Mean	Std dev
		Always Employed			
Smoking	Yes	35,280	0.38		0.49
Average number of cigarettes		13,604		15.85	8.16
Drinking	Yes	35,158	0.50		0.50
Grams		17,637		820.04	709.85
Beer	Yes	35,202	0.36		0.48
Grams		12,619		927.46	650.80
Wine	Yes	35,256	0.21		0.41
Grams		7,576		315.31	246.10
Spirits	Yes	35,297	0.01		0.09
Grams		314		1,214.17	1,158.59
Physical exercise	Yes	35,292	0.13		.34
Sessions per week		4,705		3.11	2.49
Minutes per session		4,723		78.21	57.78
Gender	Female	35,310	0.48		0.50
Age		35,310		40.13	11.13
Married	Yes	35,286	0.60		0.49
Education	Primary	35,310	0.08		0.28
	Secondary	35,310	0.32		0.47
	Vocational studies	35,310	0.27		0.44
	University	35,310	0.32		0.47
Resident in	Regional centre	35,310	0.50		0.50
	Town	35,310	0.29		0.45
	Rural	35,310	0.21		0.40
		Unemployed			
Smoking	Yes	14,408	.28		0.45
Average number of cigarettes		4,037		14.89	8.29
Drinking	Yes	14,366	0.28		0.45
Grams		4,021		754.10	828.36
Beer	Yes	14,378	0.19		0.39
Grams		2,697		852.61	673.67
Wine	Yes	14,396	0.13		0.33
Grams		1,827		298.90	267.34
Spirits	Yes	14,412	0.01		0.09
Grams		123		1,546.34	2,076.78
Physical exercise	Yes	14,406	0.13		0.33
Sessions per week		1,782		3.90	2.95
Minutes per session		1,787		83.14	65.71
Gender	Female	14,416	0.65		.47
Age		14,416		43.31	16.61
Married	Yes	14,402	0.47		0.50
Education	Primary	14,416	0.18		0.39
	Secondary	14,416	0.46		0.50
	Vocational studies	14,416	0.22		0.41
	University	14,416	0.13		0.34
Resident in	Regional centre	14,416	0.44		0.50
	Town	14,416	0.22		0.41
	Rural	14,416	0.34		0.47

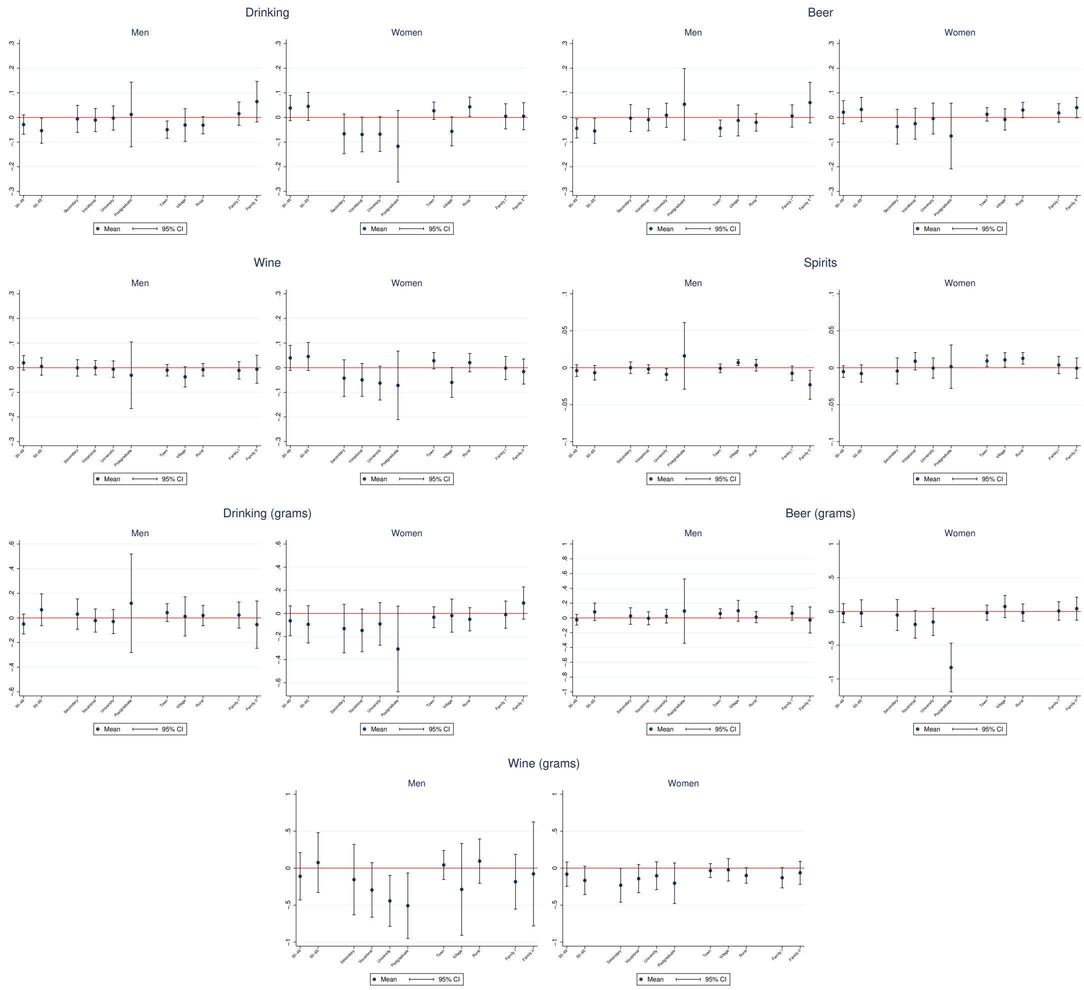
Notes: This Table provides the list, number of observations, %, arithmetic mean and standard deviation of the variables of interest. Years: 2009-2014. Population age: 17-65. Unbalanced sample.

Appendix B



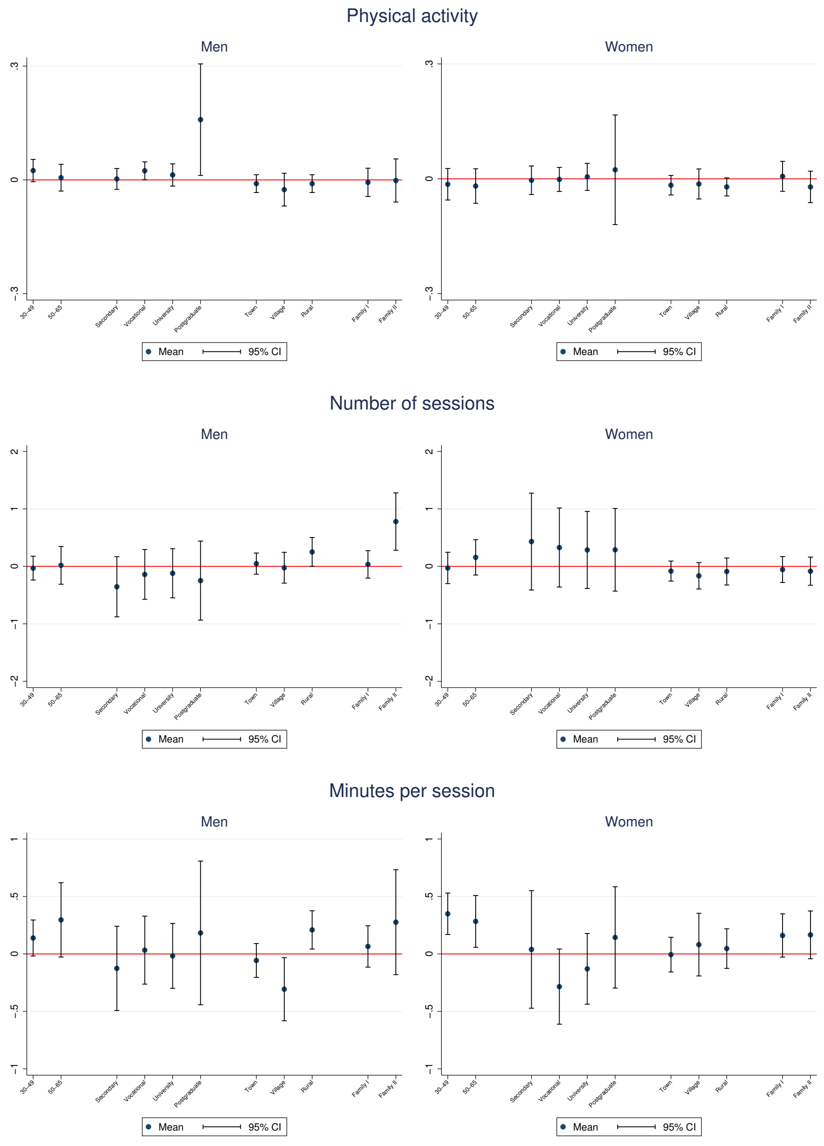
Notes: The figure plots heterogeneous effects of the smoking ban on smoking participation and consumption considering the following heterogeneity dimensions: age, education, residence status, and family type.

Figure B.1: Heterogeneity: smoking participation and consumption



Notes: The figure plots heterogeneous effects of the smoking ban on drinking participation and consumption considering the following heterogeneity dimensions: age, education, residence status, and family type. Spirits consumption is omitted: too few observations.

Figure B.2: Heterogeneity: drinking participation and consumption



Notes: The figure plots heterogeneous effects of the smoking ban on participation in and intensity of physical activity considering the following heterogeneity dimensions: age, education, residence status, and family type.

Figure B.3: Heterogeneity: physical activity

Appendix C

Table C.1: Effect of smoking bans on smoking behaviour - balanced sample.

	Smoker	Number of cigarettes
	Men	
	(1)	(2)
SB_{WP}	-0.0372**	-0.2280
	(0.016)	(0.460)
Constant	0.0174	23.9214*
	(0.382)	(13.336)
Mean of Y	0.566	17.89
SD of Y	0.496	8.301
Observations	9,263	4,912
Number of clusters	1,986	1,212
	Women	
SB_{WP}	0.0029	-0.2984
	(0.006)	(0.579)
Constant	0.2742	4.8554
	(0.247)	(17.637)
Mean of Y	0.161	11.90
SD of Y	0.368	6.447
Observations	11,907	1,838
Number of clusters	2,560	467

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on smoking participation and consumption. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.2: Effect of smoking bans on drinking participation - balanced sample.

	Drinking	Wine	Beer	Spirits
		Men		
	(1)	(2)	(3)	(4)
SB_{WP}	-0.0649***	0.0038	-0.0722***	-0.0110**
	(0.022)	(0.013)	(0.021)	(0.006)
Constant	-0.7953	-0.6228	-0.2851	-0.2775
	(0.811)	(0.565)	(0.746)	(0.190)
Mean of Y	0.460	0.0937	0.412	0.00786
SD of Y	0.498	0.291	0.492	0.0883
Observations	9,217	9,254	9,224	9,261
Number of clusters	1,986	1,986	1,986	1,986
		Women		
SB_{WP}	-0.0400***	0.0001	-0.0415***	-0.0147***
	(0.015)	(0.013)	(0.011)	(0.004)
Constant	-1.1019	-2.6231***	1.9339***	-0.1823
	(0.750)	(0.825)	(0.545)	(0.142)
Mean of Y	0.372	0.242	0.192	0.00679
SD of Y	0.483	0.428	0.394	0.0821
Observations	11,885	11,900	11,900	11,914
Number of clusters	2,561	2,561	2,561	2,561

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on drinking participation for the following categories: all, wine, beer and spirits. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.3: Effect of smoking bans on drinking consumption - balanced sample.

	Drinking (grams)	Wine (grams)	Beer (grams)
		Men	
	(1)	(2)	(3)
SB_{WP}	-0.0275	-0.1757	0.0131
	(0.073)	(0.208)	(0.065)
Constant	4.1954**	16.7324***	3.8374**
	(1.814)	(4.645)	(1.904)
Mean of Y	6.701	5.728	6.758
SD of Y	0.715	0.710	0.598
Observations	4,379	883	3,941
Number of clusters	1,442	538	1,332
		Women	
SB_{WP}	-0.0849	0.0736	-0.1034*
(0.055)	(0.067)	(0.061)	
Constant	6.1799***	5.3380**	3.4252
	(2.062)	(2.188)	(2.149)
Mean of Y	5.953	5.436	6.297
SD of Y	0.831	0.609	0.635
Observations	4,359	2,963	2,056
Number of clusters	1,623	1,346	922

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on drinking consumption for the following categories: all, wine, and beer. Spirits consumption is omitted: too few observations. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1-*

Table C.4: Effect of smoking bans on physical activity - balanced sample.

	Physical activity	Sessions/week	Minutes/session
		Men	
	(1)	(2)	(3)
SB_{WP}	0.0083	-0.2138	0.0312
	(0.015)	(0.140)	(0.133)
Constant	-0.2597	-1.0064	7.0784***
	(0.508)	(3.377)	(2.648)
Mean of Y	0.118	2.279	4.210
SD of Y	0.323	0.810	0.752
Observations	9,266	1,114	1,116
Number of clusters	1,986	555	554
		Women	
SB_{WP}	0.0066	-0.0879	0.0802
	(0.009)	(0.092)	(0.088)
Constant	0.5935	-3.6713	1.5860
	(0.644)	(4.807)	(3.348)
Mean of Y	0.107	2.324	3.958
SD of Y	0.309	0.779	0.722
Observations	11,912	1,305	1,307
Number of clusters	2,561	643	645

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on participation in and intensity of physical activity - number of sessions and sessions per week. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.5: Effect of smoking bans on smoking behaviour - only quitters.

	Smoker	Number of cigarettes
	Men	
	(1)	(2)
SB_{WP}	-0.0202**	-0.3086
	(0.010)	(0.397)
Constant	0.2304	5.2837
	(0.171)	(7.609)
Mean of Y	0.578	17.99
SD of Y	0.494	8.080
Observations	19,831	10,992
Number of clusters	7,578	4,402
	Women	
SB_{WP}	-0.0044	-0.2296
	(0.004)	(0.445)
Constant	0.4883**	11.8860
	(0.227)	(13.664)
Mean of Y	0.153	12.49
SD of Y	0.360	6.756
Observations	24,257	3,595
Number of clusters	8,704	1,556

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on smoking participation and consumption. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.6: Effect of smoking bans on drinking participation - only quitters.

	Drinking	Wine	Beer	Spirits
	Men			
	(1)	(2)	(3)	(4)
SB_{WP}	-0.0732***	-0.0161	-0.0644***	-0.0162***
	(0.018)	(0.011)	(0.017)	(0.005)
Constant	0.1086	-0.3739	0.5363	0.0826
	(0.547)	(0.367)	(0.455)	(0.116)
Mean of Y	0.500	0.107	0.450	0.00913
SD of Y	0.500	0.309	0.497	0.0951
Observations	19,738	19,818	19,757	19,837
Number of clusters	7,561	7,575	7,566	7,581
	Women			
SB_{WP}	-0.0336***	-0.0095	-0.0302***	-0.0107***
	(0.012)	(0.011)	(0.009)	(0.002)
Constant	-0.8849**	-1.4765***	0.7451*	-0.1350
	(0.439)	(0.471)	(0.392)	(0.087)
Mean of Y	0.375	0.251	0.187	0.00727
SD of Y	0.484	0.434	0.390	0.0850
Observations	24,205	24,238	24,234	24,265
Number of clusters	8,697	8,700	8,701	8,708

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on drinking participation for the following categories: all, wine, beer and spirits. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.7: Effect of smoking bans on drinking consumption - only quitters .

	Drinking (grams)	Wine (grams)	Beer (grams)
		Men	
	(1)	(2)	(3)
SB_{WP}	-0.0898	-0.1613	-0.0180
	(0.055)	(0.129)	(0.050)
Constant	5.7080***	10.1683***	5.4403***
	(0.991)	(3.448)	(1.034)
Mean of Y	6.718	5.721	6.764
SD of Y	0.712	0.695	0.604
Observations	9,979	2,164	8,982
Number of clusters	4,885	1,552	4,475
		Women	
SB_{WP}	-0.0263	0.0704	-0.0431
	(0.048)	(0.056)	(0.059)
Constant	3.7046**	2.2819	3.0996
	(1.621)	(1.478)	(2.166)
Mean of Y	5.944	5.442	6.299
SD of Y	0.833	0.613	0.633
Observations	9,088	6,315	4,273
Number of clusters	4,754	3,731	2,521

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on drinking consumption for the following categories: all, wine, and beer. Spirits consumption is omitted: too few observations. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.8: Effect of smoking bans on physical activity - only quitters.

	Physical activity	Sessions/week	Minutes/session
		Men	
SB_{WP}	0.0155	-0.1233	0.0099
	(0.012)	(0.145)	(0.099)
Constant	0.3474	-1.1057	7.0089***
	(0.399)	(2.354)	(2.118)
Mean of Y	0.139	2.290	4.233
SD of Y	0.346	0.804	0.752
Observations	19,838	2,768	2,778
Number of clusters	7,578	1,782	1,788
		Women	
SB_{WP}	0.0129	-0.1305	0.0368
	(0.008)	(0.079)	(0.071)
Constant	0.0305	-0.4574	2.4154
	(0.285)	(3.014)	(2.160)
Mean of Y	0.124	2.319	3.996
SD of Y	0.329	0.781	0.724
Observations	24,255	3,057	3,067
Number of clusters	8,703	1,950	1,956

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on participation in and intensity of physical activity - number of times and times per week. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.9: Effect of smoking bans on smoking behaviour - regional trends.

	Smoker	Number of cigarettes
	Men	
	(1)	(2)
SB_{WP}	-0.0227*	-0.3780
	(0.012)	(0.372)
Constant	0.1734	3.9336
	(0.310)	(8.120)
Mean of Y	0.574	17.54
SD of Y	0.494	8.078
Observations	23,014	12,666
Number of clusters	8,345	5,087
	Women	
SB_{WP}	0.0016	-0.3553
	(0.006)	(0.408)
Constant	0.6215**	19.1841
	(0.283)	(15.009)
Mean of Y	0.183	11.86
SD of Y	0.386	6.651
Observations	26,246	4,579
Number of clusters	9,182	1,955

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on smoking participation and consumption. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.10: Effect of smoking bans on drinking participation - regional trends.

	Drinking	Wine	Beer	Spirits
		Men		
	(1)	(2)	(3)	(4)
SB_{WP}	-0.0619***	-0.0002	-0.0626***	-0.0160***
	(0.017)	(0.010)	(0.016)	(0.005)
Constant	-0.4434	-0.4658	0.0078	0.0010
	(0.608)	(0.384)	(0.532)	(0.128)
Mean of Y	0.490	0.104	0.441	0.00895
SD of Y	0.500	0.306	0.497	0.0942
Observations	22,906	22,996	22,928	23,021
Number of clusters	8,327	8,342	8,332	8,347
		Women		
SB_{WP}	-0.0230*	0.0004	-0.0272***	-0.0102***
	(0.013)	(0.011)	(0.010)	(0.003)
Constant	-1.0012**	-1.6569***	0.8482*	-0.1079
	(0.499)	(0.514)	(0.472)	(0.104)
Mean of Y	0.387	0.254	0.200	0.00756
SD of Y	0.487	0.435	0.400	0.0866
Observations	26,191	26,226	26,224	26,257
Number of clusters	9,177	9,179	9,181	9,187

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on drinking participation for the following categories: all, wine, beer and spirits. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.11: Effect of smoking bans on drinking consumption - regional trends.

	Drinking (grams)	Wine (grams)	Beer (grams)
		Men	
	(1)	(2)	(3)
SB_{WP}	-0.1080**	-0.1394	-0.0133
	(0.051)	(0.128)	(0.047)
Constant	6.4467***	19.2022***	6.0117***
	(1.228)	(4.310)	(1.237)
Mean of Y	6.720	5.735	6.765
SD of Y	0.708	0.696	0.602
Observations	11,432	2,454	10,303
Number of clusters	5,436	1,743	4,991
		Women	
SB_{WP}	-0.0352	0.0522	-0.0245
	(0.045)	(0.054)	(0.054)
Constant	7.1087***	4.1095**	6.9910***
	(1.615)	(1.662)	(1.984)
Mean of Y	5.978	5.457	6.314
SD of Y	0.832	0.613	0.628
Observations	10,061	6,882	4,894
Number of clusters	5,140	4,022	2,807

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on drinking consumption for the following categories: all, wine, and beer. Spirits consumption is omitted: too few observations. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.12: Effect of smoking bans on physical activity - regional trends.

	Physical activity	Sessions/week	Minutes/session
		Men	
SB_{WP}	0.0167	-0.1108	0.0847
	(0.011)	(0.100)	(0.092)
Constant	0.0713	3.4296	5.8746**
	(0.451)	(2.621)	(2.476)
Mean of Y	0.136	2.284	4.243
SD of Y	0.342	0.808	0.746
Observations	23,022	3,139	3,150
Number of clusters	8,345	1,979	1,983
		Women	
SB_{WP}	0.0113	-0.0422	0.0422
	(0.008)	(0.077)	(0.074)
Constant	0.2102	0.0385	2.3897
	(0.284)	(3.668)	(2.267)
Mean of Y	0.122	2.321	3.994
SD of Y	0.328	0.781	0.723
Observations	26,247	3,295	3,307
Number of clusters	9,182	2,083	2,090

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on participation in and intensity of physical activity - number of sessions and sessions per week. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1-*

Table C.13: Effect of smoking bans on smoking behaviour - controlling for prices.

	Smoker	Number of cigarettes
	Men	
	(1)	(2)
SB_{WP}	-0.0287**	-0.3818
	(0.013)	(0.399)
Constant	0.0007	4.4651
	(0.232)	(7.422)
Mean of Y	0.574	17.54
SD of Y	0.494	8.078
Observations	17,600	9,583
Number of clusters	7,370	4,378
	Women	
SB_{WP}	0.0016	0.1300
	(0.006)	(0.457)
Constant	0.3298	3.8869
	(0.297)	(14.190)
Mean of Y	0.183	11.86
SD of Y	0.386	6.651
Observations	20,276	3,360
Number of clusters	8,167	1,635

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on smoking participation and consumption. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.14: Effect of smoking bans on drinking participation - controlling for prices.

	Drinking	Wine	Beer	Spirits
		Men		
	(1)	(2)	(3)	(4)
SB_{WP}	-0.0742***	-0.0063	-0.0701***	-0.0117**
	(0.019)	(0.011)	(0.018)	(0.005)
Constant	-0.2714	-0.4629	0.2838	0.0783
	(0.620)	(0.425)	(0.509)	(0.147)
Mean of Y	0.490	0.104	0.441	0.00895
SD of Y	0.500	0.306	0.497	0.0942
Observations	17,560	17,603	17,568	17,607
Number of clusters	7,359	7,369	7,362	7,371
		Women		
SB_{WP}	-0.0175	-0.0031	-0.0238**	-0.0084***
	(0.014)	(0.012)	(0.011)	(0.003)
Constant	-0.1915	-1.3514***	1.6200***	-0.0715
	(0.497)	(0.519)	(0.359)	(0.086)
Mean of Y	0.387	0.254	0.200	0.00756
SD of Y	0.487	0.435	0.400	0.0866
Observations	20,248	20,269	20,268	20,282
Number of clusters	8,159	8,164	8,165	8,167

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on drinking participation for the following categories: all, wine, beer and spirits. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.15: Effect of smoking bans on drinking consumption - controlling for prices.

	Drinking (grams)	Wine (grams)	Beer (grams)
		Men	
	(1)	(2)	(3)
SB_{WP}	-0.0806	-0.2257*	-0.0228
	(0.061)	(0.136)	(0.057)
Constant	5.7966***	12.7951**	5.7513***
	(1.246)	(5.165)	(1.260)
Mean of Y	6.720	5.735	6.765
SD of Y	0.708	0.696	0.602
Observations	8,630	1,831	7,772
Number of clusters	4,620	1,395	4,228
		Women	
SB_{WP}	-0.0250	0.1293**	-0.0692
	(0.052)	(0.060)	(0.059)
Constant	5.2682***	2.8737*	4.4857**
	(1.576)	(1.671)	(2.057)
Mean of Y	5.978	5.457	6.314
SD of Y	0.832	0.613	0.628
Observations	7,647	5,208	3,733
Number of clusters	4,308	3,319	2,303

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on drinking consumption for the following categories: all, wine, beer and spirits. Standard errors (in parentheses) clustered at individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.16: Effect of smoking bans on physical activity - controlling for prices.

	Physical activity	Sessions/week	Minutes/session
		Men	
SB_{WP}	0.0105	-0.1440	0.0739
	(0.012)	(0.128)	(0.107)
Constant	0.5471	-1.0073	6.5540***
	(0.451)	(2.696)	(2.274)
Mean of Y	0.136	2.284	4.243
SD of Y	0.342	0.808	0.746
Observations	17,607	2,408	2,412
Number of clusters	7,371	1,617	1,617
		Women	
SB_{WP}	0.0101	-0.0288	0.0186
	(0.009)	(0.096)	(0.087)
Constant	0.4005	-2.4018	-0.2274
	(0.319)	(3.673)	(2.859)
Mean of Y	0.122	2.321	3.994
SD of Y	0.328	0.781	0.723
Observations	20,275	2,566	2,575
Number of clusters	8,164	1,700	1,704

*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on participation in and intensity of physical activity - number of sessions and sessions per week. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table C.17: Effect of smoking bans on cigarettes consumption for heavy and light smokers.

	Heavy Smoker	Light smoker	Heavy Smoker	Light smoker
	Men		Women	
	(1)	(2)	(3)	(4)
SB_{WP}	-0.5805	0.8547*	-0.2352	-0.4450
	(0.466)	(0.443)	(0.517)	(0.566)
Constant	11.6296	6.1457	29.2821*	-8.9097
	(9.197)	(7.661)	(15.498)	(13.556)
Mean of Y	19.28	12.75	13.72	8.95
SD of Y	8.062	5.89	7.086	4.587
Observations	9,285	3,417	2,887	1,703
Number of clusters	3,962	1,148	1,359	605

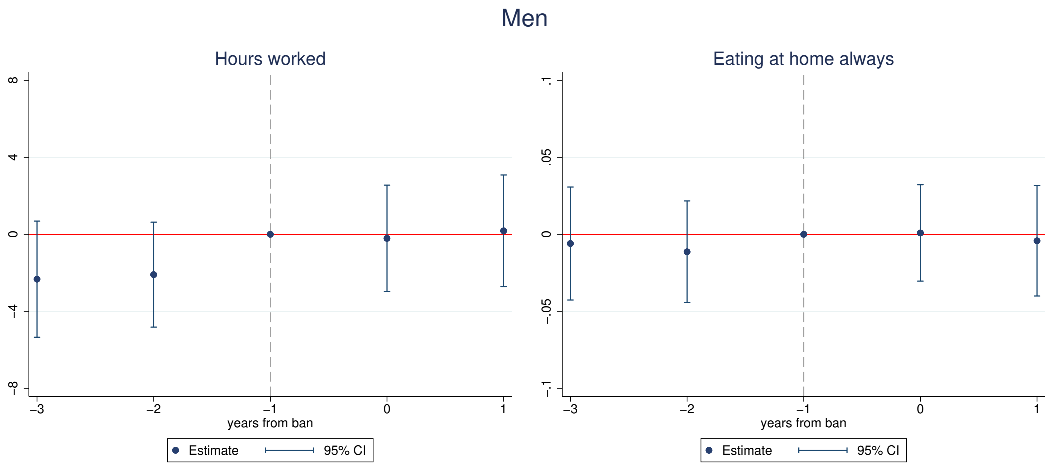
*Notes: All specifications are estimated using OLS and include individual- and year-specific fixed effects, and control for age, marital status, level of education and geographic area characteristics. The table shows DiD estimates for the effect of WSBs on cigarettes' consumption. Standard errors (in parentheses) clustered at the individual level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1*

Table C.18: P-values adjusted for multiple hypotheses testing.

	Men			Women		
	Model	Resample	RW	Model	Resample	RW
	(1)	(2)	(3)	(4)	(5)	(6)
Smoker	0.009	0.004	0.004	0.8293	0.7809	0.7809
Num cigarettes	0.200	0.0438	0.0996	0.4589	0.2749	0.6494
Drinking	0.000	0.004	0.004	0.0031	0.004	0.004
Wine	0.8051	0.6932	0.6932	0.5041	0.3466	0.6494
Beer	0.000	0.004	0.004	0.0002	0.004	0.004
Spirits	0.000	0.004	0.004	0.000	0.004	0.004

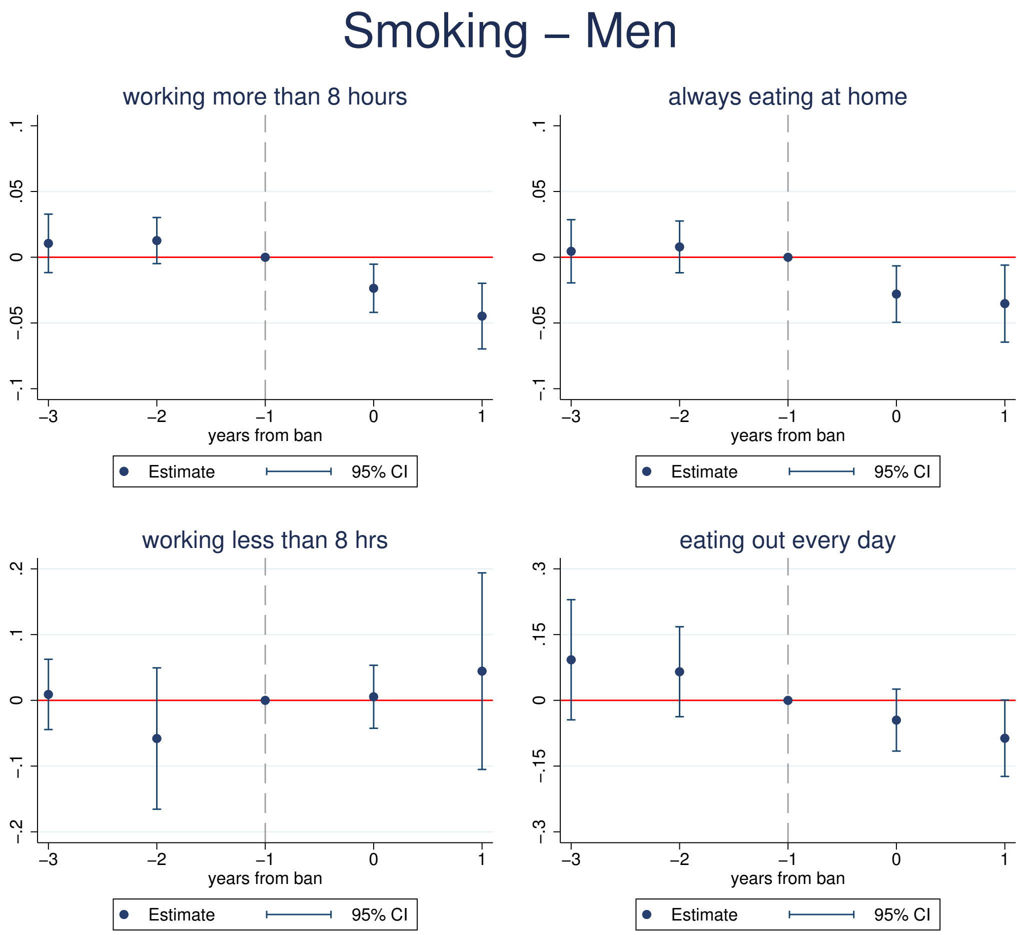
Notes: P-values are computed using the Romano-Wolf correction to (asymptotically) control the familywise error rate (FWER), with reps(250).

Appendix D



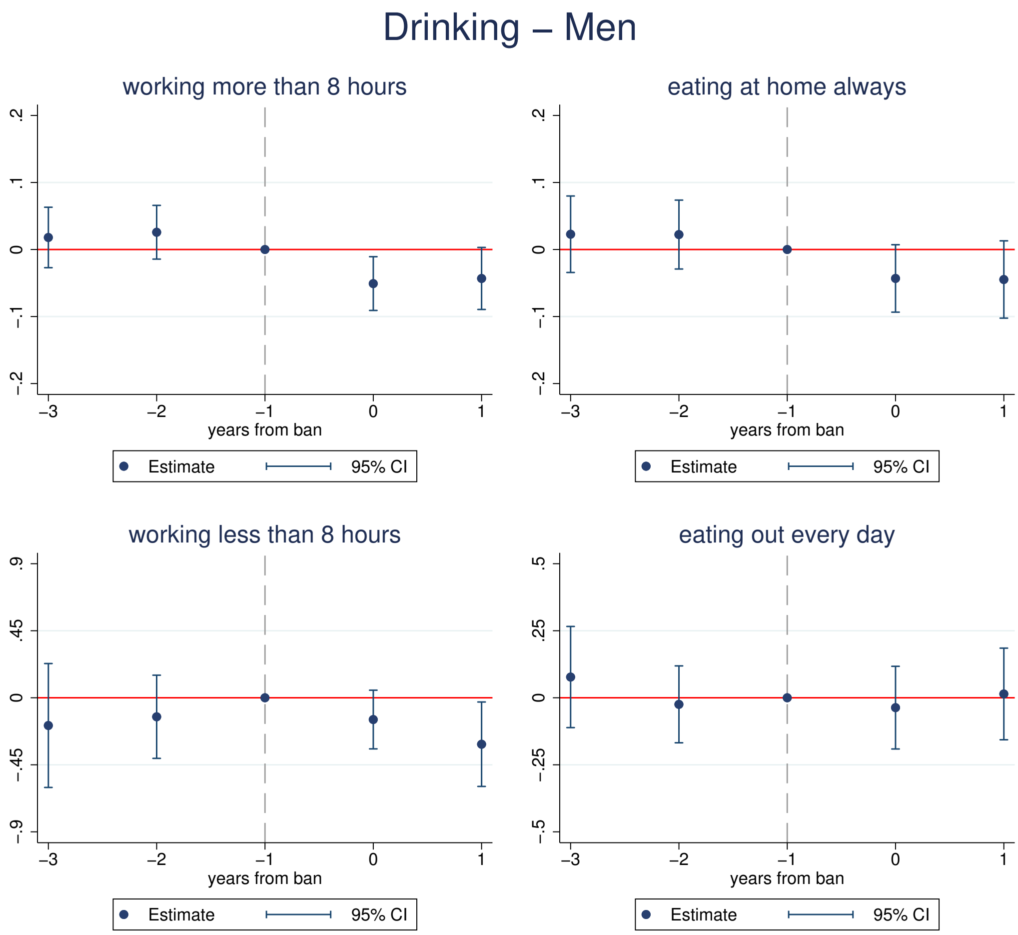
Notes: The figure plots lags and leads for the main health behaviours estimated from equation 2. The dots represent point estimates and vertical bars represent 95% confidence intervals. The year 2012 was chosen as the reference year.

Figure D.1: Event study: hours worked and eating out frequency



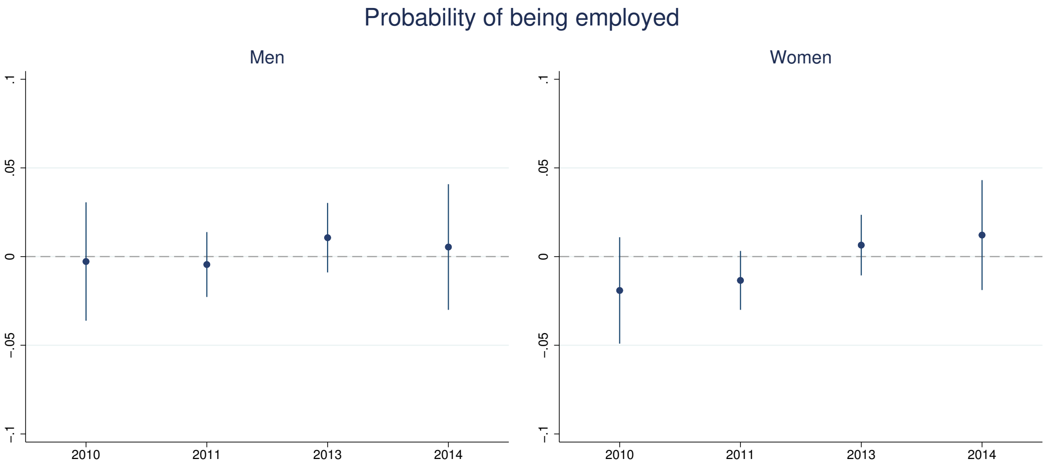
Notes: The figure plots lags and leads for the main health behaviours estimated from equation 2. The dots represent point estimates and vertical bars represent 95% confidence intervals. The year 2012 was chosen as the reference year.

Figure D.2: Event study: smoking by hours worked and eating out frequency



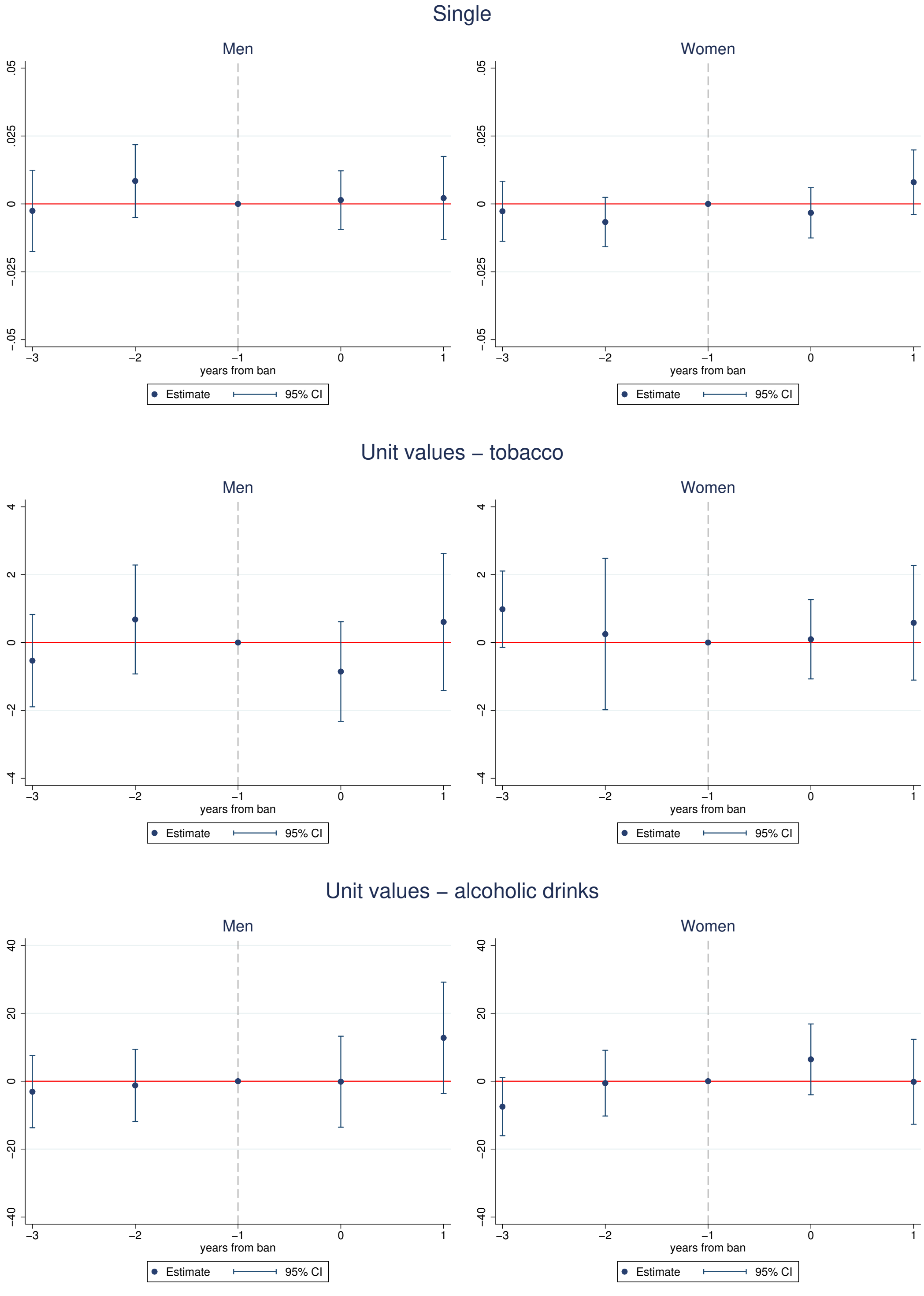
Notes: The figure plots lags and leads for the main health behavioursestimated from equation 2. The dots represent point estimates and vertical bars represent 95% confidence intervals. The year 2012 was chosen as the reference year.

Figure D.3: Event study: drinking by hours worked and eating out frequency



Notes: The figure plots coefficients associated with years obtained from a regression that has as the outcome variable the probability of being employed for men and women separately, and as covariates: age, age squared, marital status and education. The dots represent point estimates and vertical bars represent 95% confidence intervals. The year 2012 was chosen as the reference year.

Figure D.4: The effect of smoking bans on employment status



Notes: The figure plots coefficients associated with years obtained from a regression that has as the outcome variable the probability of being employed for men and women separately, and as covariates: age, age squared, marital status and education. The dots represent point estimates and vertical bars represent 95% confidence intervals. The year 2012 was chosen as the reference year.

Figure D.5: The effect of smoking bans on placebo outcomes