



Smoking bans, maternal smoking and birth outcomes[☆]

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ABSTRACT

An important externality of smoking is the harm it might cause to those who do not smoke. This paper examines the impact on birth outcomes of children of female workers who are affected by smoking bans in the workplace. Analyzing a 2004 law change in Norway that extended smoking restrictions to bars and restaurants, we find that children of female workers in restaurants and bars born after the law change saw significantly lower rates of being born below the very low birth weight (VLBW) threshold and were less likely to be born pre-term. We do not find an effect of the ban along other birth outcomes like APGAR scores and birth defects. Using detailed data on smoking status during pregnancy we find that most of the health benefits come from changes in smoking behavior of the mother. Using individual tax data, we find that the law change did not result in changes in earnings or employment opportunities for those affected, suggesting that the effects seen are likely a direct result of changes in smoke exposure in utero.

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1. Introduction

A vast medical literature has examined the (mainly negative) association between smoking or exposure to smoke and various health outcomes. As a result, governments in many countries all over the world have adopted policies to deter its citizens from smoking. While public information and ad campaigns have been a major force in influencing behavior change in this regard, other methods adopted by governments have included taxes, age restrictions and smoking bans in public areas. While getting people to quit smoking is an important outcome in its own right, one of the key factors in assessing the efficacy of such policies is the extent to which such policies have impacts beyond just smoking behavior change. An important externality in the context of smoking is the health of those not directly affected by smoking, but come in contact with the harmful effects of smoke. We attempt to quantify one such

externality – birth outcomes – as a result of laws that ban smoking in public areas or work spaces.

Smoking bans in the workplace can affect birth outcomes via two important channels – through behavior change of the mother if she is a smoker, or through the changes in second hand smoke exposure (reduced exposure at work, but perhaps increased exposure at home or other places as a result of substituting behavior). While the impact of maternal smoking on the fetus has received considerable attention in the medical literature (Kramer, 1987), with its deleterious effects ranging from low birth weight and other birth defects, to childhood and adult asthma and lower cognitive functioning (Dolan-Mullen et al., 1994; Horta et al., 1997; Sayer and Kleinman, 2002; Weitzman et al., 1990), the impacts of exposure to second hand smoke are less well studied.

On the policy side, while many papers have examined the immediate impacts of taxes or smoking bans on smoking behavior (Anger et al., 2011; Bitler et al., 2011; Brownson et al., 2002; Eagan et al., 2006; Farkas et al., 1999; Nguyen, 2013), few papers in the economic literature have examined the consequences of such policies on birth outcomes (such as birth weight, gestational age and APGAR scores).¹ Evans and Ringel (2001), Lien and Evans (2005) and Simon (2012)

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¹ APGAR scores are a composite index of a child's health at birth and take into account Activity (and muscle tone), Pulse (heart rate), Grimace (reflex irritability), Appearance (skin coloration), and Respiration (breathing rate and effort).

are some of the papers that do examine the impact of such policies on smoking during pregnancy and birth outcomes, however, their policy focus is on changes in cigarette taxes rather than smoking bans. Moreover, their papers are largely silent on the issue of second hand smoke.

Also related to our work is the important work of [Adda and Cornaglia \(2010\)](#) who show evidence consistent with the idea that certain types of smoking bans induce smoking at home, which increases exposure of young children to cigarette smoke. [Adda and Cornaglia \(2010\)](#) however, do not examine direct health effects of smoke exposure on these young children. Hence, the extent to which smoking bans, a very commonly used policy (according to the [American Non Smokers' Rights Foundation \(2012\)](#) nearly 50% of Americans live under bans that prohibit smoking in public areas, workspace and restaurants and bars), affect birth outcomes, and whether the effects arise as a result of changes in second hand exposure is to the best of our knowledge an open question.²

A law change in Norway in 2004 that extended a pre-existing smoking ban to bars and restaurants provides a natural setting for studying some of these questions. Using detailed data on place of work and work histories, we are able to identify mothers who worked in restaurants and bars during this period and find that mothers affected by the law had children with overall better health, especially a 1.8 percentage point lower incidence of very low birth weight (VLBW, defined as births below 1500 g) and a 2.5 percentage point lower likelihood of being born pre-term (defined as births before 36 weeks of gestation). These are substantial improvements given the low incidence of VLBW (2.5%) and pre term births (6.4%); however, part of the decrease in VLBW births arises simply due to lower rates of pre-term births. Controlling for gestational age, we find that the smoking ban results in 0.6 percentage point decrease in VLBW incidence. On other measures like APGAR scores or birth defects however, the overall effect sizes are small and statistically insignificant. We use a difference in difference design by comparing outcomes before and after the law change for people working in restaurants and bars to the same difference but among people who work in a similar occupation (stores). Importantly, smoking was banned in stores throughout the period we examine. A difference in difference design in this context is important to account for naturally occurring seasonal variation in birth outcomes.

Using data on self reported smoking status at the beginning (at 8–12 weeks) and at the end (at the time of hospital delivery) of the pregnancy, we are able to identify workers who would have only been exposed to second hand smoke.³ Comparing their outcomes with those of smokers allows us to examine the consequences of second hand smoke on birth outcomes. We find that second hand smoke exposure as measured in our context has little impact on birth outcomes. The changes in birth outcomes largely come from mothers who quit smoking during pregnancy. For the sample restricted to mothers who smoke at the start of the pregnancy, we find after the ban that mothers in restaurants and bars had healthier children (an improvement in birth weight of 162 g, for example). It is perhaps reassuring that our point estimates for changes in birth weight arising from quitting behavior are remarkably similar to the estimates in [Lien and Evans \(2005\)](#).

A crucial concern in such an exercise is that the law change might have induced other changes, such as changes in the composition of the workforce working in restaurants and bars, income or even the length of time worked in these occupations. Our entire study is based on mothers who were already pregnant by the time the law came into effect, mitigating any concerns of differential selection into fertility as a result of the law change. Given the availability of individual level income data from tax records we are able to address further concerns. The change in law did not result in changes in the composition of mothers who worked in bars and restaurants, nor did it change their income in the near term. Examining extended windows around the reform shows significant composition changes; hence, it is important to restrict the analysis to a short period before and after the reform. An important point to note here is that while we do find evidence that mothers in bars and restaurants were more likely to switch occupations after the reform (this is true even in the near term), the mothers who switch appear identical along observable dimension (including smoking characteristics) to mothers who do not switch. We also show that the usual parallel trends assumption required of difference in difference designs appears valid for the outcomes we examine. Placebo tests imposing a change in smoking law several years before and after the law change reveal no effects for the relevant treatment and control groups. Hence, standard difference in difference robustness checks and other tests points to a causal impact of the law change on birth outcomes. Finally, we are also able to examine children born to the same mother working in restaurants and bars before and after the reform, and establish that even with a mother fixed effect, our essential results hold.

Apart from quantifying the degree of externality due to smoke exposure and thereby addressing the effectiveness of policies that ban smoking, this paper also adds to the literature trying to understand the determinants of early childhood health. In recent years, there has been tremendous focus on the role of early childhood health in determining later life outcomes (see [Almond and Currie, 2011](#) for an excellent review). As a result, many papers seek to highlight factors that matter for infant health; this paper highlights the role of smoke exposure in in-utero development.

Finally, we link birth weight and VLBW status to adult labor market outcomes. VLBW status severely impedes success in the labor market. Using a twins based analysis to infer the causal relationship between birth weight and income and labor force participation as in [Black et al. \(2007\)](#) suggests that children who are VLBW at birth earn 12% less and are 11 percentage points less likely to be employed by the time they are 28 years old. Using these parameters, and under some (admittedly stringent) assumptions, we infer that this particular smoking ban in Norway will likely result in a gain of full time employment of 0.2 percentage points via the channel of lower rates of VLBW. We consider this benefit as only one small component of the potential multitude of benefits that are not monetized in this study (for example, [Sargent et al., 2004](#) show a lower incidence of heart attacks after the implementation of a smoking ban in a US city).

An important caveat in this work is that along with quitting smoking, mothers could also bring about other changes in their life as a result of the smoking ban. We are not able to distinguish whether the changes in birth outcomes arise specifically out of quitting smoking or through other, broader changes in the mother's life like eating healthier or getting more nutrients. To the extent that the smoking ban induced an overall healthier lifestyle, the *policy impact* of the smoking ban on birth outcomes is still relevant. The remainder of the paper proceeds as follows. [Section 2](#) discusses the 2004 smoking ban in the hospitality industry in Norway. In [Sections 3 and 4](#), we discuss our data and the empirical strategy. [Section 4](#) presents our main findings. [Section 5](#) quantifies the effects by using a twin fixed effect approach and the final section offers some concluding remarks.

² More broadly, associations between smoking bans and birth outcomes have been shown in [Kabir et al. \(2009\)](#) who examine the consequences of a comprehensive smoking ban in the workplace in Ireland in 2004. While they show significant improvements in the rate of low birth weight and pre term births after the reform, the results only show associations as the reform affected everyone in the workplace, leaving no control group for causal inference.

³ Unfortunately, we have to rely on self-reported measures of smoking as unlike [Adda and Cornaglia \(2010\)](#) we do not have measures of cotinine levels. We address measurement issues associated with this variable in [Section 2](#).

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