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One last puff? Public smoking bans and smoking behavior

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ABSTRACT

This paper investigates the short-term effects of public smoking bans on individual smoking behavior. In 2007 and 2008, state-level smoking bans were gradually introduced in all of Germany's federal states. We exploit this variation to identify the effect that smoke-free policies had on individuals' smoking propensity and smoking intensity. Using rich longitudinal data from the German Socio-Economic Panel Study, our difference-in-differences estimates show that the introduction of smoke-free legislation in Germany did not change average smoking behavior within the population. However, our estimates point to important heterogeneous effects. Individuals who go out more often to bars and restaurants did adjust their smoking behavior. Following the ban, they became less likely to smoke and also smoked less.

1. Introduction

Smoking has serious short- and long-term health impacts. Both active and passive smoking have indeed been identified as leading causes of preventable death (World Health Organization, 2009). In recent years, a growing awareness of the deadly effects of smoking has led to the enactment of tobacco control policies throughout the industrialized world. Public smoking bans have been implemented in many countries as a means of reducing the exposure of non-smokers to second-hand smoke. Yet such bans also impact the behavior of smokers—for example, by affecting smoking cessation or smoking intensity in smokers, smoking initiation in younger age cohorts, and the overall prevalence of smoking within the population. To date, however, surprisingly little research has been done on behavioral changes in smokers following the introduction of smoking bans.

This paper investigates the short-term effects of public smoking bans on individual smoking behavior in Germany, a country with relatively high smoking rates among industrialized countries (Tobacco Atlas, 2009). In 2007 and 2008, state-level smoking bans were gradually introduced in Germany. In this study, we exploit the fact that smoking bans were introduced on different dates in different states to identify the effects that smoking bans had on individuals' smoking propensity and intensity. The individual-level data employed in this study are taken from the German Socio-Economic Panel Study (SOEP), an annual household panel of roughly 20,000 individuals in around 11,000 households.

Our results show that the introduction of smoke-free policies in Germany did not change the population's average smoking behavior in the short term: following the introduction of smoking bans, individuals were neither less likely to smoke on average, nor did they smoke fewer cigarettes. However, individuals who reported going to bars and restaurants regularly—and hence were more exposed to the constraints of public smoking bans in everyday life—*did* adjust their smoking habits. People who go out more often to bars and restaurants (i.e., individuals with a propensity to go out above the median) exhibited a two percentage point lower propensity to smoke following the introduction of a smoking ban. Their likelihood to smoke regularly (ten or more cigarettes per day) also fell, as did their average daily cigarette consumption. The effects were even more pronounced for individuals in the top quartile of

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those regularly going to bars and restaurants, leading to a four percentage point reduction in these individuals' smoking probability after implementation of the smoking ban. Our findings therefore suggest that smoking bans can be an effective tobacco control policy, at least for certain subgroups of the population. As such, they can provide important health benefits beyond reducing the exposure of non-smokers to second-hand smoke—which is their immediate and prime objective.

This study makes several contributions to the literature. Our study is the first to investigate the effects of smoking bans on smoking behavior in a country with high smoking rates. Research to date has concentrated on the United States, where smoking rates are considerably lower than in European countries, particularly among young adults aged 18–25 (Tobacco Atlas, 2009).[1] Smoke-free laws may have different effects on individual smoking behavior when overall smoking prevalence in a country is high and when potential peer group effects are stronger. Furthermore, smokers in a country with low smoking prevalence, like the US, are likely to differ in a number of characteristics from smokers in European countries, where smoking is more widespread, (still) more socially acceptable, and less of a lower-class phenomenon.[2] Second, our data contain a wealth of information on respondents' socio-economic characteristics and behavior, including the frequency of going out to bars and restaurants. This information enables us to examine whether the effects of smoking bans vary across individuals who are affected to different degrees by the law depending on how frequently they go out. Individuals who regularly go to bars and restaurants are most affected by public smoking bans. All else being equal, smoking bans should therefore exert the greatest effect on these individuals. Third, to identify the causal effects of public smoking bans, we are able to exploit variation in the exposure to smoking bans over time, across states, and also within states. Smoking bans have gradually been introduced in all German federal states within a relatively short period of time. Our data enables us to separate time and reform effects even within federal states, as the interview months of survey respondents in the SOEP vary within states. Exploiting this variation reduces the risk that potential unobserved effects coinciding with the introduction of public smoking bans and influencing individuals' smoking behavior might bias our estimates.

The remainder of the article is structured as follows. Section 2 discusses the timing and coverage of smoking bans in bars and restaurants in Germany. Section 3 reviews the relevant literature, and Section 4 describes the data. Section 5 presents our estimation methods and results. Several robustness checks are discussed in Section 6. Finally, Section 7 summarizes our main findings and concludes.

2. Institutional background

The implementation of smoking bans in Germany is the responsibility of the individual states. On March 22, 2007, state health ministers convened and agreed to introduce public smoking bans in the hospitality industry (bars, restaurants, and dance clubs) (Blum, 2007). As a result, smoke-free policies were implemented in all of Germany's sixteen federal states. The state smoking bans went into effect on different dates, however, and varied to some extent in their scope. Table 1 presents an overview of when each of the sixteen federal states put its ban into effect. Baden-Wuerttemberg was the first to implement a state smoking ban (in August 2007). It was followed in October 2007 by Hesse, in November 2007 by Lower Saxony, and in January 2008 by Bavaria, Hamburg, and Schleswig-Holstein. In February 2008, Rhineland-Palatinate and Saxony imposed state smoking bans, followed by six further states in July 2008: Berlin, Brandenburg, Bremen, North-Rhine Westphalia, Saxony-Anhalt, and Thuringia. Mecklenburg-Western Pomerania was the last to ban smoking (in August 2008). All of the states, except Bavaria, continued to allow smoking in separate "smoking rooms" in bars and restaurants if this was possible, and some states allowed for additional exemptions.[3] Due to the exceptions granted, state smoking bans in Germany can be described as less comprehensive than those introduced in other countries such as the United States, England, Ireland, and Scotland. Nevertheless, initial empirical evidence suggests that cigarette sales at vending machines in bars and restaurants declined, on average, by 15 percent following the introduction of state smoking bans in Germany (Kvasnicka, 2010).

Table 1
Dates of enforcement of state smoking bans in Germany.

Federal state	Enforcement of state smoking bans
Baden-Wurttemberg	August 2007
Bavaria	January 2008
Berlin	July 2008
Brandenburg	July 2008
Bremen	July 2008
Hamburg	January 2008
Hesse	October 2007
Lower Saxony	November 2007
Mecklenburg-West Pomerania	August 2008
North Rhine-Westphalia	July 2008
Rhineland-Palatinate	February 2008
Saarland	June 2008
Saxony	February 2008
Saxony-Anhalt	July 2008
Schleswig-Holstein	January 2008
Thuringia	July 2008

Note: Information on individual states was compiled from original law texts and from a survey of state-level smoking ban legislation by the German Hotels and Restaurants Federation (DEHOGA, 2008). All smoking bans were enforced at the start of the month with the exception of Rhineland-Palatinate, which introduced the smoking ban on February 15, 2008.

Opposition to smoking bans in Germany was fierce from the start. Bar owners even filed a constitutional complaint against the bans in two states (Berlin and Baden-Wuerttemberg). Furthermore, in July 2008, the German Federal Constitutional Court ruled parts of the smoking ban legislation unconstitutional on the grounds that it discriminates against small pubs that cannot create separate rooms for smokers. Federal states had up to December 31, 2009, to modify their smoking bans. Up until this date, bars smaller than 75 square meters were allowed to declare themselves as "smoking pubs" if young people aged 18 or less were denied entry and if food was not served. As it turned out, the majority of states followed the Constitutional Court's ruling by simply adding this exemption clause to their state smoking ban legislation.

The timing of state smoking bans may be related to specific state characteristics. In the analysis, we will control for state fixed effects. It is therefore not necessary that the timing of state bans be unrelated to state characteristics (see Black et al., 2005). Nevertheless, it

[1] Smoking prevalence in continental European countries such as Germany, France, Belgium and the Netherlands ranges from 30 to 39 percent, compared to only 23.6 percent in the US (Tobacco Atlas, 2009). With about 35 percent of adults smoking, the smoking prevalence in Germany exceeds that of the US by nearly 50 percent.

[2] For example, more than 50 percent of all health professionals in Germany smoked in 2004. In the US, the respective share was less than 10 percent (Tobacco Atlas, 2009).

[3] For example, twelve states permitted smoking in specially designated smoking rooms in dance clubs, two permitted smoking rooms in dance clubs with a minimum age of 18, and several state laws allowed for the establishment of smoking clubs (Hamburg, Bavaria, Hesse, and North-Rhine Westphalia).

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is of interest to see whether the timing of the implementation of the smoking bans followed some pattern. For this purpose, we ran OLS and ordered probit regressions of the timing of state smoking bans (month in which the ban was put into effect) on various pre-ban characteristics of the states (see Table A1 in Appendix A). There appears to be no systematic relationship of the timing of implementation with the percentage of smokers in a state's population, whether the state government is conservative, the average age of state residents, the proportion of singles and university graduates in the state's population, or the state's GDP per capita. There is some (albeit tentative) evidence that state elections scheduled for early 2008 caused states to adopt a smoking ban earlier.

3. Previous literature

A large and growing body of literature has examined the effects of different tobacco control policies on smoking and health-related outcomes. Previous studies investigated, among other topics, the effects of price changes or increases in excise taxes on cigarette consumption (see, for example, Wasserman et al., 1991; Becker et al., 1994), the impact of legal restrictions on youth access to tobacco products (Chaloupka and Grossman, 1996; Gruber and Zinman, 2000), the dissemination of information on the adverse health effects of smoking (Chaloupka and Warner, 2000), and the effects of public smoking bans on the exposure of non-smokers to second-hand smoke (Adda and Cornaglia, 2010; Carpenter, 2009).

More closely related to our paper are studies that have explored the effects of workplace smoking bans. One of the first of these was the study by Evans et al. (1999), who find that workplace bans in the United States significantly reduced smoking prevalence and daily tobacco consumption among employed smokers. A comprehensive review by Fichtenberg and Glantz (2002) also concludes that workplace smoking restrictions were effective in reducing cigarette consumption and smoking prevalence.

The studies that come closest to ours are those on the effects of public smoking bans on individual smoking behavior. Work in this area, however, has produced ambiguous findings and has focused mainly on the US. Early research from the beginning of the 1990s on the impact of indoor air legislation on smoking behavior produced inconclusive results (e.g., Keeler et al., 1993; Sung et al., 1994; Wasserman et al., 1991; Chaloupka and Grossman, 1996; Chaloupka, 1992; Chaloupka and Saffer, 1992). The same applies to more recent studies (Yurekli and Zhang, 2000; Tauras, 2006; Adda and Cornaglia, 2010). These employed a quasi-experimental framework that is similar to ours. They use regional variation in the timing of smoking ban implementation to identify the effect of public smoking bans on smoking prevalence and smoking intensity. Tauras (2006) finds that smoke-free air laws reduced the average smoking intensity of adult smokers but did not strongly affect overall smoking prevalence. Yurekli and Zhang (2000), using state panel data, find a significant negative effect of public smoking bans on states' per capita cigarette consumption. Adda and Cornaglia (2010), in contrast, do not find any evidence that smoking bans in the US had a direct causal impact either on smoking prevalence or on smoking cessation. Using biomarkers (cotinine concentration), they even show that smoking bans had adverse effects on non-smokers, especially on young children, by displacing smokers from public to private places.

Note, however, that none of these latter three papers investigated heterogeneous effects of the impact of smoking bans on smoking behavior, distinguishing between subgroups of the population that are affected differently by the law. A unique aspect of our study is that we use detailed information on individual propensities to go to bars and restaurants to study the existence and magnitude of such potential heterogeneous effects. Depending on how often people go out, they are differentially exposed in everyday life to the restrictions imposed by smoking bans. As a consequence, individuals may well react differently, in terms of both their likelihood to change smoking habits and the degree of any changes they undertake.

4. Data

We use data from the German Socio-Economic Panel (SOEP), an annual ongoing household panel of roughly 20,000 individuals in around 11,000 households (Wagner et al., 2007). Adult household members are regularly interviewed on socio-economic and demographic characteristics including education, income, employment, and health. In the years 2002, 2004, 2006, and 2008, respondents were also asked whether they currently smoked, and if so, how many cigarettes they smoked on average per day. Exploiting this information, we consider three outcome measures in the empirical analysis: (i) whether an individual currently smokes (*smoking*), (ii) whether an individual is a regular smoker who smokes on average ten or more cigarettes per day (*smoking* 10+), and (iii) the average daily cigarette consumption of an individual (*number of cigarettes*).[4]

The SOEP also provides information on the months in which survey respondents were interviewed. The majority of survey respondents are interviewed in February and March. However, interview months do vary to some extent, ranging from January to November. This introduces variation in smoking ban coverage in 2008 even within states, which we can exploit for identification of the causal effects of state smoking bans on smoking behavior (see Section 5 for a more thorough discussion of this point).

Table 2 provides descriptive statistics for all outcome and explanatory variables, both for the entire sample and separately by state smoking ban coverage. In the entire sample (survey years 2002, 2004, 2006, and 2008), 28 percent of individuals smoke and 22 percent smoke regularly (10 or more cigarettes per day). The average daily number of cigarettes consumed is 4.5. Average smoking propensities and average smoking intensities are similar among individuals who are not covered by a smoking ban when surveyed in 2008 (column 2), and somewhat smaller among individuals who are covered (column 3). The average age of individuals in the entire sample (survey years 2002, 2004, 2006, and 2008) is 47 years,[5] 47 percent of survey respondents are male, 61 percent are married, and 30 percent live in a city with at least 100,000 inhabitants. Eighty percent have at least a high school education, 20 percent coreside with minors (children aged fourteen or less), and 38 percent work full time. Individuals in the two sub-samples are very similar in terms of most socio-economic characteristics. Somewhat larger mean differences between the two groups are observable in their share of foreigners and their average monthly household incomes, while the largest differences exist between their respective probabilities to reside in a city.

5. Empirical strategy and results

To estimate the effects of the state-level public smoking bans in Germany on the smoking behavior of individuals, we start by

[4] In our analysis, we consider only cigarette consumption, as two of the three outcome measures are quantity based and no objective scale exists by which units of one type of tobacco could be sensibly converted into units of another. In any case, cigar/pipe smoking is very rare in our data (only about 1% of individuals consume such tobacco products).

[5] The youngest person in the sample is aged 16 years, and the oldest person 98 years. In unreported regressions, we restricted our sample to individuals aged 65 (70) years and younger. These sample restrictions do not considerable change any of our estimates. The SOEP first interviews individuals in the year they turn 17. The SOEP data does not, therefore, allow us to study the smoking behavior of individuals aged 15 or younger.

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Table 2
Descriptive statistics.

Variable	Full sample[a]	Sample 2008	
		Smoking ban not enforced	Smoking ban enforced
	(1)	(2)	(3)
Outcome variables			
Smoking	0.28	0.28	0.25
Smoking 10+	0.22	0.22	0.19
Number of cigarettes	4.46 (8.60)	4.17 (8.02)	3.73 (7.84)
Explanatory variables			
Male	0.47	0.47	0.47
Age	47.10 (17.26)	48.82 (17.75)	48.15 (17.63)
Foreign nationality	0.07	0.04	0.07
Marital status			
Married	0.61	0.58	0.61
Separated or divorced	0.09	0.10	0.09
Never married	0.23	0.25	0.24
Widowed	0.07	0.07	0.07
Education			
Less than high school	0.20	0.17	0.20
High school	0.59	0.60	0.59
More than high school	0.21	0.22	0.21
Monthly equivalent household income (euros)	1850.61 (2507.16)	1803.90 (1418.11)	1996.33 (2684.87)
Children aged ≤ 14 in household	0.25	0.21	0.24
Household size			
1-person household	0.14	0.16	0.15
2-person household	0.38	0.41	0.39
3-person household	0.20	0.21	0.19
4 and more-person household	0.27	0.22	0.26
Employment status			
Full-time employed	0.38	0.35	0.37
Part-time employed	0.22	0.21	0.23
Unemployed	0.05	0.06	0.03
Out of the labor force	0.35	0.39	0.38
Living in a city (≥100,000 inhabitants)	0.30	0.40	0.24
Person-year observations	85,695	7,279	12,052

Notes: SOEP waves 2002, 2004, 2006 and 2008. Table shows means, with standard deviations for continuous variables in parentheses.
[a] Full sample includes all individuals surveyed in 2002, 2004, 2006, and 2008.

running the following reduced-form baseline linear regressions[6]:

$$SMOKE_{ist} = \beta\, BAN_{ist} + X_{ist}\gamma + \varepsilon_{ist}, \quad (1)$$

where $SMOKE_{ist}$ represents one of the three smoking outcomes described above for individual i living in federal state s at survey time t. The variable BAN_{ist}, our prime variable of interest, is a dichotomous variable which equals one if a smoking ban is in force in individual i's state s at survey time t, and zero otherwise. In survey years 2002, 2004, and 2006, that is, prior to the introduction of state smoking bans, BAN_{ist} takes the value zero for all individuals. In the survey year 2008, BAN_{ist} takes the value one for all individuals who live in a state that had already enforced a smoking ban prior to the date of interview at time t, and zero otherwise.

For the outcome *smoking* (*smoking* 10+), the key coefficient β measures the average change in the probability of smoking (ten or more cigarettes) due to the introduction of a smoking ban. For the outcome *number of cigarettes*, in turn, β captures the average change in the number of cigarettes smoked per day due to a smoking ban.[7] The vector X_{ist} contains controls for various socio-economic characteristics of individuals that have been found to be correlated with cigarette consumption (e.g., Wasserman et al., 1991; Tauras, 2006; Hahn et al., 2008). These include individuals' age and age squared, indicators for individuals' gender, foreign nationality, marital status, education, and employment status; indicators for household income quartiles and household size; and an indicator for the presence of minors (aged 14 or less) in the household. In addition, X_{ist} contains a maximum set of state dummies, time (month-year) dummies, linear and quadratic state-specific time trends, and dummies for the different SOEP sub-samples.[8] We include state fixed effects to control for time-invariant differences in smoking prevalence and smoking patterns between states. Year-month fixed effects account for potential common time trends across states and state-specific time trends for potential different time trends between states in smoking behavior. Standard errors are clustered at the state level throughout and calculated by a Wild cluster bootstrap with 400 bootstrap replications to account for the small number of clusters (see Cameron et al., 2008).

The key identifying assumption of Eq. (1) is that, in the absence of a smoking ban, the estimated coefficient β will be zero, i.e., there are no significant differences in smoking behavior between the treated ($BAN_{ist} = 1$) and the non-treated ($BAN_{ist} = 0$). The difference-in-differences approach we use, therefore, assumes that there are no other policy changes or regional shocks that coincide with the introduction of a smoking ban and affect individuals' smoking out-

[6] We estimate and report results of linear probability models for the ease of interpretation. Our findings are robust to the use of alternative estimation methods (probit regressions for the two dichotomous outcome measures and a tobit regression for the cigarette demand equation).
[7] We use, as an outcome measure, the average number of cigarettes consumed per day by individuals in a given survey year (unconditional demand) rather than the average number of cigarettes among smokers (conditional demand), since conditional effects do not have a causal interpretation (Angrist and Pischke, 2009).
[8] To date, the SOEP consists of eight different sub-samples (e.g., West German sample, guest worker sample, East German sample, etc.). These sub-samples vary partially in the date they were drawn and also in their sampling schemes (see, for example, Kroh (2009) and references therein for detailed information on these sub-samples).

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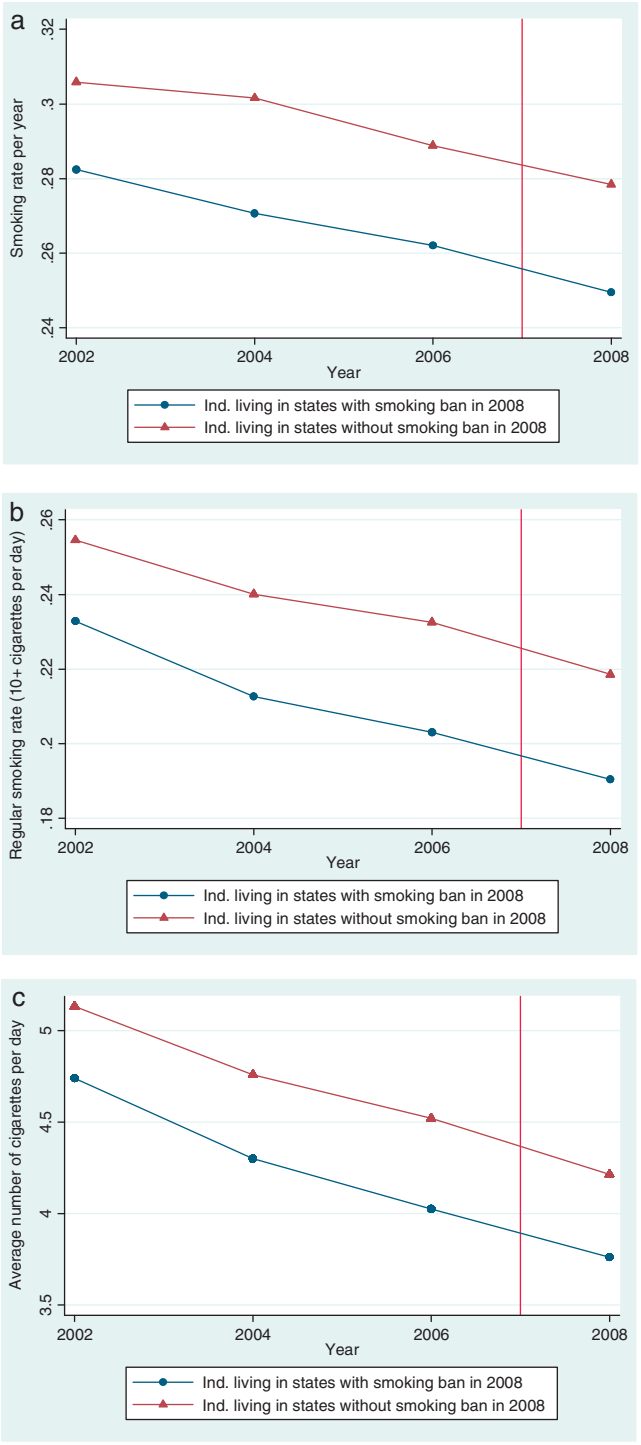
comes. Identification, therefore, requires that relative trends in the outcome variables would have had to be the same across federal states, had a smoking ban not been introduced.[9] Although SOEP respondents are regularly surveyed in spring, survey times vary somewhat, a spread that provides us with variation in smoking ban coverage in 2008 also across individuals who live in one and the same state.[10]

To investigate whether the interview month is systematically related to individual smoking behavior, we ran ordered probit regressions of individuals' survey month on individuals' socio-economic characteristics, their smoking status (overall and regular smoker status), and their smoking intensity (average daily consumption levels), both for the entire sample (all years) and for the 2008 survey wave. In none of the specifications that we estimated does individual survey month significantly correlate with individual smoking status or smoking intensity (see Table A2 in Appendix A). This suggests that the date of interview is random with respect to the three smoking outcomes.

A first and commonly used, albeit descriptive, test of the validity of this identifying assumption is to compare pre-treatment trends in the smoking behavior of individuals who live in a federal state where a smoking ban is in force at the time of their interview in 2008 (treatment group) with those individuals who live in federal states with no smoking ban in force at the time of their interview in 2008 (control group). Fig. 1 provides strong visual evidence that the assumption of a common time trend for the treatment and control group holds for all three outcome measures. The data reveal similar and parallel downward trends in the pre-ban smoking behavior of individuals who live in states where a smoking ban is in force at the time of their interview in 2008 and individuals who do not. There are no marked differences between the groups in their respective changes in overall smoking behavior between 2006 and 2008, the last pre-ban and first post-ban sampling points in the SOEP. If anything, the decline over this period appears slightly stronger for individuals who are not yet covered by a smoking ban, a difference that is, however, marginal. Although merely descriptive, this finding suggests that average smoking propensities and the average number of cigarettes consumed within state populations have not been markedly affected by the introduction of state smoking bans. It remains to be seen, of course, whether regression-adjusted analyses support this view.

Table 3 presents the results of our baseline regressions (Eq. (1)). The table shows OLS estimates of the effects that public smoking bans had on our three different smoking outcomes: whether a respondent currently smokes (*smoking*), whether he or she is a regular smoker and smokes on average ten or more cigarettes per day (*smoking* 10+), and the average daily consumption of cigarettes (*number of cigarettes*). In all three regressions, we control for the aforementioned individuals' socio-economic characteristics, a full set of state and year-month fixed effects, state-specific time trends, and a constant. The linear probability estimates in Table 3 show negative, yet small and statistically insignificant effects of state smoking bans on our three outcomes measures. State smoking bans in Germany, therefore, do not appear to have altered average smoking behavior within the population at large.

The lack of an average effect in the population, however, does not imply that state smoking bans in Germany were entirely ineffective in changing individuals' smoking habits. Smoking bans may have produced heterogeneous effects across different subgroups of the population. Individuals who go out to bars and restaurants more frequently are more exposed to smoking bans. All else being equal, we would expect such individuals to be more responsive in their smoking habits than individuals who rarely go out to bars



Notes: The first state smoking ban in Germany was introduced in 2007, indicated by the vertical line.

Fig. 1. (a) Pre- and post-ban smoking rates, by exposure to a smoking ban at the time of the interview in 2008. (b) Pre- and post-ban proportion of regular smokers, by exposure to a smoking ban at the time of the interview in 2008. (c) Pre- and post-ban cigarette consumption, by exposure to a smoking ban at the time of the interview in 2008.

[9] In Section 6, we discuss several robustness checks that we conducted to see whether this assumption seems to be plausible in the context of this study.

[10] In 2008, we observe individuals in five states both before and after the introduction of a public smoking ban. These states are Berlin, Brandenburg, North Rhine-Westphalia, Saxony-Anhalt, and Thuringia.

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Table 3
The effects of public smoking bans on smoking behavior.

Outcome variables	Smoking	Smoking 10+	Number of cigarettes
Age	0.008**	0.011**	0.282**
	(0.001)	(0.001)	(0.011)
Male	0.074**	0.089**	2.145**
	(0.003)	(0.003)	(0.060)
Smoking ban	−0.004	−0.005	−0.035
	(0.008)	(0.007)	(0.143)
Observations	85,695	85,695	85,695

Notes: SOEP waves 2002, 2004, 2006 and 2008. OLS regressions. Standard errors, clustered at the state level, in parentheses. Standard errors are Wild cluster bootstrap standard errors with 400 bootstrap replications to account for a small number of clusters (Cameron et al., 2008). Regressions also control for age-squared, marital status (4 groups), education (3 groups), household income quartiles, household size (4 groups), whether young children aged ≤ 14 are present in the household, employment status (4 groups), foreign nationality, living in a city (≥100,000 inhabitants), a maximum set of state dummies, time (month-year) dummies, linear and quadratic state-specific time trends, dummies for the different SOEP samples, and a constant.
** Significant at 1% level.

and restaurants. The above specification (Eq. (1)) ignores that not all members of a state are equally at risk of changing their smoking habits following the introduction of public smoking bans.

Table 4 shows that average rates of going out to bars and restaurants vary markedly across gender, age groups, type of residence (urban and rural areas), and marital status.[11] Weekly visits to bars, restaurants, and cafés are much more common among men, younger age cohorts, city dwellers, and unmarried individuals. To date, however, little is known about how the smoking behavior of these groups is affected by public smoking bans. Smokers, of course, may react in many different ways to public smoking bans. They may go out *less often* than before (yet smoke virtually the same amount as before), go out *as often as* before (but reduce smoking when going out), or opt for a combination of the two. In Germany, the rates at which the aforementioned groups go out appear to have changed little from the pre-ban to the post-ban period (see columns 4–6 in Table 4). Since these groups did not change their frequency of visits to bars and restaurants, they may well have changed their smoking habits instead. However, it may also be that whatever changes did occur are disguised by composition effects, i.e., smokers and non-smokers within these groups changed their behavior (rate of going to bars and restaurants) in opposite directions, leading to a zero net effect. The bottom part of Table 4 shows that smokers have a higher propensity to go out frequently than non-smokers (at least once a week) both before and after the introduction of the smoking ban. This difference narrows somewhat in the post-ban period relative to the pre-ban period. Some smokers might therefore also have responded to state smoking bans with their feet. This observation is in line with the findings of Adda and Cornaglia (2010), who show that smokers in the US have cut down significantly on their time spent in bars following the introduction of smoking bans.

To investigate whether the effects of smoking bans vary with people's exposure to these bans, we follow a methodological approach that was applied to the study of tobacco-control policies and their effects by Gruber and Mullainathan (2005).[12] Specifically, we first estimate a regression that relates pre-ban behavior (the rate of going to bars and restaurants) to observable pre-ban explanatory variables (the set of *X*'s included in regression Eq. (1)). We use going out frequently (at least once a week) as a binary outcome variable, and estimate such an equation for each year that has information on the pre-ban behavior of individuals.[13] The results of the first-stage regressions for the years 2003 and 2008 are reported in Table A3 in Appendix A. Consistent with the descriptive findings in Table 4, we find men, younger age cohorts, city dwellers, and unmarried individuals to go out more frequently. A higher propensity to go out is also observable for more educated individuals, richer households, individuals employed full-time, and individuals that do not co-reside with minors aged 14 or less.

The predicted probability of going out frequently (PGO_{ist}) is then used in the second stage as an additional explanatory variable. There, we regress individual smoking outcomes on the same set of covariates X_{ist} as in the first stage, plus the predicted probability of going out (main effect) and its interaction with the smoking ban indicator:

$$SMOKE_{ist} = \beta_1 PGO_{ist} + \beta_2 BAN_{ist} + \beta_3 BAN_{ist} * PGO_{ist} + X_{ist}\zeta + \nu_{ist}. \quad (2)$$

The key coefficient of interest in this second stage is that on the interaction term $BAN_{ist} * PGO_{ist}$. The coefficient β_3 captures to what extent, if any, the effects of smoking bans vary with individuals' exposure to a smoking ban.

Table 5 shows our main findings from this approach.[14] None of our three outcome measures is correlated with either the smoking ban indicator or the predicted outgoing propensity of individuals. Their interaction term, however, is both negative and highly statistically significant in each regression. In other words, smoking bans did reduce both the smoking propensity and the smoking intensity of individuals with a higher propensity to go out regularly. To interpret the magnitude of these coefficients we compare the effect for those individuals who actually go out at least once a week and those who go out less often. The mean of predicted outgoing probability is 0.25 in the group of individuals who go out regularly, and 0.15 in the comparison group. The introduction of a smoking ban reduces the smoking rate of those individuals who go out regularly by 1.1 percentage points, relative to those who are less likely to go out.

Next, we investigate whether the relationship between the propensity of going out regularly and smoking behavior is non-linear. Table 6 reports the results of an alternative specification that allows the effects of smoking bans to vary between individuals that have an above median predicted propensity to go out regularly and individuals that do not. The estimated coefficients of the interaction term between smoking ban and a dummy for a high propensity to go out are negative and statistically significant for each of our three outcome measures. Among individuals with an above-median weekly outgoing propensity, the likelihood to smoke and the propensity to smoke regularly (ten or more cigarettes per day) each declined by about 2 percentage points following the introduction of a smoking ban and their average daily cigarette demand fell by 0.42 cigarettes. In contrast, individuals with a below median propensity to go out regularly do not seem to have adjusted their smoking habits in response to smoking bans.

To obtain a more detailed picture of the heterogeneous effects of smoking bans, we use a third specification that allows the effects of the new laws to vary across quartiles of the distribution of the estimated individual propensities to go out regularly. The results

[11] In 2003 and 2008 (but not in 2002, 2004, and 2006), the SOEP asked respondents how often they go out to cafés, bars, or restaurants.
[12] Gruber and Mullainathan (2005) study the effects of cigarette tax increases on the happiness of smokers in the US and Canada.
[13] Estimated coefficients from the 2003 (2008) regression are used to form predicted probabilities of going out for individuals in 2002 and 2004 (2006 and 2008). The 2008 regressions are restricted to individuals who were not yet exposed to the smoking ban at the time of their interview (pre-ban probability).
[14] Table 5 reports estimated stage-two coefficients β_1, β_2, and β_3. Complete regression results for Table 5 (and also for Tables 6 and 7) are available from the authors upon request.

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Table 4
The frequency of visits to bars, restaurants, and cafés in 2003 and 2008, by personal characteristics.

	2003			2008		
	Never	Rarely/once a month	At least once a week	Never	Rarely/once a month	At least once a week
Gender						
Male	0.10	0.64	0.27	0.09	0.64	0.26
Female	0.13	0.69	0.17	0.12	0.70	0.18
Age categories						
Aged ≤ 30	0.05	0.57	0.38	0.04	0.57	0.38
Aged 31–40	0.07	0.72	0.21	0.07	0.73	0.19
Aged 41–50	0.09	0.72	0.20	0.09	0.74	0.18
Aged >50	0.17	0.66	0.17	0.16	0.67	0.17
Residence						
Living in a rural area	0.12	0.69	0.19	0.12	0.69	0.19
Living in a city	0.11	0.62	0.27	0.09	0.63	0.27
Marital status						
Married	0.11	0.74	0.15	0.10	0.75	0.15
Not married	0.12	0.57	0.31	0.12	0.59	0.29
Smoking status[a]						
Smoker	0.10	0.63	0.27	0.12	0.63	0.24
Non-smoker	0.12	0.68	0.20	0.10	0.69	0.21
Observations		21,824			19,331	

Notes: SOEP waves 2003 and 2008. Table shows weighted means.
[a] Smoking status in 2003 is approximated by smoking status in 2002, or by smoking status in 2004 if smoking status in 2002 is not available.

Table 5
The effects of public smoking bans on smoking behavior by propensity to go out to bars, restaurants, and cafés.

Outcome variables	Smoking	Smoking 10+	Number of cigarettes
Propensity to go out	−0.072	−0.050	−0.162
	(0.053)	(0.050)	(1.026)
Smoking ban	0.010	0.009	0.241
	(0.009)	(0.008)	(0.170)
Smoking ban * Propensity to go out	−0.111**	−0.100**	−1.828**
	(0.034)	(0.031)	(0.597)
Observations	85,695	85,695	85,695

Notes: SOEP waves 2002, 2004, 2006 and 2008. OLS regressions. Standard errors, clustered at the state level, in parentheses. Standard errors are Wild cluster bootstrap standard errors with 400 bootstrap replications to account for a small number of clusters (Cameron et al., 2008). Regressions also control for gender, age, age-squared, marital status (4 groups), education (3 groups), household income quartiles, household size (4 groups), whether young children aged ≤ 14 are present in the household, employment status (4 groups), foreign nationality, living in a city (≥100,000 inhabitants), a maximum set of state dummies, time (month-year) dummies, linear and quadratic state-specific time trends, dummies for the different SOEP samples, and a constant.
** Significant at 1% level.

Table 6
The effects of public smoking bans on smoking behavior by high propensity to go out to restaurants, bars and cafés.

Outcome variables	Smoking	Smoking 10+	Number of cigarettes
High propensity to go out	0.032**	0.026**	0.628**
	(0.005)	(0.005)	(0.105)
Smoking ban	0.009	0.007	0.213
	(0.009)	(0.008)	(0.142)
Smoking ban * High propensity to go out	−0.022**	−0.021**	−0.423**
	(0.008)	(0.007)	(0.165)
Observations	85,695	85,695	85,695

Notes: SOEP waves 2002, 2004, 2006 and 2008. OLS regressions. Standard errors, clustered at the state level, in parentheses. Standard errors are Wild cluster bootstrap standard errors with 400 bootstrap replications to account for a small number of clusters (Cameron et al., 2008). The variable "High propensity to go out" equals one if the propensity to go out to bars, restaurants, and cafés is higher than the median, and zero otherwise. Regressions also control for gender, age, age-squared, marital status (4 groups), education (3 groups), household income quartiles, household size (4 groups), whether young children aged ≤ 14 are present in the household, employment status (4 groups), foreign nationality, living in a city (≥100,000 inhabitants), a maximum set of state dummies, time (month-year) dummies, linear and quadratic state-specific time trends, dummies for the different SOEP samples, and a constant.
** Significant at 1% level.

reported in Table 7 show that the estimated coefficients of the interaction terms are all negatively signed and increase in absolute magnitude from the second to the fourth quartile in each of the three regressions (for each outcome measure). For the top quartile, estimated coefficients of the interaction terms are statistically significant. The propensity to smoke fell among top quartile individuals by 4 percentage points, their likelihood to be a regular smoker by 3 percentage points, and their average daily cigarette consumption by 0.72 cigarettes. These are sizeable effects, given that among individuals in the top quartile of those going out on a regular basis, the proportion of smokers was 31 percent shortly before the introduction of a ban (in 2006), 23 percent were regular smokers, and the average number of cigarettes was 4.5. The smoking probability and intensity was hence reduced by roughly 15 percent following the ban.[15]

In sum, therefore, our results show that the introduction of state smoking bans in Germany reduced neither the average smoking propensity nor the average smoking intensity within the overall population. However, we do find evidence of such effects for individuals who are more likely to be affected by the new law because they have a higher propensity to go out regularly to bars and restaurants. In particular, for individuals in the top quartile for going out regularly, the smoking ban leads to a substantial decline in both the smoking propensity and intensity.

6. Robustness section

For a causal interpretation of our results, we have to rule out that any other factors than those considered might drive our estimates.

[15] These findings are robust to the use of alternative estimation methods (probit regressions for the two dichotomous outcome measures and a tobit regression for the cigarette demand equation), as shown in Table A4 in Appendix A. The use of a higher polynomial (third order) of age instead of age and age squared, or the inclusion of a maximum set of age dummy variables, affects neither the magnitudes nor the standard errors of the estimated coefficients of our smoking ban indicator. Results are available from the authors upon request.

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Table 7
The effects of public smoking bans on smoking behavior by propensity quartiles to go out to bars, restaurants, and cafés.

Outcome variables	Smoking	Smoking 10+	Number of cigarettes
Propensity to go out:			
2nd quartile	−0.005	0.025**	0.019
	(0.005)	(0.005)	(0.099)
3rd quartile	0.000	0.050**	0.040
	(0.007)	(0.007)	(0.139)
4th quartile	−0.021	0.038**	0.028
	(0.011)	(0.010)	(0.211)
Smoking ban	0.016	0.011	0.312
	(0.009)	(0.008)	(0.175)
Interactions:			
2nd quartile * smoking ban	−0.013	−0.007	−0.141
	(0.010)	(0.009)	(0.192)
3rd quartile * smoking ban	−0.022	−0.020	−0.357
	(0.012)	(0.011)	(0.230)
4th quartile * smoking ban	−0.041**	−0.032**	−0.720**
	(0.013)	(0.012)	(0.226)
Observations	85,695	85,695	85,695

Notes: SOEP waves 2002, 2004, 2006 and 2008. OLS regressions. Standard errors, clustered at the state level, in parentheses. Standard errors are Wild cluster bootstrap standard errors with 400 bootstrap replications to account for a small number of clusters (Cameron et al., 2008). Regressions also control for gender, age, age-squared, marital status (4 groups), education (3 groups), household income quartiles, household size (4 groups), whether young children aged ≤ 14 are present in the household, employment status (4 groups), foreign nationality, living in a city (≥100,000 inhabitants), a maximum set of state dummies, time (month-year) dummies, linear and quadratic state-specific time trends, dummies for the different SOEP samples, and a constant.
** Significant at 1% level.

This section discusses several robustness checks that we carried out. Tabulated results are provided in Appendix A.

6.1. Confounding anti-tobacco policies

The present estimates are identified through a difference-in-differences design. Changes in other state-level anti-tobacco policies that were introduced concurrently with state smoking bans and that may also have affected the smoking habits of state residents could have confounded the relationship between no-smoking laws and smoking behavior.[16] Such policy changes, however, did not occur. Cigarette prices in Germany, unlike in the US, do not vary across states or regions. All taxes on cigarettes, such as sales tax and tobacco tax, are federal taxes and, as such, uniform across states. Furthermore, the tobacco tax was constant between 2006 and 2008 (it was last increased in September 2005), and the sales tax was only increased once, in January 2007, a country-wide level effect that we control for in our regression analysis through the inclusion of time dummies as explanatory variables. There were also no state-specific changes in the regulations circumscribing tobacco advertising during this period. Cigarette ads on radio and television had been banned in Germany since 1975, and ads in newspapers, magazines, and on the Internet—again for the whole of the country—since 2006.[17] Our observation period did see an increase in the minimum legal smoking age (from 16 to 18) in September 2007, and the introduction, in January 2007, of technical devices in cigarette vending machines for the electronic verification of customers' age. All of these changes, however, applied to the entire country and their impact is captured by the time fixed effects.

6.2. Regressions with additional time-varying state-level variables

In Table A5 in Appendix A, we also control for several time-varying potential confounders at the state level that might have changed at the same time that state smoking bans were introduced.[18] In particular, we control for the proportion of university graduates, the proportion of singles, the average population age, GDP per capita (in 2002 prices), and the state governing party. The estimates are barely affected by the inclusion of these variables.

6.3. Public smoking bans and cross-border shopping

Smokers living in federal states with recently introduced smoking bans may be traveling to locations abroad or to federal states that still permit smoking in bars and restaurants to avoid having to make any compromises in their smoking behavior when going out. A recent study by Adams and Cotti (2008) for the US reports that more people have been caught driving while under the influence of alcohol after the passage of smoking bans because smokers drive longer distances to bars in states with no smoking bans. Indeed, on July 31, 2008, the *New York Times* reported on the introduction of smoking bans in Germany: "Local newspapers in eastern border regions published articles at the start of the year about smokers fleeing for their evening drinks to Polish pubs, where smoking was still permitted." In regressions reported in Table A6, we checked for the importance of such behavior for our results by restricting our estimation sample to individuals that live in counties which do not border other German states or neighboring countries that still allowed smoking in bars and restaurants. Our interaction term coefficients remain negatively signed and continue to increase in absolute size from the second to the fourth quartile. However, they are also all larger in magnitude than those reported in Table 7. In counties without "smoky borders," sizeable effects of smoking bans are evident also for individuals in the third (and sometimes even the second) quartile of the distribution of the going out propensities. These findings suggest that the inability to evade a state smoking ban does add to its bite and hence also to the effect that it has on people's smoking habits. They therefore provide some evidence that stricter smoking bans are more effective in reducing smoking prevalence and intensity.

Overall, our sensitivity analysis shows that the estimates are not affected by various potentially confounding influences. If at all, we find some evidence that individuals' cross-border smoking may weaken the effects of the new policies, and that the strictness of smoking bans increases their effectiveness in reducing smoking prevalence and intensity. Hence, our results should be considered as lower bound effects of smoking bans on smoking behavior.

7. Conclusions

In this paper, we have examined the effects of state smoking bans on the smoking propensity and smoking intensity of individuals in Germany. Public smoking bans were gradually implemented in all of Germany's sixteen federal states between August 2007

[16] Note, however, that all of our models already control for state-specific linear time trends and squared time trends (e.g., Wolfers, 2006).
[17] Another federal government initiative that came into effect on September 1, 2007, was a smoking ban in public transport facilities and federal buildings. Again, this ban applied throughout Germany. Its effects should, therefore, also be captured by our time dummy variables.
[18] For the sake of brevity, we only report results for our most flexible specification.

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and August 2008. We exploit this variation across time and federal states to identify causal effects of the public smoking bans. Using data from the German Socio-Economic Panel Study (SOEP) for the years 2002, 2004, 2006, and 2008, we find no significant reduction in either the average smoking propensity or the average smoking intensity within the population in the short term. However, we do find evidence of sizeable short-term effects for individuals who tend to go out to bars, restaurants, and cafés more frequently, such as the young, the unmarried, and city dwellers. These effects can be explained by the greater exposure of these individuals, in everyday life, to the constraints of public smoking bans. Among individuals with an above-median propensity to go out, the propensity to smoke and the propensity to smoke regularly (ten or more cigarettes per day) each declined by about 2 percentage points following the introduction of a smoking ban and average daily cigarette demand fell by 0.42 cigarettes. The effects of the new law are about twice as large for individuals in the top quartile for the propensity to go out. These are considerable effects, leading to a roughly 15 percent reduction in smoking probability and intensity among top-quartile individuals.

We also find evidence that the impact of public smoking bans on individual smoking habits is stronger if these bans are stricter. Smoking bans have greater effects on individuals who live in counties that do not border other German states or neighboring countries without smoking bans. Hence, for smoking bans to be fully effective, it seems to be crucial that individuals have no way of evading the new law. Our results should be considered as lower-bound effects of smoking bans on smoking behavior, not only due to cross-border effects but also due to the exceptions granted in most of the federal states, which lead to lax enforcement in Germany compared to other countries.

A limitation of our analysis is the restriction to short-term effects, which is due to the recent nature of state smoking bans in Germany. Short-term effects might well differ from longer-term effects, but it is not clear a priori which effects are larger. On the one hand, the impact of smoking bans may be larger in the long run as individuals may need some time to adjust their smoking behavior. On the other hand, any effects may be smaller if individuals first respond strongly but then, as time proceeds, return (at least to some extent) to old habits. However, an analysis of such longer-term effects will have to wait until more data becomes available.

Overall, our findings show that the recent introduction of state smoking bans in Germany has been successful in reducing the smoking propensity and intensity of significant parts of the population over the short run. This suggests that public smoking bans have the potential to achieve major health benefits even beyond reducing the exposure of non-smokers to second-hand smoke.

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Appendix A.

Tables A1–A6

Table A1
Timing of smoking ban implementation and state characteristics.

	Late implementation[a] (OLS)	Month of implementation[b] (Ordered probit)
Proportion of smokers	0.041	1.338
	(0.056)	(0.930)
Conservative	0.030	−3.887
government	(0.276)	(3.022)
Next election early	−0.641[+]	−5.157
2008	(0.296)	(4.127)
Average population age	0.150	1.687
	(0.120)	(1.041)
Proportion of singles	0.003	−0.705
	(0.099)	(0.956)
Proportion of	0.014	0.126
university graduates	(0.068)	(0.410)
GDP per capita	0.020	0.171
	(0.018)	(0.151)
Constant	−7.537	
	(6.071)	
Observations	16	16
Adjusted *R*-squared	0.23	
Pseudo *R*-squared		0.50

Notes. The regressors are pre-ban state characteristics from administrative data sources. Proportion of smokers: Federal Statistical Office 2005; proportion of university graduates/proportion of singles/average population age/GDP per capita: Federal Statistical Office 2006; governing party/election dates: www.election.de. OLS, respectively ordered probit regressions. The indicator variable conservative government equals one if a state's prime minister is from the Christian Democratic Union (CDU), and zero otherwise. Standard errors in parentheses.

[+] Significant at 10% level.

[a] Dummy variable for implementation of the smoking ban in 2008.

[b] Month of implementation ranging from 1 (January 2007) to 24 (December 2008).

Table A2
Month of interview and smoking behavior.

	Month of interview (all years)			Month of interview (2008)		
Smoking	0.008			0.012		
	(0.011)			(0.018)		
Smoking 10+		−0.002			−0.008	
		(0.012)			(0.020)	
Number of cigarettes			−0.001			−0.001
			(0.001)			(0.001)
Observations	85,695	85,695	85,695	19,331	19,331	19,331

Notes: SOEP waves 2002, 2004, 2006 and 2008. Ordered probit regressions. The outcome variable is the month of interview, ranging from 1 (January) to 11 (November). Standard errors, clustered at the individual level, in parentheses.
Regressions also control for gender, age, age-squared, marital status (4 groups), education (3 groups), household income quartiles, household size (4 groups), whether young children aged ≤ 14 are present in the household, employment status (4 groups), foreign nationality, living in a city (≥100,000 inhabitants), a maximum set of state dummies, dummies for the different SOEP samples, and a constant. Regressions for all years (columns 1-3) also control for a maximum set of year dummies.

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Table A3
First stage regressions: the (pre-ban) probability of going out to bars and restaurants at least once a week.

	Going out at least once a week in 2003	Going out at least once a week in 2008[a]
Age	−0.009**	−0.008**
	(0.001)	(0.001)
Age^2	0.006**	0.005*
	(0.001)	(0.002)
Male	0.086**	0.064**
	(0.007)	(0.009)
Married	−0.163**	−0.109**
	(0.022)	(0.019)
Separated or divorced	−0.090**	−0.076**
	(0.015)	(0.022)
Widowed	−0.131**	−0.059
	(0.025)	(0.026)
High school	0.027**	0.044**
	(0.006)	(0.010)
More than high school	0.047**	0.081**
	(0.008)	(0.014)
Equivalent household income: second quartile	0.041**	0.057**
	(0.009)	(0.013)
Equivalent household income: third quartile	0.085**	0.066**
	(0.008)	(0.011)
Equivalent household income: fourth quartile	0.191**	0.163**
	(0.011)	(0.017)
Foreign nationality	0.007	0.020
	(0.024)	(0.029)
Children aged ≤ 14 in household	−0.073**	−0.065**
	(0.021)	(0.016)
2-person household	−0.049**	−0.036
	(0.012)	(0.026)
3-person household	−0.089**	−0.077**
	(0.017)	(0.023)
4-and-more-person household	−0.082**	−0.055*
	(0.015)	(0.025)
Full-time employed	−0.019*	−0.049**
	(0.009)	(0.010)
Part-time employed	−0.000	−0.014
	(0.008)	(0.008)
Unemployed	−0.042*	−0.085**
	(0.015)	(0.010)
Living in a city (≥100,000 inhabitants)	0.041*	0.047**
	(0.019)	(0.006)
Observations	21,824	7279
Adjusted R-squared	0.14	0.12

Notes: SOEP waves 2003 and 2008. OLS regressions. Standard errors, clustered at the state level, in parentheses. Regressions also control for a maximum set of state dummies, dummies for the different SOEP samples, and a constant.
* Significant at 5% level.
** Significant at 1% level.
[a] Subsample includes only individuals that were surveyed in 2008 at a time when they were not covered by a state smoking ban.

Table A4
Alternative estimation methods (probit and tobit regressions).

	Smoking (1)	Smoking 10+ (2)	Number of cigarettes (3)
Smoking ban	0.017	0.013	0.996
	(0.012)	(0.011)	(0.756)
Propensity to go out			
2nd quartile	0.028**	0.021**	1.640**
	(0.006)	(0.005)	(0.451)
3rd quartile	0.053**	0.041**	3.164**
	(0.006)	(0.006)	(0.424)
4th quartile	0.037**	0.027*	2.400*
	(0.010)	(0.013)	(0.948)
Interactions			
2nd quartile*	−0.016*	−0.013	−0.695
smoking ban	(0.007)	(0.008)	(0.547)
3rd quartile*	−0.022	−0.024	−1.505
smoking ban	(0.014)	(0.015)	(1.000)
4th quartile*	−0.041**	−0.034**	−2.483**
smoking ban	(0.008)	(0.007)	(0.555)
Observations	85,695	85,695	85,695

Notes: SOEP waves 2002, 2004, 2006 and 2008. Estimates in columns (1) and (2) are marginal effects from probit regressions, and estimates in column (3) are marginal effects from a tobit regression. Standard errors, clustered at the state level, in parentheses. Regressions also control for gender, age, age-squared, marital status (4 groups), education (3 groups), household income quartiles, household size (4 groups), whether young children aged ≤ 14 are present in the household, employment status (4 groups), foreign nationality, living in a city (≥100,000 inhabitants), a maximum set of state dummies, time (month-year) dummies, linear and quadratic state-specific time trends, dummies for the different SOEP samples, and a constant.
* Significant at 5% level.
** Significant at 1% level.

Table A5
Regressions with additional time-varying state-level variables.

	Smoking	Smoking 10+	Number of cigarettes
Smoking Ban	0.014	0.013	0.430*
	(0.010)	(0.009)	(0.190)
Propensity to go out			
2nd quartile	0.024**	0.020**	0.472**
	(0.005)	(0.005)	(0.102)
3rd quartile	0.047**	0.038**	0.956**
	(0.007)	(0.007)	(0.134)
4th quartile	0.037*	0.028*	0.841**
	(0.011)	(0.011)	(0.213)
Interactions			
2nd quartile * smoking ban	−0.004	−0.004	−0.132
	(0.010)	(0.010)	(0.195)
3rd quartile * smoking ban	−0.016	−0.018*	−0.348*
	(0.011)	(0.010)	(0.215)
4th quartile * smoking ban	−0.037**	−0.033**	−0.686**
	(0.011)	(0.010)	(0.121)
Observations	85,695	85,695	85,695

Notes: SOEP waves 2002, 2004, 2006 and 2008. OLS regressions. Standard errors, clustered at the state level, in parentheses. Standard errors are Wild cluster bootstrap standard errors with 400 bootstrap replications to account for a small number of clusters (Cameron et al., 2008). State level variables include the proportion of university graduates, the proportion of singles, the average population age, GDP per capita in 2002 prices (source: Federal Statistical Office 2002, 2004, 2006, 2008), and type of governing party (source: www.election.de). Regressions also control for gender, age, age-squared, marital status (4 groups), education (3 groups), household income quartiles, household size (4 groups), whether young children aged ≤ 14 are present in the household, employment status (4 groups), foreign nationality, living in a city (≥100,000 inhabitants), a maximum set of state dummies, time (month-year) dummies, linear and quadratic state-specific time trends, dummies for the different SOEP samples, and a constant.
* Significant at 5% level.
** Significant at 1% level.

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Table A6
Public smoking bans and cross-border shopping.

	Smoking	Smoking 10+	Number of cigarettes
Smoking ban	0.021	0.010	0.393
	(0.011)	(0.010)	(0.192)
Propensity to go out			
2nd quartile	0.003	−0.002	0.011
	(0.005)	(0.005)	(0.098)
3rd quartile	0.008	−0.001	0.112
	(0.007)	(0.007)	(0.139)
4th quartile	−0.018	−0.028*	−0.409
	(0.011)	(0.011)	(0.226)
Interactions			
2nd quartile * smoking ban	−0.030*	−0.016	−0.468*
	(0.011)	(0.011)	(0.209)
3rd quartile * smoking ban	−0.041*	−0.032*	−0.686**
	(0.013)	(0.012)	(0.238)
4th quartile * smoking ban	−0.051**	−0.038**	−1.030**
	(0.013)	(0.012)	(0.223)
Observations	82,985	82,985	82,985

Notes: SOEP waves 2002, 2004, 2006 and 2008. Sample without individuals who live in counties which border other German states or neighboring countries that do not have smoking bans in force. OLS regressions. Standard errors, clustered at the state level, in parentheses. Standard errors are Wild cluster bootstrap standard errors with 400 bootstrap replications to account for a small number of clusters (Cameron et al., 2008). Regressions also control for gender, age, age-squared, marital status (4 groups), education (3 groups), household income quartiles, household size (4 groups), whether young children aged ≤ 14 are present in the household, employment status (4 groups), foreign nationality, living in a city (≥100,000 inhabitants), a maximum set of state dummies, time (month-year) dummies, linear and quadratic state-specific time trends, dummies for the different SOEP samples, and a constant.

* Significant at 5% level.

** Significant at 1% level.

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