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Josef Simpartl

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**Impact of smoke-free laws on hospitality
businesses in the European perspective**

Bachelor thesis

Author: Josef Simpartl

Study program: Economics and Finance

Supervisor: doc. Petr Janský M.Sc., Ph.D.

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Abstract

Ever since smoke-free laws regarding the hospitality business were proposed, there was an argument that these policies were going to harm their revenues and employment. This bachelor thesis examines this argument in the European context. The examination is divided into three parts. First, it aims to distinguish between effects of two distinctive forms of smoke-free laws. Second, it analyzes the impact of smoke-free policies over time. Third, it attempts to assess differences of their impact based on regional or socio-economic differences. Using difference-in-differences analysis of administrative annual data from Eurostat database, this thesis does not find any permanent effect of smoke-free laws on revenues or employment of hospitality businesses. The results of the analysis also show, that if there was any significant impact throughout the first years of the smoke-free law's validity, it was always short-lasting. Still, the over time impacts of the individual forms of smoke-free laws differ. In case of a partial smoke-free law, there is a statistically significant negative impact on turnover immediately after its implementation and a positive impact on employment in the third and fourth year after its implementation. The complete smoking ban does not exhibit any statistically significant impact at all. In case of differences in impacts based on regions, no significant result can be concluded due to a high risk of including other factors that could influence turnovers and employment. The differences based on socio-economic factors appear to be more useful to observe, even though they display no statistically significant result in the short-term. Differences based on the long-term are generally at high risk of being biased.

Keywords

Smoke-free law, hospitality businesses, revenue, employment, difference-in-differences

Abstrakt

Pokaždé, když byl vznesen návrh na zavedení protikuřáckých zákonů v pohostinských podnicích, býval vznesen i argument, že tyto zákony budou poškozovat tyto podniky ve smyslu příjmů a zaměstnanosti. Tato bakalářská práce zkoumá toto tvrzení v kontextu evropských zemí. V první řadě chce rozlišit vliv dvou odlišných forem protikuřáckých zákonů. Za druhé, zkoumá vliv těchto nařízení v čase. Za třetí, pokouší se nalézt rozdíly v jejich dopadech na základě regionálních, či sociálně-ekonomických odlišností. Analýzou administrativních ročních dat z databáze Eurostatu za použití metody difference-in-differences tato práce nezjistila žádný dlouhodobý vliv protikuřáckých zákonů na příjmy či zaměstnanost v pohostinských podnicích. Výsledky analýzy též ukazují, že pokud byli některé z dopadů statisticky signifikantní v průběhu prvních let platnosti protikuřáckého zákona, tyto dopady byly pouze krátkého trvání. Přesto, vliv jednotlivých forem protikuřáckých zákonů v čase se liší. V případě částečného protikuřáckého zákona byl zjištěn negativní dopad na příjmy okamžitě po jeho zavedení a kladný dopad na zaměstnanost tři až čtyři roky po jeho zavedení. Úplný zákaz kouření nevykazuje žádný podstatný vliv. V případě rozdílů mezi regiony nelze očekávat žádný výrazný výsledek kvůli vysokému riziku ovlivnění výsledků jiným vlivy. Rozdíly založené na sociálně-ekonomických rozdílech se zdají být užitečnější, přestože neodhalily žádný statisticky významný výsledek v krátkodobém horizontu. Rozdíly v dlouhodobém horizontu se obecně zdají být vychýlené.

Klíčová slova

Protikuřácký zákon, pohostinství, příjmy, zaměstnanost, difference-in-differences

Declaration of Authorship

I hereby proclaim that I wrote my bachelor thesis on my own under the leadership of my supervisor and that the references include all resources and literature I have used.

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Prague, May 4, 2020

Josef Simpartl

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Bachelor's Thesis Proposal

Author	Josef Simpartl
Supervisor	Petr Janský
Proposed topic	Impact of smoke-free laws on hospitality businesses in the European perspective

Research question and motivation:

The main research question of my bachelor thesis is to compare how bans of smoking in pubs and restaurants in European countries affected their revenues.

Since 2004, countries throughout Europe started to implement a complete smoking ban in public places including bars, pubs and restaurants. With the ban, there has been a question whether the new legislation is not harming owners of pubs and restaurants by causing financial losses and whether the new law does not bring generally too much economic harm. To answer this question, many national research studies were conducted.

One of the first countries in Europe that implemented the complete smoking ban was Ireland in March 2004. Research conducted in 2013 (based on the data from 1999 to 2007), found that the impact of smoking ban on revenue in Irish bars was minimal and sometimes even positive (Cornelsen and Normand 2013). There was also no statistically significant impact on businesses in Norway, which introduced complete ban of smoking in pubs and bars in June 2004 (Melberg and Lund 2012). In addition to countries with the complete ban, there are also countries that allow some exceptions, such as Italy, where the impact of the smoking ban on revenues of hospitality businesses also appears to be minor and unambiguously negative. (Pieroni, Daddi and Salmasi 2013).

Several topics, however, have not been analyzed yet. In Scotland has been found that the smoking ban will cause a short-term shock that will be absorbed within a longer period (Adda, Berlinski and Machin 2006), but there has never been a study that would evaluate the overall impact in European countries internationally. There has been a study observing the impact between multiple states in the US, which confirmed that generally there is a small or no economic impact on hospitality

businesses (Loomis, Shafer, van Hasselt 2013), but I deem the US to be a different environment both in attitude to smoking and hospitality businesses, compared to Europe. Moreover, even though the effects are reported to be small, there is no analysis of which socio-economic variables might influence them.

Contribution:

Even though smoking ban in bars and pubs appears to have only a little or an insignificant impact on revenues, there still might be differences in the direction and magnitude of the impact among 23 European countries, which introduced the complete smoking ban. The aim of my thesis is identifying those differences and finding an explanation for them by using variables connected with individuals consumption in pubs and bars that might influence the effect. In addition to the result of the analysis, the thesis should also be able to address the differences geographically and provide a policy implication for countries, which may introduce smoking bans in the future.

Methodology:

I intend to use socio-economic data collected from databases of Eurostat, OECD and demographical data from website ourworldindata.org and organize these data into a time series for every observed country and every variable of interest.

The analysis of the data will consist of observation of changes in variables relevant to sales in pubs and services. Firstly, with the use of descriptive statistics, I would like to get an insight of overall conditions in which the state implemented the smoking ban. Secondly, I want to develop an econometric model with use of a dummy variable representing the smoking ban, to quantify the impact of selected relevant variables on sales in restaurants and pubs.

Outline:

Introduction

- Importance of the topic

- Existing information and reference to former research

- Aim of the thesis and stating hypothesis

- Contribution

Literature review and background

- Important events of introducing smoking ban and its enforcement

- Researches on national level in relevant countries

Hypothesis

- Economic and geographical hypotheses

- Motivation behind hypotheses

Methodology

- Data (observed variables, length of time series)

- Methods of data analysis (statistical methods for brief observation and econometric model for quantifying the effects)

Data Analysis and Results

- Analysis of the model

- Reject/Not reject the hypotheses

- Reason and important evidence for the result

Conclusion

- Interpretation of results

- Implications for public policies regarding smoking ban

List of academic literature:

Jérôme Adda, Samuel Berlinski, and Stephen Machin. "Short-run economic effects of the Scottish smoking ban." *International Journal of Epidemiology* 36.1 (2006): 149-154.

Brett R. Loomis, MS; Paul R. Shafer, MA; Martijn van Hasselt, PhD. “The impact of smoke-free laws on restaurants and bars in 9 states”. *Preventing Chronic Diseases* 2013;10:120327

Cornelsen L., Normand C. “Impact of the Irish smoking ban on sales in bars using a large business-level data set from 1999 to 2007”, *Tobacco Control* 2014;23:443-448.

Hyland A, Scollo M, Lal A, et al. “Review of the quality of studies on the economic effects of smoke-free policies on the hospitality industry.” *Tobacco Control* 2003;12: 13-20.

Melberg, Hans Olav, and Karl E Lund. “Do smoke-free laws affect revenues in pubs and restaurants?” *The European journal of health economics: HEPAC: health economics in prevention and care* vol. 13,1 (2010): 93-9. doi:10.1007/s10198-010-0287-6

Luca Pieroni; P. Daddi and Luca Salmasi, (2013), Impact of Italian smoking ban on business activity of restaurants, cafés and bars, *Economics Letters*, 121, (1), 70-73

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Introduction

Smoking bans in bars, public houses and restaurants are nowadays one of the most controversial laws. Unlike smoke-free laws in buildings of public administration, schools, hospitals, etc., where smoking has been generally considered socially inappropriate, smoking in bars, pubs, and restaurants has always been part of their culture, even after the recognition of adverse effects of smoking on the personal and public health.

The debates about an introduction of smoke-free policies have led to a clash of arguments of both supporters of the policies, including many politicians, public health activists and non-profit organizations, and their opponents, like tobacco companies and lobbyists. The common arguments of supporters of smoke-free policies regarding the hospitality industry are similar to smoke-free policies in other sectors. These include the protection of non-smoking patrons and employees from second-hand smoking or encouragement of smokers to quit this habit. Opponents typically argue that bars and restaurants are the private property of their owner and therefore he has the right to choose whether smoking will be prohibited on the premises of his enterprise. Another argument provided by the opposition of the laws is, that the prohibition of smoking in the indoor areas of hospitality enterprises will drive away their smoking patrons and have an adverse effect on revenues, profits, and employment. This argument has been scientifically examined many times with various conclusions. However, almost each of the studies have been focused on a national level and have not investigated this effect in international scope. This thesis intends to address this issue and analyze the impact of smoke-free laws in public houses in the European perspective with the use of administrative data and critical reasoning.

This thesis is organized into sections. The first section of the thesis provides an overview of important social and scientific milestones that led to the beginning of the smoke-free law initiative throughout the World and Europe. The following second section summarizes a research dedicated to this problematic, using research papers from the United States, where the first steps to create smoke-free environment in hospitality industry took place already in 1970s, and from Europe, which has been providing some evidence since the early years of the new millennium.

The third section introduces and describes collected data for the analysis and a methodology of the analysis itself. The data description includes disclosure on their origin as well as an introduction of dependent, independent and control variables and their importance for the analysis. The methodology section specifies used methods of analysis with respect to the motivation of this thesis, former literature and chosen data.

Section four states hypotheses that are tested in the analysis. The hypotheses are given in three dimensions. First, hypotheses are made with respect to a general impact of smoke-free laws. These are aimed to inspect the impact in a longer time horizon. Second, hypotheses address an evolution of effects of individual laws throughout the time. Last, but not least, hypotheses about differences of the smoking ban impact in various regions of Europe are made, based on differences in their socio-economic and political development.

Section five reports the results of the econometric analysis in a form of reporting tables and related comments. This part should make clear which hypotheses from the section four can or cannot be rejected and provide enough material for a relevant conclusion. Section six follows with an interpretation of the results and reasoning over both results and used method. Moreover, it assesses usability of the results.

Section seven concludes the thesis. The conclusion remarks the importance of the analysis results and connects them with former research and arguments of both parties involved in the debates over the smoke-free laws. On the other hand, it also states its shortcomings and other possible issues that can be addressed in relation to it. Based on a synthesis of the results and rational arguments, the conclusion also provides practical implication for policymakers in states, where smoke-free laws in bars, pubs and restaurants have not been adopted yet or are incomplete.

1 Smoking and smoke-free law initiative

The tobacco and smoking as a way of its consumption were brought to Europe during the period of an exploration of the North and South Americas. Already at the break of the 16th and 17th century smoking tobacco triggered various reactions. Spanish doctor Nicolás Monardes promoted its medical properties, including a possibility of healing cancer (Wexler, 2006). On the other hand, King James I. of England claimed smoking to be “*a custom loathsome to the eye, hateful to the nose, harmful to the brain, dangerous to the lungs, and in the black, stinking fume thereof, nearest resembling the horrible Stygian smoke of the pit that is bottomless.*” (Henningfield, Hilton, et al, 2020). Even though the consumption of tobacco was proclaimed a reason for an excommunication by Popes Urban VII. and Innocent IX. or for the capital punishment by the Ottoman sultan Murad VI., the tobacco started slowly to gain ground thanks to patronage from members of the aristocracy (Cohen, 2011). In the next two centuries, various ways of tobacco smoking were developed. An industrial-like production of pipes caused smoking being wide-spread in England and the Netherlands and hookahs popularized smoking in the Arab world. In the 19th century, smoking tobacco was already an important element of social life.

In 1881, the Bonsack rolling machine was invented (Cross and Proctor, 2014). This machine allowed a cheap mass production of cigarettes and their fast spread throughout all age groups and cohorts of society. It also triggered one of the first serious piece of legislation, prohibiting the sale of tobacco goods to minors in the United States, but with little success (Apollonio and Glantz, 2016). Another initiative was taken by the Non-Smokers Protective League in 1910, demanding smoke-free public spaces, such as restaurants (Hyland, Barnoya and Corral, 2012). This effort was however interrupted by both World Wars, when the tobacco industry was generously supporting soldiers on the front with cigarettes. Also because of those events, the popularity of cigarettes surged during the first half of the 20th century and peaked in 1950s when roughly every second citizen of industrialized countries smoked (Henningfield, Hilton, et al, 2020).

An important turning point occurred in 1954 when Richard Doll and Austin Bradford Hill provided the first empirical evidence of a link between smoking and

lung cancer, which was accepted by the Royal College of Physicians in 1962 and the US surgeon general in 1964 (Proctor, 2012). In addition, the early 1960s saw emergence of studies reporting on harmful effects of a second-hand smoke. The first results of this development came in 1966, when the Congress of the United States passed a bill that mandated tobacco companies to put health warnings on packs of cigarettes, which became the first state-wide law countering smoking in the society (Hiilamo, Crosbie and Glantz, 2014).

The first laws requiring smoke-free public places were passed in 1975 in Arizona, Connecticut, and Minnesota, which was the first state to implement a statewide smoke-free law (Hyland, Barnoya and Corral, 2012). The first complete ban of smoking in restaurants was implemented by the town of Aspen, Colorado in 1987 (American Lung Association, 2019). In 1998, California became the first American state with a comprehensive smoking ban in all public places, including bars and restaurants. Until today, such comprehensive smoke-free laws have been passed in 28 US states and the District of Columbia (American Lung Association, 2019).

In Europe, some countries like Finland or Ireland managed to pass smoke-free laws regarding public places and workplaces already in 1980s, but the first comprehensive smoking ban in bars and restaurants was implemented no sooner than in March 2004 in Ireland (Cornelsen and Normand, 2014). Most of the European countries followed suit and throughout the last 15 years passed either a complete or a partial ban of smoking on the premises of hospitality service enterprises. The last country that introduced such smoke-free law was Austria. Originally, it was scheduled to be implemented in May 2018, but under the pressure of FPÖ, the Freedom Party of Austria, the implementation the law was dismissed (Bell, 2018). After the position of FPÖ was weakened, the law was implemented in November 2019 (Belluz, 2019). Still, in the European Union, there is one exception – Germany. Germany as a federal state has not passed any federal law regarding smoking in public houses, but has only issued an agreement about laws on the level of an individual state or a free city. These laws were passed between August 2007 and July 2008 and possessed a various level of strictness. Only three German states have implemented a complete smoking ban – Bavaria, North Rhine-Westphalia, and Saarland (DGUV, 2014).

2 Literature review

Before addressing key findings in the empirical literature, there is a concern about choosing the objective studies. From the wide range of studies related to the impact of a smoking ban on the hospitality industry, many were giving conflicting conclusions. A review of studies issued before 31 August 2002 found a significant difference in quality between studies that were concluding an adverse effect smoking ban and those giving no significant effect or a positive effect. The key finding was a strong link between studies funded by tobacco companies, concluding negative economic impact and having poor scientific quality since only one of 31 tobacco industry funded studies was issued in a peer-reviewed journal, none of them satisfied stated criteria for methodological quality and 80 percent of them did not satisfy any quality test at all. On the other hand, no study satisfying all criteria concluded the adverse economic effect of the smoking ban. (Scollo et al., 2003)

Even though it would appear unambiguous that tobacco industry funded studies are generally biased, some researchers like Micheal L. Marlow or Carl Phillips claim, that this opinion is a result of a stigmatization of tobacco companies persisting from the times when tobacco industry issued positive news about the smoking to protect their interests, even at the cost of submitting false information to public. There is a suggestion that the tobacco companies should fund studies again for two reasons. First, the public caution against manipulating the research by the companies will force the companies not to intervene during the research. Second, when considering a private market, only a company experiencing some adverse effect will be motivated to make a research. Another problem for acceptance of such studies mentioned by Marlow is a very escalated debate between ban supporters and opponents, which is nowadays a general pattern observable in debates regarding most of public agendas in the United States. (Marlow, 2008)

One of the first European studies on the economic impact of a smoking ban on the hospitality industry regarded the comprehensive smoke-free law in Norway from June 2004. Since Norway was one of the first countries to issue a smoke-free law of this kind and many others were considering an implementation of similar laws, there was a big international interest in the outcome. The study concluded a 0,8 percent

decrease in value-added tax receipts during the first 12 months of the smoke-free law, while the biggest losses (4,4 percent) were exhibited by bars and pubs, i.e. enterprises selling mostly beverages, not food. Concerns of increased bankruptcies and decreased patronage of hospitality enterprises were proved wrong. (Lund, 2006)

Shortly after followed an evaluation of the smoking ban implemented in Scotland. Using data collected through questionnaires shortly before and after the smoke-free law came into force, the difference-in-differences analysis showed that in comparison to Northern England, where no ban was imposed by that time, the sales in Scotland declined by 10 percent, partly caused by 14 percent decrease in the number of customers. (Adda, Berlinski and Machin, 2007)

Similar results regarding sales exhibited a study investigating Italian smoke-free laws. In contrast to the Scottish or Norwegian ban, the Italian government allowed separate rooms designated for smokers in public houses. Using administrative data, instead of questionnaire collected, the researchers found a 3 percent lower increase in sales in Italian pubs and restaurants in comparison to the control group, consisting of food and beverage serving businesses in France and Spain. Even though this difference was statistically significant at a 10 percent level, it caused no differences in the level of profits, employment or earnings before interest, taxes, depreciation and amortization (EBITDA). (Pieroni, Daddi and Salmasi, 2013)

The case of Germany provided a very interesting opportunity to test the impact of various smoke-free laws within one state. Every German state implemented a different law at a different point of time between August 2007 and July 2008, which provided a promising setup for a study. Kvasnicka and Tauchmann decided to use such variation in time and regions. They found a negative effect of 2 percent with an evidence, that this adverse effect will disappear after a longer period of time (Kvasnicka and Tauchmann, 2012). The findings of Ahfeldt and Maennig were similar but added that only bars were affected by a decline in sales, not restaurants (Ahfeldt and Maennig, 2010).

García-Villar and López-Nicolás investigated tightening of the Spanish smoke-free law in 2012, that removed all exception provided to hospitality enterprises. The approach they took was different. Instead of collecting business-level or macro-level

data reported by bars, pubs, and restaurants, the data consisted of a sample of Spanish households, that reported their socio-economic status, including their expenditure for hospitality services or the number of smokers among the household members. Such data allowed an exclusion of tourist customers and distinction between different types of venues. On the other hand, they were also susceptible to measurement errors. The only variable that appeared to be causally affected by the reformed smoking ban was the fraction of households containing smokers. Every change in variables connected to the economic conditions of the hospitality industry was attributed to a continuation of the general downturn of the Spanish economy between the years 2006 and 2010. (García-Villar and López-Nicolás, 2015)

Another approach was taken in Belgium, where researchers decided to examine profitability of restaurants, because of an argument, that the smoking ban affects not only the income side, like changes in patronage, but also the cost side, such as changes in health conditions of employees and therefore changes in their productivity. The variable used to measure the profitability was a return on assets (ROA). Using a difference-in-differences method, controlling for size, age, liquidity and other firm-specific variables, they found, that the impact of the ban on the return on assets was negative, yet insignificant. This result persisted even after an inclusion of more control variables. The study however does not provide any disclosure on whether the impact was insignificant because all customer groups did not change their behavior, or whether some changes occurred and were counterbalanced. (De Schoenmaker et al. 2013)

In the United States, many counties or cities had already implemented their own smoke-free laws even before the state legislature took place. Yet, some owners of bars or restaurants were concerned about upcoming laws. The area of interest for a new research were south-east states of the US, where state-wide laws were not implemented yet, and more specifically North Carolina, where a new smoke-free law was passed in 2009. A method they used was OLS combined with an instrumental variable, where instruments were lagged non-sector (not related with bars and restaurants) sales and employment. The only significant change in employment due to a smoke-free law was found in West Virginia and the effect was positive. The

smoke-free law in North Carolina did not have any effect on sales or employment (Loomis, Shafer and Van Hasselt, 2013). The strength of the conclusions does not come only from the results themselves but also from the choice of the inspected region, since the south-eastern states exhibit the highest rates of smoking prevalence in the United States. More specifically the largest smoking part of population can be found in West Virginia, where 26 percent of population smoked in 2017 (CDC, 2019).

The European literature contrasts to a certain extent to the literature from the United States. Whereas in the United States the introduction of the smoke-free law is reported that it does not cause any economic harm, bars, and restaurants, in many countries of western, southern and northern Europe appear to experience some damage to their sales and revenues, even though it is small and temporary in nature. A possible reason are different attitudes towards smoking. By 2018, only 13,7 percent of Americans regularly smoked (CDC, 2019), which is more than 6 percentage point decrease in the last decade. In the states of EU28, 28 percent of citizens were smoking in 2017 (Special Eurobarometer 458, 2017). Besides that, 8 EU states (Luxembourg, Belgium, Czech Republic, Slovenia, Greece, Hungary, Cyprus and Austria) rank between 20 countries with the highest prevalence of smoking in the world (Smith, 2018).

In the European context, the impact of the smoke-free law was inspected in individual countries from various points of view, using different sources of different sorts of data and methods. The most prevalent method – difference-in-differences – proved itself to be a useful tool for assessing it. Still, there are gaps in this field that have not been filled yet. There is not much research dedicated to the smoke-free laws introduced in eastern Europe. Even though most of eastern European countries were integrated into the European Union, they might still exhibit different reactions to restrictive public policies than countries of the western Europe, partly as a mental heritage from times of the Eastern bloc. It would be also worth of inspecting, how the reaction to the new smoke-free policy evolved overtime. The process of introducing the smoking bans in European countries has taken more than 15 years, which can provide enough time variation to assess such evolution. Last, but not least, the

laws implemented by national governments are not uniform. Some countries allow for exceptions from the smoking ban, some countries chose a complete smoking ban, either with or without a preceding partial ban. The following text should address those three areas by inspecting the impact of smoke-free laws in the perspective of the whole Europe.

3 Data and methodology

3.1 Data

For the purpose of the analysis, annual administrative data from the database of Eurostat and the World Bank were gathered, from which a panel dataset was created. This dataset consists of 29 European countries (EU28 and Norway) between years 2005 and 2018 and important variables connected to a phenomenon of smoking in bars, pubs and restaurants. A positive aspect of using administrative data is their objectivity, which makes them, in contrast to data collected via questionnaires, more reliable and less susceptible to measurement errors. On the other hand, there is a lower count of observations, since such data are collected mostly on annual basis. Quarterly and monthly data are usually not available.

The dependent variables consist of total turnover (gross revenue) and number of employees in the hospitality industry in the above-mentioned time period. These data were extracted from the database of Eurostat, specifically the Structural Business Statistics. These data belong to code I56 of the statistical classification of economic activities NACE Rev.2 – food and beverage service activities. The total turnover, reported in million euros, is the main variable to be inspected, since it is directly influenced by the change of behavior of patrons. The number of employees is one of the most significant consequences of the changes in turnover and therefore it is also worth analyzing. For a simplification of the analysis and reporting of its results, both dependent variables were transformed to their natural logarithms.

To capture the existence of smoking bans, dummy variables were constructed, representing a complete ban (*ban_c*), a partial ban (*ban_p*), a complete ban that followed a partial ban (*ban_p-to-c*), and a complete ban with no previous partial ban (*ban_c-no-p*). The complete ban captures a ban without any exceptions. The partial ban represents any smoke-free law that allows for exceptions, such as allowing for smoking in separate rooms with proper ventilation, in establishments of a certain area size or in establishments that are fulfilling other technical conditions imposed by the law. Even though the partial smoke-free laws differ in detail, it can be assumed that the Stable Unit Treatment Value Assumption (SUTVA) is not violated. When a partial smoke-free law is imposed, smoking customers pay attention to the

fact, that there is still a possibility to smoke inside, rather than to a required power of ventilation or availability of serving staff.

In the years when the smoke-free laws came into force, the dummy variables reflect only the part of the year, represented in months, when the law was in effect. Another such adjustment is applied to countries, where the smoking ban applied only to a fraction of its citizens. This is the case of the United Kingdom and Germany. In the United Kingdom, the first country to completely ban smoking in bars, pubs and restaurants was Scotland in March 2006. To translate it into a dummy variable, I took a product of a fraction of citizens of the United Kingdom that are living in Scotland and a fraction of the months in the year 2006 when the law was in effect. This number added up to one as the other three parts of the United Kingdom introduced their smoke-free laws.

In Germany, this problem was even more complicated, since on the federal level Germany issued only a vague agreement to limit smoking in pubs. The law itself was agreed to be in the competence of individual states and free cities. Between 2007 and 2009, all 16 German states issued their own legislation. Until today, only three states (Bavaria, North Rhine-Westphalia, and Saarland) have chosen a complete ban. Other states have chosen laws with various exceptions. The dummy variables for Germany were created in the same manner as for the United Kingdom.

In addition, all four dummy variables described above are amended by series of five dummy variables that capture first five years of the enforcement of the ban (*ban1*, *ban2*, *ban3*, *ban4*, *ban5*). The reason to include those variables is a possibility to explain, how the repercussions of the ban differed in time and possibly verify the argument, that an eventual adverse effect of the ban on hospitality businesses is only temporary or diminishing. There was also a consideration to observe this pattern as an interaction variable between ban variable and time variable represented by years. An obvious reason to reject this option is that such variable is useless unless the smoke-free laws were implemented in the same year. Set of dummy variables allows to harmonize the time to a single reference point, i.e. the year, when the smoke-free law was adopted. Besides that, each type of ban is assigned a season variable. This variable indicates whether the law was implemented between April and August. In

this time, it is common that patrons spend their time on the outside premises of the pub or restaurant, rather than inside, and therefore the smoke-free law does not affect them that much.

Besides observing different effects of the smoking ban in time, I also consider a possibility, that reactions to it varied among countries. Therefore, the dataset contains variables regarding groups of countries with similar historical and social development, such as post-communist countries in the Eastern Europe, or recent economic development, like PIIGS countries (Portugal, Ireland, Italy, Greece, Spain). These variables will be used in interaction with the ban variables. Alternatively, an interaction of smoke-free law variable and variables capturing different social indicators, like above-average cigarette consumption or unemployment, can be used.

Besides the dummy variables, the dataset contains unemployment rates and GDP of observed countries, collected from the database of the World Bank. These variables can be used as possible controls for economic activity and well-being of the citizens of the respective state. Even though the turnover of the hospitality service enterprises is a component of the GDP, it created only 3,7 percent of it on the EU level in 2013. I do not expect this figure to change in following years. The GDP can be therefore considered a usable control variable. Other variables can be used to identify, whether the change in revenues in the hospitality sector arises from the consumption of cigarettes. According to collected data from a study of Michal Stoklosa on prices and sales of cigarettes, we can see that the numbers significantly differ among the EU countries. While observing these variables, the general phenomenon is a decrease in sales and increase in prices of cigarettes. There is one state with significantly lower level of cigarette sales all along the time series – Sweden (Stoklosa, 2018). A possible explanation is offered by the fact, that it is legal in Sweden to consume snus (form of a chewing tobacco), which is a popular substitute to a cigarette. The smoking prevalence in Sweden is the lowest in Europe, only 7 percent (Leon et al., 2016).

For a simplicity, the role of a cigarette consumption will enter the analysis as a dummy variable. This dummy variable is equal to zero, if the sales of cigarettes in a specific country and specific year were below or equal to the year's average, and

equal to one otherwise.

3.2 Methodology

The analytical part of the thesis consists of several parts. The first part examines whether the smoke-free laws caused any general harm to the revenue of hospitality businesses. The second part examines how the impact of the ban evolved throughout the time to verify the hypotheses of short-term or diminishing impact on businesses. The third part aims at differences between states or groups of states in their reaction to the smoking ban.

The chosen econometric method is differences-in-differences. The reason for this choice is that difference-in-differences is a practical tool to observe the impact of public policies. Of course, there is generally an identifying assumption of parallel trends of the observed subjects.

$$\begin{aligned} \ln(\textit{turnover})_{st} = & \beta_0 + \beta_1 \textit{ban_p}_{st} + \beta_2 \textit{ban_c}_{st} + \beta_3 \textit{unemp}_{st} + \\ & + \sum_{k=1}^{29} \beta_k \textit{STATE}_{ks} + \sum_{j=1}^{14} \beta_j \textit{YEAR}_{jt} + \epsilon \end{aligned} \quad (1)$$

Equation (1) displays a difference-in-differences regression equation in case of valid parallel trend assumption. Variables *ban_p* and *ban_c* are the variables of interest – partial smoking ban and complete smoking ban respectively - and they are used not only to identify the impact of the respective smoke-free law on the turnover, but also to control for other types of smoke-free laws, when one specific law is examined. By this, it is ensured, that the coefficient of the currently observed variable is measured with respect to a state when no smoke-free law is present. Variable *unemp* indicates unemployment, a possible control variable. In this case, it is an unemployment. The first sum of variables is a sum of 29 dummy variables for each examined state. The dummy variable *STATE* is equal to one, when $k=s$. The same applies to dummy variables *YEAR*, that equals one, when $j=t$.

The economies of the states of the EU28 are open and interdependent, which is a possible argument in favor of this assumption. However, a graphical representation of trends of individual countries shows, that the assumption does not hold. Even

stronger evidence is provided by a correlation matrix. The reason is probably an inclusion of the crisis years, which affected the European states differently both in times of economic downturn and recovery (example of PIIGS states). Even though the parallel trend assumption is most likely invalid, there is a possible control for deviating trends in form of interaction terms of dummy *STATE* variables and year variable *t* (Angrist and Pischke, 2014). If this interaction term was not included, there would be a high risk that the coefficients related to smoke-free policy variables accumulate the general economic development in respective countries and the results of the analysis would be biased. Validity of such approach is also going to be disclosed in the analysis assessing its usefulness and impact on the results.

$$\begin{aligned} \ln(\textit{turnover})_{st} = & \beta_0 + \beta_1 \textit{ban_p}_{st} + \beta_2 \textit{ban_c}_{st} + \beta_3 \textit{unemp} + \dots \\ & \dots + \sum_{k=1}^{29} \theta_k (\textit{STATE} * t)_{st} + \epsilon_{st} \end{aligned} \quad (2)$$

The equation (2) adds non-parallel trends control dummy variables. These dummy variables consist of interaction terms of dummy variables *STATE* and calendar year *t* (2005, 2006, ...).

Another issue that needs to be handled is a heteroskedasticity. The Breusch-Pagan test discovered heteroskedasticity with p-value less than 2.2e-16. Heteroskedasticity must be dealt with in order to use t-tests and F-tests that will be used to assess a statistical significance of dummy variables of interest. For this reason, the results of the analysis will be reported with White standard errors. Statistical significance of every variable will be inspected at 5 percent significance level. Nonetheless, variables statistically significant at 10 percent level will also be reported as support information for the interpretation of results.

The difference-in-differences model will be applied to examine impact of both types of complete ban and partial ban in one model to observe general impact. For the purpose of examining the time trend, the dummy variables representing the smoke-free laws will be separated to individual models to investigate the time effect of each of them. It should be noted that the coefficients of the respective time variables will be interpreted as by how much the turnover or employment is lower in comparison to the situation when no smoke-free law was implemented. This does

not necessarily mean that the turnover declined in the given period. In case of turnover, the impact of the year when the smoke-free law was implemented will be inspected separately to assess the short-term impact, that proved in some cases to be significant, like in Scotland or Germany. Changes in employment are expected to be rather a consequence of a change in turnovers and so the model capturing only the impact only in the first year will be excluded. The differences in the effects of the smoke-free laws depending on socio-economic factors or groups of countries will be assessed separately, both in the long-term and in the short-term period.

4 Hypotheses

The literature and data provide several hypotheses to be tested in the following analysis. First and most importantly the overall impact of both complete and partial smoke-free laws. I expect that presence of both forms of law, the complete ban and the partial ban, are statistically insignificant in relation to the turnover and employment in the hospitality industry. This hypothesis is inspired by the former research both in the US and Europe.

Moreover, there are other more specific hypotheses to be tested. Adda, Berlinski and Machin found a significant short-term effect in Scottish pubs. Based on this outcome, there is a hypothesis that short-term impact, e.g. impact during the first year of the ban, was different and probably more intensive than the overall impact. Given dummy variables for years after an implementation of the smoke-free law, the expected outcome is the diminishing effect of the ban, regardless its form. In relation to the effect of the ban over time, a seasonality may be also relevant variable in the analysis. It is common, that since the late spring until the early autumn the customers spend their time in pubs, bars and restaurants rather outside than inside. The smoking ban does not apply to outside premises of the hospitality enterprises. This would give some additional time to become accustomed to the new rule and therefore might cause less significant decline in revenues.

There are some hypotheses regarding a comparison between the types of smoke-free laws as specified in Section 4. First, the impact of a partial smoking ban is expected to be milder than the impact of the complete ban, since it is not such a significant change. Second, the impact of the complete ban will be even larger, if there was no preceding partial ban. This hypothesis appears to be intuitive, since patrons of the pub, where the partial ban was already introduced, should have a bigger understanding for its tightening.

The last part of the analysis aims to uncover possible differences in reactions to smoke-free laws in different groups of countries. For instance, it can be expected that the citizens of countries of the former Eastern bloc to be less keen on the smoke-free policies. Such displeasure, which can be a consequence of experiences with restrictive and oppressive laws of the former regime, can be translated in re-

duced patronage of pubs and restaurants. Another distinction can be made through unemployment rate, using countries that experienced high unemployment between years 2005 and 2018. By high unemployment is meant an unemployment rate higher than 10 percent. Related to this view is also a distinction between countries that had serious economic problems through the years of crisis (PIIGS countries).

Additional differences might be caused by a level of consumption of cigarettes. Comparing countries where the number of smoked cigarettes is above average against countries where number of smoked cigarettes is below average, there are three possible outcomes. First, there is no difference. Second, countries with above-average consumption of cigarettes might be affected negatively, because smoking patrons are more motivated not to go to bars, where they cannot smoke. Third, countries with above-average consumption of cigarettes might be affected positively in comparison to the rest of countries, because non-smoking patrons are given bigger incentive to start visiting hospitality venues or further increase their patronage.

However, the last part of the analysis is rather an experiment aimed to verify, whether the differences in the impact of the smoke-free laws can be assessed through a difference-in-differences econometric analysis.

In relation to the employment in hospitality industry, the impact of the smoke-free laws can have three possible consequences. The first possibility is a decrease of the employment due to the decline in revenue. This would result in lower demand for labor force. The second possibility is that there will be no change, either because of no change in labor supply or demand. The final possibility is an increase employment as a result of increased labor supply due to improved health conditions of employees of hospitality businesses. If the first or the third scenario is true, the effects should occur slightly later than changes in revenue.

5 Results of the analysis

This section reports on the results of the analysis. It is divided into two subsections. The first part regards the impact of smoke-free laws on the turnover of hospitality businesses, the second part reports on the impact on the employment. Each part individually inspects general and overtime impact of each type of smoke-free laws. In addition, regional and socio-economic differences are assessed both in relation to turnover and employment. The results are provided in form of regression tables and related comments. The analysis was conducted in statistical software R. A statistical significance is therefore displayed in the same manner. This means, that the statistical significance on 5 percent level is symbolized by one star (*), statistical significance at 1 percent level by two stars (**), and statistical significance at 0.1 percent level by three stars (***)

5.1 Turnover

Table 1: Impact of smoke-free laws on turnover and state specific trends

Variable	a)	b)	c)	d)
ban_c	0.057 (0.033)	0.02 (0.032)		
ban_c_no_p			0.01 (0.034)	-0.005 (0.037)
ban_p_to_c			0.19*** (0.055)	0.089 (0.057)
ban_p	0.073* (0.031)	-0.005 (0.028)	0.11** (0.037)	0.012 (0.03)
unemp	-0.031*** (0.003)	-0.02*** (0.002)	-0.033*** (0.003)	-0.02*** (0.002)
N	399	399	399	399

Table 1 refers to a general impact of both partial smoking ban (*ban_p*) and complete smoking ban (*ban_c*) over the whole time period between 2005 and 2018. Column a) summarizes an impact of those smoke-free policies with additional control variable (unemployment) and without state-specific trend control. Column b) shows the

same model amended with state-specific trend controls. Column c) decomposes the effect of the complete ban into two variables – complete ban with no preceding partial ban (*ban_c_no_p*) and complete ban following a partial ban (*ban_p_to_c*). Column d) again amends the column c) with state-specific trend controls.

Table 1 indicates how important the state-specific trend control is. If there are no such controls, economic trends, that are specific to individual countries, are included within the variables of interest. When the non-parallel trends are included in the model, there is a possibility to observe, which countries significantly differed from others. There are several reasons, why these trends differ. First, the law of economic convergence. Bars and restaurants in some countries, starting with low turnover in 2005, were able to increase it dramatically. This is the case of Bulgaria, Estonia, Lithuania, Romania and Slovakia, where bars and restaurants were able to increase their turnover by more than one hundred percent. The trend can also be of course significant because of a completely opposite reason, i.e. because of low level of growth or even negative development of the turnover. The only country, that experienced a decline in the turnover of bars and restaurants, is Greece, because of the long-lasting economic crisis. Another such country is the United Kingdom, which not only had the lowest growth from the countries of the European Union, but also appears not to be affected by the crisis years. There are also countries that have different trends because of the different impact of the crisis. Portugal experienced a second worst decline in turnover during years 2009 – 2012. On the opposite side, Sweden had the second-best development in the same period. Bars and restaurants in Croatia were able to quickly increase their turnover in 2013, probably because of increased wave of tourists in the first years after the crisis. The Czech Republic on the other hand was stagnating two more years after the crisis, similarly to Portugal and Ireland. The last country to have significantly different trend is Malta, probably because of a short period of increase in the turnover in 2010. The fact that almost every country experienced an increase in turnover of its hospitality industry during the observed period makes it evident that the results in columns a) and c), where the state-specific trends have been not controlled for, are upward biased.

Column a) shows statistical significance of the introduction of a partial ban, estimating its effect at 7,3 percent increase in revenue, which is already a sizable improvement. The impact of a complete ban is statistically significant only at 10 percent level (p-value 0,08), estimating its effect at 5,7 percent. Column c) divides the effect of a complete ban between effects of a complete ban without and with a previous partial ban, assigning them impacts of 1 and 19 percent respectively. Although the first effect seems reasonable, as well as its insignificance, the 19 percent increase of operational revenue caused by a change of smoke-free law towards a complete smoking ban is very likely upward biased and incorporates general economic development. But, because of the above-mentioned reason, these results should not be given much credit.

Columns b) and d) take the differences in economic development of individual countries into account. Every coefficient is now lower in comparison to columns a) and c). They are also all insignificant, with exception of unemployment. Still, the variable capturing the change from a partial to a complete smoking ban remains relatively high even though its statistical significance decreased (its p-value equals 0.118).

Table 2: Impact of a partial smoke-free law on turnover over time

Variable	a)	b)	c)	d)	e)	f)
ban_p	-0.005 (0.028)		0.009 (0.031)		0.003 (0.038)	
ban_p1		-0.04 (0.021)	-0.043 (0.025)	-0.036 (0.022)	-0.039 (0.033)	-0.051* (0.025)
ban_p2				0.006 (0.039)	0.004 (0.045)	
ban_p3				0.003 (0.04)	0.001 (0.043)	
ban_p4				0.015 (0.034)	0.013 (0.04)	
ban_p5				0.0001 (0.024)	-0.001 (0.029)	
season_p						0.029 (0.028)
unemp	-0.02*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)
ban_c	0.02 (0.032)	0.023 (0.031)	0.027 (0.032)	0.025 (0.03)	0.027 (0.034)	0.022 (0.031)
N	399	399	399	399	399	399

Table 2 closely examines the impact of implementation of a partial ban on hospitality business revenues. Column a) displays only a mild and highly insignificant impact of the variable, that indicates the existence of the partial ban throughout the whole time horizon. Column b) examines the partial ban only in the first year of its validity. Its coefficient, estimating a decline in the hospitality businesses turnover at 4 percent, is statistically significant at 10 percent level and with p-value equal to 0.056, not far from being statistically significant at 5 percent level. This supports a hypothesis that if the smoking ban has any impact on the turnovers of hospitality businesses, it would take place in the short-term horizon. Column c) combines variables from column a) and b). Although no variable is statistically significant, it is again evident that impact of the ban can be attributed more to the first year

of the ban ($p = 0.089$), than to the variable capturing the smoke-free law ever since its implementation ($p = 0.779$). Column d) captures an evolution of the effect of a partial smoking ban through the first five years after its implementation. It underlines the above-mentioned importance of the first year of the ban, since the variable capturing it has a p-value of 0.103, still close to being statistically significant at 10 percent level. Variables capturing the following years are nowhere near it, both in terms of statistical significance and magnitude. The column e) combines the general partial ban variable with its time variables. It can be observed that every variable in this column is statistically insignificant, while the effect of the general ban variable is pushed downwards. It should be noted that the correct interpretation of results in column e) in every year of a validity of the smoke-free law is the coefficient in the respective year plus the coefficient of the general smoking ban variable. Column f) displays an effect of implementing a partial smoking ban in a summer season. Once we separate the season effect from the partial ban, the partial ban is statistically significant at 5 percent level. The effect for countries that implemented their partial ban in the summer season is interpreted as sum of the two variables. The F-test assessing their joint significance shows p-value equal to 0.345. The partial ban introduced in summer is therefore statistically insignificant.

Table 3: Impact of a complete smoke-free law on turnover over time

Variable	a)	b)	c)	d)	e)	f)
ban_c	0.02 (0.032)		0.02 (0.036)		0.08 (0.056)	
ban_c1		0.008 (0.028)	0.00005 (0.032)	-0.001 (0.03)	-0.055 (0.046)	0.0005 (0.026)
ban_c2				0.007 (0.03)	-0.041 (0.039)	
ban_c3				-0.029 (0.026)	-0.069 (0.036)	
ban_c4				-0.018 (0.024)	-0.05 (0.029)	
ban_c5				-0.04 (0.033)	-0.062 (0.038)	
season_c						0.02 (0.048)
unemp	-0.02*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)
ban_p	-0.005 (0.028)	-0.01 (0.026)	-0.005 (0.028)	-0.016 (0.028)	-0.007 (0.028)	-0.01 (0.027)
N	399	399	399	399	399	399

Table 3 captures the impact of the complete smoking ban, regardless, whether it was following the partial smoking ban, or not. Columns are organized in the same manner as in the previous table. Still, every coefficient displayed is not statistically significant at 5 percent level, except the coefficient of unemployment. Compared to the partial smoking ban, the year of implementation does not appear to have the largest impact on the turnover of bars, clubs and restaurants. It is recognizable from columns c), d) and e). The column a) suggests no significant impact of the complete smoking ban in the perspective of the whole time horizon. Column b) and c) shows, that the smoking ban was highly insignificant in its first year with p-values 0.76 and 0.99 respectively. Column d), aside the statistical insignificance of all variables, does not provide much information. Column e) shows two coefficients

statistically significant at 10 percent level. These are the variables representing the complete ban in the third and the fourth year of the existence of the law, with p-values equal to 0.056 and 0.083 respectively. The general policy variable is close to being statistically significant at 10 percent level. Its p-value is equal to 0.116 and magnitude is equal to 0.08, which appears to be relatively high, but we have to take into account that in the first year we have to interpret the effect as a sum of the general variable coefficient and the first year variable coefficient. The same applies to following years. The last column shows statistical insignificance of both contained variables (p-value of the F-test is equal to 0.918). Therefore, there is no difference between implementing a complete smoke-free law during the summer season or in other months.

Table 4: Impact of a complete smoke-free law without any previous partial smoke-free law on turnover over time

Variable	a)	b)	c)	d)	e)	f)
ban_c_no_p	-0.005 (0.037)		-0.012 (0.044)		0.055 (0.058)	
ban_c_no_p1		0.014 (0.038)	0.02 (0.046)	0.00004 (0.039)	-0.037 (0.054)	-0.01 (0.036)
ban_c_no_p2				0.012 (0.037)	-0.018 (0.042)	
ban_c_no_p3				-0.053 (0.034)	-0.077 (0.043)	
ban_c_no_p4				-0.056* (0.025)	-0.076* (0.033)	
ban_c_no_p5				-0.033 (0.022)	-0.05 (0.029)	
season_c_no_p						0.051 (0.052)
unemp	-0.02*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)	-0.021*** (0.002)
ban_p	0.012 (0.03)	0.013 (0.029)	0.012 (0.03)	0.008 (0.03)	0.01 (0.03)	0.014 (0.03)
ban_p_to_c	0.089 (0.057)	0.089 (0.056)	0.088 (0.057)	0.082 (0.057)	0.084 (0.057)	0.091 (0.057)
N	399	399	399	399	399	399

Table 4 reports about the complete ban that was implemented without any previous partial ban. Column a) capturing its long-term effect indicates, that it is statistically insignificant and negligible as such. The column b), reporting on the impact in the first year, shows also a statistically insignificant result. Interestingly, the only statistically significant coefficients besides the unemployment coefficient are coefficients regarding the impact of this smoking ban in the fourth year of its validity in columns d) and e). After a closer inspection, an impact of a similar magnitude can be seen already in the third year, yet the standard error is too high, so it is

not even statistically significant at 10 percent level. The fourth year exhibits almost no increase in the magnitude, but a decrease in the standard error enough for the variable to be statistically significant at 5 percent level. These results show that over the course of four years after the implementation the impact of the complete ban materialized further decreasing turnovers of bars, pubs, and restaurants, peaked at 5.6 percent and vanishes afterwards. Even though the column e) shows similar results to the column d) it appears that including the variable capturing the general impact only pushes other variables of their real values. It also increases standard errors. The column f) shows no impact of whether the smoking ban was implemented during a summer season.

Table 5: Impact of a change from a partial to a complete smoke-free law

Variable	on turnover over time					
	a)	b)	c)	d)	e)	f)
ban_p_to_c	0.089 (0.057)		0.097 (0.061)		0.19 (0.12)	
ban_p_to_c1		-0.006 (0.035)	-0.034 (0.04)	0.006 (0.039)	-0.1 (0.082)	0.019 (0.029)
ban_p_to_c2				0.01 (0.048)	-0.099 (0.082)	
ban_p_to_c3				0.019 (0.039)	-0.074 (0.066)	
ban_p_to_c4				0.056 (0.043)	-0.022 (0.055)	
ban_p_to_c5				-0.027 (0.07)	-0.07 (0.078)	
season_p_to_c						-0.1* (0.043)
unemp	-0.02*** (0.002)	-0.02*** (0.002)	-0.021*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)
ban_p	0.012 (0.03)	-0.012 (0.027)	0.012 (0.03)	-0.005 (0.027)	0.012 (0.03)	-0.012 (0.027)
ban_c_no_p	-0.005 (0.037)	-0.009 (0.037)	-0.005 (0.037)	-0.007 (0.037)	-0.008 (0.038)	-0.009 (0.037)
N	399	399	399	399	399	399

Table 5 examines a change from a partial to a complete smoking ban. The column a) displays that this change of a smoke-free law increased the aggregated hospitality industry revenue by 9,4 percent, while the coefficient is statistically significant at 10 percent level ($p = 0.085$). The column b) and c) show a completely insignificant impact of the new law in its first year of its existence. Still, in the column c) the variable capturing the general impact of the change almost retains its statistical significance, the p-value is now equal to 0.094. The column d) captures a sudden increase in statistical significance in case of the variable capturing the fourth year

after the change of the partial smoking ban into the complete smoking ban, just as in case of a direct implementation of the complete ban, yet it is so mainly due to an increase of the coefficient in comparison to the third year, not due to a decrease of a standard error. The column e) once again shows the statistical significance of the general variable ($p = 0.089$), but the value of the coefficient does not really reflect a real impact of a smoke-free law. An increase by 20 percent is not realistic, even if we sum them with negative effects in individual years and is very likely affected by some other variable that is not reflected in the model. The column f) shows a statistically significant impact of a season, but given that the impact smoke-free law is defined as a combined impact of both *ban_p_to_c* and *season_p_to_c*, the deciding measure is an F-test. In this case, its p-value is equal to 0.875. This means that these two variables are statistically insignificant.

Table 6: Differences in the impact on turnover based on regional and socio-economic differences (long-term)

Variable	a)	b)	c)	d)	e)
ban	-0.047*	-0.005	0.002	-0.013	-0.016
	(0.022)	(0.029)	(0.026)	(0.025)	(0.024)
post_com	20.74				
	(11.701)				
ban*post_com	0.113				
	(0.059)				
cig_cons_high		-0.027			
		(0.032)			
ban*cig_cons_high		0.023			
		(0.036)			
PIIGS			26.42*		
			(11.33)		
ban*PIIGS			0.008		
			(0.048)		
unemp_high				-0.144**	-0.069
				(0.051)	(0.048)
ban*unemp_high				0.098	0.121*
				(0.062)	(0.059)
unemp	-0.02***	-0.02***	-0.02***		-0.023***
	(0.002)	(0.002)	(0.002)		(0.003)
N	399	399	399	399	399

Table 7: Differences in the impact on turnover based on regional and socio-economic differences (short-term)

Variable	a)	b)	c)	d)	e)
ban1	-0.017 (0.015)	-0.021 (0.026)	-0.006 (0.019)	0.008 (0.02)	0.001 (0.019)
post_com	7.075 (7.938)				
ban1*post_com	0.027 (0.036)				
cig_cons_high		-0.017 (0.02)			
ban1*cig_cons_high		0.049 (0.042)			
PIIGS			25.49** (8.94)		
ban1*PIIGS			0.013 (0.042)		
unemp_high				-0.064*** (0.016)	-0.028 (0.018)
ban1*unemp_high				-0.008 (0.051)	-0.036 (0.052)
unemp	-0.02*** (0.002)	-0.02*** (0.002)	-0.02*** (0.002)		-0.022*** (0.003)
N	399	399	399	399	399

Table 6 aims to capture differences in impact of the smoke-free laws based on socio-economic and regional differences throughout the Europe. In this case the model captures the effect a smoke-free law regardless its form. The variable of interest in every column is the interaction term. According to the column a) implementing a smoke-free law in a post-communist country is associated with 11.3 percent increase in turnovers of bars, clubs and restaurants compared to other countries that implemented a smoke-free law. The coefficient is statistically significant at 10 percent level ($p = 0.056$). It is however very improbable that such improvement could be

attributed entirely to a smoke-free law, since an accumulation of higher economic growth in the coefficient cannot be excluded. Therefore, the coefficient provides no reliable information. The column b) show an insignificant difference in countries, where people buy more than average amount of cigarettes. Hospitality industry of PIIGS countries also do not seem to be affected differently than other countries. Columns d) and e) aim to identify and effect of smoke-free law in state of high unemployment. Column d) excludes a control variable and therefore it is not surprising that the variable capturing the high unemployment rate is statistically significant. The interaction term is statistically insignificant. Column e), where the control is included again, shows a different result. The interaction term is now statistically significant and is impactful. The estimated impact equals to 12.1 percent improvement in turnover. In the short-term, i.e. in the year of implementation of the smoke-free law, that is analyzed in the Table 7, all differences based on socio-economic conditions or specific area appear to be statistically insignificant. The only coefficient, that is worth further inspection, is an above-average consumption of cigarettes. Its p-value decreased from 0.515 in the long-term to 0.163 in the short-term.

5.2 Employment

Table 8: Impact of smoke-free laws on employment and state specific trends

Variable	trends			
	a)	b)	c)	d)
ban_c	-0.045 (0.026)	-0.024 (0.024)		
ban_c_no_p			-0.091*** (0.027)	-0.014 (0.026)
ban_p_to_c			0.093* (0.041)	-0.045 (0.053)
ban_p	0.005 (0.031)	0.031 (0.026)	0.047 (0.037)	0.026 (0.03)
unemp	-0.01*** (0.003)	-0.012*** (0.003)	-0.012*** (0.003)	-0.012*** (0.002)
N	394	394	394	394

Once again, table 8 displays, how important it is to control for state specific trends. For the same reason as in case of turnovers, impact and significance of every variable diminishes when the state specific trends have been controlled for. The standard errors decrease as well with only one exception, the standard error of the coefficient of the variable capturing the change of partial ban to a complete ban. In comparison to the column a), indicating an impact of a complete smoking ban being statistically significant at 10 percent level with p-value equal to 0.08, column b) reports no significant impact of both complete and partial smoke-free law. Nonetheless, it is quite interesting, that once the state specific controls have been included, the significance of the partial ban increased, although remaining statistically insignificant with p-value equal to 0.23. The columns c) indicates surprisingly significant impact of both ways of implementation of a complete smoke-free law. According to results, the implementation of a complete smoking ban without any previous partial ban is related to a 9.1 percent decrease in employment in hospitality industry. On the other hand, the implementation of a complete smoking ban succeeding a partial smoking ban can be associated with 9.3 percent increase in employment. Magnitudes and statistical

significance of both coefficients are surprisingly high, unless the controls are introduced again in column d). The controls turn both coefficients highly insignificant and drastically decrease their magnitude. The control variable, the unemployment rate, is always statistically significant estimating its impact roughly at -0.01 percent in every column. This remains in all following models.

Table 9: Impact of a partial smoke-free law on employment over time

Variable	a)	b)	c)
ban_p	0.031 (0.026)		-0.075 (0.047)
ban_p1		0.027 (0.024)	0.078 (0.042)
ban_p2		0.058 (0.039)	0.1* (0.049)
ban_p3		0.059 (0.033)	0.097* (0.042)
ban_p4		0.047 (0.024)	0.081* (0.033)
ban_p5		0.019 (0.033)	0.045 (0.037)
unemp	-0.012*** (0.002)	-0.012*** (0.002)	-0.013*** (0.002)
ban_c	-0.024 (0.024)	-0.023 (0.023)	-0.049 (0.025)
N	394	394	394

According to Table 9, the partial ban appears not to have any dramatic impact on the employment in the hospitality industry. The general long-term variable is statistically insignificant. While decomposed in first five years of its validity, at first insignificant effect accumulates in the following two years, culminating in the third and fourth year after the implementation. Their coefficients report an increase by 5.9 and 4.7 percent respectively, both being statistically significant at 10 percent level, while the ban in its fourth year is already close to statistical significance at 5 percent

level ($p = 0.053$). The column c) shows three coefficients to be statistically significant – smoke-free law in its second, third and fourth year of validity. Nonetheless, their effect combined with the general effect is very small.

Table 10: Impact of a complete smoke-free law on employment over time

Variable	a)	b)	c)
ban_c	-0.024 (0.024)		-0.022 (0.046)
ban_c1		0.013 (0.025)	0.027 (0.041)
ban_c2		-0.014 (0.028)	-0.001 (0.038)
ban_c3		-0.022 (0.022)	-0.012 (0.03)
ban_c4		-0.035 (0.023)	-0.026 (0.029)
ban_c5		-0.009 (0.03)	-0.003 (0.035)
unemp	-0.012*** (0.002)	-0.012*** (0.002)	-0.013*** (0.002)
ban_p	0.031 (0.026)	0.033 (0.024)	0.03 (0.026)
N	394	394	394

As displayed in Table 10, the complete ban, regardless the way of its implementation, is statistically insignificant. It appears that most of the effect of the complete ban can be attributed to the fourth year after its implementation. The associated variable in column b) reports a decrease in employment by 3.5 percent and being close to statistical significance at 10 percent level ($p=0.13$). Moreover, an interesting pattern can be seen in column b). From the first year of its validity, the effect of the complete smoking ban increases, culminates in the fourth year, both in terms of magnitude and significance, and then significantly decreases in the fifth year. Same applies to the column c), but the statistical significance decreases.

Table 11: Impact of a complete smoke-free law without any previous partial smoke-free law on employment over time

Variable	a)	b)	c)
ban_c_no_p	-0.014 (0.026)		-0.129** (0.041)
ban_c_no_p1		0.042 (0.027)	0.127*** (0.035)
ban_c_no_p2		0.033 (0.024)	0.1** (0.035)
ban_c_no_p3		0.003 (0.02)	0.06* (0.026)
ban_c_no_p4		-0.007 (0.026)	0.04 (0.029)
ban_c_no_p5		0.002 (0.022)	0.04 (0.024)
unemp	-0.012*** (0.002)	-0.013*** (0.002)	-0.012*** (0.002)
ban_p	0.026 (0.03)	0.027 (0.031)	0.025 (0.031)
ban_p_to_c	-0.045 (0.053)	-0.044 (0.054)	-0.05 (0.053)
N	394	394	394

Table 11 illustrates the impact of imposing a complete ban without a prior partial ban. It is evident, that it does not cause any serious economic harm nor benefit in the long run, since the respective coefficient indicates only a 1.4 percent decrease in the employment in the hospitality industry and is not statistically significant. The column b) furthermore indicates, that the short-run effect was rather positive, although statistically insignificant (p-value of variables reflecting the smoke-free law in its first and second year are equal to 0.11 and 0.17 respectively). The columns c) displays most of the variables being statistically significant, yet while combining them similarly as previously, they should not be given much credit.

Table 12: Impact of a change from a partial to a complete smoke-free law on employment over time

Variable	a)	b)	c)
ban_p_to_c	-0.045 (0.053)		0.24* (0.1)
ban_p_to_c1		-0.065 (0.06)	-0.2* (0.085)
ban_p_to_c2		-0.11* (0.051)	-0.24** (0.078)
ban_p_to_c3		-0.092 (0.049)	-0.207** (0.073)
ban_p_to_c4		-0.111** (0.042)	-0.212*** (0.061)
ban_p_to_c5		-0.048 (0.06)	-0.099 (0.063)
unemp	-0.012*** (0.002)	-0.01*** (0.002)	-0.01*** (0.002)
ban_p	0.026 (0.03)	0.003 (0.026)	0.024 (0.03)
ban_c_no_p	-0.014 (0.026)	-0.021 (0.026)	-0.023 (0.026)
N	394	394	394

Table 12 reports on the complete ban implemented after a partial ban. The column a) indicates that such change in a legislature can be associated with a 4.6 percent decline in employment in the hospitality industry in the long-term. Still, this result is not statistically significant. Column b) elaborates on the result and further specifies, that the highest level of this negative effect appears in the fourth year after the change of the smoke-free law. The same magnitude can be also attributed to the second year, but this result is not as robust as in the fourth year. The third year is also statistically significant, but it has slightly lower magnitude, than the second and the fourth year. Column c) indicates even more variables to be statistically significant. Once again, the effect peaks in the fourth year. An F-test, used to

assess a joint statistical significance of all variables of interest, shows p-value equal to 0.083. This means that these variables are jointly statistically significant at 10% level.

Table 13: Differences in the impact on employment based on regional and socio-economic differences (long-term)

Variable	a)	b)	c)	d)	e)
ban	-0.045 (0.028)	0.024 (0.028)	0.013 (0.025)	0.006 (0.023)	0.004 (0.022)
post_com	41.13*** (9.55)				
ban*post_com	0.135* (0.056)				
cig_cons_high		0.005 (0.029)			
ban*cig_cons_high		-0.026 (0.032)			
PIIGS			10.23 (8.24)		
ban*PIIGS			0.029 (0.039)		
unemp_high				-0.077 (0.052)	-0.02 (0.051)
ban* unemp_high				0.055 (0.061)	0.072 (0.06)
unemp	-0.014*** (0.002)	-0.013*** (0.002)	-0.013*** (0.002)		-0.017*** (0.004)
N	394	394	394	394	394

Table 14: Differences in the impact on employment based on regional and socio-economic differences (short-term)

Variable	a)	b)	c)	d)	e)
ban1	0.039 (0.032)	0.047 (0.028)	0.027 (0.026)	0.035 (0.022)	0.03 (0.021)
post_com	23.28*** (3.507)				
ban1*post_com	-0.033 (0.045)				
cig_cons_high		-0.01 (0.023)			
ban1*cig_cons_high		-0.053 (0.045)			
PIIGS			9.488 (5.784)		
ban1*PIIGS			-0.025 (0.038)		
unemp_high				-0.031 (0.016)	-0.038 (0.023)
ban1*unemp_high				-0.018 (0.081)	-0.038 (0.082)
unemp	-0.013*** (0.002)	-0.013*** (0.002)	-0.013*** (0.002)		-0.017*** (0.004)
N	394	394	394	394	394

The long-term regional differences in employment caused by an implementation of a smoke-free law reported in Table 13 are all statistically insignificant with exception of interaction term of smoke-free law variable and post-communist country variable, which shows a statistically significant increase in employment. As previously mentioned in case of turnover, this coefficient is probably affected by general economic conditions rather than the smoke-free law. Differences in the year when the smoking ban was implemented, displayed in the Table 14, are all statistically insignificant.

6 Interpretation of results

6.1 Turnover

Results regarding the turnover mostly reflect the previous research on national level well. Once the control for state-specific trends is included in the model, every variable capturing all forms of smoke-free law in the long run turns statistically insignificant. This implies, that smoke-free laws have no permanent adverse or positive impact on hospitality enterprises. The only unexpected result is a relatively high impact of the complete smoke-free law implemented after a partial law. Its statistical significance at 10 percent level is also interesting. However, countries that used this way of implementing a complete smoking ban represent by far the smallest part of observed countries. It consists of only six countries – Austria, Greece, Latvia, Malta, Romania, and Spain. Moreover, Austria implemented the complete smoke-free law in 2019 and therefore it does not enter the analysis at all. For this reason, the part of the analysis focused on the transformation of a partial smoking ban to a complete smoking ban should not be given much credit.

Results regarding the partial ban show that the strongest impact of a smoke-free law is present right after its implementation and that it also depends on the time of the year, when it was implemented. Reported results indicate 4 percent lower turnovers in the first year of the law’s validity compared to countries, where no smoke-free law is implemented. Still, this result is statistically insignificant. The impact turns statistically significant at 5 percent level and increases to 5.1 percent, if we account only for laws implemented from September to April, i.e. outside the summer season. The impact of a partial smoke-free law implemented in summer months remains insignificant. This confirms the hypothesis, that the impact of the smoking ban will be milder, if it is implemented in summer. Still, in the following years, the impact disappears relatively quickly. This is the same result as provided by researchers in Norway, Scotland and Germany – a mild immediate adverse impact on turnovers after the implementation of the partial smoke-free law and a quick return to a previous trend in following years. The most important amendment to this statement is, that the choice of the season of the year, when the partial smoking ban is implemented, matters.

The analysis of the complete smoke-free law puts forward surprising results to a certain extent. First, if we compare the results to the partial ban, we see that the impact is milder both in terms of significance and magnitude. This contradicts one of the hypotheses stated in Section 4, which states that a complete smoking ban has more dramatic impact than a partial smoking ban. Second, the results do not display any significant differences between the magnitude of coefficients or statistical significance attributed to individual time periods. This contradicts the hypothesis, that the impact of the smoke-free law is the most powerful in the short time after its implementation. In this case the significance of the complete smoke-free law appears to peak in the third or fifth year after its implementation. Still this statement should be rather considered as a detail, since the complete smoking ban is not statistically significant in any of those periods. The seasonality does not have any effect either.

If the impact of the complete smoke-free law is decomposed, two different results emerge. The complete smoking ban implemented without any prior form of a smoke-free law, just as the before mentioned types of smoking ban, does not cause any economic harm to hospitality businesses in the long term. However, this type of smoke-free law gains statistical significance in the fourth year after the its implementation. This process is gradual, which leaves a question, whether the results are not influenced by any other effect. This way of implementation of smoke-free laws was chosen by eleven states, from which four (Germany, France, Lithuania, and the United Kingdom) implemented their smoking bans in years 2007 and 2008, shortly before the economic crisis. Still, according to HOTREC, an association that shields hospitality enterprises in Europe, the adverse effect of the crisis on related businesses lasted only through 2009 (HOTREC, 2018). The critical period of the analysis is 2010-2011, when the growth was already restored. Therefore it is safe to say that other adverse economic effects are contained in control variables and do not have any influence on the identified impact of the complete smoke-free law.

As mentioned before the credibility of the results capturing the impact of changing the smoke-free law from a partial to a complete one is very speculative, since it does not contain many countries and two of them were severely hit by the economic crisis.

The analysis of the regional differences does not appear to be useful. If the impact is inspected in the long-term, the impact is probably biased by the difference in general economic outcomes in the region with respect to the rest of the countries. The results regarding the short-term should not be impacted by such bias. Still, the differences of regions chosen for the analysis (post-communist countries and PIIGS) are statistically insignificant.

Slightly different results are displayed by differences by socio-economic indicators. The long-term results are affected similarly as in case of regional differences. But, the statistical significance of the differences between countries that smoke more and countries that smoke less improved dramatically, when the analysis shifted from long-term to short-term. Even though it still remains statistically insignificant, it is an interesting information. Moreover, its positive coefficient has some logic. If the smoke-free law is implemented in a country, where people smoke above average, it can increase an incentive of non-smoking customers to visit bars, pubs and restaurants more often, than in case of other countries, where the health environment does not change that dramatically. One way or another the socio-economic indicators appear to be more useful tool to measure such differences, than division by regions.

6.2 Employment

The employment does not appear to be affected by smoke-free laws in long-term, regardless the type of the smoke-free law. This confirms the hypothesis that the effect of the smoking ban on the employment in hospitality industry will be similar to the impact on the turnover.

When it comes to the evolution of the impact over time, some differences in relation to the impact on revenue can be seen. In case of the partial ban in the third and the fourth year of its validity, the impact on employment in hospitality businesses is statistically significant at 10 percent level and it is positive. This is compatible with the third of possible scenarios stated in the Section 4. It means that the employment in the hospitality businesses rises due to improved health conditions on the workplace. It also suggests that the relationship between the revenue and em-

ployment in the hospitality industry is looser than expected. A possible explanation is, that a sufficient labor force is a necessity in this branch and owners of related enterprises seek savings by other means than sacking their employees. Besides that, the hypothesis, that the impact of the smoke-free law on the employment appears later than the impact on the turnover, seems to be valid, even though it does not appear to be a consequence of the impact on turnover.

In case of the complete smoke-free law, the employment appears to be affected similarly as in case of turnover. There is no statistically significant result and the evolution of the impact of the law also appears to be similar. Therefore the complete smoke-free law cannot be associated with any change in the employment. This can have two reasons. First, there was no change in a supply or demand for labor. Alternatively, both sides were affected, but the effects countervailed. Given the reasoning in the last paragraph, the first scenario appears to be more probable.

The complete law imposed without any previous form of the smoking ban does not exhibit any significant changes as well. This, just as in case of the partial smoke-free law, indicates that the employment is more strongly affected by other means than the turnover in hospitality enterprises. The analysis revealed that the effect is of the highest significance in the first two years of the smoke-free laws validity and dramatically declines afterwards.

The analysis of the impact of the change of a partial smoke-free law from a complete smoke-free law does not appear to be any useful to assessing it due to a small number of treated countries.

Conclusion

The topic of this thesis was the impact of smoke-free laws on hospitality businesses in European countries, which was one of the most stressed concerns when smoke-free laws were implemented. Furthermore, it was aimed to point out differences between different forms of smoke-free laws, the evolution of their impact in time, and differences based on regions or socio-economic indicators.

Through difference-in-differences analysis of administrative data from Eurostat and World Bank, this thesis concludes, that smoking ban in hospitality venues do not cause any economic harm over the long-term horizon. A small adverse effect on revenue of food and beverages serving businesses is present only in the short-term. Additionally, in case of the partial smoke-free law, this adverse effect was statistically significant only if it was implemented outside the summer season. The impact of the complete smoking ban does not appear to be having impact on turnovers of hospitality businesses in any inspected period of time and it also does not seem to be affected by the season. There is only one informative detail brought by the analysis. The significance of the impact of the complete smoke-free law intensifies in its first years and peaks around the fourth year of its validity. Similar results are brought forward in the analysis of complete smoke-free laws, that were implemented without any previous partial law, but in this case, it appears to have a statistically significant adverse impact in the fourth year after its introduction. The results of the analysis of the impact of a complete smoke-free law, that was implemented after a partial smoke-free law, had to be declared inconclusive due to a small number of treated countries.

The differences across regions do not appear to be a relevant metric for measuring differences in the impacts of smoke-free laws. Socio-economic indicators seem to be a better way, but only in the short-term when the smoke-free law affects revenues of hospitality enterprises.

In the long-run, the employment also appears not to be affected by the smoke-free laws as well. But, unlike the revenue, there is no adverse or negative impact in the short-term, except the change from the partial ban to a complete smoke-free law. This result was however disregarded because of above-mentioned reason. The

analysis of different impacts based on region or socio-economic indicators does not provide any statistically significant result.

The results bring several implications. First, the arguments about smoke-free laws having an adverse impact on revenues of hospitality businesses should not be completely dismissed as unfounded. Even though this effect is only temporary in nature, policy makers should not put unnecessary legal pressure on owners of hospitality enterprises in the same year, when they intend to implement the smoke-free law. Moreover, it is advisable to introduce such laws in summer months, when the customers of bars, pubs and restaurant spend their time rather on outside premises. This should put smaller burden on hospitality businesses, since in such case, their patrons are generally not affected by the law.

The analysis has several shortcomings. Most importantly, the dataset is relatively small, which makes its use quite inflexible. An example of this issue are results of the change of a partial smoke-free law to a complete smoke-free law. The part of the affected countries in relation to the whole dataset is so small, that no relevant result could be concluded, both regarding the turnover and the employment. To solve this issue, the dataset would require a higher frequency of collected data, larger sample of observed countries or business-level data, instead of aggregated data. This is also a direction for a possible future research in this area.

Even though this thesis reports on mild adverse effects of the smoke-free laws on revenue of hospitality businesses, it is not meant to raise any debate on whether smoke-free laws should or should not be implemented. First, the reported adverse impact is only mild and short-lasting. Second, the purpose of the law is a protection of public health and it is reported that smoke-free laws are impactful in this way. The right question to ask is when and how the law should be implemented, so it delivers the desired health outcomes and mitigates any unnecessary economic damage.

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