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Smoking Bans, Leisure Time, and Subjective Well-being

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Abstract: During 2007 and 2008 smoking bans were gradually implemented in all of Germany's sixteen federal states to prohibit smoking in bars, restaurants, and dance clubs. Aimed at reducing smoking and improving health, tobacco control policies are often controversially discussed as they entail potential side effects. We exploit regional variation to identify effects of smoking bans on life satisfaction and leisure time satisfaction. Difference-in-differences estimates reveal that predicted smokers who used to visit bars regularly are less satisfied with life and leisure time, following the enforcement of a smoking ban. We show that changes in use of leisure time likely explain these findings. On the contrary, predicted non-smokers who did not visit bars and restaurants frequently benefit from the smoking bans, as their satisfaction with leisure time increases. They show an increase in hours spent on free-time activities and are more likely to go out with smoking bans in effect.

JEL: D62, I18, I31, J22.

Keywords: Smoking bans, subjective well-being, leisure time, treatment effects.

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1. Introduction

How do public smoking bans affect individual well-being? The answer to this question is important, as smoking bans constrain individuals' behavior and interfere with personal choice. Nevertheless, many European countries have implemented smoking bans in public places and the European Union is calling for the adoption of complementary tobacco control policies to increase the number of smoke-free environments (European Commission 2013). Policymakers motivate the introduction of anti-smoking policies by protecting citizens from the exposure to second-hand smoke, as not only active smoking but also passive smoking can increase the risk of cardiovascular diseases, asthma, and cancer. Numbers provided by the World Health Organization (2009) confirm the need for smoke-free environments. According to the organization 8.7 percent of the world's deaths can be attributed to the risk factor tobacco use. However, to what extent tobacco control policies actually have a positive impact on smoking behavior and health is controversial, as previous research provides ambiguous findings. In particular, empirical evidence on the influence of smoke-free laws on health and well-being is mixed (e.g., Adda and Cornaglia 2006, 2010, Gruber and Mullainathan 2005, Kuehnle and Wunder 2017, Odermatt and Stutzer 2015, Origo and Lucifora 2013).

To analyze the relationship between smoking bans and subjective well-being is the purpose of this paper. We thereby go beyond existing research by extensively examining individuals' leisure time. This seems to be a promising approach, as smoking bans in public places such as bars and restaurants particularly affect individuals in their leisure time. Thus, the strength of the impact of smoking bans may depend crucially on how often someone actually visits bars and restaurants. To investigate the link between smoking bans, leisure

time, and subjective well-being, we use the implementation of smoking bans in Germany.

In Germany, smoke-free laws regulating the exposure to second-hand smoke in the hospitality sector did not exist until 2007. Following a nonbinding agreement between the federal ministry of health and the German hospitality union which did not have the desired effect, the state health ministers agreed in February 2007 to implement smoking bans in all of Germany's sixteen federal states. Although the smoke-free laws differ to some extent in their strictness across states, they broadly prohibit smoking in bars, restaurants, and dance clubs, unless the owners can provide a separate room for non-smokers. In August 2008 smoking bans were in force in all sixteen federal states. Following previous studies (Anger et al. 2011, Kuehnle and Wunder 2017), we exploit the fact that the smoking bans were enforced on different dates across states. More precisely, we use the regional variation in the implementation of the bans as a quasi-random experiment to estimate difference-in-differences models.

Our results show that being exposed to a smoking ban strongly influences well-being. Individuals who used to be regular guests in bars and restaurants are less satisfied with life and leisure time, following the ban. The estimates are particularly strong in magnitude for predicted smokers. This is supportive of the notion that smoking bans in the hospitality sector interfere with individuals' leisure pursuits. Moreover, our results suggest that restricting individuals' habits decreases well-being. We further show that changes in use of leisure time likely explain these findings by providing evidence that smoking bans displace smokers from public buildings to private places. Exploiting time use data reveals that likely smokers spend less time with friends and are less likely to go to night clubs and dancing, when covered by a smoking ban. On the contrary, they spend more time at home engaging in housework and

child care. We provide additional evidence that predicted non-smokers who did not visit bars frequently prior to the bans are more satisfied with leisure time. This may suggest that smoke-free laws raise non-smokers' options for free-time activities. If non-smokers did not go out very often due to smoking, they would notably benefit from the lower exposure to second-hand smoke in bars and restaurants. Examining time use supports this contention. When covered by a smoking ban, likely non-smokers spend more time on leisure time activities and are more likely to go out. Furthermore, they spend less time at home dealing with child care and garden work. We run several robustness checks to increase confidence in the basic pattern of results.

This study provides several contributions to the literature. First, to the best of our knowledge we provide the first study that analyzes in detail the consequences of smoking bans on well-being for Germany.¹ Second, while previous articles have only considered overall well-being and life satisfaction, we also investigate the influence of smoking bans on satisfaction with leisure time. As we analyze smoking bans in bars and restaurants that primarily affect individuals in their free-time, we assume that satisfaction with leisure time responds more quickly to the bans than overall life satisfaction. Third, we extend previous research by examining individuals' leisure time activities. This approach not only allows us to consider groups who are particularly affected by the bans but also to better understand the influence of smoking bans on well-being. Finally, as we use panel data from the German Socio-Economic Panel (SOEP), we are able to take individual fixed effects into account.

In what follows, the next section reviews the related literature. The third section

¹ One exception is Odermatt and Stutzer (2015) who also consider smoking bans in Germany. As the authors exploit data from 40 European countries and regions, however, they do not provide an individual analysis for Germany.

presents the data and variables and the fourth section describes the empirical approach. The fifth section provides the results and the sixth section concludes.

2. Previous Literature

Tobacco control policies aim to reduce smoking and improve health. However, the actual effectiveness of those policies is not clear, as neither empirical studies nor theoretical models provide conclusive evidence. From a theoretical perspective, one of the first models on the effects of smoking regulations was contributed by Becker and Murphy (1988). Their theory of rational addiction predicts that price changes of addictive goods decrease consumption in the long-run but only have a limited effect on consumption in the short-run. Moreover, as regulations of addictive goods constrain individuals' behavior, Becker and Murphy conclude that individuals' well-being is likely to decrease. An extension of the model is provided by Adda and Cornaglia (2006). The authors not only consider the number of cigarettes but also the intensity of smoking in their model. They show that smokers can compensate tax increases by extracting more nicotine per cigarette. As inhaling cigarette smoke more intensively is detrimental to health, the usefulness of cigarette taxes is questionable according to the authors. On the contrary, theoretical models of O'Donoghue and Rabin (1999) and Gruber and Köszegi (2004) predict that smoking regulations can increase the cost of smoking and thus serve as self-control device for smokers who want to reduce or quit smoking. Smokers do not need to solely rely on willpower with smoking bans in force, as bans decrease smokers' temptation to smoke in public places. Hence, if smokers desire to reduce or quit smoking, smoke-free laws can help to decrease consumption and increase well-being.

Empirical studies on the effects of tobacco control policies on smoking also present

conflicting results. While earlier studies show that smoking regulations can be an important tool in reducing cigarette consumption (e.g., Chaloupka and Warner 2000, Tauras 2006), more recent economic studies report no effect (Adda and Cornaglia 2010, Carpenter et al. 2011) or only a limited effect on specific subgroups (Anger et al 2011, Jones et al. 2015). Nonetheless, as anti-smoking policies primarily focus on protecting non-smokers from passive smoking, these policies can still play an important role. And indeed, smoking bans decrease exposure to second-hand smoke in public places, particularly in bars and restaurants (Carpenter et al. 2011). Furthermore, the lower exposure to tobacco smoke likely results in health benefits, as non-smokers' health improves after the introduction of smoking bans in public places (Meyers et al. 2009, Kuehnle and Wunder 2017, Wildman and Hollingsworth 2013). Analyzing smoking bans in European workplaces, Origo and Lucifora (2013) show that bans reduce exposure to second-hand smoke and decrease work-related respiratory problems. However, the authors also find that restricting individuals in their smoking habits causes mental distress among smokers. Further unintended effects of smoking bans are highlighted by Adda and Cornaglia (2010). Using data on cotinine levels, a biological marker for nicotine intake, the authors find that tobacco control policies can also entail negative health effects. Smoking bans displace smokers from public to private places, where particularly non-smokers and children of smoking families suffer from the higher exposure to second-hand smoke.

Considering those previous studies suggests that not only smoking status but also individuals' time use is an important channel when analyzing the effects of public-place smoking laws on health, as the strength of the impact depends on how much time individuals spend in public buildings. While so far ignored by previous research on smoking laws and

well-being, leisure time use may play a significant role in explaining well-being effects. Smoking bans in bars and restaurants directly affect leisure time, since individuals primarily visit bars and restaurants in their leisure time and thus, face the consequences of the policy mainly during that part of the day. If smokers dislike being constrained in their smoking habits during free-time, their well-being is likely to decrease. Furthermore, if smokers spend less time in bars and restaurants due to smoking bans, they may be less satisfied with leisure time. In contrast, non-smokers benefit from the lower exposure to second-hand smoke. Following the smoking bans, they likely have a better time in bars and restaurants and tend to go out more often. The effect on non-smokers' well-being may be positive.

The fact that one should not ignore smoking status or leisure time use when analyzing well-being, is also highlighted when we consider the perception of the smoke-free laws in the German public. The implementation of the smoking bans led to a strong opposition from the beginning. Several groups and clubs emerged, which collected signatures for petitions and organized protests in every major city. Particularly smokers rejected the tobacco control policy, as they perceived the bans were interfering excessively with personal choice. However, not only smokers but also non-smokers expressed concerns. Regular customers of bars and restaurants worried about the bar and restaurant culture and the survival of their local pub. As non-smokers who frequently visit bars are the main beneficiaries of the lower exposure to second-hand smoke, this potential negative impact of smoking bans seems an important aspect to consider. Hence, we argue that it is not only crucial to take into account smoking status but also how much time is spent in bars and restaurants, when examining the consequences of smoking bans on individual well-being.

Empirical knowledge about the influence of smoking laws on well-being is very

limited. The prominent study by Gruber and Mullainathan (2005) shows for Canada and the US that higher cigarette taxes make individuals with a high propensity to smoke happier. In contrast, Brodeur (2013) uses more recent US data and shows that higher cigarette taxes have no effect on smokers' life satisfaction. Studies for the UK (Leicester and Levell 2015) and the Netherlands (Weinhold and Chaloupka 2017) also find no evidence for smoking bans affecting well-being. Providing the only study that uses German data (amongst data for 40 other European countries and regions), Odermatt and Stutzer (2015) identify effects of smoking bans and cigarette prices on life satisfaction. As the authors can exploit detailed information on smokers' intentions to stop smoking, they are able to differentiate between smokers who have no intention to quit and smokers who would like to stop smoking. They find that smokers who intent to stop smoking report an increase in life satisfaction, following the introduction of a smoking ban. Higher cigarette prices instead decrease life satisfaction of smokers who would like to quit.

Overall, previous empirical evidence is mixed and predominantly focuses on smokers and their smoking habits. Moreover, none of the studies examining well-being considers the role of leisure time use. Investigating the link between smoking bans, leisure time, and well-being is a unique aspect of this study.

3. Data and Variables

3.1 The Data Set

The data used in this study are obtained from the German Socio-Economic Panel (SOEP), a representative longitudinal panel of private households in Germany. Annually, the SOEP conducts interviews with more than 20,000 individuals in over 11,000 households on living

conditions in Germany (Wagner et al. 2007). The empirical analysis is restricted to the years 2003 to 2008, as information on the key variables is only available for this period.

3.2 Key Explanatory Variable

Variable of primary interest is the implementation of state-level public smoking bans in German bars and restaurants. The German federal states enforced smoking bans on different dates during 2007 and 2008 (see Table 1). Starting in August 2007, Baden-Wuerttemberg was the first state covered by a smoking ban. During the next twelve months the remaining fifteen states followed with Mecklenburg West Pomerania being the last one in August 2008.

[Table 1]

The indicator *ban* is a dichotomous variable which is coded as one if the individual resides in a federal state that was covered by a smoking ban at time of interview. The variable equals zero if the individual lives in a state where a smoking ban was not in force yet. This implicates that the dummy is always equal to zero in the years prior to the smoking bans (2003 to 2006). Table 2 provides definitions and descriptive statistics of the variables used in this study.

[Table 2]

3.3 Outcome Variables

This study uses two outcome variables in the main analysis. In the SOEP, respondents are asked to evaluate their life and certain life domains on an eleven-point scale ranging from 0 (completely dissatisfied) to 10 (completely satisfied). For our analysis we use the variable *life satisfaction* which is based on the question “How satisfied are you with your life, all

things considered?”. For the second outcome we consider the life domain leisure time and use *satisfaction with leisure time* as dependent variable. In the subsequent analysis we examine leisure time activities. As the SOEP provides data on individuals’ time use, we employ *average leisure time on a weekday in hours*. The last two outcomes are measures for *spending time with friends* and *going to night clubs, dancing, and concerts*. Respondents are asked whether they never, rarely, monthly, or weekly engage in those leisure time activities.

3.4 Control Variables

Control variables for age, educational attainment, number of doctor visits², number of children under age 16, marital status, household income, residential area, work experience, and employment status are included.³ Explanatory variables of special interest are frequency of bar and restaurant visits prior to the bans and smoking status. The SOEP provides information on smoking behavior in the even-numbered years, but as smoking behavior likely has changed due to the enforcement of smoking bans, we cannot add current smoking status directly as a control variable. Instead we follow the strategy by Gruber and Mullainathan (2005) and use an individual’s propensity to smoke. Gruber and Mullainathan argue that cigarette taxes affect constant non-smokers and former smokers differently. To avoid mixing the two groups, the authors use predicted smoking behavior instead of actual smoking behavior. Hence, we also include an individual’s propensity to smoke. Based on information on smoking status in the even-numbered years, we calculate an individual’s probability to smoke given their personal characteristics. Thereupon, we generate a dummy variable that is

² As smoking bans may influence doctor visits, we use number of doctor visits in 2006 for the waves 2006 to 2008.

³ Note that we do not include time-invariant variables such as gender or migration background as we estimate fixed effects models.

equal to 1 if an individual has an above median predicted propensity to smoke.⁴

To control for the number of bar and restaurant visits prior to the bans, we follow Anger et al. (2011) and rely on information from 2003. We define a dummy variable which is coded as one if the individual visited bars and restaurants weekly and zero otherwise. Finally, we add time-varying state characteristics (unemployment rate, share of foreigners, share of students, average age), state fixed effects, a linear and a quadratic time trend, and month-year dummies. Adding a dummy for each month of each observed year to the specification allows us to capture common time trends across states in subjective well-being. More precisely, the time effects control for policy changes and shocks that coincided with the implementation of the smoking bans and may have influenced well-being.

4. Empirical Methodology

We use the implementation of state-level public smoking bans as a quasi-random experiment to estimate the effects of smoking bans on well-being and leisure time activities. Fortunately, the enforcement of the smoke-free laws not only provides variation across federal states but also variation within federal states. The SOEP conducts interviews each year from January to November which allows us to observe individuals who were surveyed before the smoking bans were in force and individuals who were interviewed after the smoke-free laws were in effect within the same state. To exploit the regional variation in the exposure to smoking bans, we apply a difference-in-differences approach (see Angrist and Pischke 2009: 234-

⁴ The estimated smoking propensity in 2002 is used for the wave 2003. Respectively, smoking propensity in 2004 (2006) is used for the years 2004 and 2005 (2006 to 2008). Note that the shares of potential smokers and non-smokers are not exactly 50 percent, as all available observations were used for the smoking propensity estimations and not only the estimation samples of the satisfaction analysis. Table A4 in the Appendix reports the results of the smoking propensity estimations.

235). The estimation strategy considers a group who received treatment and a group who did not receive treatment in the period before the treatment and in the period after the treatment. The federal states enforced smoking bans on different dates during 2007 and 2008, which provides us with a treatment group (covered by a smoking ban) and a control group (not covered by a smoking ban). To identify the effects of smoking bans on our outcomes, we estimate fixed effects linear probability models of the following form:

$$Y_{ist} = \alpha Ban_{ist} + \beta \mathbf{X}_{ist} + \varepsilon_{ist} + \nu_i, \quad (1)$$

where Y_{ist} is one of the outcomes of interest for individual i in federal state s at time t . Ban_{ist} is a dummy variable that is equal to one if the individual i resides in a federal state s that was exposed to a smoking ban at survey time t , and zero otherwise. The coefficient α identifies the effect of smoking bans on the outcomes. \mathbf{X}_{ist} is a vector of time-varying control variables, ε_{ist} is the error term, and ν_i is an individual-level fixed effect.

The key assumption for a difference-in-differences approach is that the outcomes for treatment and control group would follow the same trend in absence of the smoking bans.

[Figure 1]

Figure 1 provides descriptive evidence for the common trend assumption using pre-treatment data from 2003 to 2006. For each of the outcomes we compare the trends for individuals exposed to a smoking ban in 2008 and individuals who did not live in a state covered by a smoking ban at time of their interview in 2008. The pre-treatment data shows that the trends are very similar for both groups. The only exception is satisfaction with leisure time where the average satisfaction slightly increases for the treatment group between 2004 and 2005 but

decreases for the control group. However, given that the difference in trends can be considered as marginal, we conclude that the common trend assumption holds for all five outcomes.

5. Results

5.1 Main Analysis

Table 3 reports estimates from the difference-in-differences models for individuals with an above median predicted propensity to smoke (likely smokers) and individuals with a smoking propensity below the median (likely non-smokers).⁵ For completeness we also include results for the full sample.

[Table 3]

In the full sample smoking bans have a significant negative effect on life satisfaction. As life satisfaction has a mean value of 6.872, the coefficient of -0.058 implies a decrease from the mean value by 0.8 percent. While the influence of smoking bans on life satisfaction is negative, the coefficient on ban in column (2) has the opposite sign. Being exposed to a smoking ban increases leisure time satisfaction by 1 percent. Separate regressions by smoking status show that likely smokers and likely non-smokers are less satisfied with life after a smoking ban is in force. The decrease amounts to 0.8 percent for predicted smokers and to 0.9 percent for predicted non-smokers. The negative effect on life satisfaction, however, is for non-smokers only significantly different from zero. For smokers, the coefficient on ban just misses to be statistically significant at conventional levels ($p=0.15$).

⁵ Table A1 in the Appendix reports the full results of the difference-in-differences models.

The positive influence of bans on leisure time satisfaction found for the full sample is driven by individuals with a low propensity to smoke. When covered by a smoking ban, likely non-smokers are by 1.3 percent more satisfied with leisure time.

First regressions show ambiguous findings for non-smokers, as their leisure time satisfaction increases and their life satisfaction decreases. To better understand how smoking bans impact individuals' well-being further analysis is necessary. As our background discussion strongly suggests that smoking bans in the hospitality sector particularly affect individuals who often go to bars and restaurants, we consider a moderating role of bar and restaurant visits. Table 4 presents the results of an interaction of weekly bar and restaurant visits and exposure to smoking bans.

[Table 4]

The estimates show that the important patterns of results are revealed only when taking into account the interaction. Likely smokers who went to bars and restaurants weekly prior to the implementation of the smoke-free policy are by roughly 2 percent less satisfied with life and leisure time after smoking bans are in force. The interpretation is straightforward, as smokers who often go out are mostly affected by smoking bans in the hospitality sector and the resulting changes in the pub culture. Moreover, the estimates support the notion that restricting smokers' habits decreases smokers' well-being.

To set a benchmark, we compare our estimated effects against the effects of involuntary job loss on life satisfaction. Fixed effects regressions suggest that involuntary job loss decreases life satisfaction by about 3.9 percent in the short-run. Thus, the negative impact of smoking bans on life satisfaction is almost half the size of the effect of involuntary job loss

and therefore quite substantial.

For likely non-smokers the effects of smoking bans on satisfaction are more diverse. Predicted non-smokers who previously often went out also suffer from lower life satisfaction, when covered by a smoking ban. The decrease in life satisfaction amounts to 1.6 percent. In column (2) the interaction is also negative and significant, implying a slightly overall negative effect on leisure time satisfaction for predicted non-smokers who used to be regular guests in bars. On the contrary, the estimates also provide evidence for a positive impact of smoking bans on well-being. Likely non-smokers who did not visit bars and restaurants regularly prior to the bans are by 1.4 percent more satisfied with leisure time after smoking bans are enforced.

The estimates suggest that use of leisure time plays an important role when explaining the impact of smoking bans on well-being. We find that all individuals (and smokers in particular) who often visited bars and restaurants prior to the bans suffer from the smoke-free law, as their satisfaction with life and leisure time decreases. The findings for non-smokers are particularly striking, as non-smokers who are regular guests in bars should benefit the most from the lower exposure to second-hand smoke. The results also show, however, that non-smokers who previously did not go out very often report higher satisfaction with leisure time. We investigate the role of time use further in the next subsection. More specifically, we check for displacement of individuals from public buildings to private places and vice versa.

5.2 Smoking Bans and Use of Leisure Time

In this chapter we analyze the effects of smoking bans on leisure time activities. The first

outcome variables used are the number of hours spent per day on free-time activities, spending time with friends, and going to night clubs, dancing, and concerts. The results are presented in Table 5.

[Table 5]

Likely smokers who previously often went to bars and restaurants spend significantly less time on leisure time activities, when covered by a smoking ban. The decrease amounts to 4.3 percent in hours spent on free-time activities, to 4 percent in spending time with friends, and to 3.4 percent in going to clubs or dancing. Likely non-smokers who used to go to bars a lot also show a reduction in going to clubs or dancing by 4.2 percent. The results suggest that smoking bans lead former regular guests of bars and restaurants to go out less and to spend less time with friends which, consequently, negatively impacts their leisure time satisfaction and life satisfaction. Finally, the estimates show that likely non-smokers who previously did not visit bars and restaurants weekly also report a change in use of leisure time. When covered by a ban, they spend more time on free-time activities (increase by 4.9 percent) and exhibit an increase in going to clubs, concerts, or dancing by 2 percent.

Adda and Cornaglia (2010) point out the importance of displacement for health consequences. The authors show that smoking bans lead smokers to spend more time at home where they contaminate non-smokers. As a potential displacement from bars and restaurants to private places may also be relevant to explain the well-being effects found in the previous subsection, we investigate individuals' time use at home in Table 6. For that purpose, we consider three variables that measure time spent on household duties. More precisely, we employ as outcomes the average number of hours spent on a weekday on housework, on

garden work and repairs around the house, and on child care.

[Table 6]

Likely smokers who used to be regular guests in bars exhibit an increase in time spent on housework (5.2 percent) and child care (11.4 percent). The results confirm the findings by Adda and Cornaglia (2010). Smokers spend less time in public buildings and more time at home. Finally, we find that likely non-smokers spend significantly less time on garden work/repairs around the house (5.4 percent) and child care (6.9 percent). Hence, non-smokers who did not visit bars frequently spend less time on household duties and spend more time going out after bans are enforced.

5.3 Robustness Checks

In this subsection, we provide robustness checks of our main findings (Table 4) to increase confidence in the basic pattern of results. To validate the findings, we (a) use an alternative definition of smoking status, (b) run a placebo check, (c) add state-specific time trends, and (d) apply a different method. In Table 7 we use a stricter definition of smoking status. We only consider an individual to be a likely smoker if the person is in the top tertile of the distribution of the estimated individual propensity to smoke.

[Table 7]

The results shown in Table 7 are very similar in magnitude and significance to the ones reported in Table 4. For likely smokers, the estimates even slightly increase in magnitude. Hence, the main results are robust to the definition of smoking status. In a second robustness

check we follow Kuehnle and Wunder (2017) and apply a placebo ban where we pretend the smoking bans were implemented in 2005 and 2006. Table 8 presents the results. The placebo ban does not emerge with a significant coefficient in any of the regressions.

[Table 8]

Third, we address the specification of time effects and add state-specific time trends in addition to the month-year dummies. State-specific time trends capture unobserved changes over time that may be correlated with well-being and the timing of the implementation of the smoking bans in the federal states. Note, however, that this is likely not a major issue as Anger et al. (2011) provide convincing evidence that the timing of the adoption is not correlated with state characteristics but rather random. The results of the estimations are presented in Table A2 in the Appendix. Finally, we apply an alternative method to validate the results. For the ease of interpretation, we so far ignored the ordinal nature of the dependent variables and treated them as if they are cardinal. To take the ordinal scale of the outcomes into account, we apply fixed effects ordered logit models. More specifically, we use the BUC estimator proposed by Baetschmann et al. (2015). The regressions are reported in Table A3 in the Appendix. Our results are robust to the specification of time effects and the choice of method.

6. Conclusions

During 2007 and 2008 all of Germany's sixteen federal states enforced smoking bans which prohibit smoking in bars, restaurants, and night clubs. This study exploits the variation across states in the implementation of smoking bans to investigate the influence of state-level

smoking bans on subjective well-being. We extend previous research by extensively examining the role of leisure time use.

The implementation of smoking bans had a strong impact on well-being, although the important patterns of results are revealed only when taking into account how intense individuals are exposed to the changes imposed by smoking bans. More specifically, the results show that it is crucial to consider how often an individual actually visits bars and restaurants when analyzing well-being effects. Overall, we find that individuals who used to go out a lot are less satisfied with life and leisure time after a smoking ban is enforced. The decline in satisfaction is particularly strong for predicted smokers. This is supportive of the notion that restricting individuals' habits and interfering with leisure pursuits decreases subjective well-being. To provide further evidence for this contention, we examine time use data. The estimates show that the same individuals spend less time with friends and are less likely to go to clubs or dancing with smoking bans in force. Hence, the decrease in well-being is likely induced by a change in leisure time activities. Checking for displacement effects reveals that likely smokers who visited bars and restaurants often prior to the bans are now more likely to stay at home dealing with housework and child care. The findings are in line with the results provided by Adda and Cornaglia (2010). The authors use US data to show that smoking bans displace smokers from public to private places. Adda and Cornaglia, however, focus on health and not satisfaction. Nevertheless, our results on changes in smokers' time use suggest that the negative health consequences resulting from displacement of smokers to private places found for the US may also be relevant in the German case. Future research analyzing health effects of smoking bans in Germany, thus, could benefit from considering these findings.

Smoking bans aim at reducing second-hand smoke for non-smokers. And indeed, the estimates provide evidence that likely non-smokers who previously did not visit bars often are the beneficiaries of the tobacco control policy. Our results show that smoking bans increase this group's satisfaction with leisure time. The examination of time use suggests that changes in use of leisure time likely explain this finding. Predicted non-smokers spend more time on free-time activities and are more likely to go out after bans are in force. On the contrary, they spend less time at home engaging in home duties. This supports the notion that smoking bans make it more appealing to non-smokers to go out, which accordingly increases satisfaction with leisure time.

For further insight into the relationship between smoking bans and subjective well-being, future research could link the findings of this study with smokers' intentions to quit smoking. As Odermatt and Stutzer (2015) point out the importance of smokers' intentions, this seems a promising approach. Unfortunately, our data does not provide information on smokers' desire to quit, hence analyzing this mechanism is left for future work. Furthermore, it would be interesting to investigate the long-run effects of smoking bans on subjective well-being. As regular customers of bars and restaurants slowly get used to the new situation, they may benefit from the lower exposure to second-hand smoke and their well-being improves.

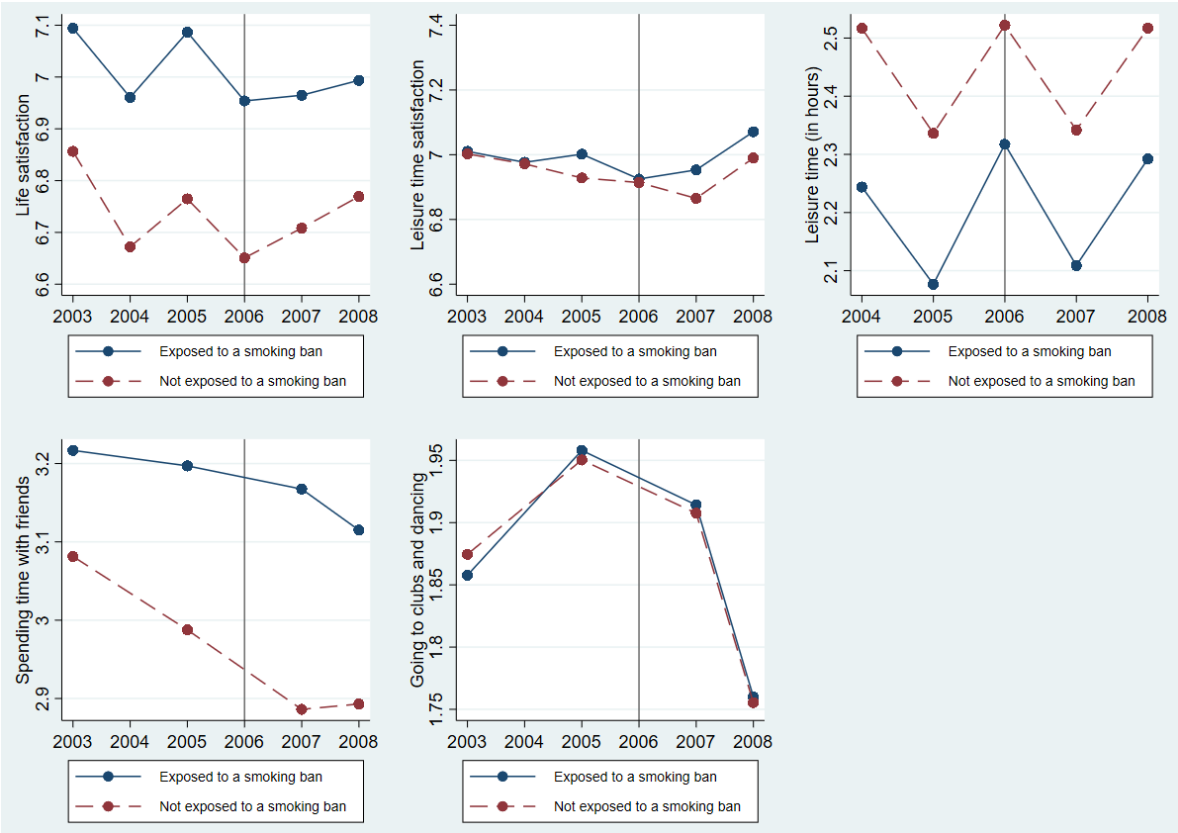
Overall, the results suggest that the implementation of smoking bans not only influenced individuals' health and smoking behavior but also other life domains. Hence, it is important to take potential side effects into account when evaluating the economic effects of smoking bans. Policymakers need to consider consequences on leisure pursuits and well-being, when enforcing policy changes intended to constrain individuals' behavior.

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Figure 1: Average well-being and leisure time activities over time by exposure to smoking bans



Smoking bans were gradually enforced in all German states between 2007 and 2008. Pre-treatment data is obtained from the years 2003 to 2006, indicated by the vertical line.

Table 1: Implementation of smoking bans in German bars and restaurants

Federal state	Date of enforcement
Baden-Wuerttemberg	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

Information on enforcement of smoking bans was compiled from original law texts. With the exception of Rhineland-Palatinate and Saarland, which enforced the smoking bans on February 15th, the bans were enforced in all states at the first of the month.

Table 2: Variable definitions and descriptive statistics

Variable	Description	Mean (Std.dev)
Life satisfaction	Score of life satisfaction on an eleven-point Likert scale that ranges from 0 “completely dissatisfied” to 10 “completely satisfied”.	6.872 (1.793)
Leisure time satisfaction	Score of leisure time satisfaction on an eleven-point Likert scale that ranges from 0 “completely dissatisfied” to 10 “completely satisfied”.	6.971 (2.201)
Leisure time activities ^a	Average time spend on leisure time activities on a weekday in hours.	2.314 (2.054)
Spending time with friends ^b	Spending time with friends coded as 1 “never”, 2 “less than once a month”, 3 “monthly”, and 4 “weekly”.	3.145 (0.835)
Going to clubs and dancing ^b	Going to clubs, concerts, movies, and dancing coded as 1 “never”, 2 “less than once a month”, 3 “monthly”, and 4 “weekly”.	1.883 (0.815)
Ban	Dummy equals 1 if the individual resides in a federal state that was covered by a smoking ban at time of interview and 0 otherwise. Dummy is always coded as 0 in the years prior to the smoking bans (2003-2006).	0.083 (0.276)
Likely smoker	Dummy variable coded as 0 “likely non-smoker” (below median) and 1 “likely smoker” (above median) based on the individual’s estimated propensity to smoke.	0.473 (0.499)
Weekly bar and restaurant visits	Dummy equals 1 if the individual visits bars and restaurants weekly in 2003. Dummy is coded as 0 if the individual visits bars and restaurants monthly, less than once a month, or never.	0.229 (0.420)
Age 30-44	Dummy equals 1 if the individual is 30 to 44 years of age.	0.282 (0.450)
Age 45-59	Dummy equals 1 if the individual is 45 to 59 years of age.	0.286 (0.452)
Age ≥60	Dummy equals 1 if the individual is 60 years or older.	0.304 (0.460)
Skilled	Dummy equals 1 if the individual’s highest educational attainment is a completed apprenticeship training.	0.543 (0.498)
University degree	Dummy equals 1 if the individual has a university degree.	0.286 (0.452)
Doctor visits	Number of doctor visits in the last three months.	2.511 (3.930)
Married	Dummy equals 1 if the individual is married.	0.645 (0.479)
Number of children	Number of children under age 16 in the household.	0.506 (0.888)
Log(household income)	Log of deflated household income.	7.928 (0.586)
Living in an urban area	Dummy equals 1 if the individual lives in an urban area.	0.668 (0.471)
Work experience	The individual’s work experience in years.	21.13 (13.48)
Full-time	Dummy equals 1 if the individual works full-time.	0.404 (0.491)
Part-time	Dummy equals 1 if the individual works part-time.	0.110 (0.313)
Out of labor force	Dummy equals 1 if the individual is out of labor force.	0.363 (0.481)
Unemployed	Dummy equals 1 if the individual is unemployed.	0.061 (0.239)
Log(unemployment rate)	Log of unemployment rate (state-level).	2.286 (0.409)
Log(share of foreigners)	Log of share of foreigners (state-level).	1.953 (0.639)
Log(share of students)	Log of share of students (state-level).	3.146 (0.213)
Average age	Average age (state-level).	38.88 (1.012)

Descriptive statistics for the dependent variables are based on the full samples of the respective regressions. Descriptive statistics for the explanatory variables are based on the full sample of the life satisfaction analysis. The regressions also include state fixed effects, month-year dummies, and a linear and a quadratic time trend.

^a Information obtained from the waves 2004 to 2008.

^b Information obtained from the waves 2005, 2007, and 2008.

Table 3: The effects of smoking bans on life satisfaction and leisure time satisfaction

Dependent variables	(1) Life satisfaction	(2) Leisure time satisfaction
PANEL A: FULL SAMPLE		
Ban	-0.058** (0.024)	0.066** (0.030)
Observations	101,391	100,180
PANEL B: LIKELY SMOKERS		
Ban	-0.054 (0.038)	0.031 (0.048)
Observations	47,998	47,920
PANEL C: LIKELY NON-SMOKERS		
Ban	-0.064** (0.032)	0.094** (0.039)
Observations	53,393	53,260

Method: Fixed effects OLS. Years 2003 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. Table A1 in the Appendix reports the full results of the regressions. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 4: The effects of smoking bans on life satisfaction and leisure time satisfaction; interaction of smoking ban and weekly bar and restaurant visits (prior to the ban)

Dependent variables	(1) Life satisfaction	(2) Leisure time satisfaction
PANEL A: LIKELY SMOKERS		
Ban	-0.020 (0.040)	0.061 (0.051)
Ban*weekly bar and restaurant visits	-0.125** (0.052)	-0.126** (0.062)
Observations	47,998	47,920
PANEL B: LIKELY NON-SMOKERS		
Ban	-0.030 (0.034)	0.102** (0.041)
Ban*weekly bar and restaurant visits	-0.115** (0.045)	-0.106** (0.054)
Observations	53,393	53,260

Method: Fixed effects OLS. Years 2003 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions include the full set of control variables. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 5: The effects of smoking bans on use of leisure time

Dependent variables	(1) Leisure time activities ^a	(2) Spending time with friends ^b	(3) Going to clubs and dancing ^b
PANEL A: LIKELY SMOKERS			
Ban	-0.017 (0.043)	-0.059** (0.025)	-0.007 (0.021)
Ban*weekly bar and restaurant visits	-0.089* (0.054)	-0.070** (0.030)	-0.070*** (0.027)
Observations	37,978	21,157	21,160
PANEL B: LIKELY NON-SMOKERS			
Ban	0.130*** (0.040)	-0.055** (0.023)	0.034** (0.016)
Ban*weekly bar and restaurant visits	0.013 (0.058)	0.001 (0.028)	-0.106*** (0.023)
Observations	44,384	25,097	25,094

Method: Fixed effects OLS. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions contain the full set of control variables. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

^a Regressions based on the years 2004 to 2008.

^b Regressions based on the years 2005, 2007, and 2008.

Table 6: Displacement effects of smoking bans

Dependent variables	(1) Housework	(2) Garden work/repairs around the house	(3) Child care
PANEL A: LIKELY SMOKERS			
Ban	0.013 (0.026)	0.022 (0.024)	0.040 (0.064)
Ban*weekly bar and restaurant visits	0.070** (0.029)	0.019 (0.028)	0.135* (0.074)
Observations	38,010	37,972	38,046
PANEL B: LIKELY NON-SMOKERS			
Ban	0.019 (0.026)	-0.052** (0.022)	-0.076* (0.046)
Ban*weekly bar and restaurant visits	-0.005 (0.031)	0.019 (0.027)	0.099 (0.069)
Observations	44,374	44,378	44,412

Method: Fixed effects OLS. Years 2004 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions contain the full set of control variables. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 7: Robustness check; alternative definition of smoking status

Dependent variables	(1) Life satisfaction	(2) Leisure time satisfaction
PANEL A: LIKELY SMOKERS		
Ban	0.038 (0.053)	0.062 (0.067)
Ban*weekly bar and restaurant visits	-0.143** (0.068)	-0.132* (0.079)
Observations	31,608	31,551
PANEL B: LIKELY NON-SMOKERS		
Ban	-0.036 (0.030)	0.090** (0.037)
Ban*weekly bar and restaurant visits	-0.095** (0.039)	-0.100** (0.047)
Observations	69,783	69,629

Method: Fixed effects OLS. Years 2003 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions contain the full set of control variables. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. Only individuals in the top tertile of the distribution of the estimated individual propensity to smoke are considered as likely smokers. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table 8: Robustness check; placebo ban

Dependent variables	(1) Life satisfaction	(2) Leisure time satisfaction
PANEL A: LIKELY SMOKERS		
Placebo ban	0.130 (0.084)	0.140 (0.098)
Placebo ban*weekly bar and restaurant visits	-0.012 (0.038)	-0.044 (0.050)
Observations	35,173	35,100
PANEL B: LIKELY NON-SMOKERS		
Placebo ban	0.050 (0.061)	-0.023 (0.082)
Placebo ban*weekly bar and restaurant visits	0.021 (0.037)	-0.043 (0.047)
Observations	37,210	37,121

Method: Fixed effects OLS. Years 2003 to 2006. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions contain the full set of control variables. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Appendix

Table A1: The effects of smoking bans on life satisfaction and leisure time satisfaction; full results

Dependent variables	Full sample		Likely smokers		Likely non-smokers	
	(1) Life satisfaction	(2) Leisure time satisfaction	(1) Life satisfaction	(2) Leisure time satisfaction	(1) Life satisfaction	(2) Leisure time satisfaction
Ban	-0.058** (0.024)	0.066** (0.030)	-0.054 (0.038)	0.031 (0.048)	-0.064** (0.032)	0.094** (0.039)
Likely smoker	0.025 (0.022)	0.001 (0.029)	-	-	-	-
Age 30-44	0.036 (0.040)	-0.066 (0.058)	0.084* (0.048)	-0.044 (0.070)	-0.096 (0.082)	-0.134 (0.123)
Age 45-50	0.075 (0.051)	-0.039 (0.071)	0.134** (0.065)	-0.027 (0.089)	-0.096 (0.096)	-0.088 (0.142)
Age ≥60	0.204*** (0.064)	0.148* (0.086)	0.251*** (0.096)	0.128 (0.118)	0.033 (0.106)	0.118 (0.156)
Skilled	-0.025 (0.059)	-0.032 (0.081)	-0.198*** (0.070)	-0.143 (0.094)	0.132 (0.149)	0.018 (0.198)
University degree	-0.136 (0.088)	0.231* (0.124)	-0.458*** (0.112)	0.001 (0.154)	0.244 (0.225)	0.562* (0.294)
Doctor visits	-0.024*** (0.002)	-0.006*** (0.002)	-0.023*** (0.004)	-0.008** (0.004)	-0.023*** (0.003)	-0.004 (0.003)
Married	0.223*** (0.039)	-0.122** (0.048)	0.228*** (0.051)	-0.029 (0.065)	0.303*** (0.076)	-0.245*** (0.089)
Number of children	0.032** (0.016)	-0.178*** (0.022)	0.040* (0.023)	-0.130*** (0.029)	0.011 (0.026)	-0.239*** (0.038)
Log(household income)	0.209*** (0.021)	-0.013 (0.026)	0.249*** (0.029)	0.050 (0.035)	0.155*** (0.032)	-0.083** (0.040)
Living in an urban area	-0.102 (0.077)	-0.034 (0.096)	-0.106 (0.104)	-0.099 (0.123)	0.023 (0.140)	0.107 (0.189)
Work experience	0.029*** (0.010)	0.002 (0.012)	0.003 (0.016)	-0.017 (0.020)	-0.047** (0.021)	0.031 (0.022)
Work experience squared	0.0001 (0.0002)	0.0005** (0.0002)	0.0001 (0.0002)	0.0004 (0.0003)	0.001** (0.0003)	0.0002 (0.0004)
Full-time	0.169*** (0.032)	-0.574*** (0.042)	0.257*** (0.041)	-0.441*** (0.054)	0.073 (0.052)	-0.822*** (0.075)
Part-time	0.044 (0.031)	-0.110*** (0.041)	0.099** (0.044)	0.030 (0.057)	-0.007 (0.045)	-0.283*** (0.064)
Out of labor force	-0.024 (0.029)	0.234*** (0.037)	-0.078* (0.044)	0.299*** (0.055)	0.005 (0.043)	0.115** (0.055)
Unemployed	-0.488*** (0.038)	0.512*** (0.045)	-0.492*** (0.045)	0.643*** (0.055)	-0.273*** (0.082)	0.235** (0.097)
Log(unemployment rate)	-0.172* (0.102)	0.110 (0.134)	-0.218 (0.160)	0.119 (0.213)	-0.107 (0.142)	0.152 (0.177)
Log(share of foreigners)	-0.056 (0.142)	0.316 (0.320)	-0.159 (0.271)	0.454 (0.451)	-0.475 (0.310)	0.258 (0.539)
Log(share of students)	0.080 (0.114)	0.381** (0.149)	-0.018 (0.176)	0.271 (0.233)	0.207 (0.171)	0.343* (0.204)
Average age (state-level)	-0.147*** (0.051)	0.088 (0.066)	-0.119 (0.088)	0.284** (0.112)	-0.108 (0.068)	0.005 (0.086)
Constant	11.667*** (2.154)	1.902 (2.851)	10.610*** (3.536)	-6.170 (4.826)	11.306*** (2.862)	5.275 (3.770)
Observations	101,391	100,180	47,998	47,920	53,393	53,260
R ²	0.022	0.021	0.033	0.027	0.017	0.017

Method: Fixed effects OLS. Years 2003 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions include state fixed effects, month-year dummies, and a linear and a quadratic time trend. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table A2: Robustness check; models include state-specific time trends

Dependent variables	(1) Life satisfaction	(2) Leisure time satisfaction
PANEL A: LIKELY SMOKERS		
Ban	0.031 (0.046)	0.008 (0.060)
Ban*weekly bar and restaurant visits	-0.118** (0.053)	-0.124** (0.063)
Observations	47,998	47,920
PANEL B: LIKELY NON-SMOKERS		
Ban	-0.002 (0.039)	0.091** (0.046)
Ban*weekly bar and restaurant visits	-0.108** (0.045)	-0.102* (0.054)
Observations	53,393	53,260

Method: Fixed effects OLS. Years 2003 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions include the full set of control variables. State-specific time trends are added to the specification. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table A3: Robustness check; alternative method

Dependent variables	(1) Life satisfaction	(2) Leisure time satisfaction
PANEL A: LIKELY SMOKERS		
Ban	-0.024 (0.069)	0.081 (0.065)
Ban*weekly bar and restaurant visits	-0.206** (0.094)	-0.176** (0.083)
Observations	47,998	47,920
PANEL B: LIKELY NON-SMOKERS		
Ban	-0.046 (0.065)	0.155** (0.064)
Ban*weekly bar and restaurant visits	-0.243*** (0.090)	-0.160* (0.083)
Observations	53,393	53,260

Method: Fixed effects ordered logit (BUC estimator). Years 2003 to 2008. The table shows the estimated coefficients. Standard errors clustered at the individual level are in parentheses. All regressions contain the full set of control variables. As the variable weekly bar and restaurant visits is time-invariant by definition, it is dropped from the estimation. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.

Table A4: Determinants of smoking

Dependent variables	(1) Smoking in 2002	(2) Smoking in 2004	(3) Smoking in 2006
Female	-0.096*** (0.007)	-0.085*** (0.007)	-0.082*** (0.007)
Migration background	0.0002 (0.008)	-0.004 (0.009)	0.006 (0.009)
Age 30-44	0.020 (0.014)	0.010 (0.014)	0.005 (0.014)
Age 45-50	-0.036** (0.015)	-0.038** (0.016)	-0.033** (0.016)
Age \geq 60	-0.169*** (0.016)	-0.180*** (0.017)	-0.175*** (0.017)
Skilled	-0.018** (0.008)	-0.011 (0.009)	-0.023*** (0.009)
University degree	-0.134*** (0.010)	-0.109*** (0.010)	-0.124*** (0.010)
Doctor visits	-0.0003 (0.001)	-0.002*** (0.001)	-0.003*** (0.001)
Married	-0.078*** (0.008)	-0.083*** (0.008)	-0.064*** (0.008)
Number of children	0.011*** (0.004)	0.002 (0.004)	-0.008* (0.004)
Log(household income)	-0.033*** (0.006)	-0.044*** (0.006)	-0.058*** (0.006)
Living in an urban area	0.009 (0.008)	0.008 (0.008)	0.013 (0.008)
Work experience	0.005*** (0.001)	0.005*** (0.001)	0.004*** (0.001)
Work experience squared	-0.0001*** (0.00002)	-0.0001*** (0.00002)	-0.0001*** (0.00002)
Full-time	0.008 (0.014)	-0.010 (0.015)	0.005 (0.014)
Part-time	-0.001 (0.017)	-0.009 (0.017)	0.024 (0.016)
Out of labor force	-0.064*** (0.014)	-0.076*** (0.015)	-0.064*** (0.014)
Unemployed	0.119*** (0.019)	0.113*** (0.019)	0.131*** (0.018)
Constant	0.671*** (0.071)	0.812*** (0.111)	0.715*** (0.157)
Observations	21,225	19,932	19,879
R ²	0.094	0.095	0.098

Method: OLS. The table shows the estimated coefficients. Robust standard errors are in parentheses. All regressions include state fixed effects and a linear time trend. *** Statistically significant at the 1% level; ** at the 5% level; * at the 10% level.