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Federica Origo
Claudio Lucifora

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Forschungsinstitut
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Federica Origo
Università di Bergamo

Claudio Lucifora
Università Cattolica
and IZA

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IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

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ABSTRACT

The Effect of Comprehensive Smoking Bans in European Workplaces*

In recent years many countries of the European Union (EU) have implemented comprehensive smoking bans to reduce exposure to tobacco smoke in public places and all indoor workplaces. Despite the intense public debate, research on the impact of smoking regulation on health, particularly within the workplace, is still very limited. In this paper, we use a Diff-in-Diff approach and comparable micro-data – for a large number of European countries – to evaluate the impact of national comprehensive smoking bans on both perceived workers' health and presence of respiratory problems within workplaces. Results show that the introduction of comprehensive smoking bans has a significant effect on workers' perceived health, particularly on the probability of exposure to smoke and fumes, also controlling for risk exposure. We also highlight some unintended effects of smoking bans in terms of mental distress, which counteract the positive impact on risk exposure and physical health. The impact across countries is shown to vary with the degree of strictness of the bans.

JEL Classification: I18, J28

Keywords: smoking bans, workers health, difference-in-differences

Corresponding author:

Federica Origo
Università di Bergamo
Via dei Caniana 2
24127 Bergamo
Italy
E-mail: federica.origo@unibg.it

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1. Introduction

Tobacco smoke is a major concern for public health. While health problems caused by active smoking are well known and extensively documented, in recent years much attention has been paid to the negative consequences of exposure to tobacco smoke (or passive smoking). Passive smoking can in fact cause substantial health and economic costs, both private and social. Continuous exposure to tobacco smoke at home, in enclosed public places and at the workplace can actually be as dangerous as active smoking, since it can cause lung cancer, cardiovascular disease and respiratory difficulties. According to the most recent estimates, in the EU-25 (European Union) passive smoking is the prime cause of death for more than 79 thousands adults each year and almost 9% of them die for exposure to tobacco smoke at work (Jamrozik, 2006).

The economic costs associated to passive smoking may be very high not only for the individuals and their households (in terms of increased healthcare expenditure and earning loss due to tobacco-related illnesses), but also for the employers (in terms of lower productivity due to smoking breaks and sickness absence, fire damage caused accidentally by smoking and maintenance costs related to smoking). Furthermore, social costs include also reduced income taxes and social security contributions of ill workers who have to exit employment and the long run productivity loss of workers who prematurely die for tobacco-related diseases.

This evidence has prompted both international organisations and single countries to design and implement more effective and comprehensive tobacco control policies. According to the World Bank (2003), the latter should include a wide set of measures: bans and restrictions on smoking in public places and workplaces, cigarette taxation, public information campaigns, bans on the advertising and promotion of tobacco products, health warnings on tobacco product packaging and treatment to help quitting. In its 2007 Green Paper, the European Commission has further emphasized the role of comprehensive smoke-free regulation (banning smoking in all workplaces, indoor public places and public transport) in reducing exposure to tobacco smoke, with subsequent positive effects on health of both active and passive smokers (European Commission, 2007).

Following these Community recommendations, in the last five years almost all Members of the European Union (EU) have implemented such type of comprehensive smoking bans, albeit at different dates and with different degree of enforcement. The first EU-15 country moving in this direction was Ireland (March 2004), immediately followed by Italy (January 2005) and Sweden (June 2005). Most of the other countries did the same between 2006 and 2008, while the remaining ones planned to do so by the beginning of 2009.

Despite of the intense public debate and the high expectations following these reforms, very limited (and all country-specific) research has been carried out in order to evaluate the impact of these comprehensive smoking bans on health. Even less attention has been paid to their effects within the workplace or to the existence of unintended effects.

This paper tries to fill the gap using a quasi-experimental approach to evaluate the impact of national comprehensive smoking bans on perceived workers' health for a large number of European countries on the basis of comparable micro-data. The paper is organized as follows. In Section 2, we review the relevant literature, pointing out the value added of our contribution with respect to previous research. Section 3 outlines the institutional setting and some stylized facts, while in Section 4 we briefly describe the data and the empirical strategy. The main results are discussed in Section 5, and a number of robustness checks are performed in Section 6. Further empirical results in terms of unintended effects are reported in Section 7. The last Section concludes.

2. Literature review

There is a large body of medical and economics literature on the effects of different types of smoking bans on a number of health-related outcomes, both within and outside the workplace. When looking at the economics and public health studies, it is possible to classify most of the empirical research in the field into three main groups: studies looking at the impact of privately initiated workplace smoking bans on workers smoking behaviour and health; those studying the impact of local smoking restriction at the workplace and those investigating the effect of public smoke-free policies on cigarette consumption and health (not necessarily within the workplace).

Most of the earlier studies are based on single country cross-section data and are rather descriptive. Conversely, in recent years, the increasing availability of better data (i.e.

longitudinal micro data) and more sound econometric techniques have produced a new vintage of studies that, rather than focussing on simple correlations, have investigated the causal effects of smoking restrictions on health. One of the earliest work to evaluate the impact of workplace smoking bans on workers smoking prevalence is Evans *et al* (1999). Using data from two representative US surveys for the early Nineties and accounting for unobserved heterogeneity and the sorting of workers across workplaces (i.e. healthier workers are more likely to search jobs at firms with smoking bans, while smokers do not), Evans *et al* find that workplace bans significantly reduce both smoking prevalence and daily cigarettes consumption among smokers at the workplace. The progressive diffusion of such bans is then put forward as an explanation for the drop in smoking habits among employed workers relative to non employed.

More generally a number of recent studies, which have adopted a meta-analysis approach to assess the overall effects of workplace bans, show that (private) workplace smoking restrictions are effective in protecting non smokers from passive smoking also reducing smoking prevalence -- and the number of cigarettes smoked by continuing smokers -- in the entire population (Fichtenberg and Glantz, 2002; Levy and Friend, 2003).

Some contributions point out that privately initiated workplace smoking restrictions are highly correlated with public smoking bans, particularly at the local level, showing subsequent positive effects on quitting behaviour and workers' health. Most of these studies have used cross-section data matched with public information on the strength of local workplace ordinances. In this context, Moskowitz *et al* (2000) -- using data for California in 1990-- find that smokers resident in areas with strong local smoke-free laws, compared to smokers in areas without local smoke-free laws, were significantly more likely to report the existence of smoking policies at the workplace and to report quitting behaviour. Similarly, Stephens et al (1997), using cross-section data for 1990-1991, compare Canadian residents in provinces with strong smoking laws with residents in others provinces, and find that residents in provinces with strong smoking laws were significantly less likely of being current smokers with respect to individuals in areas with weak laws. Carpenter (2009) provides new quasi-experimental evidence on the effects of local laws on actual workplace smoking policy and the impact of the latter on the exposure to tobacco smoke at the workplace in Ontario (Canada) over the period

1997-2004. By exploiting the differential timing of adoption of local smoking laws in different counties and using a Diff-in-Diff estimator, he shows that the effect of local laws on actual workplace policies vary with workers' occupation: only for blue collars local laws were effective in increasing the presence of smoking bans at the workplace. Moreover, workplace smoking bans were found to further reduce smoking and exposure to tobacco smoke, particularly for blue collars compared to white collars and sales/service workers.

Another relevant strand of literature has dealt with the impact of public smoke-free policies on smokers' behaviour and their demand for cigarettes. Almost all these studies (which mainly focus on the US experience), find that smoking bans in public places have a significant detrimental effect on cigarette demand, both for the young and the adults (Wasserman et al., 1991) and especially in the case of males (Chaloupka, 1992). Usually these analyses are carried out on the basis of individual (repeated) cross-section data matched with information on state smoking regulation, but similar results are found also with monthly regional time series data (see Keeler *et al.*, 1993 for a study focused on California). Furthermore, the conclusion that public policies promoting smoke-free environments significantly reduce cigarette consumption still holds even when state and year fixed effects are included in the model specification (Yurkely and Zhang, 2004; Tauras, 2005). A very recent study for Germany, however, finds that the introduction of comprehensive smoking bans in 2007-2008 did not change average smoking behaviour in the whole population, but only affected selected groups – i.e. smoking incidence and intensity declined significantly for men, young and unmarried individuals, as well as for those living in urban areas (Anger et al. 2010). Results are mixed also when we consider the impact of smoking bans on physical health, particularly in the short run. On the one hand, a number of epidemiological studies find that smoking bans may lead to substantial short-term decrease (between 8-40%, depending on the study considered) in the incidence of acute myocardial infarction (measured both in terms of annual mortality and hospitalization rates), which is known to be one of the main smoke-related illnesses (see Sargent *et al.*, 2004; Bartecchi *et al.*, 2006; Juster *et al.*, 2007 for evidence on the USA; see Cesaroni *et al.*, 2008 for Italy, Pell *et al.*, 2008 for Great Britain). On the other hand, combining different nationally representative US data-sets, Shetty *et al.* (2009) reject the hypothesis that, in the short run, such bans may be related

to a statistically significant decline in mortality or hospital admissions for myocardial infarction or other diseases, except for a reduced all-cause mortality rate among the elderly.

Finally, some studies have shown that there might also be some "unintended" effects. For example, Adams and Cotti (2008) show that the implementation of smoke-free policies in the USA was associated to increasing rates of vehicular deaths, due to either longer time spent by smokers driving to find public smoking places, or due to the fact that such bans are likely to induce smokers to smoke more in their cars, thus generating a source of distraction while driving. In line with these results, Adda and Cornaglia (2006) provide some evidence on the displacement effects generated by some types of smoking bans. Exploiting state and time variation across US states, and using information on the intensity of exposure to tobacco smoke (i.e. 'cotinine' concentration, a metabolite of nicotine, in the blood) on a large sample of non smokers by means of repeated blood tests, they show that smoking bans on public transport or in schools actually decrease non smokers exposure to smoke, while bans in recreational public places perversely increase their exposure. The displacement effects of bans in public places induce smokers to increase smoking in private places, such as cars and homes, with adverse effects on other non smokers, particularly young children. An opposite result is found by Cutler and Glaeser (2007), who focus on the role of peer effects and social interactions in smoking by studying the smoking behaviour of a representative sample of US couples. In order to control for sorting effects -- smokers tend to marry other smokers --, they use workplace smoking bans as an instrument (i.e. assuming that workplace smoking bans should influence smoking behaviour, but not the choice of partner) and find that both partners, when one of them is covered by smoking bans at work, are significantly less likely to smoke[2]. Furthermore, they provide evidence for the existence of a "social multiplier", as the impact of smoking bans becomes stronger at

[2] Other studies have also argued that smoking bans, especially comprehensive ones, should decrease "social acceptability" of smoking, thus reducing smoking also in private places, particularly at home (Gallus et al., 2007). Descriptive evidence in the case of Italy actually show that in 2006 (one year after the introduction of the first comprehensive smoking ban; see Section 3 for further details) the majority of people (around 55%) declared that their guests could smoke only outside of their houses. Unfortunately, the lack of this information before the introduction of the new ban does not allow studying its causal effect on this proxy of social acceptability, even if it is important to monitor this indicator in the following years.

higher levels of aggregation. This social multiplier could explain the large drop in smoking among some demographic groups registered in the US in the last decade.

This paper contributes to the literature reviewed above in the following ways. First, we focus on the effects of a specific type of public smoking control policy -- the so called "comprehensive" smoke-free law -- on workers' health within workplaces. These types of smoking bans, covering all public indoor places and all workplaces (either public or private), represent one of the pillars of the EU smoking control policy and in recent years have been implemented in most of the EU Member States, while little is still known about their effects on workers' health. Second, we use comparable micro-data for a large number of (European) countries to study the effect of smoking control policies both on exposure to smoke, as well as on direct measures of workers physical health (such as the presence of respiratory problems). Our empirical strategy exploits variation in the timing and design of smoking control policies, as implemented by various countries, to assess the causal effect of comprehensive smoking regulations on workers perceived health using a quasi-experimental approach (i.e. a 'Diff-in-Diff' estimator). Finally, we test whether such bans may produce some "unintended" effects within workplaces beyond those expected on risk exposure and workers smoke-related health.

3. Institutional setting and stylised facts

At the EU level, tobacco control policies have been so far promoted through non binding resolutions and recommendations. More specifically, in 1989 a Council Resolution (89/C 189/01) invited Member States to adopt adequate measures to ban smoking in public places and on public transport. More recently, in 2003 a Council Recommendation (2003/54/EC) asked for more national measures against passive smoking in indoor workplaces, enclosed public places and public transport. Other indications against smoking are highlighted in a number of EU Directives covering all the risks to the health and safety of workers or addressed to specific sectors or specific groups of workers (such as the 1992 Pregnant Workers Directive). Furthermore, the European Community has signed the World Health Organization Framework Convention on Tobacco Control (FCTC), the most widely embraced international treaty recognising that "[…] the spread of the tobacco epidemic is a global problem, with serious

consequences for public health that calls for the widest possible international cooperation and the participation of all countries in an effective, appropriate and comprehensive international response" (World Health Organization, 2003). As co-signatories of the FCTC, the European Community and its Member States have to design and implement all the necessary measures to tackle passive smoking in indoor workplaces and public places, including public transport.

All these principles are recalled in the 2007 Green Paper, *Towards a Europe free from tobacco smoke: policy at the EU level* (COM(2007) 27 final), which acknowledges health, economic and social costs associated to exposure to tobacco smoke and investigates all the possible policy options that may be implemented to tackle this problem.

In recent years, following the EU recommendations, many EU countries have adopted new laws banning smoking in all indoor public places and all workplaces. In this respect, Table 1 presents the ranking of the EU-15 countries according to the date of actual introduction of such smoking bans. These were first introduced by Ireland in 2004, followed by Italy and Sweden in 2005. All the other EU countries did the same in the following years, albeit at different dates: Belgium, Spain and Luxembourg in 2006; the UK, Finland and Denmark in 2007. A large group of countries (namely, France, Germany, the Netherlands and Portugal) made the new law effective since January 2008, while the remaining two EU-15 countries (Austria and Greece) are adopting comprehensive smoking bans by the beginning of 2009.

To compare and quantify the implementation of tobacco control policies across European countries, a specific "smoking scale" (Tobacco Control Scale, TCS) has been created by a group of international experts (Jossens and Raw, 2006). The scale is based on six policies which, according to the existing evidence and the recommendations of international institutions (see the World Bank, 2003), should be adopted together in comprehensive and effective tobacco control policies. Such policies are, other than bans and restrictions on smoking in public places and workplaces, cigarette taxation, public information campaigns, bans on the advertising and promotion of tobacco products, health warnings on tobacco product packaging and treatment to help quitting. For each policy, a score was assigned by national experts according to both quantitative data (such as the price of a pack of 20 pieces of Marlboro) and subjective evaluation based

on a common questionnaire. A maximum score was associated to each policy, such that the overall maximum sum could be equal to 100 (corresponding to the overall TCS). In the case of smoking bans, the maximum score was equal to 22 and it was the result of the subjective evaluation on three different aspects: bans in cafes and restaurants, bans in other workplaces and bans on public transport and in other public places (such as educational, health, government and cultural places)[3]. The TCS was created in 2004 and applied for the first time in 2005. An update is also available for 2007.

In Table 1 we report the TCS for both available years, presenting both the overall score and the specific score for comprehensive smoking bans. The latter is highly consistent with the timing of adoption of such bans by EU countries. The 2005 TCS for smoking bans was in fact very high (15 or higher) only for Ireland, Italy and Sweden, the three countries which actually implemented such type of policy before July 2005. The 2007 TCS measures the subsequent reforms implemented in this field in some of the other countries, showing a large improvement mainly in the UK and Spain. Consistently with the timing of adoption discussed before, no change in the TCS for smoking bans is registered in either of the three countries which first adopted such bans or in the remaining countries which did that after July 2007[4].

Furthermore, the overall TCS highlights that comprehensive smoking bans are important in the tobacco control policies of many countries, but also other policies may play a crucial role, as shown by the relatively high score registered by the UK even before the introduction of comprehensive bans (determined by high taxation, spending on public information campaigns and on treatment to help quitting).

Despite the degree of enforcement of such reforms and the public debate, which preceded and followed their implementation in almost all the EU countries, comparable aggregate statistics -- as shown in Table 2, taken from the Eurobarometer survey -- do not reveal clear cut effects in trends of smoking prevalence and the intensity of smoking in the entire population[5]. Countries are once again ranked according to the date of introduction of comprehensive smoking bans but, if we compare countries in the ranking, we do not observe larger changes in either the share of smokers, the share of

[3] See Jossens and Raw (2006) for a detailed description of the scale.

[4] A major exception is France, which has been implementing its smoke-free legislation in two stages, in 2007 and 2008.

[5] The Eurobarometer survey periodically monitors the attitude of Europeans towards tobacco.

regular smokers, or the number of cigarettes smoked right after the adoption of the new smoke-free laws. In the last decade all the EU countries have been actually experiencing a progressive decline in smoking prevalence and intensity, with no substantial differences after the date of implementation of comprehensive smoking bans[6].

Some effects, at least at the descriptive level, seem instead to emerge when we consider the incidence of passive smoking, particularly at work. Unfortunately, so far there are no official time series statistics providing such information, but the few cross-section data available show a positive correlation between the adoption of comprehensive smoking bans and the incidence of passive smoking. Figure 1 depicts the incidence of workers exposed to tobacco smoke at the workplace in 2005 (panel 1a) and 2006 (panel 1b) according to two different sources: the European Working Conditions Survey (EWCS) and the Special Eurobarometer (SE), respectively. In both panels countries are ranked in ascending order according to the incidence of passive smoking at work. The first panel clearly shows that this indicator is much lower in those countries that introduced a new smoke-free law before the end of 2005. At a descriptive level, with the exception of Italy, the evidence presented in the second panel for 2006 confirms the above patterns, where the relative improvement in the ranking of Luxembourg and Belgium is explained by the implementation of the new law in 2006[7].

Hence, in light of this descriptive evidence, it seems important to pay specific attention to the causal effects of comprehensive smoking bans on individual health at the workplace.

4. Data and empirical strategy

The empirical analysis is based on individual data from different waves of the European Working Condition Survey (EWCS). This survey is carried out every five years by the European Foundation for the Improvement of Living and Working Conditions on a representative sample of workers in the EU Member States and other European

[6] Italy is partly an exception, since the share of regular smokers has been significantly decreasing since 2005 and this reduction has been larger than in the other countries.

[7] The comparison between the two figures is not informative in terms of trends over time, since they are based on different sources and different questions. Rather, this comparison may be useful to check the robustness of rankings based on cross-section data. Note also that the Eurobarometer survey is addressed to the entire population (including a sub-sample of workers), while the EWCS survey is focused only on workers. The number of valid observations for work-related statistics is then much larger (and subsequent results more reliable) in the second case. See the next section for further details on the EWCS.

countries[8], with the aim to investigate the main characteristics and evolution of working conditions across Europe. The survey then provides detailed information on a wide range of work-related issues, such as work organisation, wage structure, working time, contractual arrangements, equal opportunities, training and job satisfaction. It includes also demographic and other background information like age, gender, education (in the last wave), family composition and social attitudes (such as union or sport club membership). As many other individual socio-economic surveys, some questions required subjective evaluation on specific work aspects, such as job security, work-related health, exposure to risk and work intensity. Even if subjective measures may be different from objective ones, it is not necessarily true that the last are always preferable to the first: in most cases individual choices are in fact more driven by subjective perceptions rather than by objective conditions, with relevant socio-economic consequences (Karppinen et al., 2006). The survey was conducted for the first time in 1990; at present four waves are available, referring respectively to 1990, 1995, 2000 and 2005.

In light of the institutional setting discussed above, we base the core of our empirical analysis on the last two waves (2000 and 2005). We exploit the institutional reforms and the different timing of introduction of comprehensive smoking bans across the EU countries as an exogenous shock, which provides the kind of randomisation needed to identify causal effects of comprehensive smoking bans on perceived workers health. In practice we implement a Diff-in-Diff approach using late adopters as the comparison group. More specifically, we compare the evolution of different measures of perceived work-related health of workers in countries introducing a comprehensive smoking ban (the so called "treated") with respect to workers in countries which did not implement such reform over the period considered (the so called "controls").

More formally, we estimate the following model:

$$Y_{it} = \alpha + \beta_1 Treat + \beta_2 Y_{2005} + \beta_3 Treat * Y_{2005} + \gamma X_{it} + \varepsilon_{it} \quad t = 2000,2005 \qquad [1]$$

where Y_{it} is a measure of (perceived) health for the i-th worker in year t, *Treat* is a

[8] For each wave, the target number of interviews is around 1.000 in all countries, except the smallest ones (such as Cyprus, Estonia, Luxemburg, Malta and Slovenia). The survey provides also sampling weights in order to make reliable comparisons across countries.

dummy equal to one for treated countries, Y_{2005} is a dummy equal to one for the post-treatment year (in our case, 2005), X_{it} is a vector of controls (including national, personal, firm and job characteristics) and ε_{it} the usual error term. α, βs and γs are parameters to be estimated, with β_3 identifying the causal effect of comprehensive smoking bans on workers health (i.e., the change in *Y* before and after the treatment for the treated with respect to the controls).

In light of the institutional setting discussed above and the nature of the data, we considered as "treated" those countries which passed and enforced a new (wider) law on comprehensive smoking bans between 2000 and 2005, namely Ireland, Italy and Sweden[9]. Note that, according to the Tobacco Control Scale 2005 reported in table 1, these are actually the three countries with the highest score for the extension and enforcement of smoke-free legislation (see the "Smoking bans" column under TCS 2005). All the other EU-15 countries are considered as controls[10].

Regarding workers' health, the EWCS contains different measures of perceived work-related health. We decided to focus our analysis on those outcomes that are likely to be more directly influenced by the introduction/restriction of smoking bans. More specifically, we consider a measure of risk exposure (proxied by the exposure to smoke at work) and an indicator of health problems linked to smoke exposure (such as respiratory problems caused by working conditions).

Regarding the first outcome, unfortunately a specific question related to the exposure to tobacco smoke from other people at work was asked for the first time only in 2005, thus preventing to study its change over time. We then use the general exposure to smoke and fumes at work as a proxy for risk exposure also to passive smoking: the time span considered, the definition of the treated and control group and the large set of controls (including occupation, industry and a rich set of working conditions) should allow to take into account potential changes in the outcome due to composition effects (for example, a shift towards industries/occupations characterized by higher risk exposure to fumes different from tobacco smoke) or deterioration in working conditions (implying a

[9] Given that the treated group is quite heterogeneous in terms of geographical position and socio-economic characteristics and given that almost all the EU countries, following EU recommendations, implemented such laws in a relatively short period of time, it is reasonable to assume that the treatment is exogenous.

[10] We decided to exclude the Eastern European countries from the control group in order to get a set of countries relatively more comparable with the treated ones.

greater risk to exposure to fumes different from tobacco smoke). The first dependent variable is then a dummy equal to one if the worker declares to be exposed at work to breathing in smoke or fumes for at least 25 percent of the time.

The second outcome we consider is the presence of respiratory difficulties due to work, which is measured by a dummy variable equal to one if the workers mentioned it among a list of possible work-related health problems[11].

We use a rich set of controls both at the individual as well as country level (see Appendix I for the complete list and basic statistics). More specifically, since identification is based on differences between countries and over time, we include a large set of time varying country-specific controls to capture national attributes in terms of size, wealth, life expectancy, labour market conditions, smoking prevalence, outdoor air quality and national occupational health and safety (OHS) regulations. Concerning individual working conditions, EWCS data also allow us to control for specific risk exposure at work (such as, exposure to noise, vibration and high/low temperatures) and specific working conditions (such as moving loads, tiring positions, use of personal computer or special clothes)[12].

Finally, we tested the existence of heterogeneous effects among the treated by estimating the following specification:

$$Y_{it} = \alpha + \sum_{j=1}^{K} \beta_{1j} Treat_j + \beta_2 Y_{2005} + \sum_{j=1}^{K} \beta_{3j} Treat_j * Y_{2005} + \gamma X_{it} + \varepsilon_{it} \qquad t = 2000,2005 \qquad [2]$$

where all the variables and parameters have the same meaning as above and K is the number of treated (in our case K=3).

[11] More specifically, the workers were asked whether their work affected their health and they had to look at a card showing a list of potential work-related health problems (including respiratory difficulties) and they had to mention those affected by their work.

[12] The inclusion of these controls may be a way to better account for unobserved heterogeneity. Note that Angrist and Pischke (2008) point out that the vector of regressors may include individual level characteristics as well as time-varying variables measured at the state level. Only the latter are likely to be a source of omitted variables bias, but individual-level controls can increase estimates precision by reducing the standard error of the Diff-in-Diff effect. Furthermore, the Diff-in-Diff specification should include only individual controls which are not expected to be influenced by the treatment. Given that national comprehensive smoke-free laws apply to all the workplaces and public places within a country, we expect our firm and job-related controls to be largely unaffected by the policy considered.

5. Main results

Given the binary nature of the dependent variables (i.e. exposure to smoke and fumes (0,1); having respiratory problems (0,1)), we use a standard probit model to estimate equation [1] and [2] above. The estimated causal effect of comprehensive smoking bans on workers' health, using the same notation as before, is given by the β_3 parameter. The main set of estimates is presented in Tables 3 and 4 (marginal effects are reported) [13]. In particular, in column 1 we report the most parsimonious specification (i.e. simple Diff-in-Diff estimates without additional controls); in column 2, we add country-level controls; column 3 includes personal and firm characteristics; job characteristics are added in column 4; controls for detailed working conditions and specific risks exposure are included in the specification reported in column 5. The more general specification, in column 5, is our preferred choice. Finally, in column 6 we report estimates with heterogeneous effects (see equation [2])[14].

Results show that the introduction of comprehensive smoking bans has significant effects on workers' perceived health, particularly on the probability of exposure to smoke and fumes. Estimates based on the Diff-in-Diff specification (Table 3) provide evidence that exposure to smoke is lower for workers in the treated countries after the treatment period, as compared to the control group, and the difference is statistically significant also when we control for risk exposure. According to our estimates, in column 5, the probability of exposure to smoke and fumes on the job for workers in the treated countries after the introduction of the comprehensive smoking ban is 1.6 percent points lower than for workers in the control group (see the β_3 estimate)[15]. There is also evidence of heterogeneous effects among the treated: when we enter each treated country separately a statistically significant negative effect is found for Italy and Sweden, but not for Ireland (see the β_3 estimates in Table 3, column 6)[16].

Similar results are found when we consider work-related physical health: the impact of

[13] Puhani (2008) shows that the treatment effect with a non linear "difference-in-differences" model is measured by the marginal effect of the coefficient of the interaction term of the time and the treatment group indicator (i.e., the marginal effect of β_3 in our notation).

[14] While heterogeneous effects of equation [2] were estimated also by gradually adding the set of controls, in column 6 we only report estimates based on our preferred specification. The whole set of results is available from the authors upon request.

[15] Note that all the EU-15 countries are characterized by a significant reduction in the probability of exposure to smoke (given that the estimated β_2 is negative and statistically significant), but this reduction was more pronounced in the treated countries (as measured by the β_3 coefficient).

[16] Note that in the case of Ireland, this results is mainly due to a relatively high standard error rather than an estimated effect close to zero.

comprehensive smoking bans on the indicator of work-related respiratory health problems is negative and statistically significant, but the size of the effect is smaller than that found for risk exposure (Table 4). Furthermore, also in this case, the estimated Diff-in-Diff effect is negative and statistically significant only for Italy and Sweden.

It should be pointed out that smoking bans in Ireland are stricter than those implemented in Italy and Sweden: the Irish law actually ensures total protection against smoking in all enclosed workplaces and public places, while the Italian and Swedish laws promote comprehensive protection by allowing smoking only in separate ventilated smoking rooms. Given these differences, our estimates suggest that the impact of smoking bans is not necessarily higher where they are more severe.

Overall, the evidence presented suggests that the introduction of comprehensive smoking bans has (statistically) significant effects on perceived workers' health. The effect, however, varies with the outcome variable considered: it is more relevant when the probability of exposure to smoke at work is considered, as opposed to the probability of declaring work-related respiratory problems[17]. Moreover, these results stress the relevance of enforcement practices to make comprehensive smoking bans effective. In this respect, the Italian case is a useful example: while being historically characterized by a plethora of various smoking restrictions -- which were never really fully enforced -- the comprehensive smoke-free legislation recently introduced in Italy has been strictly enforced and widely complied with by people (Joossens and Raw, 2007)[18].

6. Robustness checks

In order to test the robustness of our results, we performed a number of robustness checks. First, we verified whether our estimates were sensitive to the set of countries included in the control group. The model was re-estimated excluding workers of one country at a time from the control group. The relevant Diff-in-Diff estimates (i.e., estimates of parameter β_3, with corresponding 95% confidence intervals) are shown in

[17] Given that the post-treatment period is very close to the introduction of the treatment, this result may also be due to the fact that comprehensive smoking bans produce immediate effects on risk exposure, but more time is needed to see direct effects of such lower exposure to tobacco smoke on workers' health (Peto et al., 2000).

[18] According to official data, only 1.5% of the total inspections carried out by the police and other civil forces resulted in a violation of the current law (Gallus et al., 2006).

figure 2. The corresponding excluded country is reported on the horizontal axis of each panel, while estimates are sorted in ascending order according to the overall score of the 2005 TCS referred to the excluded country. As it appears from the figures, overall our results do not appear to be much sensitive to the number and types of countries included in the control group. Furthermore, Diff-in-Diff estimates are not systematically influenced by the position held by the excluded country in the TCS (i.e. no statistically significant smaller (larger) effect is found when the excluded country scored low (high) in the 2005 TCS).

Second, the model was re-estimated using as dependent variable a more general indicator of perceived work-related health, which should not be directly affected by changes in smoking bans at the workplace. More specifically, we considered a dummy variable equal to one for workers declaring that their jobs affected (negatively) their health. Even if it is true that the introduction of smoking bans can be expected to influence also this outcome (at least in the medium-long run), such effect should be indirect and arguably smaller as compared to that estimated for outcomes that are more related to such type of policy. In other words, if the introduction of smoking bans produces sizeable effects also on this general job-related health outcome, the robustness of our results in terms of causal effects of smoking bans (on both exposure to smoke and respiratory problems) would be weaken, suggesting the existence of specification errors or other confounding factors affecting our preferred outcomes (such as more general public health policies implemented simultaneously with the comprehensive smoking bans). The main results reported in table 5 show that the estimated Diff-in-Diff effect, when statistically significant, bear the wrong sign. With respect to workers in the control group, the introduction of comprehensive smoking bans seems to increase, rather than to decrease as expected, the probability of job-related general health problems in the treated countries (particularly in Ireland and Sweden) after the treatment. Hence, we are comforted that the causal effects estimated and discussed in the previous sections are not spurious correlations.

Finally, we exploited the previous waves of the EWCS to perform a sort of "placebo" test by pretending that the introduction of comprehensive smoking bans in the three treated countries happened between 1995 and 2000 (instead of between 2000 and 2005). We considered the 1995 wave as the pre-treatment year and the 2000 wave as the post-

treatment one and we re-estimated our model still considering Ireland, Italy and Sweden as our treated group (and the other EU-15 countries as controls). In this case, the finding that the artificial introduction of smoking bans produces significant effects on either the probability of exposure to smoke or the probability of declaring respiratory difficulties would suggest the existence of a long term trend in reported smoking problems within workplaces and cast doubts on our identification procedure. The main results of the "placebo" test, as reported in table 6, support the reliability of our main findings. In the first two columns, for each outcome variable, we present estimates of equation [1] (respectively, without controls and with the complete vector of controls), while in the third column we present estimates of the heterogeneous effects (as in equation [2], with the whole set of controls). Diff-in-Diff estimates show no statistically significant effect of the treatment on either of the outcomes considered (see the estimated coefficient β_3). In the case of Sweden, the "placebo" effect of the smoking bans goes in the opposite direction increasing, rather than decreasing, the probability to declare respiratory difficulties (see estimate of β_3(Swe) in the last column is positive and statistically significant).

7. A step further: are there indirect or unintended effects?

A few studies discussed in Section 2 highlight that smoking bans, particularly in public recreational places, may sometimes produce unintended effects which can partly off-set their positive impact in terms of declining smoke exposure and improving physical health. In light of this evidence, we explore the hypothesis that comprehensive smoking bans may have unintended effects within the workplace.

For example, since smoking bans seem to improve work-related health, we should observe some effects in terms of declining absenteeism, and related (positive) effects on firms productivity. Alternatively, the introduction of smoking restrictions within workplaces may increase the level of anxiety and irritability of workers used to smoke at the workplace, with (negative) effects on firm productivity and worse relationship with co-workers.

In this respect, we consider two new binary outcomes measuring, respectively, whether the worker has been absent from work in the twelve months before the survey for work-related health reasons and whether the worker declared to be anxious or irritable due to

his/her job. Our main results on absenteeism and work-related mental distress are reported in table 7 – i.e. estimates from different specifications are reported in columns 1-3 (absenteeism) and columns 4-6 (mental distress). [19]

Overall our results suggest that indirect and unintended effects may be relevant, particularly those affecting work-related mental health. According to our estimates, the Diff-in-Diff effect on the probability to be absent from work for work-related health reasons is generally negative, but not statistically significant with the only exception of Italy. Conversely, the estimated effect on work-related mental health problems is positive and statistically significant both for the treated group as a whole and for each treated country. Overall, the introduction of comprehensive smoking bans increases the probability to declare anxiety or irritability due to work by more than 8 per cent and this effect is particularly large in the case of Ireland.

While largely overlooked in previous studies, comprehensive smoking bans may have adverse effects on workers' (mental) health at work, which, in the short-run, may reduce the benefits from the reduction in (the probability of suffering from) work related respiratory problems.

8. Concluding remarks

In this paper we have investigated the effects of national comprehensive smoking bans on workers' perceived health with respect to exposure to smoke and presence of respiratory problems within workplaces. We exploited the fact that many European countries introduced, in recent years, comprehensive smoking bans to reduce exposure to tobacco smoke in public places, while others have not, to implement a quasi-experimental method (Diff-in Diff approach) to evaluate the impact of such smoking bans on workers' health. Using comparable micro-data for a large number of European countries with information on workers' perceived health (exposure to smoke and the presence of respiratory problems), we showed that the introduction of comprehensive smoking bans has a significant effect on workers' perceived health. Our point estimates suggest that countries which did introduce comprehensive smoking bans were successful in reducing by 1.6 percent, on average, the probability of exposure to smoke,

[19] For each outcome variable, we report results obtained with different model specifications (no controls in columns 1 and 4; the complete vector of controls in columns 2 and 5) and estimates of heterogeneous effects (columns 3 and 6).

and the presence of respiratory problems. These results are shown to be robust to the inclusion of a large set of country-level controls, as well as to a number of robustness checks. Differences across European countries suggest that the impact is not necessarily larger when the bans are stricter, as in the case of Ireland.

Furthermore, regardless of their degree of strictness, smoking ban reforms seem also to produce relevant indirect and unintended effects, some of which may offset the positive effects on workers' physical health. More specifically, we found an adverse effect on workers' reported mental health at work. In other words, the introduction of smoking bans seems to increase the probability to report work-related irritability and anxiety, which in turn may (negatively) affect workers' motivation and productivity.

Our empirical evidence confirms that comprehensive smoking bans are an effective policy to fight exposure to tobacco smoke: compared with country rankings in terms of the Tobacco Control Scale indicator, our empirical results actually provide additional support to the effectiveness of comprehensive smoking bans in curbing exposure to tobacco smoke and work-related respiratory problem. However, more effort is needed to identify and evaluate their potential "side" effects in order to implement the proper policy mix. For example, given our evidence on the unintended increase of mental distress, the introduction of smoking bans within workplaces should be supported by psychological counselling and/or treatment to help those workers who were used to smoke at the workplace. Alternatively, a further way to assist individuals is to develop appropriate information campaigns to accompany smoking bans, such as publicising health and productivity effects, for both workers and firms.

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Table 1 - Comprehensive smoking bans and the Tobacco Control Scale (TCS)

		TCS 2005		TCS 2007		Change 2005-2007	
	Date 1st comprehensive smoking ban	Smoking bans (max 22)	Total (max 100)	Smoking bans (max 22)	Total (max 100)	Smoking bans	Total
IRELAND	March 2004	21	74	21	74	0	0
ITALY	January 2005	17	57	17	57	0	0
SWEDEN	June 2005	15	60	15	61	0	1
BELGIUM	January 2006	8	50	13	58	5	8
SPAIN	January 2006	3	31	15	55	12	24
UK	March 2006-July 2007°	1	73	21	93	20	20
LUXEBOURG	September 2006	4	26	11	36	7	10
FRANCE	February 2007*	6	56	12	59	6	3
FINLAND	June 2007	12	58	12	58	0	0
DENMARK	August 2007	3	45	3	45	0	0
GERMANY	August 2007-2009°	2	36	2	37	0	1
PORTUGAL	January 2008	5	39	5	42	0	3
NETHERLANDS	July 2008	9	52	9	50	0	-2
AUSTRIA	January 2009	4	31	4	35	0	4
GREECE	July 2009	7	38	7	36	0	-2

° Depending on the region. * The deadline was extended to January 2008 for bars and restaurants.

Note: Countries are ranked according to the date of introduction of a comprehensive smoke-free legislation (as reported by the European Commission). The score for smoking bans refers to legislation in force on 1st July of each year. The TCS is a composite indicator based on both quantitative and qualitative information gathered and evaluated by national experts on the basis of a common questionnaire and common guidelines. Other than the presence and intensity of smoking bans, it measures the price of cigarettes and other tobacco products (max score: 30), spending on public information campaigns (max score: 15), comprehensive bans on advertising and promotion (max score: 13), large direct health warning labels (max score: 10) and treatment to help quitting (max score: 10)

Table 2 - Recent trends in smoking prevalence in the EU-15

	% smokers			% regular smokers			% heavy smokers		
	2002	2005	2006	2002	2005	2006	2002	2005	2006
IRELAND	34	32	29	91	84	88	39	40	37
ITALY	34	30	31	90	82	77	27	21	19
SWEDEN	24	21	20	75	82	80	11	12	11
BELGIUM	32	29	29	87	78	81	45	31	31
SPAIN	41	32	34	89	86	91	34	36	28
UK	42	30	37	90	82	86	40	33	28
LUXEBOURG	32	35	28	88	85	91	36	35	38
FRANCE	43	38	36	91	87	89	33	23	25
FINLAND	33	27	28	84	83	78	31	29	27
DENMARK	39	39	30	86	86	86	33	35	28
GERMANY	35	33	32	84	88	85	31	31	22
PORTUGAL	28	29	25	89	90	89	43	46	38
NETHERLANDS	39	34	34	82	79	81	23	27	25
AUSTRIA	38	42	33	84	84	81	42	32	36
GREECE	42	43	42	91	91	89	61	64	53

Source: Eurobarometer 58.2, 64.1 and 66.2

Note: Countries are ranked according to the date of introduction of a comprehensive smoke-free legislation. Smokers include people smoking cigarettes, cigars and pipe. Regular smokers is the % of smokers declaring to smoke regularly. Heavy smokers is the % of cigarettes smokers who smoke 20 or more cigarettes a day.

Table 3- The effect of comprehensive smoking bans on exposure to smoke and fumes at the workplace

Marginal effect from probit estimates; dep. var: dummy equal to 1 if the worker declares to be exposed to fumes or smoke at work

	(1)	(2)	(3)	(4)	(5)	(6)
β_1	-0.009	-0.013	-0.013	-0.010	-0.007	-
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	
β_1(Ire)	-	-	-	-	-	-0.014
						(0.01)
β_1(Ita)	-	-	-	-	-	-0.006
						(0.01)
β_1(Swe)	-	-	-	-	-	0.011
						(0.02)
β_2	-0.047***	-0.067***	-0.071***	-0.064***	-0.070***	-0.067***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
β_3	-0.030***	-0.023	-0.022	-0.021	-0.016**	-
	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	
β_3 (Ire)	-	-	-	-	-	-0.018
						(0.01)
β_3 (Ita)	-	-	-	-	-	-0.013**
						(0.006)
β_3 (Swe)	-	-	-	-	-	-0.008*
						(0.00)
Country-level controls	no	yes	yes	yes	yes	yes
Personal and firm characteristics	no	no	yes	yes	yes	yes
Job characteristics	no	no	no	yes	yes	yes
Risk exposure	no	no	no	no	yes	yes
Pseudo R2	0.006	0.013	0.139	0.203	0.387	0.387
N. Observations	30180	30180	30180	29805	29805	29805

Note: Weighted estimates. Robust standard errors in brackets. * p<.1; ** p<.05; *** p<.01.

Table 4 - The effect of comprehensive smoking bans on work-related respiratory problems

Marginal effect from probit estimates; dep. var: dummy equal to 1 if the worker declares to have respiratory problems due to work

	(1)	(2)	(3)	(4)	(5)	(6)
β_1	-0.009***	-0.013***	-0.012***	-0.010***	-0.006***	-
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
β_1(Ire)	-	-	-	-	-	-0.005
						(0.00)
β_1(Ita)	-	-	-	-	-	-0.009***
						(0.00)
β_1(Swe)	-	-	-	-	-	-0.004
						(0.00)
β_2	0.003	-0.006	-0.008	-0.005	-0.004	-0.003
	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)
β_3	-0.010*	-0.010*	-0.008*	-0.007**	-0.006**	
	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	
β_3 (Ire)	-	-	-	-	-	-0.000
						(0.01)
β_3 (Ita)	-	-	-	-	-	-0.008***
						(0.00)
β_3 (Swe)	-	-	-	-	-	-0.006***
						(0.00)
Country-level controls	no	yes	yes	yes	yes	yes
Personal and firm characteristics	no	no	yes	yes	yes	yes
Job characteristics	no	no	no	yes	yes	yes
Risk exposure	no	no	no	no	yes	yes
Pseudo R2	0.003	0.024	0.074	0.107	0.192	0.192
N. Observations	30180	30180	30180	29805	29805	29805

Note: Weighted estimates. Robust standard errors in brackets. * p<.1; ** p<.05; *** p<.01.

Table 5 - The effect of comprehensive smoking bans on a general work-related health measure

Marginal effects from probit estimates. Dep. Var.: Dummy equal to 1 for workers declaring that their jobs afftect their health

	(1)	(2)	(3)	(4)
β_1	-0.059***	-0.143***	-	-
	(0.01)	(0.05)		
β_1(Ire)	-	-	-0.285***	-0.272***
			(0.01)	(0.03)
β_1(Ita)	-	-	0.036**	0.032
			(0.02)	(0.06)
β_1(Swe)	-	-	0.098***	-0.016
			(0.02)	(0.09)
β_2	-0.262***	-0.373***	-0.262***	-0.319***
	(0.01)	(0.03)	(0.01)	(0.05)
β_3	0.122***	0.149**		-
	(0.02)	(0.06)		
β_3 (Ire)	-	-	0.217***	0.357***
			(0.03)	(0.04)
β_3 (Ita)	-	-	-0.004	-0.006
			(0.03)	(0.04)
β_3 (Swe)	-	-	0.123***	0.134***
			(0.02)	(0.04)
Country-level controls	no	yes	no	yes
Personal and firm characteristics	no	yes	no	yes
Job characteristics	no	yes	no	yes
Risk exposure	no	yes	no	yes
Pseudo R2	0.043	0.197	0.058	0.199
N. Observations	30180	29805	30180	29805

Note: Weighted estimates. Robust standard errors in brackets.** p<.05; *** p<.01.

Table 6 - The effect of comprehensive smoking bans: a placebo experiment
Marginal effects from probit estimates

	Exposure to fumes/smoke			Respiratory problems		
	(1)	(2)	(3)	(4)	(5)	(6)
β_1	-0.022**	-0.011	-	-0.018***	-0.013***	-
	(0.01)	(0.01)		(0.00)	(0.00)	
β_1(Ire)	-	-	-0.042*	-	-	-0.016***
			(0.02)			(0.00)
β_1(Ita)	-	-	0.052	-	-	0.019**
			(0.03)			(0.01)
β_1(Swe)	-	-	-0.001	-	-	-0.014**
			(0.03)			(0.00)
β_2	0.001	-0.042***	-0.026	0.001	-0.005	-0.006
	(0.01)	(0.01)	(0.02)	(0.00)	(0.00)	(0.01)
β_3	0.009	-0.001		0.012*	0.010	
	(0.01)	(0.01)		(0.01)	(0.01)	
β_3 (Ire)	-	-	-0.002	-	-	0.009
			(0.03)			(0.01)
β_3 (Ita)	-	-	-0.032	-	-	-0.009
			(0.03)			(0.01)
β_3 (Swe)	-	-	0.026	-	-	0.026**
			(0.03)			(0.02)
Country-level controls	no	yes	yes	no	yes	yes
Personal and firm characteristics	no	yes	yes	no	yes	yes
Job characteristics	no	yes	yes	no	yes	yes
Risk exposure	no	yes	yes	no	yes	yes
Pseudo R2	0.006	0.3660	0.3890	0.0026	0.1922	0.1955
N. Observations	30363	24571	24571	30363	24571	24571

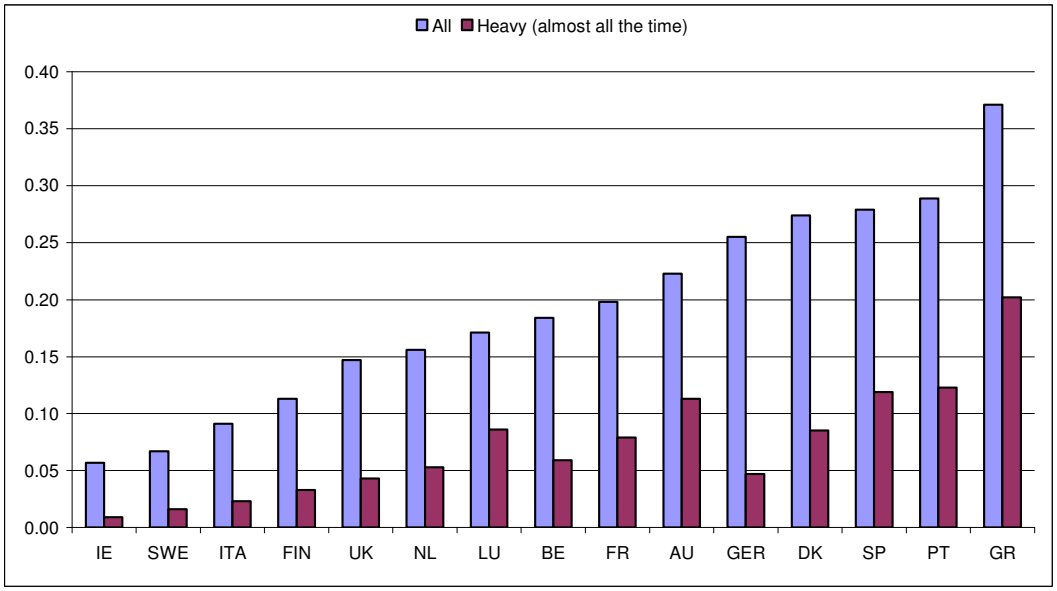
Note: Weighted estimates. Robust standard errors in brackets. ** p<.05; *** p<.01.
Treatment has been fictitiously assigned to the treated countries in 2000. Diff-in-diff is the estimated difference between treated and controls in the 1995-2000 change.

Table 7 - The effect of comprehensive smoking bans: unintended effects
Marginal effects from probit estimates

	Absenteeism fror health reasons due to work			Anxiety, irritability and stress		
	(1)	(2)	(3)	(4)	(5)	(6)
β_1	-0.007	-0.021**		0.012	-0.050	
	(0.01)	(0.01)		(0.01)	(0.03)	
β_1(Ire)	-	-	-0.019**	-	-	-0.141***
			(0.01)			(0.02)
β_1(Ita)	-	-	0.005	-	-	0.013
			(0.02)			(0.04)
β_1(Swe)	-	-	-0.042***	-	-	0.105
			(0.02)			(0.07)
β_2	-0.037***	-0.035***	-0.039***	-0.059***	-0.136***	-0.092**
	(0.00)	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)
β_3	-0.010	-0.011		0.050***	0.083***	
	(0.01)	(0.01)		(0.01)	(0.03)	
β_3 (Ire)	-	-	-0.012	-	-	0.260***
			(0.01)			(0.04)
β_3 (Ita)	-	-	-0.038***	-	-	0.054***
			(0.01)			(0.02)
β_3 (Swe)	-	-	0.001	-	-	0.068**
			(0.01)			(0.03)
Country-level controls	no	yes	yes	no	yes	yes
Personal and firm characteristics	no	yes	yes	no	yes	yes
Job characteristics	no	yes	yes	no	yes	yes
Risk exposure	no	yes	yes	no	yes	yes
Pseudo R2	0.018	0.088	0.089	0.004	0.144	0.146
N. Observations	30180	29805	29805	30180	29805	29805

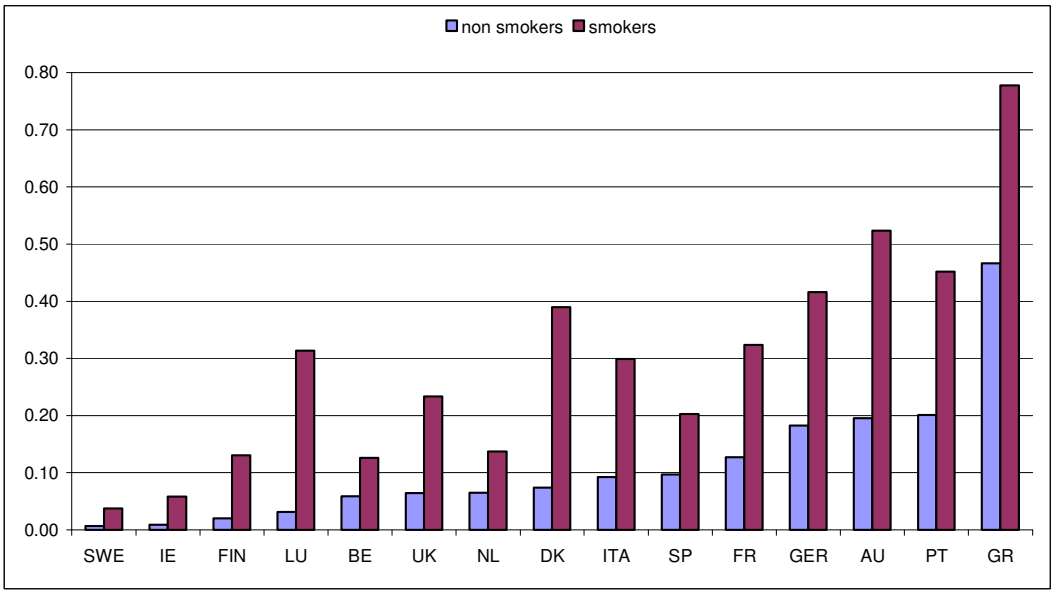
Note: Weighted estimates. Robust standard errors in brackets. ** p<.05; *** p<.01.

Figure 1a - Incidence of passive smoking at work in the EU-15 in 2005



Source: Fourth European Working Condition Survey
Note: countries are ranked in ascending order according to the % of workers exposed to passive smoking at work

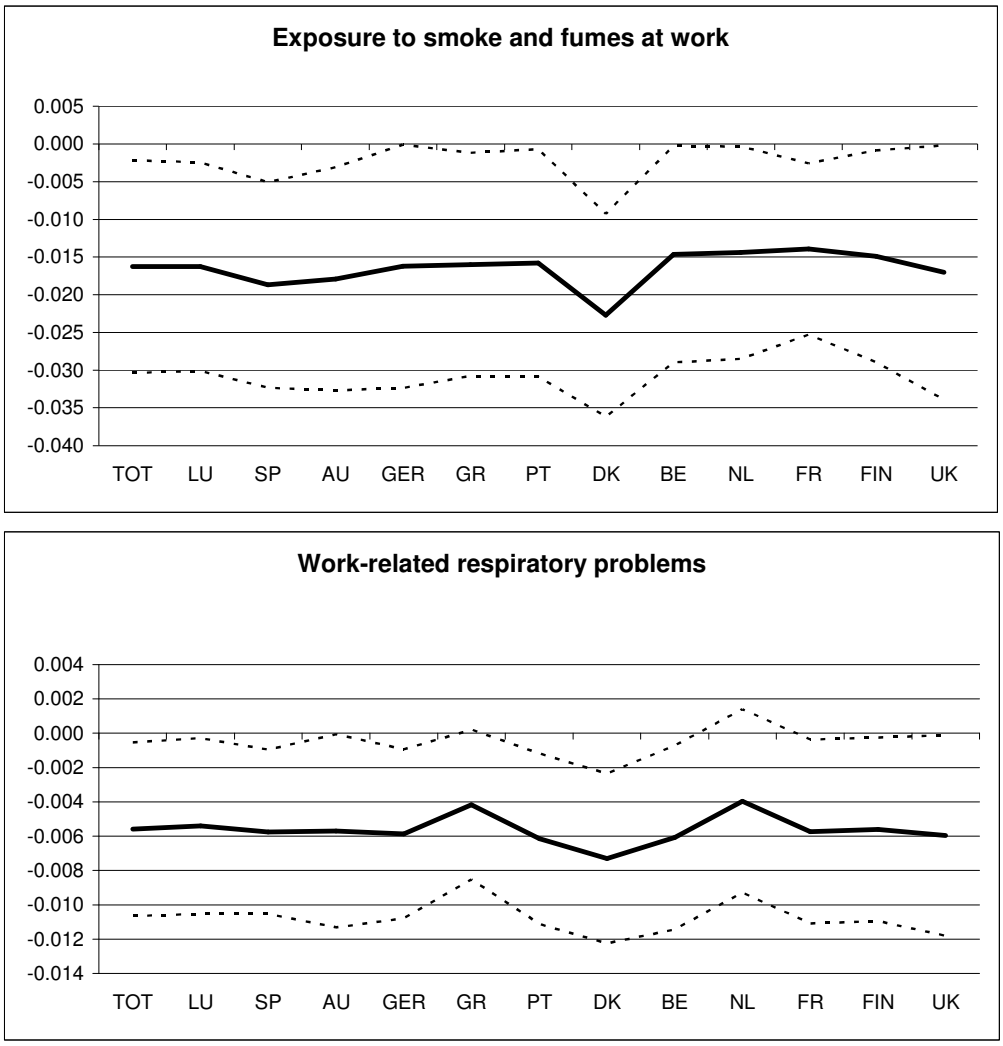
Figure 1b - Exposure to tobacco smoke for people working in indoor workplaces and offices, 2006



Source: Eurobarometer 66.2
Note: countries are ranked in ascending order according to the % of non smokers exposed to tobacco smoke in indoor workplaces and offices
In 2006, comprehensive smoking bans were introduced also in Belgium, Luxembourg, Spain and part of the UK

Figure 2 - Robustness check: estimated Diff-in-Diff effects by changing the control group

Marginal effects and 95% confidence intervals



Appendix

Variables list and basic descriptive statistics

Variables	Mean	St. dev.	Variables	Mean	St. dev.
Dependent variables			**Risk exposure**		
exposed to smoke at work	0.179	0.384	exp_vibrations	0.192	0.394
respiratory problems due to work	0.037	0.190	exp_noise	0.278	0.448
Country-level controls			exp_hightemp	0.218	0.413
log(population)	16.485	1.191	exp_lowtemp	0.187	0.390
GDP per capita	121.673	30.064	exp_chemical	0.132	0.338
Life expectancy at birth	78.737	1.120	exp_xrays	0.049	0.216
Unemployment rate	6.820	2.471	inv_tiring positions	0.434	0.496
Outodoor air quality (1)	26.925	7.823	inv_move loads	0.325	0.468
% smokers	28.386	7.082	inv_repetitive movements	0.608	0.488
Taxes on cigarettes (2)	75.428	3.281	inv_telework	0.108	0.311
Indicator of regulation of OHS (3)	11.202	5.306	inv_pc	0.481	0.500
Personal characteristics			inv_clothes	0.289	0.453
female	0.518	0.500	risk_informed	0.788	0.409
age	38.514	11.620	repetitive tasks	0.468	0.499
member (politics or unions)	0.092	0.289	flexible tasks	0.812	0.390
sports	0.757	0.429	high speed	0.342	0.474
Firm and job characteristics			tight deadlines	0.356	0.479
Firm size (ref:<10 employees)			monotonous tasks	0.402	0.490
size10_49	0.311	0.463	complex tasks	0.569	0.495
size50_99	0.109	0.312			
size100_249	0.100	0.300			
size250_499	0.059	0.235			
size500over	0.104	0.306			
size_dk	0.037	0.189			
Contract (ref: permanent)					
temporary	0.126	0.332			
apprentice	0.015	0.120			
other contract	0.089	0.285			
part_time	0.216	0.411			
tenure	9.270	9.414			
weekly hours	35.972	10.724			
Wage level (ref: low)					
wage_midlow	0.237	0.425			
wage_midhigh	0.217	0.412			
wage_high	0.177	0.382			
shifts	0.178	0.382			
flexible working time	0.503	0.500			
team	0.615	0.487			
free breaks	0.585	0.493			
free holidays	0.583	0.493			
task_rotation	0.486	0.500			
regular second job	0.032	0.177			

Note: Controls include also 22 industries and 10 occupations

(1) population weighted annual mean concentration of fine particulates (PM10, i.e. particulates whose diameter is less than 10 micrometers) at urban background stations in agglomerations.

(2) total taxes (including VAT) as % of retail price of a pack of cigarettes

(3) Number of ILO Occupational Health and Safety (OHS) conventions ratified at the national level (Max=25)