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ESCOLA DE ECONOMIA DE SÃO PAULO

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Smoke-free law and birth outcomes: Evidence from São Paulo

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Dissertação apresentada à Escola de Economia de São Paulo como pré-requisito à obtenção de título de mestre em Economia de Empresas.
Orientador: Prof. Dr. Daniel da Mata

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Resumo

Analisa-se o impacto sobre os resultados do nascimento de recém-nascidos de trabalhadoras grávidas que foram afetadas pela proibição do fumo em seus locais de trabalho. Analisamos o caso de São Paulo, Brasil, primeiro estado a restringir a lei antifumo em locais fechados em 2009. Nossos achados mostram que a lei melhorou a saúde da gestante, medida pelo aumento do peso médio ao nascer em torno de 28g. Esses efeitos positivos foram mais fortes para grupos relacionados à gravidez indesejada: mães não casadas e jovens. Essas descobertas, juntamente com a hipótese da origem fetal, indicam que a nova legislação pode ter impactos de bem-estar de longo prazo.

Palavras-chave: Economia da saúde, lei antifumo, avaliação impacto

Abstract

We explore the impact of the smoke-free law on birth outcomes of the newborn from pregnant workers affected by the legislation. We analyzed the case of São Paulo, Brazil, the first state to restrict smoke-free law in indoor places in 2009. Our findings show that the law improved infant health, measured by the increase in mean birth weight of around 28g. These positive effects were stronger for groups related to unintended pregnancy: single and young mothers. These findings along with the fetal origins hypothesis indicate that new legislation may have long-term welfare impacts.

Keywords: Health economics, smoke-free law, impact evaluation

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1 Introduction

The World Health Organization estimates that smoking is the main cause of avoidable deaths in the world (WHO (2021)). However, this risk is not just for smokers as secondhand smoker - despite not consuming tobacco - suffers from its adverse effects. Furthermore, this negative externality goes beyond just the death risk. The environmental tobacco smoke exposure has short-run risk (e.g. breathing problems), long-run (e.g. cancer) and intergenerational implications for infants whose mothers are exposed to the smoking environment.

Despite initial controversy, nowadays is well established that there is a causal effect between the number of cigarettes smoked by mothers and the weight at birth. Several studies support this association (Abel (1980), Brooke *et al.* (1989), Asmussen (1988), Foy (1988)). The focus on secondhand smoke has also attracted the attention of researchers, and although more difficult to find causality, several articles reached a similar conclusion: The environmental tobacco smoke exposure reduces birth weight (Dejmek *et al.* (2002), Rashid & Rashid (2003), Dejin-Karlsson *et al.* (1998)).

An important consequence of smoking exposure is the intergenerational implications. If smoke affects birthweight, should the last have long-lasting adverse impacts on individuals? This question started to be answered by Barker & Osmond (1986) who find a correlation between prenatal nutrition, infant mortality and adults' heart problems. The medical literature firstly investigated this topic and today it also permeates economic discussions. Black *et al.* (2007), for example, improve the identification problem and focused on economic factors, concluded that low birthweight has an impact on earnings and education. Nowadays, this literature related to the fetal origins hypothesis is well established and shows us that weight at birth has an impact on health and economic outcomes throughout life.

This study aims to evaluate the effect of smoke-free law in the state of São Paulo, Brazil. This law was created in 2009 and with the objective of minimizing the negative short-run effect of smoking-related health problems, the state of São Paulo, adopted new legislation restricting smoking in indoor places. The focus was especially on bars and restaurants, even though other establishments were also involved. As imagined, the smokers did not enjoy this novelty and the owners of bars and restaurants tried to protect their customers. However, the law was enacted and the improvement o air quality was the first signal that the law was necessary (Issa *et al.* (2011)). The first studies on this law also focused on the short-run, ScholzI & AbeII (2016) conclude that there was a reduction in hospitalization rates for stroke and heart attack.

However, our focus in this study is on another group affected by law: pregnant women. Until 2009, all pregnant who work in these jobs had to spend time as passive smokers, a situation that changes from May 2009. Our interest is to study if this new legislation indeed improved neonatal health. More precisely, we leverage individual-level administrative data to investigate the effects of the legislation on birth outcomes. Collecting data from SINASC ("National System of Information on Birth Records"), we have information about the newborn, like birthweight and attributes from mothers, such as workplace, schooling, and race. Therefore, we can compare the birthweight from mothers who were working in bars and restaurants to those who were workers in less exposed occupation and estimate the impact of the law. Due to this setup, we use the difference-in-difference approach to measure the impact of the smoke-free law on birthweight.

We contribute to the literature on the health consequences of smoking-free legislation (Been *et al.* (2015), Cox *et al.* (2013), McKinnon *et al.* (2015)). Our work is closely related to Bharadwaj *et al.* (2014), which studied the effects of a smoking-ban law on birth outcomes in Norway. Our analysis innovates in at least four aspects. Firstly, they used the date of birth instead of the date of conception (on section 5 we explain the importance of this approach). Secondly, Bharadwaj *et al.* (2014) used just the static difference-in-difference while we employ the dynamic DiD in our estimation. Thirdly, their setting is in a developed country (Norway), while we access whether the effect differs in a developing country. In the context of developing countries, poorly enforced legislation is not unusual, so the potential positive benefits may not be verified. By contrast, when legislation is enforced, our prior guess is that we should have a greater outcome in Brazil, because in developed countries they have a better health system implying greater medical follow-up, which could overcome some possible troubles during pregnancy, such as secondhand smoking. Finally, as São Paulo has a population eight times larger than Norway's, we could assess heterogeneous impact in our analysis.

Our results reveal that the mean birthweight from treatment group increased 28g after the new legislation. The Norway case showed higher numbers: a gain of 58g for the infant, however maybe because they used a smaller sample, they did not reach statistical significance at 10%. Other studies focused on secondhand smoke, but relying on surveys, found similar numbers. Zhang & Ratcliffe (1993) related the environmental tobacco exposure to a reduction of 30g in the newborn weight while Leonardi-Bee *et al.* (2008) in their meta-analysis found 33g reduction due to passive smoke. Moreover, assessing heterogeneous effect, we show that the positive effects were stronger for infants born to younger and non-married mothers.

The policy we study has far-reaching implications for different issues societies face beyond smoke-bans, as it involves the role of policies dealing with the internalization of externalities. Related topics include adherence to climate change mitigation policies and vaccination. In those topics, the internalization of negative externalities may be key, and, thus, understanding the effects of policies in this context could be critical.

The paper is organized as follows. Section 2 summarizes the literature on smoking and birth outcomes, and review previous research on fetal origins. Section 3 we report all the details from the law. Section 4 describe the SINASC microdata. In section 5, we explain the methodology used in this study and section 6 reports all the results and robustness checks. We finish our master thesis with the conclusion in section 7.

2 Literature Review

2.1 Smoking and birth outcome

The relationship between smoking and pregnancy outcomes is well established by the medical literature and has been extensively studied. Smoking is a secular habit in mankind, but at the beginning of the last century, the society started to see its problems. One of the first analysis on the harm of smoking in pregnancy, yet in animals, back to the 1940s, where few articles showed the relationship between nicotine and pregnancy outcomes, such as low weight at birth and stillbirth (Essenberg *et al.* (1940), Schoeneck (1941)). However, as these studies were not conducted in humans, the skepticism remained.

This panorama started to change in the 1950s, Simpson (1957) found a higher incidence of premature birth and lower birth weight for infants born to mothers who smoked. Since then, this topic receives a lot of attention from researchers, Meyer *et al.* (1976) discovered other problems due to cigarette consumption: It reduces the gestational length, weight at birth and increases placental complication and perinatal mortality. Himmelberger *et al.* (1978) investigated the association of smoking and spontaneous abortion, finding that this risk for the heavy smoker is estimated to be as much as 1.7 times that of the nonsmoker in certain risk groups.

As the literature progressed, governments began to react. In 1990, The US Department of Health and Human Services concluded that smoking is probably the most important modifiable cause of poor pregnancy outcomes among women in the country. Australia reached the same conclusion (Foy (1988). They also listed 12 adverse pregnancy outcomes with which smoking had been associate and concluded that smoking during pregnancy retards fetal growth, causes an average reduction in birth weight of 200g, and doubles the risk of having a low-birth-weight baby.

However, what has been showing so far was an observed association between maternal smoking and pregnancy outcome. Yerushalmy (1971) was the first one to highlight this problem remembering that correlation is not causation. He proposed a hypothesis that smokers tend to differs from nonsmokers. According to the author, the nonsmokers were more likely to use contraceptive methods, to plan the baby, less likely to drink coffee and hard liquor, and in general, appeared to live at a much slower and moderate pace than smokers. Therefore, these characteristics explain the difference in birth weight and not smoking. According to Oakley (1989), smoking is a manifestation of social disadvantage, which is likely to be the real cause of adverse pregnancy outcomes.

The gold standard for studying causal relationships is the randomized controlled trial, where you draw some people to receive the treatment and use the other group of people as a control, with this set up the randomization eliminates much of the bias inherent with other study designs. However, for ethical reason, one can not select some pregnant women to smoke while others don't and, therefore, the medicine literature tried to solve this problem using different approaches.

Firstly, the literature tried to answer using biological evidence. Spira *et al.* (1977) and Rush *et al.* (1986) showed that historical examination of the human placenta indicates that the placenta from smokers is more likely to show signs of abnormal pathology than the placenta of nonsmokers. Asmussen (1988) reached the conclusion that placentas from mothers who smoke show major alterations of the placental vascular bed: a reduced number of capillaries and an increased endothelial cell turnover rate resulting in a thickened basement membrane. Another plausible explanation is because nicotine is strong vasoconstriction and, therefore, reduces placental blood flow in pregnant women, which creates a pathologically hypoxic environment.

The biological evidence shows us that maternal smoking could indeed reduce fetal growth. Another channel used is the dose-response gradient, that is the more intense the treatment, the greater the response. In our case, if the mother smokes more cigarettes per day, we should see a worse pregnancy outcome. Abel (1980) did a review on 12 studies that compared pregnant nonsmokers with women smoking 1-10, 11-20, and >20 cigarettes daily. This analysis confirmed the dose-response relation between the number of cigarettes smoked and mean birth weight. Brooke *et al.* (1989) reached the same conclusion in their report. The recent studying using the dose-response approach focused on the children's outcome. Koshy *et al.* (2011) found that the more cigarette the mother smoked, the worse is the health of a 5-years old kid. Mortensen *et al.* (2005) target the long run, and using the dose-response way, they found a relationship between maternal smoking and adult intelligence.

Combining the three channels (association, biological, dose-response), the medical literature provided evidence that maternal smoking was associated with worse pregnancy outcomes. The focus now goes to secondhand smoking: Does this harmful relationship between smoking and birth outcome also happen in passive smokers?

The problem is harder to answer for passive smokers. The biological evidence remains the same, however, all the remained studies depend on self-reported analysis, and in the case of dose-response, the data may be subject to inaccuracy. Chen & Petitti (1995) conducted an analysis interviewing face-to-face to collect information on exposure to passive smoking during pregnancy, but again, it depends on the accuracy of these answers that is complex to standardize. In their study, it was not found an association between passive smoking and small-for-gestational-age (SGA). Using a different strategy, Nafstad *et al.* (1998) collected data on nicotine concentration in the hair of nonsmoking mothers. If this design reduces the inaccuracy, it increases the bias, as they just collect information on the day the mother gave birth. Overall, they conclude that passive maternal smoking increases the risk of small-for-gestational-age births.

Most studies on this topic focus on the first approach: Correlation. Dejmek *et al.* (2002) using a sample of 6,866 singleton births and self-reported smoking status, used multiple regression and logistic regression procedures with adjustment for many associated covariates. They find that environmental tobacco smoke (ETS) exposure reduced the mean birth weight of their infants by 53 g. Dejin-Karlsson *et al.* (1998) explore data from Sweden, and gathering self-reported information from 872 women found that maternal passive smoke doubles the chance of delivering small-for-gestational-age. Rashid & Rashid (2003) did a similar application for Saudi Arabia. They gather data from 868 women, asking them about the habits and if they had exposure to passive smoking, at the end, they reached the same conclusion: secondhand smoking is related to lower birth weight.

Summarizing these and other results, Leonardi-Bee *et al.* (2008) ran a meta-analysis with 58 studies and conclude that environmental tobacco smoke (ETS) exposure was associated with a 33 g (95% CI 16 to 51) reduction in mean birth weight. As a result of this progress in medical literature, the government around the world adopted new policies to restrict smoking. Firstly, public information and campaign have been the major approach to change its citizens' behavior. After that, new policies were taken: raising the tax, age restriction, and smoking bans.

This last policy is the goal of this master's thesis, and also has been studying by other authors. Hone *et al.* (2020) studied the Brazilian case, where since 2008, each state had been adopting new laws to restrict smoking in public areas, especially bars and restaurants. The study use data aggregated at the municipality level and concluded that the implementation of partial smoke-free legislation was associated with a 3.3 % reduction in the municipal infant mortality rate and comprehensive smoke-free legislation implementation was associated with a 5.2 % reduction. However, their article above does not use individual data and adopts a different research design, using a municipal-level linear fixed-effects regression model.

Bharadwaj *et al.* (2014) also reviewed a smoking ban policy, but at this time in Norway. In 2004, a law in the Scandinavian country extending smoking restriction to bars and restaurants, and using a difference-in-difference approach, the authors compare the women who were working in these establishments with the women working in stores. The comparison with the treatment and comparison group using a DiD strategy tries to find a causal impact of the law, and they found that the new legislation reduces the rates of being born below the very low birth weight (VLBW) threshold and were less likely to be born pre-term.

We also have in the literature other articles trying to estimate the impact of smoke-free law on birth outcome. However, they all shared the same methodology, using regression to fit the model and in the end, finding a correlation between the law and birth outcomes. McKinnon *et al.* (2015) evaluate the impact of a 2006 ban on smoking in public places in Quebec, Canada and found an increase of 17g in mean birth weight. Cox *et al.* (2013) use the Belgian case to estimate the preterm birth, finding a change in the risk of spontaneous preterm delivery of 3.13%. Finally, Been *et al.* (2015) focused on the England scenario and concluded that smoke-free legislation was associated with an immediate 7.8% reduction in stillbirth, a 3.9% reduction in low birth weight, and a 7.6% reduction in neonatal mortality.

Our analysis in this study would be to evaluate the impact of smoking bans in the state of São Paulo and its effect on infants' weight. At first glance, this topic is important because we can use weight as a proxy for infant health, but it is not just it, weight at birth could be a good indicator of life prosperity.

2.2 Fetal origins hypothesis

There is a growing literature studying the fetal origins hypothesis. On this topic, they find that birth weight is a good measure for numerous indicators, such as health quality, economic conditions, and education. This idea started in the 1980s, Barker & Osmond (1986) detected a correlation between prenatal nutrition, infant mortality, and adults' heart problems, supporting that the weight at birth could influence the future of these children.

Later on, Barker revisited and expanded his work. Analyzing 13,517 men and woman who were born in Helsinki during 1924-1944, Barker *et al.* (2002) found that the combination of small size at birth and during infancy, combined with accelerated weight gain from age 3 to 11, predicts a large difference in the cumulative incidence of coronary heart disease, hypertension, and type 2 diabetes. In this article, he also added a biological basis for the causal link.

As economists started to study this topic, they tried to improve the identification strategy. One of the most common use to try to infer causal effect between birth weight and later effect is to use twins. Almond *et al.* (2005) using twins born in the United States between 1983 and 2000 found a positive short-run effect for health results, however below the one found previously in the literature. Another article using a similar strategy that finds estimates of comparable magnitude was Conley & Bennett (2000).

On the other hand, Behrman (2004) using female monozygotic twins from the Minnesota Twin Register focused on the longer-run effect of birth weight. The author concluded that the heavier twin goes on to be taller, have a greater wage and higher education levels. Combining the short and long-run effect of the newborn weight was the paper of Black *et al.* (2007). For the short run, they found evidence of the effect of birth weight on one-year mortality. Looking at characteristics in adulthood, the author discovered a causal link in height, IQ at age 18, earnings, and education.

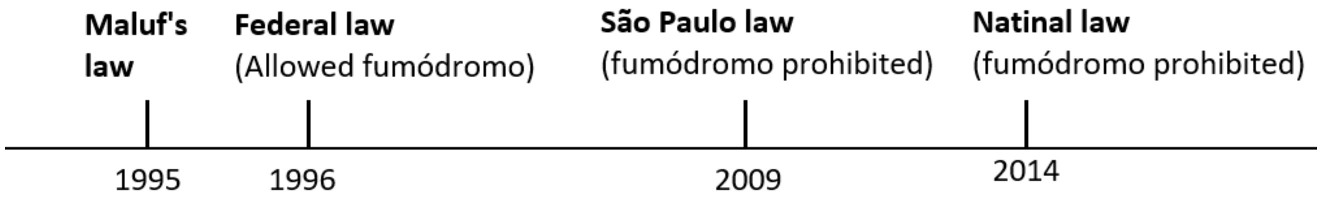
Using data back to the Spanish flu, Almond (2006) compared the infants born during the shock and others just before the pandemic or babies born in states less affected. They concluded that children of infected mothers were about 20 percent more likely to be disabled experienced wage decreases of 5 percent or more, as well as reduced education.

Almond & Mazumder (2011) showed that prenatal exposure to Ramadan results in lower birthweight - that is explained due to fasting during daylight, resulting in less nutrient to the fetus. Looking at the long-run effect, the authors found a strong association between in utero exposure to Ramadan and the likelihood of being disabled as an adult. The second study, Almond *et al.* (2011), analyzed the effect of daytime fasting by pregnant during the month of Ramadan. Comparing test scores at age seven for Muslims who were in utero during Ramadan to those who weren't, they found that scores are 0.05 to 0.08 standard deviation lower to kids affected by fasting.

3 Background

One of the first anti-smoke initiatives in bars and restaurants took place in the city of São Paulo. In 1995, mayor Paulo Maluf banned smoking in commercial establishments such as restaurants, cafeterias and bars. He also instituted a fine of R$ 318,60 for those who smoke in restaurants, which represents more than 3 times the minimum wage from that time (minimum wage in May/95: R$100).

Figure 1: Timeline of smoking bans in Brazil



Notes. Elaborated by the author

The national smoke-free law in Brazil was introduced one year later, in 1996. This national legislation prohibited smoking in public indoor places, albeit it allowed the creation of "fumódromo" - an exclusive area for smokers. Conforming to national law, these "fumódromo" should have proper ventilation and isolated from common areas.

However, it is well known that these laws did not work properly (Jaques (2011)). The lack of penalties and monitoring agencies prevented the national law from being effective. One widely read magazine in Brazil, the VEJA magazine, once stated about the national legislation: "one of the most confusing and inaccurate legal texts ever produced in the country". The magazine also claimed that as there are no sanctions, smokers who light a cigarette anywhere in a restaurant will have, at least in theory, their impunity ensured (Veja (1996)). In Maluf's case, VEJA points out that an appeal made in court by owners of bars and restaurants prevented the Mayor from applying the law in the capital of São Paulo. This appeal was not unexpected, the journal de São Paulo (1995) argued, just after Maluf's announcement, that this law was unconstitutional.

As mentioned, this scenario started to change on May, 7th 2009. On this day, the legislative assembly of São Paulo State created a new smoke-free law. According to Article 2: "The consumption of cigarettes, cigarillos, cigars or any other smoking product, whether or not derived from tobacco, is prohibited in the territory of the State of São Paulo, in collective, public or private environments".

For this law, the expression "collective environments" includes, among others, workplace, school, temples, leisure, sport or entertainment environments, common areas of condo, concert, theaters, cinemas, bars, cafeterias, nightclubs, restaurants, hotels, inns, shopping centers, banks, supermarkets, butchers, bakeries, pharmacies and drugstores, public offices.

The difference from the previous regulation is the ban of "fumódrumo" and the enforcement of the law. In order to achieve better results, the legislation defines who is the monitoring agencies, and then if they see someone smoking in a restaurant, the owner of the establishment should pay the fine. The first three months of the law were used as a training period where no fine was applied and some public workers visited bars and restaurants to explain how this new regulation should work. After this experiment period, fines were applied to enforce the law.

Jaques (2011) did a historical review of the Brazilian smokefree laws and confirmed the hypothesis that this law just worked after 2009 with a better monitoring and enforcement system. The proof of this efficiency could be seen in the study Shimabukuro *et al.* (2016), who ran an experiment comparing the air quality before and after the law, showing that ,on average, the CO_2 concentration fell 70%.

Data on inspections support the claim that the law was enforced. According to the State Department of Health, after 8 years, 3.8 thousand fines were applied with 99.7% of adherence and an average of 200,000 inspected establishments per year. The success also influences customers, according to Datafolha, 9 out of 10 Paulistanos (people who were born in São Paulo city), felt benefited by the law and 93% find it more pleasant to go to public places.

Other sources of information endorsing the enforcement of this law are journals and newspapers. In figure 9 on Appendix, the Exame magazine shows that the law is being enforced ("a lei pegou" in Portuguese). The newspaper Gazeta do Povo, figure 10, asks on their cover page why the smoke-free law is working well while the dry law (drinking and driving) has little impact, they also emphasize that waiters are not smoking 7 cigarettes per night, due to secondhand smoking. Folha de São Paulo, figure 11, also examine the law discussing why this law has worked and they point out that the high level of monitoring agencies and the population support were crucial to achieving better results

This new legislation was considered a success and other governors copied this model and replicate it in their states. In 2014, the federal government implemented and became national law. Nevertheless, we will focus our attention on the state of São Paulo. We can summarize 3 reasons for that: Firstly, because it was the first major state to adopt this law and so was unexpected. Secondly, according to Steffens (2018), São Paulo was the most effective to enforce the law. Thirdly, the state is the most populated in Brazil, so we gain statistical power.

4 Data

We collect our data from SINASC ("National System of Information on Birth Records"). SINASC is held by DATASUS, the informatics division of Integrated Health System (SUS), and it was created with the goal of collect data about all Brazilian newborns. This system was gradually implemented by Brazilian cities using a unified form, the Declaration of Live Born (DNV- Declaração de Nascido Vivo) to collect information from hospitals and from Civil Registration Offices for births occurring outside a hospital (Borges & LO (2015)).

The SINASC database is publicly available on the website of the Health Ministry containing data since 1994. The DNV form has changed since its conception, gathering different characteristics from the mother and the newborn. However, our period of analysis ranges from 2005 until 2010 and on this interval we have the following characteristics for newborns: Birth weight, day of birth, and APGAR - a test to check the baby's health scored on a scale of 0 to 10.

For the mother, we have the following characteristics: Age, the number of children, schooling (grouped into 5 ranges: 0 years, 1-3 years, 4-7 years, 8-11 years, 12+ years), race (White, Black, Asian, Brown and Amerindian), marital status (single, married, widow, divorced), gestational age (grouped into 6 ranges: less than 22 weeks, 22-27 weeks, 28-31 weeks, 32-36 weeks, 37-41 weeks, more than 42 weeks) and occupation.

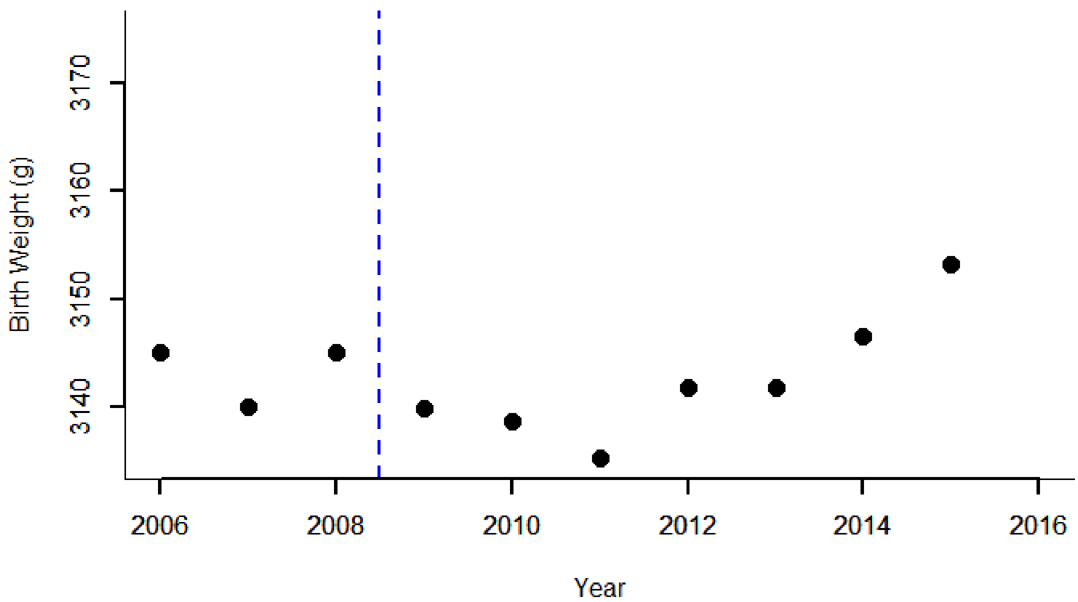
The occupation is defined according to the "Brazilian Classification of Occupations" (CBO). CBO is a document that portrays the reality of the professions in the Brazilian labor market.

It was instituted on a legal basis in Ordinance No. 397, dated Oct, 10th, 2002. We use this classification to select our treatment group, which is composed of the following occupations: Waiter, barmen, cafeteria attendants, chambermaid, hotel receptionist, cashier (bar, restaurant, supermarket, stores). Our main comparison group is the rest of the pregnant from São Paulo, however, other comparison groups are also tested.

Following the medical literature and WHO (2014), we define as low weight at birth the infants who were born with less than 2,500g and very low weight at birth with less than 1,500g. Preterm is defined as when birth occurs before 37 weeks of pregnancy.

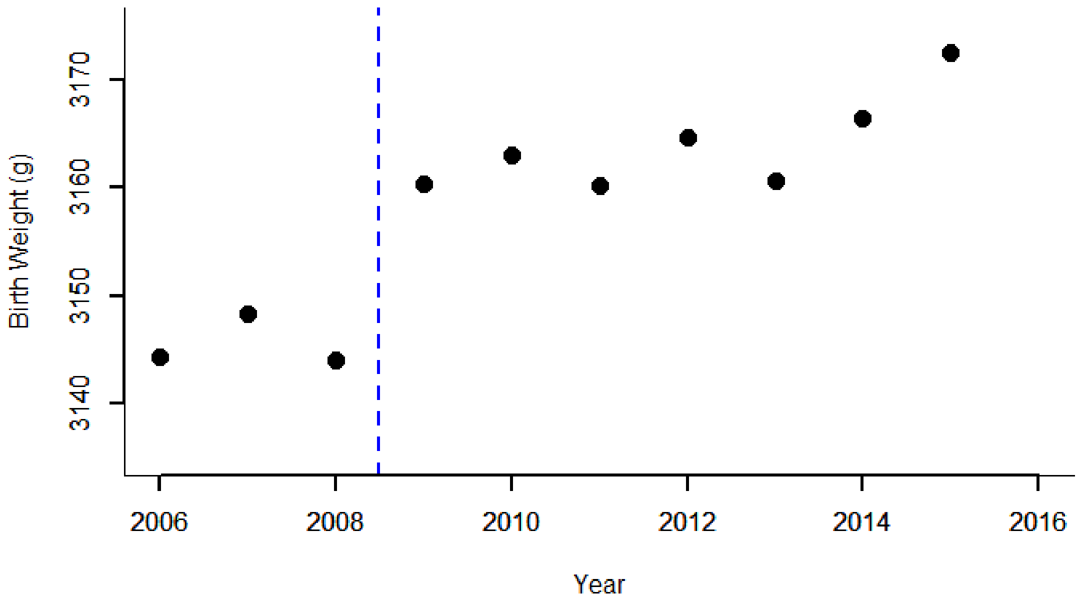
Analysing the raw data from SINASC, figure 2 and 3 display the trend between treatment and comparison group. Fig 2 shows the average birth weight from mothers in the comparison group, while fig 3 reflects the birth weight in our treatment. Until 2009 both groups appears to have the same path, however, there is a change in the level for the treatment after the law. This initial and simple result raised some questions about the effects of the law.

Figure 2: Overall births in SP



Notes. Data from SINASC. Figure shows the mean birth weight, measured in grams, of all births who occurred in the state of São Paulo between 2006 and 2016

Figure 3: Group affected by legislation



Notes. Data from SINASC. Figure shows the mean birth weight, measured in grams, of all births who occurred in the treatment group between 2006 and 2016

5 Empirical Strategy

Our empirical strategy starts with a standard difference-in-difference (DiD) specification to compare the treatment group (mothers affected by law) with the comparison group (mothers who were working in occupations not directly affected by the legislation). We extend our analysis using the dynamic difference-in-difference, to try to provide a more formal check of pre-trends in the dependent variables and assess the timing of post-treatment effects.

Our first DiD modeling use the following specification:

$$Y_{ipt} = \beta \text{Post}_t \times \text{Treat}_p + X'_{ipt}\Theta + \omega_p + \lambda_t + \varepsilon_{ipt} \qquad (1)$$

Where Y_{ipt} is the outcome of interest for infant i, whose mother's occupation is p in time t. X_{ipt} is a vector of covariates (mother and newborn characteristics), ω_p is the occupation fixed effect and λ_t is the time fixed effect. Our interest relies on β which is our difference-in-difference coefficient. We cluster standard errors at the "treat x period" level to account for occupation-specific shocks that could be correlated within a given month. We define treatment as working in the following occupation: Waiter, barmen, cafeteria attendants, chambermaid, hotel receptionist, cashier (bar, restaurant, supermarket, stores).

We use the date of conception instead of the date of birth to be consistent with current literature (Kyrklund-Blomberg *et al.* (2005), Shah & Bracken (2000), Jaddoe *et al.* (2008)) showing that smoke affects pregnancy duration. The law was created on May, 7th, thus we use as "after period" the conception that occurred until 20 weeks (half pregnancy period) before the law, figure 4 illustrates it. Imagining the standard 40 weeks pregnancy, in the worst-case scenario, the fetus that was conceived just after the 18th of December spent half of the period in the womb under the old law (between 18th December until 7th May) and the rest of 20 weeks under the new legislation. On the other hand, the fetus conceived just before 7th May will spend the whole pregnancy under the new law. Therefore, all the infants in the "after period" spent at least half of the pregnancy under the smoke-free law.

We include an intermediate period with 20 weeks length that was not considered in the first DiD estimation and finally we get 20 weeks before the intermediate period as our "before period". In this group, even the fetus conceived just before July 31th will spend the whole pregnancy under the old law as they will be born close to May 7th.

Figure 4: Date of conception 1

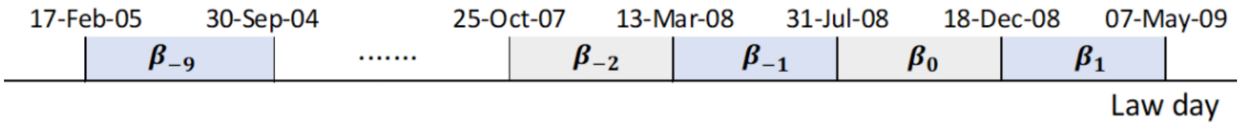
Notes. Elaborated by the author. The "after period" includes all infant who were conceived between December 18, 2008 and May 7, 2009. The "before period" includes all infant who were conceived between March 13, 2008 and Jul 31, 2008.

Our second strategy consists of expanding the initial analysis incorporating the dynamic differences-in-differences. We use the following specification

$$Y_{ipt} = \sum_{\tau=-9}^{1} \beta_\tau I\left(t_{pt} - t^* = \tau\right) + X'_{ipt}\Theta + \omega_p + \lambda_t + \varepsilon_{ipt} \quad (2)$$

Where the indicator $I\left(t_{pt} - t^* = \tau\right)$ measures the time (in half pregnancy period, or 140 days) relative to the day the law was created, t^*. We set 9 periods of 20 weeks each prior to the legislation and 2 periods (of 20 weeks each) after. The correspondence between the standard DiD (equation 1) and the dynamic DiD (equation 2) is as follows: β_1 is the treatment period in the static DiD case, the β_0 uses the interval that we ignored in the previous specification, and we set the coefficient β_{-1} equal to zero to use period immediately prior to the beginning of the new legislation as the reference. If prenatal exposure to secondhand smoke has adverse consequences on birth outcomes, we would expect that the coefficients β_0 and β_1 to be positive and significant. The figure below helps to better understand our setting.

Figure 5: Date of conception 2



Notes. Elaborated by the author. β_1 represents the "after period" in image 4 and includes all infant who were conceived between December 18, 2008 and May 7, 2009. β_0 includes all infant who were conceived between July 31,2008 and December 18, 2008, β_{-1} includes all infant who were conceived between March 13,2008 and July 31,2008 and so on.

We did not use the period before 2004 because there is no data available, and we did not use further data under the new legislation because the law could endogenously change the mothers' behavior, so we could have a bias on the estimators.

The identifying assumption is that children born to mothers working in occupations more exposed to the legislation during their gestational duration would have had similar trends in birth outcomes as those working in less-exposed occupations in the absence of the legislation.

6 Results

Table 1 presents a descriptive table from 2008, a year before the law. Although not necessary to support our identification strategy, we can note some similarities between the treated and comparison groups. Our first goal is to measure the effect of the law on birth weight and we can notice that the two groups, treatment and comparison, display a high similarity, with a difference in mean birth weight of just 1 gram (p-value = 0.86). On the other hand, the difference between Brazil and São Paulo state is 40 grams (p-value = 0.00). Another outcome analyzed is the percentage of infants with low weight ($<$ 2,500 g), the difference between treatment and comparison groups is 0.09 percentage points (p-value = 0.782) while the state as a whole against the country exhibiting a difference 8x higher (p-value = 0.00). The third outcome that we have studied in this Maters' thesis is preterm birth. We have similar results: treatment and comparison group shows a difference of 0.04 p.p (p-value = 0.94) while the difference between São Paulo state and Brazil is 1.42 p.p (p-value = 0.00).

Table 1: Descriptive Table (2008)

	Brazil	São Paulo	Dif.	P-value	São Paulo (Treat)	São Paulo (Control)	Dif.	P-value
Nº of births	2,928,237	600,120	-	-	8,597	591,523	-	-
Average weight (g)	3,185	3,145	40.3	0.000	3,144	3145.05	-1.03	0.863
Low weight (%)	8.29	9.08	-0.79	0.000	8.99	9.08	-0.090	0.782
Average APGAR1	8.22	8.32	-0.10	0.000	8.26	8.32	-0.06	0.001
Preterm birth (%)	6.86	8.28	-1.42	0.000	8.32	8.28	0.04	0.945
Mothers'age	25.3	26.4	-1.0	0.000	25.8	26.4	-0.6	0.000
Educ. (0 year) (%)	1.57	0.40	1.18	0.000	0.03	0.41	-0.37	0.000
Educ. (1-3 year) (%)	7.63	3.11	4.53	0.000	0.99	3.14	-2.14	0.000
Educ. (4-7 year) (%)	30.01	20.71	9.30	0.000	7.34	20.90	-13.55	0.000
Educ. (8-11 year) (%)	44.07	56.93	-12.86	0.000	80.53	56.58	23.94	0.000
Educ. (12+ year) (%)	16.00	18.42	-2.42	0.000	10.87	18.53	-7.66	0.000

Notes. Tabulations from SINASC microdata for four groups: Brazil (column 1) , São Paulo (column 2), São Paulo - treatment (column 5), São Paulo - control (columns 6). Column 3 shows the difference of each category between Brazil and São Paulo. Column 7 shows the difference of each category between São Paulo - treatment and São Paulo - control. Columns 4 and 8 reports the P-value from a two-sample t-test where the alternative hypothesis is that the true difference in means is not equal to 0. In column 4, the difference is between Brazil and São Paulo and in column 8 the difference is between São Paulo - treatment and São Paulo - Control. The average weight is measured in grams.

6.1 Static Difference-in-Difference

We start in table 2 by showing the static Difference-in-Difference for the whole treatment group, then we split our sample to present some heterogeneity in our data. After, in subsection 6.2 exhibit the dynamic DiD for two reasons: investigate the parallel trend and the timing of the effect. We are also interested in other outcomes, so we ran the static DiD using different variables in subsection 6.3, such as preterm birth and a dummy for the low weight. Finally, we evaluate possible channels and problems in the robustness session (subsection 6.4).

As mentioned above, table 2 presents the main result of our static difference-in-difference. We ran five different regressions, in column (1) we pose the coefficient of equation (1) without any control. Columns (2) - (5), we add different controls, where we prefer the third specification as does not include gender. The sex of the newborn could be a bad control because there are some studies (e.g. Coutant *et al.* (2001)) showing that smoking affecting gender.

Table 2: DiD Results

	Birth Weight (g)				
	(1)	(2)	(3)	(4)	(5)
DiD	28.25**	28.51**	28.25**	27.97**	27.71**
	(13.13)	(13.36)	(13.22)	(13.31)	(13.19)
Control	No	Yes	Yes	Yes	Yes
Observations	456,665	456,665	456,665	456,665	456,665

Notes. This table presents results from the estimation of Equation (1) and DiD is the difference-in-difference coefficient which corresponds to β. Each column represents a different control (X) with the following order: (1): No control (2): Schooling, race, marital status, age (3): Race schooling, marital status, age, family size (4): Schooling, race, sex, age, marital status (5): Schooling, race, marital status, age, family size, sex. The overall sample includes 448,800 newborns in the comparison group. Robust standard errors (in parentheses) are clustered at the "treat x period" level;
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Our results show that the infant from the treatment group gained between 27-28g due to the new legislation, with all the coefficients statistically significant at the 5 percent significance level. These results suggest that the smoke-free law indeed increases the birth weight of our treatment group. This magnitude is similar to a meta-analysis proposed by Leonardi-Bee *et al.* (2008) who conclude that environmental tobacco smoke (ETS) exposure was associated with a 33 g reduction in mean birth weight. Bharadwaj *et al.* (2014) used a similar strategy and found 58g increase in birthweight due to the smoke-free law, however statistically insignificant, probably because they have a small sample (São Paulo has a population eight times bigger than Norway and we have a sample of 456,665 against 4,007 in the Norway case). Dejmek *et al.* (2002) using self-reported smoking status, reached a 53g reduction in birth weight due to secondhand smoke. We are assuming that passive smoking is driving our results, the impact of maternal smoking is even higher: between 100g - 200g depending on the study (Haug *et al.* (2000), Horta *et al.* (1997), Sexton & Hebel (1984)).

Furthermore, we believe that the coefficient of 28g found in our base case could be seen as a lower bound. Firstly, because the comparison group is also exposed to the law in two ways: the occupation selected in our comparison group is less affected, but are exposed to some extent. Moreover, if a pregnant would like to go to a restaurant after May 2008, she will enjoy an environment free of tobacco exposure. Obviously, they will be much less affected, however, we cannot measure how much, as our difference-in-difference methodology cannot remove this downside bias. Another source of bias is the relationship between smoking and miscarriage. Pineles *et al.* (2014) conducted a meta-analysis pointing out that the cigarette increases the chance of spontaneous abortion and so, the infant that would enter in our counting with low weight, raising the point estimator, will not even be taken into account.

However, the treatment was not homogeneous throughout the entire population, so we studied the heterogeneous effect of the law according to selected characteristics of the mother. Table (3) shows how the effect varies with the mother's age and marital status. Column (2) reports the DiD estimator for mothers under the age of 24 (median age of mothers in São Paulo) and column (3) above 24 years. Columns (4) and (5) show our results for single and married women respectively.

We can see that young mothers are the most affected group with the law being responsible for 56g improvement in the newborn weight, this coefficient is also statistically significant at the 1 percent significance level. The group of the single mother also had an important impact, exhibit a positive, 37g, and statistically significant coefficient. There is some hypothesis trying to explain this behaviour, Theme-Filha *et al.* (2016) studied the factors associated with unintended pregnancy in Brazil and concluded that maternal age and having no partner are the two main reason. Therefore, we think that unintended pregnancy is the channel driving these high results. A mother who is prepared to have a baby tends to follow all doctor's instruction before and during pregnancy, so she can partially overcome some pregnancy problem, such as passive smoking. On the other hand, a woman who has had an unexpected pregnancy tends to be less committed to the pregnancy and a problem that could be partially overcome, will not be. However, when this issue - passive smoke - is not happening, this group has more room for improvement, and that is what is probably explaining our results. This channel could be seen as similar to the difference between developed and developing countries.

Table 3: Heterogeneous effect

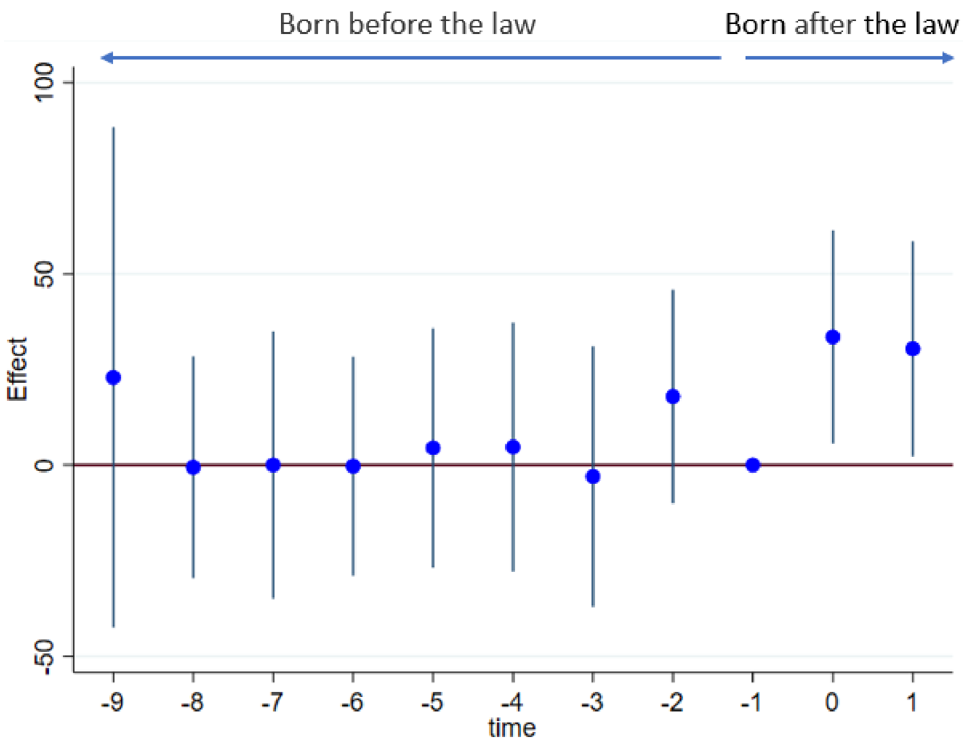
	Birth Weight (g)				
	(1) All	(2) Young	(3) Old	(4) Single	(5) Married
DiD	28.25**	56.47***	-14.99	37.83***	11.64
	(13.22)	(16.83)	(13.38)	(13.05)	(19.24)
Observations	456,665	235,296	221,369	249,277	187,073

Notes. This table presents results from the estimation of Equation (1) and DiD is the difference-in-difference coefficient which corresponds to β. Each column represents a different sample. Column (1) is our base case, column (2) for young mother, column (3) for old mother, column (4) for single and column (5) for married. We define young the mother below the median (24 years) and old the complementary. Robust standard errors (in parentheses) are clustered at the "treat x period" level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6.2 Dynamic Difference-in-Difference

In order to investigate the parallel trend hypothesis and the timing of the effect, we propose a second strategy using the dynamic difference-in-difference. Figure 6 shows our outcome where each time-period represents 20 weeks length (half-pregnancy period). The result from the entire population reinforces what we have found in the static DiD, with both periods after the law showing positive, around 28g, and statistically significant at the 5 percent significance level. The trend before the intervention is also interesting because reveals to us a similar path between treatment and comparison group until May 9, 2009, as there is no significant coefficient - that is well indicative of no differential pre-trends in the dependent variable. The timing of the effect appears to have little difference, with both periods after the intervention exhibiting similar coefficients.

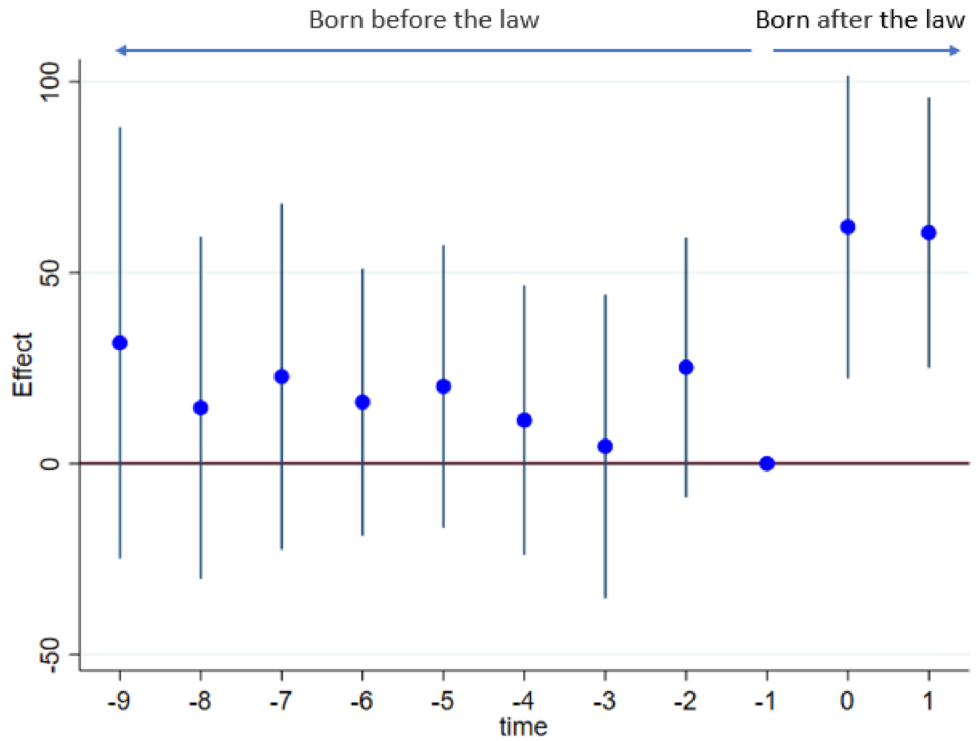
Figure 6: Dynamic DiD - Entire Sample



Notes. This figure plots the coefficients of Equation (2). Each time period represents 20 weeks length (half-pregnancy period). The period immediately prior to the law (time -1) is used as the reference period. Bars show 95 percent confidence intervals.

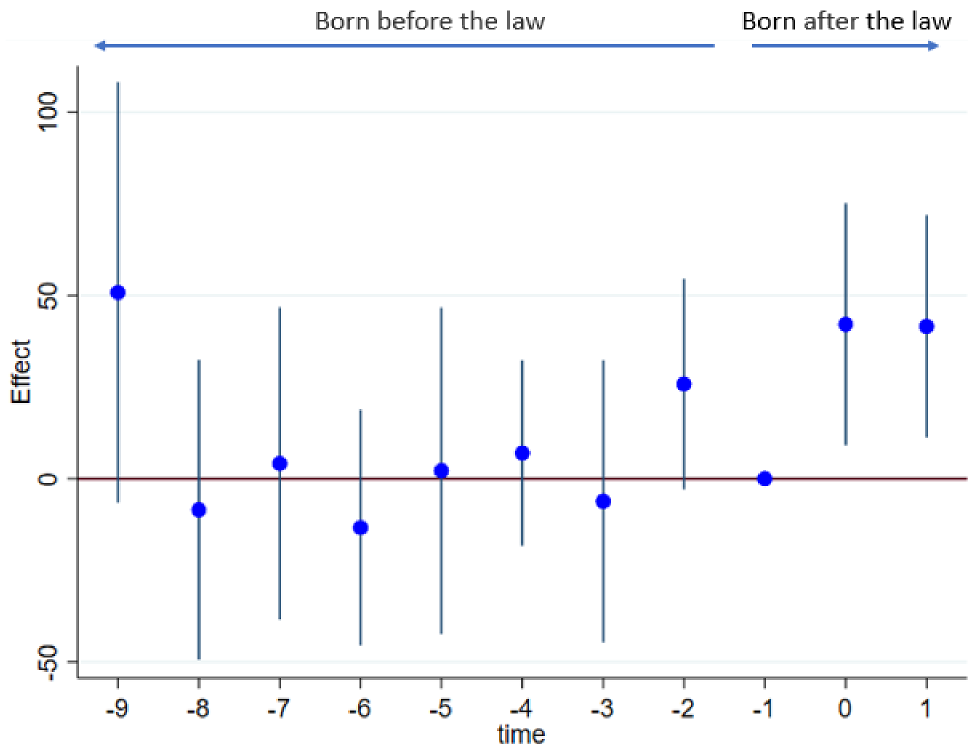
Rebuilding the same analysis that we did on the static DiD, we incorporate the heterogeneity in the analysis. Figure 7 shows the results for young mothers. Firstly, it is worth notice that we halve our sample and that partially explains the lower precision in our estimates. However, the big picture remained the same: we have insignificant, at 5 percent, coefficients until the intervention and positive and significant after the law. The estimation of around 55 grams remained similar in both periods after May 2009. In the figure 7, we display the results for single mothers. Here, we use less than 50% of our sample, implying lower precision as mentioned above. However, the trend is almost the same: insignificant coefficient until the law, positive and significant after that.

Figure 7: Dynamic DiD - Young Mothers



Notes. This figure plots the coefficients of Equation (2). Each time period represents 20 weeks length (half-pregnancy period). The period immediately prior to the law (time -1) is used as the reference period. Bars show 95 percent confidence intervals. We define young the mother below the median (24 years).

Figure 8: Dynamic DiD - Single Mothers



Notes. This figure plots the coefficients of Equation (2). Each time period represents 20 weeks length (half-pregnancy period). The period immediately prior to the law (time -1) is used as the reference period. Bars show 95 percent confidence intervals.

6.3 Other outcomes

In this Master's thesis, we assess the impacts on additional outcomes. According to Shiono *et al.* (1986), mothers who smoke during pregnancy are more likely to have a premature birth. We would like to test if this hypothesis holds in the environment of our study. We ran the equation (1) replacing the outcome Y for a dummy of preterm birth. Table 4 reports these results, showing that for the overall population we didn't find significance. However, in column (2) we can see that the law reduce the preterm birth for young mother by 2.7%, while among single mothers diminished by 1.8%.

We also analyzed the impact over low weight. Now, the independent variable is a dummy for the low weight ($\leq$ 2,500g) or very low weight ($\leq$ 1,500g). Table 5 shows us that we just have significance for young and single mothers. For the latter group, the law reduces in 1.2% the

Table 4: Preterm birth

	Preterm birth		
	(1)	(2)	(3)
	All	Young	Single
DiD	-0.00757	-0.0270***	-0.0187***
	(0.00655)	(0.00937)	(0.00564)
Observations	422,284	214,859	231,197

Notes. This table presents results from the estimation of Equation (1) and DiD is the difference-in-difference coefficient which corresponds to β. The dependent variable is a dummy for preterm birth where preterm birth is defined when birth occurs before 37 weeks of pregnancy. Robust standard errors (in parentheses) are clustered at the "treat x period" level. Column (1) for the overall sample, column (2) for young mothers and column (3) for single mothers.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

presence of low weight, while the former group 2.7%. In table 6 we found similar results, where we did not find a significant coefficient for the overall population, but on the other hand, we have negative and significant coefficients for the vulnerable groups. Here we have an interesting point, the base case using birth weight as dependent variable reports significant coefficients (table 2, while when the dependent variable is a dummy for the low weight (table 5) we lose the significance. In the article Bharadwaj *et al.* (2014), the author found the opposite, while the dependent variable was a dummy for low weight, the coefficients were statistically significant, when the dependent variable was the birth weight, they found insignificant coefficients.

6.4 Robustness

São Paulo approving this new legislation was an important step, which encouraged other states to change their law to meet this new demand from society. However, it was not every state that followed immediately the São Paulo's case. The majority of the neighboring states (Rio de Janeiro, Parana, Mato Grosso do Sul) did, but Minas Gerais did not adopt it (Steffens (2018)). Therefore, we use this environment to perform some robustness checks.

The first assumption that could be made to invalidate the identification hypothesis is that

Table 5: Low weight

	Low weight		
	(1)	(2)	(3)
	All	Young	Single
DiD	-0.00392	-0.0201**	-0.0124**
	(0.00650)	(0.00752)	(0.00519)
Observations	422,284	214,859	231,197

Notes. This table presents results from the estimation of Equation 1 and DiD is the difference-in-difference coefficient which corresponds to β. The dependent variable is a dummy for low birth where low birth is defined when an infant born weighing less than 2500g. Robust standard errors (in parentheses) are clustered at the "treat x period" level. Column (1) for the overall sample, column (2) for young mothers and column (3) for single mothers.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Extreme Low weight

	Extreme Low weight		
	(1)	(2)	(3)
	All	Young	Single
DiD	-0.00270	-0.00899	-0.00540*
	(0.00198)	(0.00275)	(0.00215)
Observations	422,284	214,859	231,197

Notes. This table presents results from the estimation of Equation 1 and DiD is the difference-in-difference coefficient which corresponds to β. The dependent variable is a dummy for extremely low birth where extreme low birth is defined when an infant born weighing less than 1500g. Robust standard errors (in parentheses) are clustered at the "treat x period" level. Column (1) for the overall sample, column (2) for young mothers and column (3) for single mothers.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

there was another shock happening simultaneously in Brazil for the treatment group in May/09. If that is the case, it is not the law responsible but this aggregate shock in Brazil. However, we can test this hypothesis by running the same analysis that we have done on table 2, but just for the state of Minas Gerais. If it is a national shock, the coefficients for Minas Gerais should be similar to the one found in São Paulo, if the coefficient goes to zero, we can exclude this hypothesis. Table 7 reports the results and we can see that all the coefficients are insignificant, nullifying the hypothesis of an aggregate shock.

Table 7: Minas Gerais (Placebo)

	Birth Weight (g)				
	(1)	(2)	(3)	(4)	(5)
DiD	3.875	-0.708	0.444	-4.140	-2.729
	(26.80)	(27.21)	(26.45)	(28.27)	(27.61)
Control	No	Yes	Yes	Yes	Yes
Observations	193,993	173,360	168,188	173,360	168,188

Notes. This table presents results from the estimation of Equation (1) and DiD is the difference-in-difference coefficient which corresponds to β. Each column represents a different control (X) with the following order: (1): No control (2): Schooling, race, marital status, age (3): Race schooling, marital status, age, family size (4): Schooling, race, sex, age, marital status (5): Schooling, race, marital status, age, family size, sex. Robust standard errors (in parentheses) are clustered at the "treat x period" level. We use here the same empirical strategy as of table 2, but for Minas Gerais.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Our second strategy using Minas Gerias is to run a difference-in-difference analysis but just for the mothers affected by the law. The treatment group should be the mothers in São Paulo and the comparison group the ones living in Minas Gerais working in the same occupations. Table 8 reports the results and in column (1) we can see that for the overall population we have similar results, increasing 30g compared to the 28g increase in the baseline estimates (see Table 2). However, the number of observations fell considerably and so we lose significance. It is worth highlight the result for young mothers, here we see a large and positive coefficient. Our hypothesis here is because, in the previous/base case, the comparison group is also influenced by law when a pregnant woman goes to a restaurant (in fact, our estimator is downside biased). However, in this setting, the comparison group is zero affected by law and treatment group benefits from the legislation during work and leisure, again, different from the base case when they benefit just in work. Therefore, the group of women who goes out the most, mostly young women, should gain the most.

A question that could be raised is if taking advantage of this environment, we could run the same analysis here in others states, that is, the methodology employed in the result section, but applied to Rio de Janeiro, Parana and others. However, we can highlight some problems in this approach. Firstly, as São Paulo was the first to adopt the law, the behaviour of the pregnant working in bars and restaurants did not change because they didn't know the law would be approved. On the other hand, a woman that was working in a restaurant in Rio de Janeiro and realizing that the law was approved in São Paulo, Parana, and seeing the legislation talking about it, they could change the behaviour and wait until the legislation is approved to get pregnant. Another important characteristic of São Paulo, is because we need the law to be enforced in order to get proper results, and Steffens (2018) shows us that São Paulo was the most effective state to enforce the law among its citizens.

Table 8: Minas Gerais vs. São Paulo

	Birth Weight (g)		
	(1) All	(2) Young	(3) Single
DiD	31.95	105.4***	39.56
	(29.70)	(31.65)	(58.65)
Observations	9,071	5,385	5,120

Notes. This table presents results from the estimation of Equation 1 and DiD is the difference-in-difference coefficient which corresponds to β. Robust standard errors (in parentheses) are clustered at the "treat x period" level. Column (1) for the overall sample, column (2) for young mothers and column (3) for single mothers.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In order to evaluate possible channels, we run some robustness checks. Firstly, we use the date of birth instead of the date of conception as used in Bharadwaj *et al.* (2014). As mentioned in section 2, several papers use the date of conception instead, but we would like to see if our results change. Using the same framework as in table 2, we run a static difference-in-difference analysis comparing infants that were born 140 days before the law as a comparison group and infants born between 140 and 280 days after May, 7th 2009 as treatment. Table 10 reports the results from this analysis, however, we almost did not find a difference from the base case, for the overall population, the law reduces 27g, against 28g found in our main result.

Table 9: Date of birth as Bharadwaj *et al.* (2014)

	Birth Weight (g)				
	(1) All	(2) Young	(3) Old	(4) Single	(5) Married
DiD	27.34*	45.98**	-2.507	24.50	23.51
	(15.48)	(21.36)	(17.38)	(20.18)	(18.32)
Observations	462,874	235,456	227,418	253,495	189,031

Notes. This table presents results from the estimation of Equation (1) and DiD is the difference-in-difference coefficient which corresponds to β. Each column represents a different control (X) with the following order: (1): No control (2): Schooling, race, marital status, age (3): Race schooling, marital status, age, family size (4): Schooling, race, sex, age, marital status (5): Schooling, race, marital status, age, family size, sex. Robust standard errors (in parentheses) are clustered at the "treat x period" level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Another robustness analysis that we have done was to change the comparison group from the main specification. In table 2, we use all mother that was not in the selected occupations as our comparison group, therefore every type of o profession were included. Now, we change the comparison group according to the type of occupation. Firstly, exclude all the mothers from the agriculture sector, and in column (1) we notice that the coefficient does not change: 28 g. Excluding agriculture and manufacturing, we also had very similar results, where the magnitude change just 1g, from 28 to 27g. Overall, controlling for the occupation does not change materially our results.

Table 10: Different comparison group

	Birth Weight (g)			
	Excluding Agriculture		Excluding Agriculture & Manufact.	
	(1) All	(2) Young	(3) All	(4) Young
DiD	28.17*	57.40***	27.29*	47.45**
	(14.02)	(18.29)	(15.28)	(18.98)
Observations	358,687	183,705	124,964	43,113

Notes. This table presents results from the estimation of Equation (1) and DiD is the difference-in-difference coefficient which corresponds to β. Each column represents a different comparison group. Column (1) excluding agriculture for the overall population. Column (2) excluding agriculture for young mothers. Column (3) excluding agriculture and manufacturing for the overall population and column (4) excluding agriculture and manufacturing for young mothers. Robust standard errors (in parentheses) are clustered at the "treat x period" level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

6.5 Cost-benefit analysis

According to Clarke *et al.* (2017), the labor market return of each additional gram of birth weight is approximately US$14. Using our baseline case in table 2, the law was responsible for increasing by 28g for the overall treated population, that is a total of US$392 for the infant or R$ 2,211. Accounting for 8,597 newborns in 2009, we reach a gross benefit of R$6.74 million. On the cost side, one should consider the cost to approve the law and the cost to enforce the law. We will assume that the cost to approve the law is zero. We perform a simple calculation to obtain the amount spent in monitoring agencies to enforce the law, as the state of São Paulo does not directly release these numbers. Public data provide us information on (i) the average number of inspections per year (around 200,000), (ii) the average salary for a typical health inspector (up to 2 times the value of the monthly minimum salary) and (iii) that inspections are performed by two inspectors at a time. We consider that the salary is equivalent to the value of two monthly minimums salaries and that with the inspectors' pair visit three establishments per day on average. Taking into account these parameters, the amount needed to reach the 200,000 inspections is equivalent to R$6.76 million. As a result, the simple cost-benefit analysis implies that just one of many benefits from the law offsets the program costs.

7 Conclusion

In May 2009, the state of São Paulo took the initiative to strict the smoke-free law in an indoor place. This paper aims to evaluate if this new legislation adopted in São Paulo had a positive effect on the health of pregnant women who were working in an indoor place. More precisely, we would like to examine if the weight of the newborn from these pregnant was affected by the law. To estimate the impact, we compare this treatment group with different comparison groups, using a static and dynamic difference-in-difference approach. According to our main estimate, the new legislation was responsible to increase 28 grams of the weight of the newborn. In more vulnerable groups, the effect was even bigger, for young mothers the effect was 56 grams, and for single mothers, 37 grams.

The importance of these results goes beyond the extra grams gained by the newborn. The literature on fetal origins hypothesis points out that weight at birth has significant impacts on the developmental health and well-being outcomes. The benefits range from health factors, such as less incidence of coronary heart disease, hypertension, diabetes, to economic components, such as earning and education.

The legislators who created the law likely targeted the short/medium run consequence of the smoke-free environment and that indeed happened. Abe (2016) conclude that there was a reduction in hospitalization rates for stroke between the 7th and 12th months and a reduction in hospitalization rates for heart attack in the initial 3 months. However, a second and non-expected result comes out: the improvement of pregnant health reflects on the newborn weight who has long-last positive effects on their lives.

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8 Appendix

Figure 9: Exame Magazine

BRASIL

Lei Antifumo completa três anos em SP com 1.885 multas

A maior parte das multas foram aplicadas porque equipes da Vigilância Sanitária flagraram pessoas fumando no interior dos estabelecimentos

Por **Da Redação**
Publicado em: 10/08/2012 às 23h31
Tempo de leitura: **3 min**

ão Paulo – A cada três multas aplicadas no estado de São Paulo com base na Lei Antifumo, duas ocorrem em bares, restaurantes e lanchonetes. Desde 2009, quando a lei passou a vigorar em todo o estado, foram registradas 1.885 multas em estabelecimentos de São Paulo 570 delas na capital.

"Podemos comemorar. A lei 'pegou' no estado de São Paulo. Ela já está incorporada na rotina da população", disse Maria Cristina Megid, diretora do Centro de Vigilância Sanitária, em entrevista hoje à Agência Brasil.

Para a diretora, o sucesso da lei se deve, sobretudo à fiscalização intensa. "Temos fiscalização todos os dias da semana. Intensificamos [a fiscalização] também em eventos, festas e baladas", disse Maria Cristina. De acordo com a secretaria, 726 mil inspeções foram feitas pelas equipes da Vigilância Sanitária durante os três anos de existência da lei.

Source: Exame

Figure 10: Gazeta do Povo

Por que a Antifumo pegou e a Lei Seca não?

Fiscalização popular ajudou a consolidar a norma que há um ano baniu o cigarro em ambientes coletivos. Enquanto isso, motoristas continuam dirigindo embriagados

Por **Vinicius Boreki** 18/11/2010 21:01

Saúde

Garçons já não fumam sete cigarros por noite

Trabalhadores de casas noturnas, bares e restaurantes, como garçons, barmens e promotores, são os maiores beneficiados pela Lei Antifumo. De acordo com João Adriano de Barros, professor da Universidade Federal do Paraná e membro das Sociedades Brasileira e Paranaense de Pneumologia e Tisiologia, estudos comprovam que um garçom fumava passivamente sete cigarros por noite antes de a legislação entrar em vigor é possível medir o nível de nicotina por meio da urina. "Para os indivíduos que ficam muito tempo nesses ambientes, há diminuição da chance de desenvolver bronquite crônica ou enfisema pulmonar", explica.

Source: Exame

Figure 11: Folha de São Paulo

OPINIÃO • JOSÉ HENRIQUE GERMANN FERREIRA E MARIA CRISTINA MEGID

Lei Antifumo, 10 anos: uma lei que pegou

Estudo apontou redução dos níveis de contaminação

2

Source: Exame