Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies

MASTER'S THESIS

Medical Tourism within the Czech Republic

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Declaration of Authorship

The author hereby declares that she compiled this thesis independently, using only the listed resources and literature, and the thesis has not been used to obtain a different or the same degree.

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Prague, July 29, 2016

Signature

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Abstract

The thesis analyses factors influencing medical tourism within the Czech Republic where districts ("okresy") and regions ("kraje") are considered as the units where the patient can travel to receive health care. The dataset was provided by the Czech general health insurance (VZP). The research covers the period 2011-2014 and reveals the differences between "medical tourism" for hospitalizations and for medical treatments and between travelling into other districts ("okresy") and travelling into other regions ("kraje") for medical service in the analyzed regions of the Czech Republic. The results statistically approved how particular diagnoses, their seriousness, age, gender, availability of health care and other factors influence travelling for health care in the Czech Republic.

JEL Classification	A12, C22, C55, I11, I12, I19
Keywords	medical tourism, the Czech Republic, health care

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Abstrakt

Tato práce analyzuje faktory, které ovlivňují turismus za zdravotnictvím v České republice, přičemž okresy a kraje jsou považovány za jednotky, kam může pacient cestovat za zdravotní péčí. Data poskytla Všeobecná zdravotní pojišťovna (VZP). Výzkum pokrývá období 2011-2014 a odhaluje rozdíly v analyzovaných krajích ČR mezi turismem za zdravotnictvím v rámci hospitalizací a zdravotních ošetření a také mezi cestováním do jiných okresů a do jiných krajů za zdravotní péčí. Výsledky statisticky prokázaly, jak určité typy nemocí, jejich závažnost, věk, pohlaví, dostupnost péče v regionu a další faktory ovlivňují pravděpodobnost cestování za zdravotní péčí v České republice.

Klasifikace	A12, C22, C55, I11, I12, I19
Klíčová slova	turismus za zdravotnictvím, Česká republika, zdravotní péče

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Acronyms

EU15 Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom

EU28 Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, United Kingdom, Austria, Finland, Sweden, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Bulgaria and Romania, Croatia

GDP Gross domestic product

GP General practitioner

PHC Primary health care

SDR Standardized death rate

SHI Social health insurance

VZP Všeobecná zdravotní pojišťovna

Master's Thesis Proposal

Author	Bc. Eva Němečková
Supervisor	PhDr. Jana Votápková
Proposed topic	Medical Tourism within the Czech Republic

Motivation Term "medical tourism" or "health tourism" stands for travelling of patients in order to obtain some medical treatment abroad. Patients can have various reasons for taking advantage of health care in the different country than their own. The most frequent ones include lower costs, getting treatment that is not available in their home country, advanced technologies or medical equipment, shorter waiting times, better quality, doctor's expertise and attitude to patients and also the lack of insurance. Over the last years medical tourism has increased in popularity which can be confirmed by rising number of foreign patients or establishment of agencies providing services connected with medical care abroad, such as airport pickup, accommodation booking, assistance during the treatment and translation of all of the necessary information about the treatment.

There is much more theory about medical tourism than empirical evidence in the existing literature. Theoretical background for health tourism can be found in the studies by Dotson, Guy and Henson (2015), Cohen (2011) or Tseng (2013). They are all searching for motivation of patients to travel for health care. Some of the motivators are mentioned in the previous paragraph. Empirically, medical tourism has been explored in Canada on time series data by Loh (2015) or in Singapore by Lee (2009). Loh discovered increasing trend of health tourism in Canada and important role of private investment in health equipment. Lee (2009) realized differences between short-run and long-run effects of health care on international tourism. It was shown that tourists are more attracted to Singapore health care in the long run than in the short run.

The Czech Republic is not included in any of the empirical studies, therefore this thesis aims to cover the Czech Republic as well and to learn something about health tourism there. Moreover, no one has investigated medical tourism within one country, although it seems to bring interesting results with respect to the quality of

health care in individual regions of the country. As a result, this thesis is going to research a brand new issue –medical tourism within one country. The Czech Republic has been chosen as the country to be analyzed.

Hypotheses

Hypothesis #1: Probability of travelling for health care to Prague is higher than probability of travelling for health care to other regions of the Czech Republic.

Hypothesis #2: Probability of travelling for health care increases with the proximity of the health center from the residence of the patient.

Hypothesis #3: Young and employed people are more willing to travel for health care than the old ones or the unemployed.

Methodology Transition-probability matrix is a type of a matrix which includes probabilities of migrating from one category to another. For the purposes of this thesis, Czech regions represent these categories. It means that the thesis is going to estimate probabilities with which an inhabitant from one Czech region travels to another Czech region in order to obtain medical treatment. The matrix will be created in Stata and it will be in the form, where a column will stand for regions where the health care is provided and a row will represent the residence of patients (manual for Stata here: `http://www.stata.com/manuals13/xtxttab.pdf`):

	Prague	Central Bohemia	North Bohemia	West Bohemia	South Bohemia	East Bohemia	South Moravia	North North
Prague	%	%	%	%	%	%	%	%
Central Bohemia	%	%	%	%	%	%	%	%
North Bohemia	%	%	%	%	%	%	%	%
West Bohemia	%	%	%	%	%	%	%	%
South Bohemia	%	%	%	%	%	%	%	%
East Bohemia	%	%	%	%	%	%	%	%
South Moravia	%	%	%	%	%	%	%	%
North Moravia	%	%	%	%	%	%	%	%

All of these probabilities are expected to be non-negative and not greater than unity. The sums of each row should equal 1.

In the second part of the thesis, we will create two subsample - the seriously ill and other patients - to discover whether the behaviour of the seriously ill differs from the behaviour of an average patient.

In the last part, we will create logit models and search for factors influencing travelling to individual regions of the Czech Republic for health care. The covariates include age, gender, marital status, employment and seriousness of illness and distance of patient from the other Czech region. The model looks as follows:

$$\begin{aligned} P(healthcare = Prague|x) &= G(\beta_0 + \beta_1 age_i + \beta_2 male_i + \beta_3 married_i \\ &+ \beta_4 employed_i + \beta_5 seriousness\ of\ illness_i \\ &+ \beta_6 distance_i + \epsilon_i) \end{aligned}$$

where G(z) is a standard logistic function defined as

$$G(z) = \frac{e^z}{1 + e^z}$$

P(health care = Prague |x) describes the probability of getting health care in Prague with respect to some factors and i stands for individual obtaining health care. Factors that may influence this probability include age, gender (male as a dummy variable), marital status (married as a dummy variable), employment (employed as a dummy variable), seriousness of illness (this dummy variable will be created using relevant data that help us to determine if the illness is serious or not, e.g. kind of surgery, length of medical treatment) and distance in kilometres representing the distance of patient from Prague.

Expected Contribution As the Czech Republic is the country where no one has empirically investigated the quality of health care yet, this thesis aims to change it and find some empirical evidence about health service provided in the Czech Republic. The assumption used in accordance with applied data says that people search for high-quality health care, therefore they are willing to travel to the other regions than their own if the quality of provided service is higher there. With the knowledge of migration matrix, the thesis is able to reveal the regions of the Czech Republic with good and bad health care.

The second contribution of this thesis lies in discovered factors influencing travelling in order to obtain health care. The recognition of these factors may help some doctors to improve their marketing strategies (especially if the doctor provides paid health care).

Outline

1. Introduction
2. Health care in the Czech Republic
3. Literature review
4. Data
5. Methodology

6. Empirical findings
7. Discussion
8. Conclusion

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Chapter 1

Introduction

"*It is health that is real wealth and not pieces of gold and silver.*"
–Mahatma Gandhi

Health is very important for our well-being and nowadays there are more and more people who are willing to travel out of their place of residence to receive care. The term "medical tourism" or "health tourism" stands for travelling of patients in order to obtain a medical treatment abroad. The most frequent reasons why the patients decide to travel for health care include lower costs, getting treatment that is not available in their home country, advanced technologies or medical equipment, shorter waiting times, better quality, doctor's expertise and attitude to patients and also a lack of insurance.

The increasing popularity of "medical tourism" is confirmed by a number of studies from academic literature based on the statistical data (e.g. Connell 2006, Lunt & Carrera 2010). Many researchers reveal the reasons for this popularity. The others look at "medical tourism" empirically and they attempt to answer a variety of different questions associated with "medical tourism". One example is a study by Lee (2010) who realized differences between short-run and long-run effects of medical care on international tourism. He showed that "medical tourism" in Singapore in more frequent in the long run than in the short run.

All studies dealing with "medical tourism" view this term as travelling into other countries in order to get the required medical treatment there. However, none of the studies investigate "medical tourism" within one country only. This may bring also interesting results that could be useful for the health care provided in the country analyzed.

The aim of this study is to look at the concept of "medical tourism" differ-

ently than other studies from the academic literature and to research "medical tourism" in one country only. This is a brand new issue that has not been examined before. The Czech Republic has been chosen as the country to be analyzed and the districts ("okresy") and the regions ("kraje") are used as the units where the patients can travel for medical care.

The empirical part of this thesis is based on the data provided by the Czech general health insurance fund (VZP). We have basic information about insured patients (age, gender, place of residence), about the healthcare facilities where the patients were treated (type and place of medical facilities) and also more characteristics about the treatment (e.g. the main diagnosis the patient was treated with or the length of hospitalization). The target of the empirical research is to discover how different factors influence the probability that the patient will travel for health care into other districts and into other regions than where she/he live. For the main analysis, we choose five regions from which the patients travel most for hospitalizations (Central Bohemia, Karlovy Vary Region, Usti Region, Pardubice Region and Vysocina Region) and for medical treatments (Central Bohemia, South Bohemia, Usti Region, Liberec Region and Vysocina Region) in the Czech Republic and, for the period of 2011-2014, we compare the differences of results between travelling for medical care into other districts and travelling for health care into other regions. The research is prepared for the total of approximately 350.000 observations for hospitalizations and around 22.400.000 observations for medical treatments for every year included in the investigated period.

The thesis is structured as follows. Chapter 1 briefly presents the topic of this thesis and describes the motivation of the main research. Chapter 2 introduces the Czech Republic as the country to be analyzed. Firstly, there are some basic facts about this country, secondly, the health status of Czech citizens is analyzed based on the demographic data and, finally, the health system of the Czech Republic is described, i.e. how it is organized, financed and divided. Chapter 3 focuses on the concept of "medical tourism". It defines what this term means and it adds facts about the motivation of patients to travel for health care, the history of "medical tourism" and its development. Moreover, it is explained how "medical tourism" is viewed within the scope of this thesis. Chapter 4 familiarizes us with some studies about "medical tourism", with the techniques that were used in various studies and also with their findings. Chapter 5 is the core chapter of the thesis. It concentrates on the empirical research and it is divided as follows. Firstly, the data used for the research are

described. Secondly, it is explained which sample of data was chosen for the main analysis and why. And lastly, the model is characterized and evaluated. Chapter 6 summarizes the main findings of this thesis and compares the differences of results between medical treatments and hospitalizations and between travelling to other districts and travelling to other regions to receive medical care there. It also contains ideas and motivation for further research.

Chapter 2

Health Care in the Czech Republic

2.1 Basic Facts about the Czech Republic

The Czech Republic is a country situated in the heart of Europe, with 10.553.843 inhabitants [1] on the area of 78.865 square kilometres [2]. It is surrounded by Germany in the west, Austria in the south, Slovakia in the southeast and Poland in the northeast. The capital city Prague is a home to almost 1.268.500 citizens (Dragoun 2016). The Czech Republic as an independent country was established on the 1st January, 1993, after the split of Czechoslovakia. In 1995, the Czech Republic became a member of the OECD (Ministerstvo zahraničních věcí České republiky 2015a), in 1999, a part of the NATO (Ministerstvo zahraničních věcí České republiky 2015b) and in 2004, one of the members of the European Union (Ministerstvo zahraničních věcí České republiky 2015c). The Czech Republic is a parliamentary democracy and the president is the head of the state (elected in 2013).

The Czech Republic is divided into 14 regions (further "kraj" in singular and "kraje" in plural) and 77 districts (further "okres" in singular and "okresy" in plural)[3]. These are the official numbers of the Czech Statistical Office[4]. "Kraje" are considered as the self-governing regions and they have been existing since 2000. The specific "kraj" is the capital city Prague which is the city and "kraj"

[1] https://www.czso.cz/documents/10180/32853387/1300721601.pdf/a4c46080-e030-410a-a7fa-f7a6e0074fa3?version=1.0

[2] https://www.czso.cz/documents/10180/20548145/4032120101.pdf/c1675e94-73a8-490f-ac08-08a45abb6c9b?version=1.0

[3] There are no exact words for these territorial units in English, therefore, we will use official Czech terms in this thesis.

[4] https://www.czso.cz/documents/11288/26886771/2005uc.jpg/cee79a6d-7668-4114-be37-7215dd985cbb?version=1.1&t=1425563434561

together. "Okresy" are smaller units than "kraje" and they do not officially exist anymore. They were abolished in 2000 and in 2003, their authorities were officially dissolved. However, the term "okres" stayed for statistical purposes and it is commonly used by the Czech Statistical Office. The average "kraj" consists of 5 or 6 "okresy". The most complex "kraj" is Central Bohemia constituted by 12 different "okresy".

According to Alexa *et al.* (2015), the Czech Republic returned to the time of economic expansion in 2014, after the years of financial crisis which had a great impact on the Czech Republic as well. The real GDP grew by 1.975 % from 2013 to 2014 and from 2014 to 2015, it increased even more than twice - 4.3 % (Trading economics 2016). Concerning the levels of unemployment, according to Eurostat (2016), the unemployment in the Czech Republic decreased from 7 % in 2013 to 6.1 % in 2014 and it decreased in the following year as well.

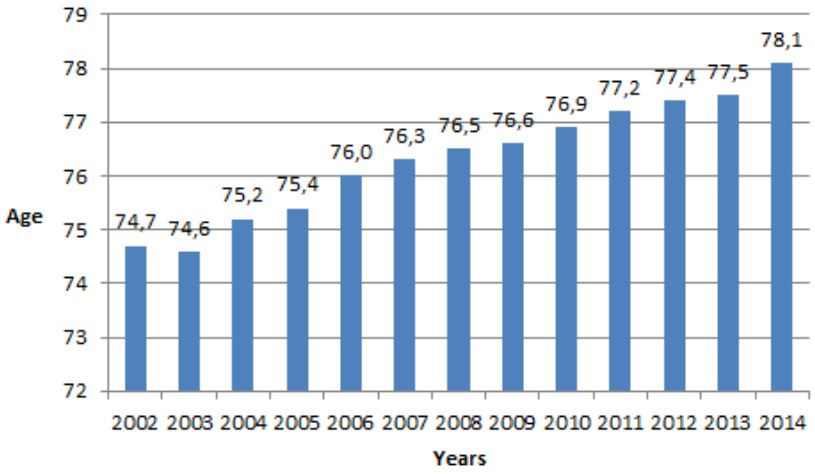
2.2 Health Status of Czech Population

Life expectancy is continuously rising in the Czech Republic. In 2014, the average life expectancy reached 78.1 years. Figure 2.1 depicts the evolution of the life expectancy of the Czech Republic. According to the same data, we can compare life expectancy for men and women. It is statistically approved that women live longer. In the Czech Republic, it holds true as well: according to the statistics from 2014, men's life expectancy at birth is 75 years while women live more than 6 years longer – 81.1 years. Life expectancy of the Czech inhabitants has been rising much faster than the average of the European Union since 2011.

Life expectancies at birth are higher due to lower probabilities of infant mortality which appeared thanks to modern medical equipment and new techniques of medical treatments. The infant mortality of the Czech Republic is considered as one of the lowest all over the world. The probability of dying until the age of 1 was only 0.26 % in 2012 while the world average achieved the probability of 0.4 % (WHO Regional Office for Europe 2014a). The probability of death at the age of 5 is also very low compared to the average of EU15.

Diseases of the circulatory system still belong to the most common causes of death (WHO Regional Office for Europe 2014b) both internationally and in the Czech Republic. Malignant neoplasm was ranked as the second most frequent cause of death according to the same data sources. In 2011, the standardized death rate (further SDR) caused by malignant neoplasms reached higher levels than the average of the EU28. Malignant neoplasm is followed by the problems

Figure 2.1: Life expectancy of the Czech Republic



Source: Eurostat

of respiratory system which became the third most frequent cause of death in the Czech Republic.

The high proportion of the diseases of the circulatory system may be also affected by increasing numbers of bad habits such as smoking, not enough exercise or unbalanced food. Smoking and alcohol consumption have reached very high levels, mainly among teenagers, in the Czech Republic in recent years. Moreover, many people suffer from overweight.

Regarding the coverage of vaccination in the Czech Republic, the rates are very high and exceed 98 % (OECD 2013). Some vaccinations are obligatory – e.g. against measles, rubella, diphtheria, tetanus and the others.

2.3 Organization

The main legislation for health care has been valid since the 1990s. According to OECD (2014), both the government and the individual "kraje" are responsible for the medical care in the Czech Republic. Based on Alexa *et al.* (2015), the policy agenda is given by the Ministry of Health that is accountable for the governance of health system, the preparation of legislations, the administration of several health institutions (e.g. State Institute for Drug Control) and it also controls public network of the health care in the Czech Republic.

In the Czech Republic the system of "statutory health insurance" is applied. Every Czech citizen has to be ensured with one out of seven health insurance funds, which buy and pay for health care on their behalf. Moreover, all Czech

citizens are authorized to freely choose both insurance fund and provider. By law, also the insurance funds should not reject any eligible applicants. All Czech insurance funds are depicted in Table 2.1.

Table 2.1: Health insurance funds

Codes	**Names of Czech Health Insurance Funds**
111	Všeobecná zdravotní pojišťovna ČR (VZP ČR)
201	Vojenská zdravotní pojišťovna České republiky (VoZP ČR)
205	Česká průmyslová zdravotní pojišťovna (ČPZP)
207	Oborová zdravotní pojišťovna zaměstnanců bank, pojišťoven a stavebnictví (OZP)
209	Zaměstnanecká pojišťovna Škoda (ZPŠ)
211	Zdravotní pojišťovna ministerstva vnitra ČR (ZPMV ČR)
213	Revírní bratrská pokladna, zdravotní pojišťovna (RBP)

Source: Ministry of Health Czech Republic

2.4 Financing

The Czech health care is financed primarily through monthly contributions to the social health insurance (further SHI) paid by employers, employees and freelancers. These contributions are compulsory and are collected by Czech health insurance funds and, afterward, they are redistributed among insurees. The redistribution is based on the special risk-adjustment formula which depends mainly on the gender and the age (divided to 5-year categories) of the insurees. This division forms 36 different groups. In addition, there exists one specific criterion for the individuals with the annual costs that are at least 25 times higher than the average of all individuals insured within the SHI system. For these insurers the formula also contains "ex post compensation of 80% of the costs above the limit" (Alexa *et al.* 2015, pg. 61). SHI contributions of the economically inactive inhabitants, e.g. children or the unemployed, are made by state on their behalf.

Alexa *et al.* (2015, pg. 45) also denote how the Czech hospitals are reimbursed for the inpatient and outpatient care. Since 2007, the inpatient care is reimbursed by so called "diagnosis-related group system" (further DRG), "individual contracts" and "global budgets". The outpatient care of the hospitals has been financed by "capped fee-for service" (further FFS) payments since

2009. General practitioners are paid both through capitation and FFS system (used especially for preventive care).

Compared to the other EU countries, the total health expenditure of the Czech Republic is relatively low (e.g. in 2012 7.7 % out of total GDP). In the years of financial crisis, the share of health expenditure of the total GDP increased, but afterward, it decreased again and remained low.

2.5 Types of Health Care

We distinguish three main types of the health care:

1) Primary Health Care

Primary health care (further PHC) describes the very first contact of the patient with the health system. Alexa *et al.* (2015, pg. 101) denote that despite the nonexistence of any definition of PHC in the Czech Republic, these services are considered as primary care: "general medical care, maternal and child health care, gynaecology, dentistry, home care by nurses, 24-hour doctor-on-duty care, and a number of preventive services, such as immunization and screenings".

Alexa *et al.* (2015) also mention that the accessibility varies for different "kraje" of the Czech Republic. Based on the data from ÚZIS (2013), the density of physicians is highest for Prague and lowest for Pardubice Region and Central Bohemia. As a result, there is a lack of patients for some physicians in Prague and sometimes the patients are attracted even with the promotional leaflets in front of the means of Prague public transport.

Patients are authorized to choose providers of primary health care on their own and they can also switch them every three months. On the contrary, the physicians can reject the new patient in case the capacity is full.

2) Secondary Health Care

Secondary health care is represented by hospitals and specialized medical facilities. It can be provided uppon referral given by primary health care provider or the patient can seek medical treatment included in secondary health care on her/his own.

Alexa *et al.* (2015) present that the Czech Republic has 188 hospitals with 58.832 beds and also 160 other medical facilities with 21.672 beds. Large hospitals situated especially in bigger cities provide maximum healthcare. Smaller

hospitals that lie in smaller towns/cities concentrate on fewer specialties of medical service and the extent of their health care is not so large as in big hospitals. In the Czech Republic, there exist also 10 university hospitals operated by the Ministry of Health. These hospitals serve mainly for educational purposes and for research. The educational duties are controlled by the Ministry of Education. However, also normal outpatient and inpatient care is provided in these facilities.

3) Tertiary Health Care

Tertiary health care is much more specialized than secondary health care. It is used in the situations when the secondary care is insufficient. This type of care is searched by a very small number of patients and it is very costly. It includes for example organ transplantation, dialysis or artificial fertilization (Nováková 2006).

Chapter 3

Medical Tourism

3.1 Definition

Connell (2006) mentions that tourism is connected with pleasure, relaxation and better life. Moreover, it may bring some learning experience. In the last two decades, the amount of people who also try to get healthier while travelling rises. They relax from their everyday working stress, exercise or travel to spas. This may be already considered as one form of the "medical tourism".

The academic literature is full of different definitions of "medical tourism". Pocock & Phua (2011, p.2) look at "medical tourism" as "the organized travel outside one local's environment for the maintenance, enhancement or restoration of the individual's wellbeing in mind and body". Hanefeld *et al.* (2014, p.1) define it as "people travelling abroad with the expressed purpose of accessing medical treatment". Lunt & Carrera (2010) describe "medical tourism" as the choice of the consumers to travel overseas or across borders in order to obtain the treatment.

3.2 Reasons for Medical Tourism

There are many different reasons for travelling for health care. According to Guy *et al.* (2015), the most frequent arguments to travel for health care are lower costs, getting treatment that is not available in the home country, shorter waiting times, better quality and attractiveness of combination of vacation and medical treatment abroad. Tseng (2013) adds shortage of insurance, non-affordability as a result of high prices and different language and culture. The last reason is associated with immigrants who reside in the US, but they

prefer health care in their home country. Bennie (2014) also writes about these motives for "medical tourism": to obtain treatment not reimbursed by health insurance in the home country, to buy cheaper medicaments and to get the medical procedures not allowed in the home country.

3.3 Trend of Medical Tourism

"Health tourism" has a very long history. Howze (2006) mentions that the concept of travelling for health care has been frequent since the Roman Empire. The purposes of the first forms of travelling were directly associated with well-being and better health. It can be confirmed by a large number of spas that are situated in Europe and other places. Travelling to spas became popular by the 18th century. After that, the spas expanded also to the other places such as the French territory of New Caledonia. Later on, tourism moved to the seaside in developed states and spread from high societies to working classes. Recreation at the sea side became the new healthy form of travelling (Connell 2006).

Concerning "medical tourism" as the form of travelling to obtain medical treatment abroad, it is worth emphasizing that this concept changed very much as well. In the past, the people from developing countries used to search for health care in the developed countries because the adequate care was not available in their home countries. Nowadays, this trend has the opposite direction. The people seek medical treatments in developing countries such as Thailand or India and avoid expensive surgeries (Carrera & Bridges 1995; Bies & Zacharia 2007).

The people very often travel to undergo elective cosmetic surgeries such as liposuction, dental surgeries such as reconstruction, heart surgeries such as bypass, orthopaedic surgeries such as knee replacement, bariatric surgeries such as gastric banding, fertility treatments, organ transplantations, eye surgeries(Lunt & Carrera 2010) and they search for alternative medicine abroad as well (Bennie 2014).

3.4 Globalization

Lunt & Carrera (2010, p.27) introduce "medical tourism" as the increasing phenomenon connected with globalization which is defined as "the increas-

ing economic integration and interdependence of nation states and regions". Pocock & Phua (2011) add that the health care globalization is given by growing international trade both in health products and health services, especially through the cross border movements of patient.

Lunt & Carrera (2010) consider these aspects to increase the volumes of "medical tourism": cheap flights and the popularity of air travel, easier communication (e.g. internet, mobile phones) and also the freedom of travelling for education which may cause that well-qualified doctors and specialists provide health care in the countries with low incomes. All of these aspects are the effects of globalization.

3.5 Medical Tourism within the Czech Republic

In the previous subchapters, "medical tourism" was described as travelling abroad in order to get medical service there.

This thesis brings a very new concept of "medical tourism" as it describes travelling for health care within one country only. It means that the patient travels to obtain medical care, but she/he stays in the country of her/his residence. Therefore, the territorial units of one country can be considered as the places where the patients can travel for health care.

Within the scope of this thesis, the Czech Republic is investigated and "okresy" and "kraje" are the units where the inhabitants can travel to receive medical care. The patient can travel either to "okres" situated in "kraj" where she/he lives (then she/he travels into other "okres" only) or to different "kraj" than her/his residence (then she/he travels simultaneously into other "okres" and "kraj").

Chapter 4

Literature Review

"Medical tourism" or "health tourism" attracts many researchers in recent academic literature. Henson *et al.* (2015) and Tseng (2013) state that the attractiveness of "health tourism" has rapidly increased in last years. The academic papers explore "medical tourism" internationally, i.e. travelling from one country to another to receive health care there, and most of them originated in the United States. They investigate many issues associated with "medical tourism" and use various techniques for that. Some of them research "medical tourism" theoretically only and the others are based on empirical analysis.

Tseng (2013) theoretically explained the increasing trend of "health tourism" and underlay it by the statistics and by the ideas found in other academic papers. Tseng (2013) found that medical condition is very important when a patient decides if to travel for medical care. When the health problems are too serious, it is not always possible for the patients to travel abroad, even though they would like to.

Some authors search the main characteristics of medical tourists. Flanigan (2009) used statistical data to show that the willingness to travel for health care increases with the age. Based on survey data, Gan & Frederick (2013) discovered that the younger and the older consumers are more sensitive to the factors of travel and economy than the others. The questionnaires have been used also by the others.

Henson *et al.* (2015) divided respondents into several categories and evaluated a hypothetical health condition of each category. Afterward, they prepared different versions of questionnaire which were assigned to respondents with regard to into which category they belonged to. Some of the questions included respondents' probability of searching for health care in another country with

respect to different conditions, their healthcare coverage or their decision motivators to travel for medical treatment abroad. The questionnaires were divided almost evenly between men and women. The results revealed that medical treatment abroad is searched mainly because of lower costs or because such medical treatments are not accessible in their home country. The importance of the quality of medical treatment, shorter waiting times and combination of vacation and medical treatment abroad are also the reasons why the people travel for health care abroad. The filled questionnaires showed as well that the most probable age group included in medical tourism is the group of people of the age between 30 and 45. Older people and females more care about the accessibility of the health care which follows afterward.

Lunt & Carrera (2010) emphasize the gaps in empirical research of medical tourism and support the others to investigate the role, the process and the results of medical tourism. Empirical methods to investigate medical tourism include especially time-series models and probability models. Lee (2010) compared short-run and long-run effects of health care on international tourism. It was shown that tourists are more attracted to Singapore health care in the long run than in the short run. The result of this study helped policy makers in Singapore better understand the very important role of the "medical tourism" –in the long run, the development of the medical care supports the international tourism activities. As a result, the medical centers in Singapore decided to become one of the most leading medical center in order to pull more tourists into their country. Loh (2015) used also time-series data to show the relationship between "health tourism" and investments in health equipment and between "health tourism" and private investments. The first dependency was proved to be negative and the second one positive.

A lot of authors dealing with the issues of "health tourism" construct transition probability matrices in their analyses. Transition-probability matrix is a type of a matrix which includes probabilities of migrating from one category to another and it is applied especially for panel data sets. Olson *et al.* (2010) used the transition probability matrix to investigate the impact of taxes on the insurance coverage and to show how the individuals are affected by the changes in tax environment. The transition probability matrix was created from four possible insurance categories and with the use of "one factor model", the probabilities of switching the categories were counted. The authors managed to show the effects of tax burdens on the health care coverages.

The transition matrices were also applied in the study by Jung (2006). This

research is based on several techniques that enable counting probabilities: “a counting method”, “ordered logit and ordered probit regression models”, “non-parametric Kaplan-Meier estimator and semi-parametric proportional hazard (Cox) model” (Jung 2006, p.1). The author reveals the limitations and pros of each of the used method. Therefore, this paper illustrates the effectiveness of different probability models. The transition probability matrix is created for the migration between one health state into another. The aim of this study is also to find some characteristics (such as gender, age, reached education or regular income) that may influence the movements between the health states. Women are more likely to stay healthy than men. Conversely, men recover more probably from illnesses than women. Both income and education increase health of the individuals. It was shown that smoking has negative effects on health. Nevertheless, the author found some restrictions during testing and incompleteness, therefore, not all of the given final results were accurate in this study.

Chapter 5

Empirical Research

5.1 Data Description

The data for this thesis are provided by the Czech general health insurance fund (VZP). They include the basic description of the insured patients and the health facilities where these patients were treated/hospitalized and also characteristics about the diagnoses and hospitalizations.

We analyze two datasets:

1. hospitalizations – pooled data for 2009–2014
2. medical treatments – annual data for 2009–2014

Most variables in both sets repeat, but some of them are specific for one data set only. The tables in Appendix A introduce the list of variables offered for the analysis.

5.1.1 Hospitalizations

The number of hospitalizations in our data set reaches 4.920.331. Table 5.1 provides the numbers of observations in individual years and shows that the data have been properly collected since 2011. The hospitalizations were provided either in hospitals (74.4 %) or in university hospitals (25.6 %).

Focusing on the ages of hospitalized patients, it was found out that the oldest patient appearing in our dataset was treated with the problem of respiratory system in 2013. She was a 109–year–old woman from Opava in Moravia–Silesia and she did not travel for health care. The dataset also contains the total of 261.170 hospitalizations newborn babies. Interestingly, 32.23 % of them are

Table 5.1: Number of observations for hospitalizations

Year	Number of hospitalizations
2009	3
2010	13.580
2011	1.236.290
2012	1.251.328
2013	1.219.489
2014	1.199.641

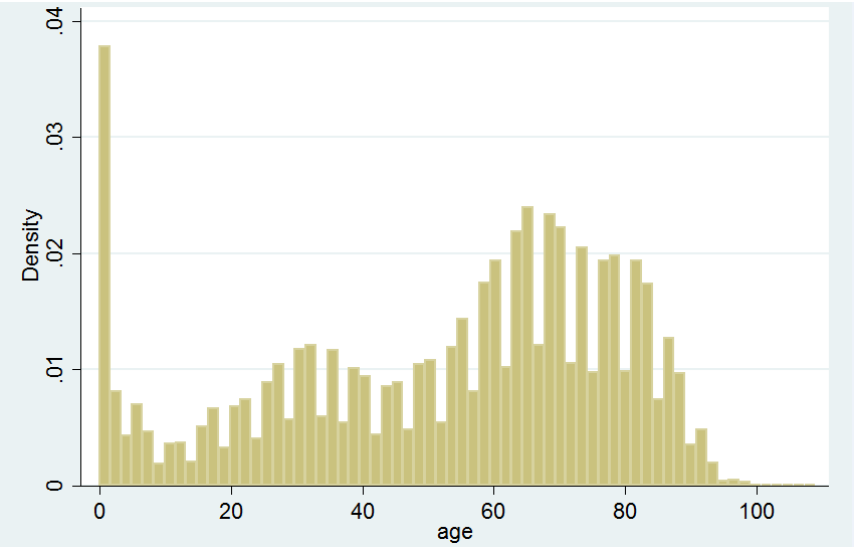
Source: VZP

the cases of medical tourism to other "okresy". And as many as 14.93 % were treated in other Czech "kraje" than where the patients lived. A very high number of medical tourism of babies to other "kraje" can be noticed between Central Bohemia and Prague. The reason for that is transparent – Central Bohemia borders with Prague and the quality of health care related to giving births is believed to be high in Prague. The total of 86.27 % hospitalizations of the new–born babies not provided in Central Bohemia when residing there took place in Prague. Travelling in the opposite direction also reaches high levels. The total of 70.06 % hospitalizations not provided in Prague when a patient lived there took place in Central Bohemia. Significant numbers are also evident in case of travelling from Parbudice Region to Hradec Kralove Region. As many as 54.32 % cases of medical tourism from Pardubice Region regarding the new-born babies directed to Hradec Kralove Region. In the opposite direction, from Hradec Kralove Region to Pardubice Region, it reaches only 26.51 %. The reason may be that Hradec Kralove, a region with a university hospital, neighbors Pardubice.

Age distribution of hospitalizations is depicted in Figure 5.1. It can be recognized that except for newborn babies where the density is extremely high, hospitalizations occur most in older ages between 60 and 85. On the other hand, the fewest hospitalizations were found for the patients older than 95 (there are probably not many people of this age).

The distribution of males' and females' hospitalizations show us that there are more women in-patients (54.09 %). The older age is associated with more illnesses which may also cause comorbidities. According to Section 2.2, average life expectancy is larger for women in the Czech Republic. As a result, they may need more hospitalizations than males.

Figure 5.1: Age distribution of in-patients

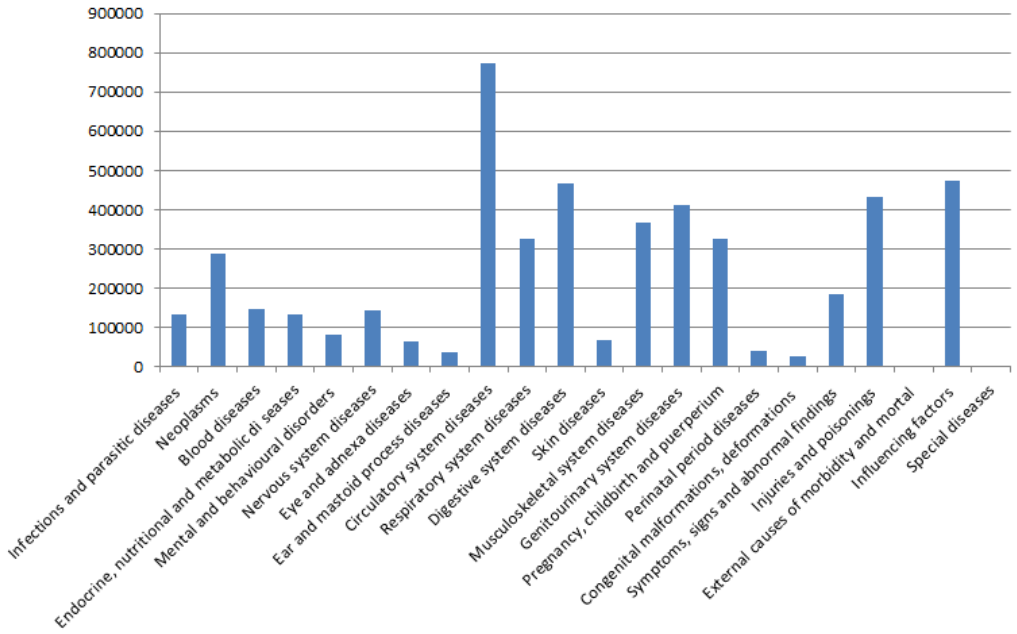


Source: Author's creation

Figure 5.2 denotes the frequency of the individual diagnoses with which patients were hospitalized. The most common diagnoses are diseases of circulatory and digestive system and "influencing factors" (=the hospitalizations with the aim to examine future possible incidents such as various kinds of screening examination). However, the number of circulatory diseases, 771.725 in total, exceeds rapidly other diagnoses. It is followed by digestive system diseases with the total of 467.164 and 475.207 hospitalizations due to "influencing factors".

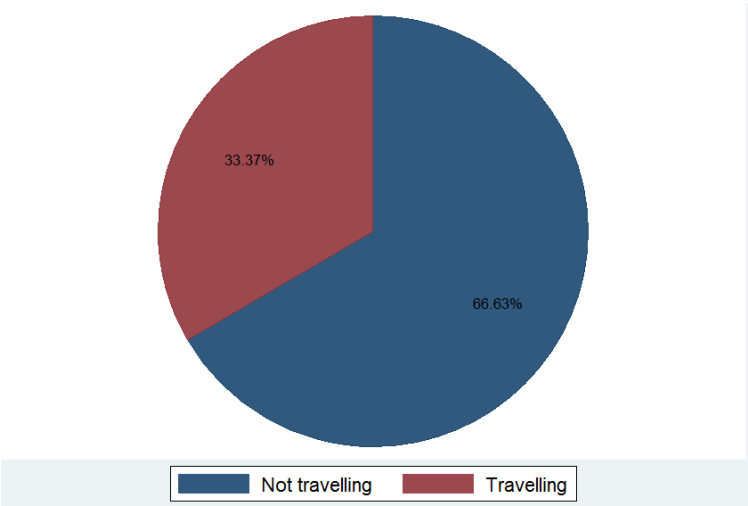
Within the scope of this thesis, two variables of medical tourism are introduced - the first one standing for medical tourism into other "okresy" and the second one denoting medical tourism into other "kraje" (for closer description see Section 5.5). It is obvious that travelling to other "okresy" is more likely than travelling to other "kraje", because "kraje" are larger units than "okresy". The hospitalizations received outside the "okresy" of patients' residence comprise 33.37 % of total hospitalizations, i.e. a third of total hospitalizations are classified as medical tourism. For medical tourism within the total of 14 Czech "kraje", it holds that 15.11 % of hospitalizations were obtained outside the "kraj" of patient's residence. These numbers are depicted in Figure 5.3 and Figure 5.4.

Figure 5.2: Occurence of individual diagnoses for hospitalizations



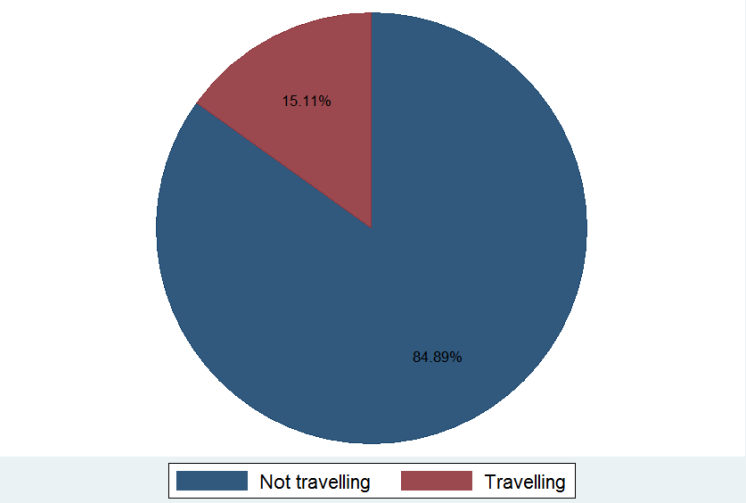
Source: Author's creation

Figure 5.3: Medical tourism into "okresy" for hospitalizations



Source: Author's creation

Figure 5.4: Medical tourism into "kraje" for hospitalizations



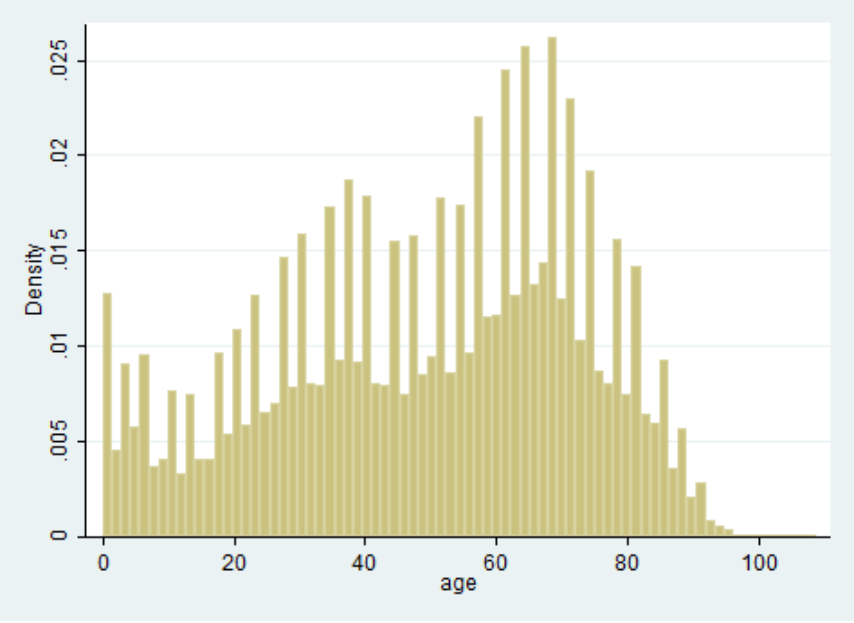
Source: Author's creation

5.1.2 Medical treatments

For medical treatments, we have about 60 million observations available for each year in the period of 2009 – 2014. The most observations, 60.683.630 in total, are present for the year 2009 and the least, 59.210.701, for the year 2012.

If we concentrate on the age distribution, density of all years 2009 – 2014 is similar and looks as follows:

Figure 5.5: Age distribution of medical treatments



Source: Author's creation

It is very different from the density for hospitalizations. The reason is that medical treatments are searched also for less serious health problems and because of regular check–ups which are obligatory for patients of all ages. The rapid growth of medical treatments can be noticed for the patients of the age 57 and older as these people have much more health problems. The oldest patients obtaining medical treatments were found in datasets for the years 2013 and 2014. These patients all reached 109 years. In 2013, there were 7 such medical treatments and in 2014, even 17. All these patients were women and one of them was treated outside the place of her residence, specifically she lived in Vsetin and visited a doctor in Novy Jicin. It means that she represented not only medical tourism into other "okresy", but also medical tourism into other "kraje". The remaining 109–years–old patients came from Vsetin, Opava and Pilsen. They were treated because of the total of 14 various diagnosis. As far as we focus on the treatments of newborn patients, we find out that the largest number of medical treatments was provided in 2010. Conversely, the lowest number was found for the year 2014. These statistics are associated with the birth–rate in the period 2009–2014. Based on the analyzed data, there were 617.759 treatments on newborn babies in 2010. It was discovered that 29.45 % of these treatments are the cases of medical tourism and 15.75 % of them even the cases of medical tourism into other "kraje". Travelling between Central Bohemia and Prague is the most common. As many as 85.24 % treatments provided outside Central Bohemia when residing there took place in Prague. Conversely, the total of 58.13 % of treatments of Prague residents were provided in Central Bohemia. Medical tourism has also a huge impact on South Bohemia, Usti Region, Pilsen Region and Hradec Kralove Region. The numbers and percentage values of medical treatments of newborns provided in Prague when residing in South Bohemia/Usti Region/Plzen Region/Hradec Kralove Region are in Table 5.2.

Table 5.2: Medical treatments of newborn patients in Prague

South Bohemia	3.679 treatments, 70.47 % of all medical treatments of newborn patients from South Bohemia
Usti Region	4.356 treatments, 69.68 % of all medical treatments of newborn patients from Usti Region
Pilsen Region	2.38 treatments, 63.80 % of all medical treatments of newborn patients from Pilsen Region
Hradec Kralove Region	2.774 treatments, 54.38 % of all treatments of newborn patients from Hradec Kralove Region

Source: VZP

The results tell us that Prague has a very significant effect on travelling for health care with newborn babies as most of the treatments provided outside the place of residence took place in Prague. The reason for that may be that there are many specialized health facilities in Prague .

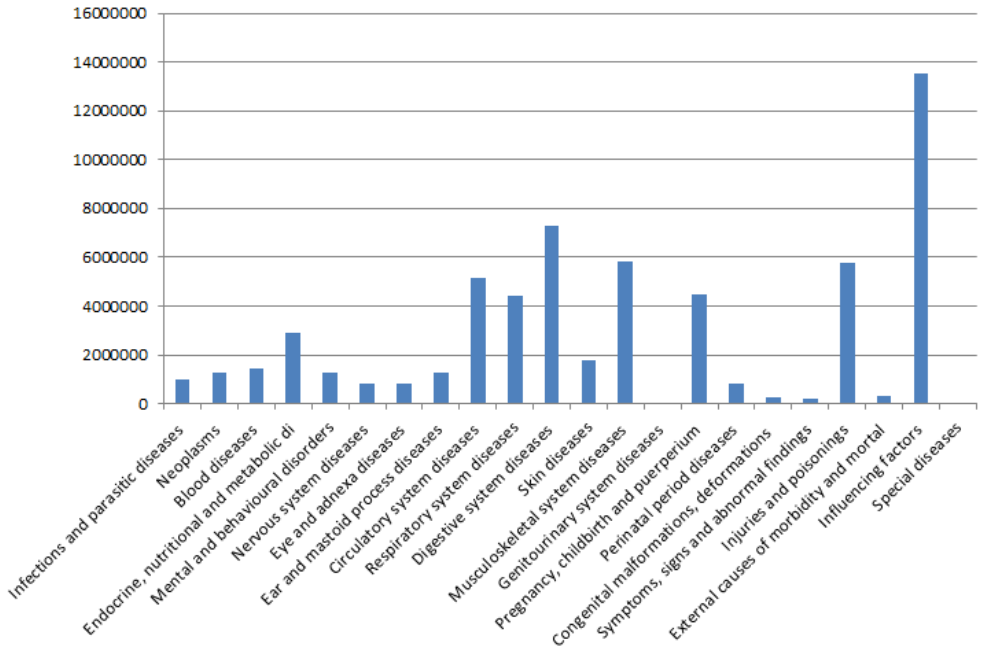
Files for all of the years show almost the same results for the distribution of males and females. Every year in the period of 2009 – 2014, there are between 59.5 % and 60 % of the treatments provided to women. The highest share of women′s treatments was found in 2011. It may be again caused by larger average life expectancy of women (as explained in Section 2.2) and by comorbidities of their health problems.

Medical treatments take place in many types of health establishments. Most of them are provided in hospitals and by independent specialists. Treatments obtained by general practicioners and stomatologists reach very high levels as well. If we compare the numbers of treatments in hospital and university hospital, more of them are provided in hospitals. About 14 million of treatments were provided in hospitals every year and only about 5 million in university hospitals. It shows that the network of classical hospitals is broader in the Czech Republic.

The most common reason why patients get medical treatment is associated with "influencing factors". It means that patients search medical service for a specific purpose such as regular check–up, vaccination or counselling of her/his health status. The term "influencing factors" includes also the treatments provided because of some symptoms that may influence the health of the patient, but the patient is not ill. The number of the treatments associated with "influencing factors" exceeds rapidly other treated diagnoses. In each year between 2009 and 2013, there are about 13.5 million of such treatments. There are also many treatments due to the problems of digestive and musculoskeletal system, injuries and poisonings and diseases connected with genitourinary system. The frequencies of individual diagnoses are different in time. Figure 5.6 and Figure 5.7 show the difference between years 2009 and 2014.

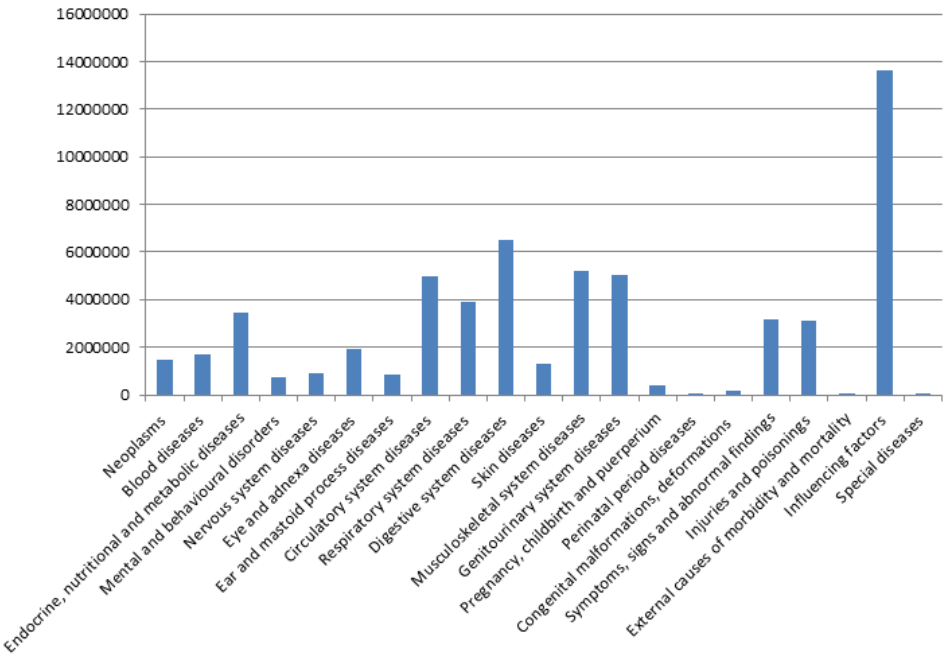
Data gained for this thesis confirm the increasing trend of medical tourism to other "okresy" and "kraje" in time. Every year in the period of 2009–2014 there was approximately a 1% increase from the previous year in terms of medical tourism. In 2009, the total of 22.3 % of treatments were cases of medical tourism to other "okresy" and 10.97 % of them to other "kraje". In 2014, the same values reached 27.24 % and 15.7 %, respectively. The exact percentage rates of medical tourism are depicted in Figure 5.8 and Figure 5.9.

Figure 5.6: Occurence of individual diagnoses for medical treatments in 2009



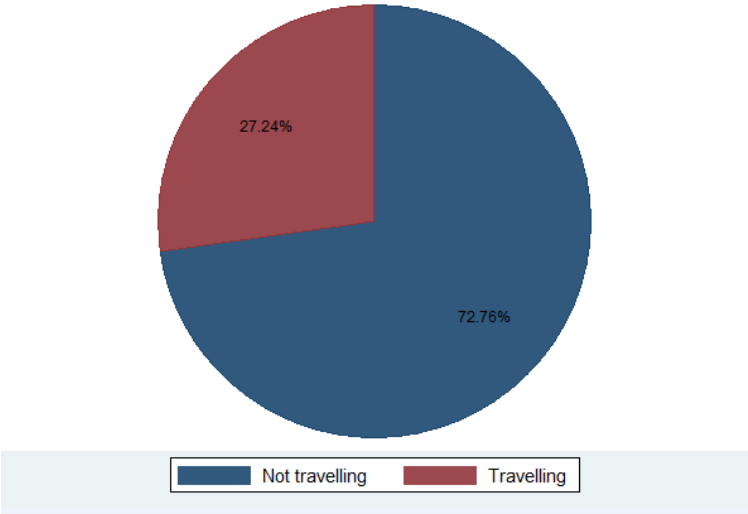
Source: Author's creation

Figure 5.7: Occurence of individual diagnoses for medical treatments in 2014



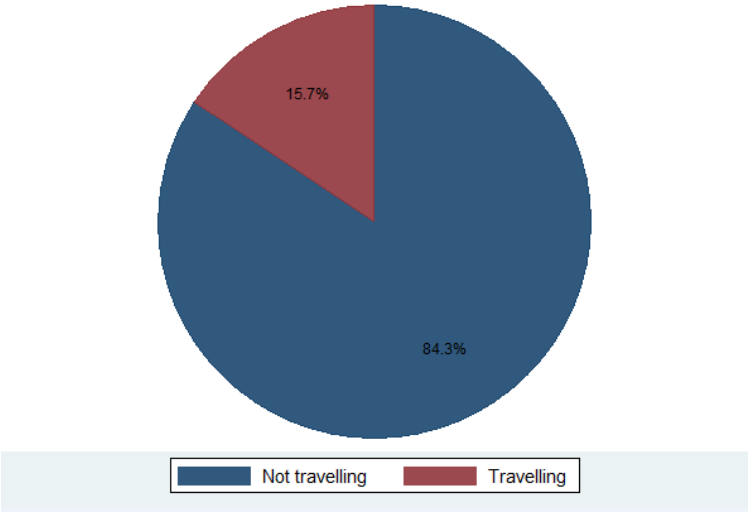
Source: Author's creation

Figure 5.8: Medical tourism to other "okresy" for medical treatments 2014



Source: Author's creation

Figure 5.9: Medical tourism to other "kraje" for medical treatments 2014



Source: Author's creation

5.2 Preliminary Analysis

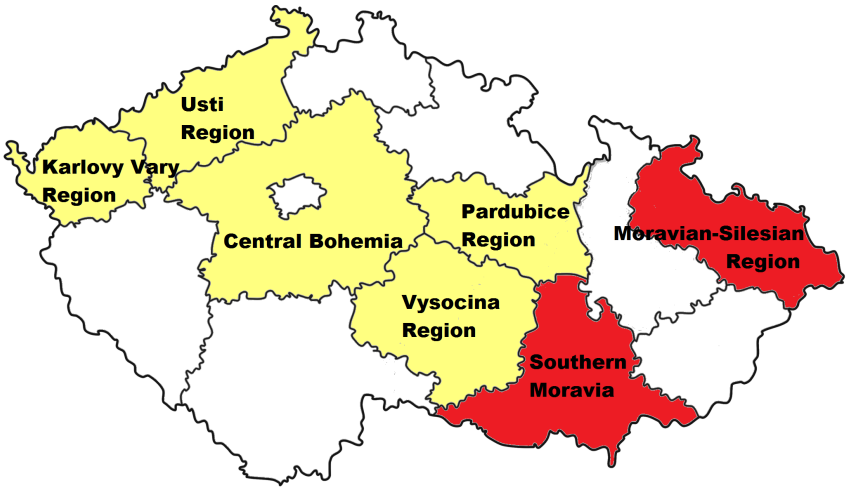
Before the main analysis, we look at "kraje" and "okresy" from which the people travel most into other "kraje" and "okresy" respectively. Based on this analysis, we decide about the data sample that will be used for the empirical research in this thesis. As the sample is different for hospitalizations and for

medical treatments, this section is divided into two subsections –"Hospitalizations" and "Medical Treatments". Preliminary analysis covers the period 2011-2014, consistent with the main analysis.

5.2.1 Hospitalizations

If we concentrate on travelling from "kraje" to "kraje", we discover that "kraje" from which it is travelled most include Karlovy Vary, Usti, Central Bohemia, Vysocina and Pardubice. On the contrary, least is travelled from Southern Moravia and from Moravian-Silesian Region. All these "kraje" are depicted in Figure 5.10. The yellow "kraje" stand for "kraje" from which residents travel most and the red "kraje" represent "kraje" from which residents travel least.

Figure 5.10: Medical tourism from "kraje" to "kraje" for hospitalizations



Yellow for "kraje" from which it is travelled most to other "kraje"
Red for "kraje" from which it is travelled least to other "kraje"
Source: Author's creation

Based on the received data, Central Bohemia is the most important source for medical tourism into "kraje" because every year as many as one third of hospitalizations of the residents from Central Bohemia were provided in other "kraje" than Central Bohemia. It may be caused by the fact that many areas situated in Central Bohemia are very close to Prague where the choice of hospitals and university hospitals is larger. Moreover, many people from Central Bohemia work or study in Prague and they have a temporary residence there.

Karlovy Vary and Pardubice have very similar shares of medical tourism into

other “kraje” regarding hospitalizations. These shares move slightly above 20 % every year in the period of 2011-2014. Travelling from these “kraje” may be influenced by the fact that neither Karlovy Vary Region nor Pardubice Region have a university hospital. Data show that the residents from Karlovy Vary Region travel at most into Pilsen Region and Prague Region where university hospitals are situated. The same is valid for Pardubice Region. The residents living in Pardubice Region travel often to Hradec Kralove Region where a university hospital can be found.

Similar shares of medical tourism outflow (15-17 % every year between 2011 and 2014) were also recorded for Usti Region and Vysocina Region. The people living in Usti Region travel a lot to Prague and the residents of Vysocina Region often search for health care in Southern Moravia. This may be again caused by the absence of university hospitals in these regions.

The sample for the empirical analysis is created from these five “kraje” as they are important for the medical tourism regarding hospitalizations.

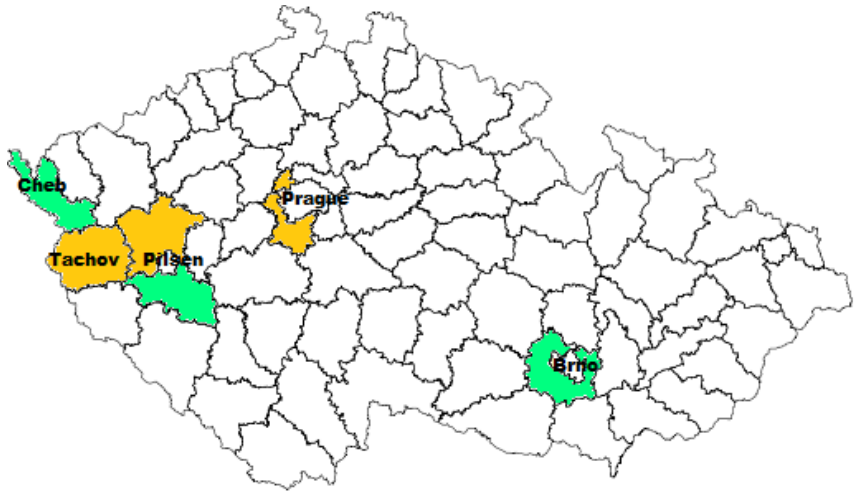
As already mentioned, the lowest importance for medical tourism to other “kraje” has been proved for Southern Moravia and for Moravian-Silesian Region. The reason for that may be that both these “kraje” own a university hospital - in Brno for Southern Moravia and in Ostrava for Moravian-Silesian Region. The residents living in these “kraje” do not travel even to Prague so much as it is quite far away from there.

“Okresy” from which it is travelled most to other “okresy” are presented in Figure 5.11. Orange represents the “okresy” from which all residents travel for hospitalizations to other “okresy”. This is the case of Pilsen-North and Prague-West. The residents of these “okresy” are medical tourists probably either because these is no hospital or because the hospital available in that “okres” belongs to the hospital in another “okres”. Data also show that all residents of Rychnov nad Kneznou travelled for hospitalizations in 2014. This happened because the hospital in Rychnov nad Kneznou joined the hospital in Nachod. Therefore, the patients may not have travelled for health care, but it was treated as if they had. This fact is neglected in this thesis.

Green in Figure 5.11 presents the “okresy” where not all residents travel for hospitalizations, but the share of medical tourists from these “okresy” is very high. These “okresy” include Cheb, Pilsen - South and Brno - countryside. It can be seen in the map that most “okresy” from which it is travelled most for hospitalizations are situated very close to big Czech cities - Prague, Brno and

Pilsen. It is predicted that from this reason the popularity of travelling for health care is very high there.

Figure 5.11: Medical tourism from "okresy" to "okresy" for hospitalizations



Green for "okresy" from which it is travelled most to other "okresy"
Orange for "okresy" from which all residents "travel" to other "okresy"
Source: Author's creation

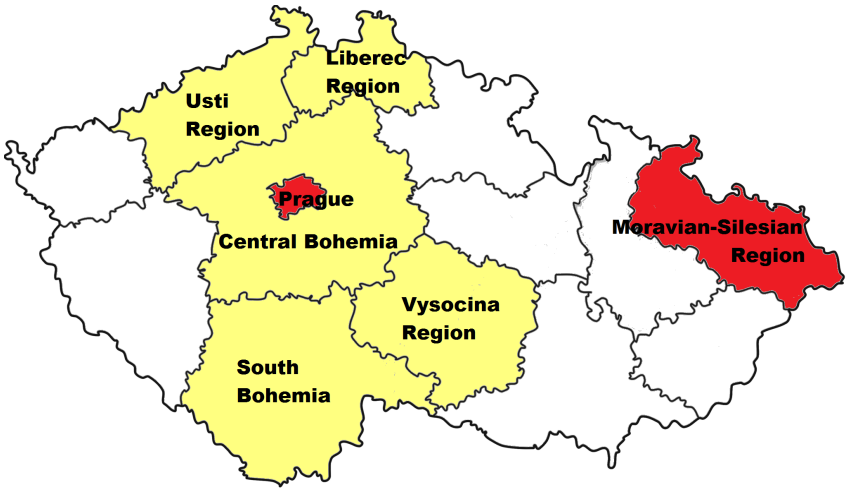
5.2.2 Medical Treatments

"Kraje" from which it is travelled most to other "kraje" in order to get a medical treatment there include Central Bohemia, Usti Region, Liberec Region, South Bohemia and Vysocina Region. These "kraje" are depicted in yellow in Figure 5.12. On the contrary, Prague and Moravian-Silesian Region are "kraje" from which it is travelled at least to other "kraje" with the same purpose. They are marked in red in Figure 5.12.

The obtained data for medical treatments prove us again that Central Bohemia is a very important "kraj" for medical tourism into other "kraje". Every year between 2011 and 2014, more than one third of medical treatments provided for residents of Central Bohemia took place in another "kraj". It is also evident from the data that year-on-year trend has an increasing character in the period 2011-2014. In 2014, the share of treatments on the residents of Central Bohemia provided in another "kraje" reached the value of 37.25 %. Most residents of Central Bohemia who decide to travel for health care choose Prague as the place for their medical treatment, similar to hospitalizations. The reason for that can be that the residents of Central Bohemia believe that

they find the treatments of better quality in Prague or they require a medical treatment which is not available in Central Bohemia.

Figure 5.12: Medical tourism from "kraje" to "kraje" for medical treatments



Yellow for "kraje" from which it is travelled most to other "kraje"
Red for "kraje" from which it is travelled least to other "kraje"
Source: Author's creation

Other four "kraje" included in top 5 "kraje" of medical tourism to other "kraje" regarding medical treatments are not as significant as Central Bohemia. The shares of their residents travelling for health care to other "kraje" do not exceed 20 % for any "kraj" in any year between 2011 and 2014. Our data confirm that the residents of all of these "kraje", Usti Region, Liberec Region, South Bohemia and Vysocina Region, travel most to Prague in order to receive medical treatment there. It is probably caused by the fact that the people living in these "kraje" search for some specialized medical care which can be offered only in Prague.

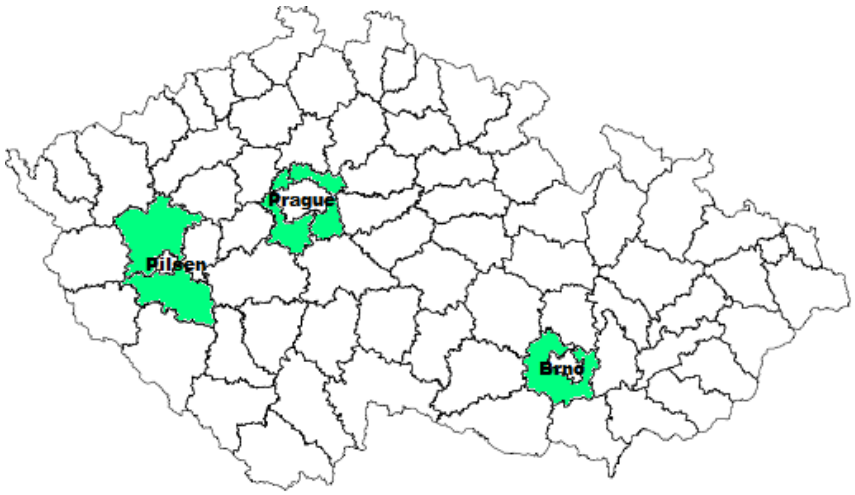
To keep the same structure of datasets, the sample for medical treatments comprises five "kraje" from which the residents travel most to other "kraje" in order to obtain medical treatment there (see details in Section 5.3).

The data confirm that the residents of Prague and Moravian-Silesian Region travel at least for medical treatments to other "kraje". The shares of medical tourism from these "kraje" did not exceed 10 % for any year between 2011 and 2014. The offer and the quality of provided medical treatments is probably high there, therefore the residents do not need to travel elsewhere. Moreover, it is possible for the patients to find specialized medical treatments there.

The Figure 5.13 introduces the "okresy" whose residents travel most to

other "okresy" for medical treatments. All of the presented "okresy" (Prague-West, Prague-East, Pilsen-North, Pilsen-South, Brno-countryside) surround large Czech cities - Prague, Pilsen and Brno. The medical care provided in these "okresy" is probably restricted compared to health care provided in big cities. Therefore, the residents living in such "okresy" travel for health care to the closest cities a lot. It is the most evident for Prague-West and Prague-East where the share of medical treatments not provided in the home "okres" of the patients exceeded 70 % for all years in the period of 2011-2014.

Figure 5.13: Medical tourism from "okresy" to "okresy" for medical treatments



Green for "okresy" from which it is travelled most to other "okresy"

Source: Author's creation

5.3 Data Sample

The whole datasets as described at the beginning of this chapter are not used in the empirical part of this thesis. Based on the preliminary analysis, only the patients from the "kraje" important for medical tourism were included. Specifically, each sample (for hospitalizations and medical treatments) includes 5 "kraje" from which the patients travel most into other "kraje" in order to receive health care there. These "kraje" are different for hospitalizations and for medical treatments and they are presented in Table 5.3.

Table 5.3: Data samples for hospitalizations and medical treatments

Hospitalizations	**Medical treatments**
Central Bohemia	Central Bohemia
Karlovy Vary Region	South Bohemia
Usti Region	Usti Region
Pardubice Region	Liberec Region
Vysocina Region	Vysocina Region

Source: Author's creation

As we wish to compare the empirical results for hospitalizations and medical treatments and the data for hospitalizations have been collected properly since 2011, we exclude the years 2009 and 2010 in the analysis. Therefore, we are going to evaluate the model for the years 2011-2014.

The total numbers of observations for our analysis for both hospitalizations and medical treatments are in Table 5.4. We aimed to deduce some panel structure from the datasets, but it was not possible, because some patients were treated more than once a year. Therefore, we analyze all data as single-year cross sections.

Table 5.4: Numbers of observations for the final analysis

Year	**Hospitalizations**	**Medical treatments**
2011	380.480	22.350.083
2012	373.795	22.304.333
2013	350.080	22.548.288
2014	339.476	22.589.328

Source: Author's computation

5.4 Methodology

For the estimation of parameters we will apply the probability model. The dependent variable is binary (or dichotomous), therefore it can equal either 1 (=yes) or 0 (=no). Within the scope of this thesis the dependent variable standing for medical tourism takes value 1 if the patient travels for health care and 0 otherwise.

For the binary response variables, the combination of cumulative distribution function (further CDF) and maximum likelihood estimation (further MLE) is the most popular method of estimation. It is applied by two very

similar models – logit model and probit model. Wooldridge (2002) mentions that there exists no real reason to prefer one model over the other. The main difference between them lies in the fact that the logit follows the logistic distribution function while the probit uses standard normal cumulative distribution function. As a result, the probit CDF is a little steeper than the logit CDF. If one multiplies the coefficients of the probit by 1.81, the results approximately equal the values of the logit coefficients (Gujarati 2003).

Both Gujarati (2003) and Wooldridge (2002) confirm that the logit is applied more often in the academic literature, because of its mathematical simplicity. Therefore, the logit model has also been chosen for the purpose of this thesis.

5.4.1 Logit

According to Gujarati (2003), logistic distribution function looks as follows:

$$P_i = \frac{1}{1 + e^{-Z_i}} = \frac{e^z}{1 + e^z} \tag{5.1}$$

where P_i is the probability ranging between 0 and 1 and $Z_i \subset (-\infty, +\infty)$ is defined as $Z_i{=}\beta_1{+}\beta_2 X_i$. The equation can be rewritten as:

$$P_i = E(Y = 1|X_i) = \frac{1}{1 + e^{-(\beta_1+\beta_2 X_i)}} \tag{5.2}$$

As P_i is nonlinear in βs, the classical OLS procedure cannot be applied.

Now assume that P_i as defined above is the probability of travelling for health care. Then, (1-P_i), the probability of not travelling, would be given as

$$1 - P_i = \frac{1}{1 + e^{Z_i}} \tag{5.3}$$

In order to estimate the model which is non–linear in X and βs, we transform it to the linear version:

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}} = e^{Z_i} \tag{5.4}$$

where (4.4) stands for "odds ratio", the ratio of the probability of travelling for health care to the probability of not travelling. This ratio will be used later for the interpretation of the final model.

Taking the natural logarithm of (4.4), we obtain the logit model (Gujarati 2003, p.596):

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = Z_i = \beta_1 + \beta_2 X_i \tag{5.5}$$

where L_i, standing for the natural logarithm of the "odds ratio", is a linear function both of the Xs and of the parameters βs. Therefore, keeping the value of L_i positive, the odds move in the same direction as the independent variable(s). Taking the value negative, it works opposite. The logit model can be interpreted such that the slope, β_2, shows the change of L_i for a change in X by one unit.

Note also some differences between L_i and P_i. L_i is the linear function of X_i, but the probabilities are not. Then, although the probabilities are bounded by 0 and 1, L_i is not. It lies between $-\infty$ and $+\infty$.

Statistics for logit evaluation

Without any appropriate model statistics, the final results are not valid. Logit model uses these statistics for the goodness of fit:

1. Pseudo R^2

"Pseudo R^2", also known as "McFadden R^2", works similarly as R^2 used in linear regression models, but it reaches lower values all the time. According to Chater & Oaksford (2008), the values of 0.2 to 0.4 indicate that the model is already well-fitted. "Pseudo R^2" takes the following form (McFadden *et al.* (1973)):

$$1 - \frac{L_{ur}}{L_o} \tag{5.6}$$

where L_{ur} stands for the log-likelihood function for the model being estimated and L_o for the log–likelihood model for the model with intercept only. This follows the same logic as the classical R^2.

2. Count R^2

"Count R^2" is calculated as

$$Count\ R^2 = \frac{number\ of\ correct\ predictions}{total\ number\ of\ observations} \tag{5.7}$$

As the dependent variable can reach the value of 0 or 1 only, we classify the predicted probability P≥0.5 as 1 and P<0.5 as 0. After this adjustment, we are able to count the number of correct predictions as the sum of the records where the predicted 1s equal actual 1s and the predicted 0s equal actual 0s. If we divide this number by the total number of observations, we get the value of "Count R^2".

3. LR statistics

"Likelihood ratio" (further LR) statistics decides on the joint significance of the independent variables and is based on chi–square distribution.

4. Z statistics

Z statistics, or "standard normal" statistics, decides on individual significance of independent variables and it replaces T statistics in the OLS regression models.

Model Interpretation

Logit model is interpreted differently than the classical linear regression models. The value of coefficients is not straightforward for the interpretation of the final results. Instead we focus on "odds ratios", "marginal effects" and probabilities.

Probabilities and "odds ratios" are introduced at the beginning of this chapter. "Marginal effects" are the percentage margins from the mean values of explanatory variables. They depend on the coefficients and on the probability values from which the margins are computed (Gujarati 2014).

5.5 Variables

For better understanding the variables occuring in both, hospitalizations and medical treatments analyses, are marked in bold.

5.5.1 Dependent Variables

The variable "**med_tourism**" equals 1 if the treatment/the hospitalization was obtained outside the district ("okres") of patient' s residence, so the patient

travelled for health care. If health care was provided in the "okres" of patient's residence, "med_tourism" has the value of 0.

The variable "**med_tourism2**" equals 1 if the treatment/the hospitalization was obtained outside the region ("kraj") of patient' s residence, so the patient travelled for health care. If health care was provided in the "kraj" of patient' s residence, "med_tourism2" takes the value of 0.

5.5.2 Independent Variables

"**Age**" stands for the age at the time of the treatment/the hospitalization. It is counted as:

$$\text{age} = \text{the year of the treatment/the hospitalization - year of birth} \tag{5.8}$$

It is expected than younger patients travel more than old ones as they are more used to travelling.

The variable "**female**" takes on the value 1 for females and 0 for males. The assumption for the model is that males travel more for health care than women as they are more mobile.

The variable "nights_hosp" states how many nights the patient stayed in the hospital/the university hospital. It was obtained as the difference between the end date and the start date of hospitalization. As more nights spent in hospital imply a more serious reason for hospitalization which can be caused either because of the bad state of the patient or because of the specialized/more difficult treatment, it is unsure if the effect on medical tourism will be positive or negative.

The variable "category_patient" stands for the average category of the patient who was hospitalized. It describes the state of health of the patient during the time of hospitalization. The category is assigned to each patient every day of the hospitalization except for the last one. If the state of health is getting worse during the hospitalization, the category of patient rises and if the state is getting better, the patient's category decreases. The Table 5.5 introduces the meaning of individual categories. The average category of the patient is calculated as:

$$1 + \frac{\text{points of the patient's category}}{(\text{end date of the hospitalization - start date}) \times 75} \tag{5.9}$$

Table 5.5: Categories of patients

1	The patient is self-contained, not dependent on medical service, or a self-contained child older than 10 or a newborn baby in the neonatal unit.
2	The patient is partially self–contained, or a 6– to 10–year–old child, self-care with help, able to move out of the bed with assistance, either on her own or on a wheelchair.
3	The patient needs to be under increased medical supervision, or the patient is a child between the age of 2 and 6, lucid and unable to move out of bed, neither with assistance nor in a wheelchair, requiring almost complete medical service, or mentally altered with the necessity of increased supervision, or the temporary movement restriction/ pharmacology / sedation is obvious.
4	The patient is not mobile and self–contained, or is a child at the age of 0 to 2, except for a newborn baby in the neonatal unit, or a lucid patient that is almost immobile or incontinent, requiring medical service at common activities.
5	The patient is unconscious.

Source: VZP

The effect of the variable "category_patient" on medical tourism is unsure. On one hand, it may be negative because the patient can be in such a bad state of health that she/he is not able to travel for health care. On the other hand, the patient's relatives/friends can help her/him to travel for health care even if she/he is seriously ill or the patient may need some specialized treatment not available in the place of her/his residence (e.g. treatments for congenital malformations or deformations).

The dummy variables "reason_end_X" represent various reasons why the hospitalization was ended. The letter X stands for the reasons. It is obligatory for all hospitals to give such a reason every time the hospitalization is finished. For the analysis in this thesis, these three reasons have been selected and they are used as dummy variables in the model:

- "reason_end_inpatient" - patient was tranferred into inpatient care
- "reason_end_institutional_acute" - patient was transferred into institutional care on an acute hospital bed
- "reason_end_death" - patient died

The selected reasons of the end of hospitalizations show that the state of health of the patient is serious. Therefore, the hypothesis is same as for the variable "category_patient" from the same reasons.

There is also a group of dummy variables which denote the category of the main diagnosis ("**main_diag_category**"). Diagnoses are divided into several categories according to "International Statistical Classification of Diseases and Related Health Problems". For the model analysis, only the most significant ones have been chosen. They are presented in Table 5.6 and their description can be found in Appendix B.

Table 5.6: Main diagnoses variables for the empirical analysis

Hospitalizations	**Medical Treatments**
neoplasms_dis	neoplasms_dis
eye_dis	eye_dis
malformation_dis	ear_dis
musculoskel_dis	musculoskel_dis
perinatal_dis	genit_dis
influence_dis	symptoms_dis
	injury_dis
	influence_dis

Source: Author's creation

The hypothesis is that diagnoses can influence medical tourism either positively or negatively. It depends if the patient can treat the diagnosis in the place of her/his residence or not.

The variable "number_sec_diagnosis" denotes the number of secondary diagnoses that arose during the hospitalization of patient. We expect that this variable has a negative effect on medical tourism, because the patients with more secondary diagnoses are often hospitalized for a longer time and it is preferable for their relatives to have such patients in the place of their residence.

There is also a set of dummies representing the types of "**medical facilities**" where the hospitalizations or the treatments took place. These facilities were chosen for the analysis:

- "hospital"
- "university_hospital"
- "specialist"
- "GP"
- "stomatology"

As hospitalizations can be provided only in hospital or in university hospital, the variable "university_hospital" is used as a dummy for hospitalizations.

Medical treatments can appear in more types of medical facilities than those mentioned above. The chosen types of medical facilities are the most frequent ones and all of them are used in the model for medical treatments. The remaining medical facilities are in form of the base group.

We expect that the effect of individual types of medical facilities on medical tourism can be both positive and negative. It depends on the fact if the patient is able to find sufficient medical care of particular medical facility in the place of her/his residence or not.

5.6 Model Specification

5.6.1 Hospitalizations

We estimate the following models for hospitalizations:

$$\begin{aligned} P \quad & (y = \text{med\_tourism}|X) = G(\beta_0 + \beta_1 \text{female} + \beta_2 \text{age} + \beta_3 \text{category\_patient} \\ + \quad & \beta_4 \text{nights\_hosp} + \beta_5 \text{university\_hospital} + \beta_6 \text{reason\_end\_inpatient} \\ + \quad & \beta_7 \text{reason\_end\_institutional\_acute} + \beta_8 \text{reason\_end\_death} \\ + \quad & \beta_9 \text{number\_sec\_diagnosis} + \beta_{10} \text{neoplasms\_dis} + \beta_{11} \text{eye\_dis} \\ + \quad & \beta_{12} \text{musculoskel\_dis} + \beta_{13} \text{perinatal\_dis} + \beta_{14} \text{malformation\_dis} \\ + \quad & \beta_{15} \text{influence\_dis}) \end{aligned} \tag{5.10}$$

$$\begin{aligned} P \quad & (y = \text{med\_tourism2}|X) = G(\beta_0 + \beta_1 \text{female} + \beta_2 \text{age} + \beta_3 \text{category\_patient} \\ + \quad & \beta_4 \text{nights\_hosp} + \beta_5 \text{university\_hospital} + \beta_6 \text{reason\_end\_inpatient} \\ + \quad & \beta_7 \text{reason\_end\_institutional\_acute} + \beta_8 \text{reason\_end\_death} \\ + \quad & \beta_9 \text{number\_sec\_diagnosis} + \beta_{10} \text{neoplasms\_dis} + \beta_{11} \text{eye\_dis} \\ + \quad & \beta_{12} \text{musculoskel\_dis} + \beta_{13} \text{perinatal\_dis} + \beta_{14} \text{malformation\_dis} \\ + \quad & \beta_{15} \text{influence\_dis}) \end{aligned} \tag{5.11}$$

Before the estimation, the multicollinearity among independent variables used in Equation 5.10 and Equation 5.10 is tested. The results for all years are very similar and show the maximum correlation between the number of secondary diagnoses and the number of nights spent in hospital. However, as this correlation did not exceed 30 % for any year between 2011 and 2014, it does not mean any serious problem and we can claim that the independent variables are not correlated.

Additionally, the Wald test was chosen to test the individual variables of

the model. It examines the model with more parameters and evaluates whether omitting these parameters harms the goodness-of-fit of the model or not. As the samples of data for every year 2011-2014 contain the same variables with the same information, the results are also very similar for all years. Based on the results, we can reject the hypotheses that the coefficients individually equal 0 in all cases for both Equation 5.10 and Equation 5.10.

5.6.2 Medical Treatments

We estimate the following models for medical treatments:

$$\begin{aligned} P \quad & (y = \text{med\_tourism}|X) = G(\beta_0 + \beta_1 \text{female} + \beta_2 \text{age} + \beta_3 \text{neoplasms\_dis} \\ + \quad & \beta_4 \text{eye\_dis} + \beta_5 \text{ear\_dis} + \beta_6 \text{musculoskel\_dis} + \beta_7 \text{genit\_dis} \\ + \quad & \beta_8 \text{symptoms\_dis} + \beta_9 \text{injury\_dis} + \beta_{10} \text{influence\_dis} \\ + \quad & \beta_{11} \text{university\_hospital} + \beta_{12} \text{hospital} + \beta_{13} \text{specialist} \\ + \quad & \beta_{14} \text{GP} + \beta_{15} \text{stomatology}) \end{aligned} \tag{5.12}$$

$$\begin{aligned} P \quad & (y = \text{med\_tourism2}|X) = G(\beta_0 + \beta_1 \text{female} + \beta_2 \text{age} + \beta_3 \text{neoplasms\_dis} \\ + \quad & \beta_4 \text{eye\_dis} + \beta_5 \text{ear\_dis} + \beta_6 \text{musculoskel\_dis} + \beta_7 \text{genit\_dis} \\ + \quad & \beta_8 \text{symptoms\_dis} + \beta_9 \text{injury\_dis} + \beta_{10} \text{influence\_dis} \\ + \quad & \beta_{11} \text{university\_hospital} + \beta_{12} \text{hospital} + beta_{13} \text{specialist} \\ + \quad & \beta_{14} \text{GP} + \beta_{15} \text{stomatology}) \end{aligned} \tag{5.13}$$

Before we estimate the Equation 5.12 and the Equation 5.13, we test for multicollinearity among the independent variables included there. The correlation for all years 2011-2014 shows the maximum of 25 % which does not cause any problem for the model. The relationship between specialist and eye diagnoses and also between specialist and hospital show such levels of correlation. There are probably many specialists who treat eye diagnoses and also some specialists who work in hospital.

Besides, we run the Wald test to show if omitting some independent variables would worsen the goodness-of-fit model or not. The results are similar for all years in the period of 2011-2014 and prove us that no coefficient equals

0 for any model (Equation 5.12 and the Equation 5.13) in any year between 2011-2014.

5.7 Empirical Results

5.7.1 Hospitalizations

Medical tourism into other districts ("okresy")

Table 5.7 summarizes goodness-of-fit statistics for the model with "med_tourism" as the dependent variable. The value of Pseudo R^2 is greater than 0.21 for all the researched years and it is increasing in time. These values show that the model is well-fitted. The log likelihoods for the whole model and for the model with an intercept are all negative and increasing in years as well. The values of likelihood ratios χ^2 and p-values confirm us that the model is significant as a whole and better than an empty model, i.e. with an intercept only, because the null hypothesis that all coefficients are simultaneously equal to 0 is rejected. The count R^2 is relatively high for all years 2011-2014.

Table 5.7: Goodness-of-fit values for the model with "med_tourism", hospitalizations

	Pseudo R^2	**Log likelihood Full model**	**Log likelihood Intercept only**	**Likelihood ratio χ^2**	**P-value**	**Count R^2**
2011	0.2192	-194929.14	-249657.052	109455.83	0	0.776
2012	0.2235	-191260.2	-246303.080	110085.75	0	0.775
2013	0.2267	-180168.88	-232972.234	105606.70	0	0.769
2014	0.2304	-174513.67	-226756.200	104485.07	0	0.770

Source: Author's computation

The results of the model are provided in Table 5.8. The coefficients state if the effect on travelling for health care into other "okresy" is positive or negative, the values of Z statistics and p-values show if the variables are significant within the model or not and the marginal effects with the odds ratios are helpful for the interpretation of the magnitude of the effects.

The values of Z statistics and p-values confirm that all variables included in the model are statistically significant. Therefore, all of them have some impact on the dependent variable "med_tourism". The signs of the coefficients tell us that the estimated probability of medical tourism into other "okresy" increases with the variables "nights_hosp", "university_hospital", "reason_end_institutional_acute" and also with all chosen diagnoses. On the other hand, it decreases with

Table 5.8: Results –"med_tourism", hospitalizations 2011-2014

	Coefficients				Z statistics				P-value			
	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014
female	-.0936586	-.121834	-.1113926	-.1204697	-11.75	-15.16	-13.48	-14.34	0.000*	0.000*	0.000*	0.000*
age	-.0029892	-.0037122	-.0053996	-.0060299	-16.10	-20.24	-29.18	-32.25	0.000*	0.000*	0.000*	0.000*
category_patient	-.0166644	-.0204369	.0086613	.0478719	-3.30	-4.01	1.65	8.98	0.001*	0.000*	0.099**	0.000*
nights_hosp	.0089788	.0085042	.0085548	.0067459	16.42	14.49	13.94	10.53	0.000*	0.000*	0.000*	0.000*
university_hospital	3.218769	3.2214	3.259942	3.308487	238.10	239.41	229.09	228.73	0.000*	0.000*	0.000*	0.000*
reason_end_inpatient	-.3871233	-.2268915	-.2971189	-.2653785	-15.07	-10.20	-13.76	-12.47	0.000*	0.000*	0.000*	0.000*
reason_end_institutional_acute	.5639745	.6064194	.5979818	.5989649	30.61	33.59	33.12	33.18	0.000*	0.000*	0.000*	0.000*
reason_end_death	-.278849	-.2338673	-.2417739	-.2345179	-10.55	-8.86	-9.24	-8.68	0.000*	0.000*	0.000*	0.000*
number_sec_diagnosis	-.0520733	-.0637546	-.0490866	-.0419343	-32.60	-35.63	-25.46	-21.02	0.000*	0.000*	0.000*	0.000*
neoplasms_dis	.3471635	.4205896	.4386463	.4212745	20.84	24.41	24.52	22.76	0.000*	0.000*	0.000*	0.000*
eye_dis	.8286208	.8304322	.7791679	.8264185	27.87	25.95	20.74	22.00	0.000*	0.000*	0.000*	0.000*
musculoskel_dis	.3694656	.4035238	.3447246	.313356	25.48	27.39	21.99	19.80	0.000*	0.000*	0.000*	0.000*
perinatal_dis	.4622717	.4655228	.5706946	.3123374	12.22	11.43	14.43	6.85	0.000*	0.000*	0.000*	0.000*
malformation_dis	.7673659	.9088877	.9812689	.9025912	10.01	11.28	10.78	9.59	0.000*	0.000*	0.000*	0.000*
influence_dis	.5073214	.5065364	.5951805	.4960277	34.33	36.65	43.36	36.13	0.000*	0.000*	0.000*	0.000*
constant	-.8175116	-.7415721	-.7260019	-.766849	-55.53	-49.81	-47.60	-49.65	0.000*	0.000*	0.000*	0.000*
	Average marginal effects				Odds ratios							
	2011	2012	2013	2014	2011	2012	2013	2014				
female	-.0218455	-.0285997	-.0266219	-.028991	.9105936	.8852953	.8945875	.8865039				
age	-.0006967	-.0008707	-.0012897	-.0014503	.9970153	.9962947	.9946149	.9939883				
category_patient	-.0038839	-.0047934	.0020688	.0115138	.9834737	.9797705	1.008699	1.049036				
nights_hosp	.0020926	.0019946	.0020434	.0016225	1.009019	1.00854	1.008591	1.006769				
university_hospital	.6431687	.6429331	.64085	.644497	24.99732	25.06318	26.04804	27.34373				
reason_end_inpatient	-.0852643	-.0516875	-.0685935	-.0620721	.6790074	.7970073	.7429557	.7669156				
reason_end_institutional_acute	.1374562	.1484434	.1474475	.1480332	1.757644	1.833853	1.818445	1.820234				
reason_end_death	-.0624864	-.0531773	-.0561583	-.0549934	.7566542	.7914668	.7852337	.7909521				
number_sec_diagnosis	-.0121364	-.0149533	-.0117246	-.0100857	.9492593	.9382352	.9520987	.9589328				
neoplasms_dis	.0835113	.1020904	.1077374	.103813	1.415048	1.522859	1.550607	1.523903				
eye_dis	.2033827	.204135	.1922569	.2037108	2.290158	2.29431	2.179658	2.28512				
musculoskel_dis	.0889538	.0977811	.0843116	.076876	1.446961	1.497091	1.411601	1.368008				
perinatal_dis	.1124261	.1136561	.1409464	.0768132	1.587677	1.592847	1.769496	1.366616				
malformation_dis	.1884721	.2232198	.2403172	.2217424	2.154085	2.481561	2.667839	2.465985				
influence_dis	.1231159	.1232392	.1464434	.1222161	1.660837	1.659533	1.813358	1.642185				
constant	-	-	-	-	.441529	.4763644	.4838396	.4644743				

* Significant at the 0.01 level
** Significant at the 0.1 level

Source: Author's computation

the variables "female", "age", "reason_end_inpatient", "reason_end_death" and "number_sec_diagnosis". The direction of these effects is the same for all the researched years 2011-2014. All these directions of the effects correspond with our stated hypotheses or they clarify the effects for variables where the effect on medical tourism was unsure.

The variable "category_patient" is specific in its behaviour because it has a negative sign for years 2011 and 2012 and a positive sign for years 2013 and 2014. The results of the model show us that in 2011 and 2012, more serious states of health of the patient indicate lower tendency to travel for health care and in 2013 and 2014, it works in the opposite way –more serious states of health of the patient signify higher tendency to travel for health care. It may be caused by development. People are more mobile, therefore they are also more willing to travel for better health care when the state of their relatives/friends is serious. Moreover, there are probably many patients travelling for health care with some specialized diagnoses (e.g. congenital malformations or deformations).

Average marginal effects describe how much the predicted probability of the whole model is influenced by the individual independent variables. The predicted probability for the whole model with the dependent variable "med_tourism" was rising in the period from 2011 to 2014. It confirms us the increasing importance of medical tourism to other "okresy". Keeping all independent variables at their mean value, the model reached the predicted probabilities that are depicted in Table 5.9.

Table 5.9: Predicted probabilities of the model with "med_tourism", hospitalizations

	Predicted probability
2011	0.36986333
2012	0.37567931
2013	0.39443518
2014	0.40259398

Source: Author's computation

Based on the results of average marginal effects in Table 5.8, the largest impact on predicted probability of medical tourism to other "okresy" was detected for the variable "university_hospital". University hospitals influence medical tourism positively. The predicted probability that the patient will travel for health care is 0.64 greater for the hospitalizations in university hospitals than for the hospitalizations in normal hospitals. It indicates that a lot of Czechs search university hospitals when they are not available in their place of resi-

dence. The same outcome can be described with the use of odds ratios. The odds ratio greater than 1 signifies a positive sign of the effect of independent variable on the odds of success of dependent variable. In our case, the odds of success stand for the probability of travelling for health care into other "okresy" divided by the probability of non-travelling for the health care. The values of odds ratios for the variable "university_hospital" tell us that for university hospitals, the odds of travelling for health care into other districts are 24–27 times (depending on year) larger than for normal hospitals. It confirms the importance of university hospitals in the area of medical tourism for hospitalizations.

All chosen diagnoses have a positive impact on medical tourism. The values of average marginal effects and odds ratios indicate that some of them influence medical tourism to other "okresy" considerably. Eye diagnoses and congenital malformations or deformations affect it at most. It is probably caused by the fact that these diagnoses require special treatment that is not available in every "okres" of the Czech Republic. Therefore, people demanding this type of medical service are forced to travel for health care.

The results from Table 5.8 show as well that some variables used in the model indicate very small effect on the dependent variable "med_tourism". The most negligible impact on travelling for health care to other "okresy" can be noticed for the variable "age". The odds ratios for all years 2011-2014 almost equal 1. It means that age does not have almost any effect on medical tourism to other "okresy". The average marginal effect of age states that the increase of the mean age, i.e. at about 55, by 1 lowers the predicted probability by a very low level (not exceeding 0.15 % for any year in 2011-2014). The age does not play any important role for medical tourism in the Czech Republic. When the patients are so old that they are not able to travel for health care on their own, their relatives can help them with travel into other "okres" so that the patients could be hospitalized there.

The variable "category_patient" has low values of average marginal effects and odds ratios as well. It shows that the state of health of the patient is not so decisive for medical tourism to other "okresy".

The variable "nights_hosp" has the negative effect on medical tourism. It means that the effect of travelling to specialists is greater than the effect that the patient cannot travel because of a bad state of health. The Czech patients travel to specialists who are good at particular surgeries or these surgeries are not even available in their place of residence. However, the average marginal effects and the odds ratios indicate that this effect is not so large.

Concerning gender, the model confirms for all years 2011-2014 that if the patient is a female, the predicted probability of the model is by 2.1 - 2.9 % (depending on year) lower than for males. The odds ratios lower than 1 indicate the negative effect for females as well. This conclusion confirms the hypothesis that men are more mobile than women, therefore they also travel more for hospitalizations.

The variable "reason_end_institutional_acute" has the largest impact on travelling for health care into other "okresy" from all the variables denoting the reasons for the end of hospitalization selected for the purposes of the model. Moreover, it is the only reason of hospitalization end that has a positive impact on medical tourism. The odds ratios tell us that for this type of the hospitalization end, the odds of travelling into other "okresy" are 1.75 - 1.82 (depending on year) greater than for the other reasons of hospitalization ends. This reason of the hospitalization end means that the patient may be even in danger of her/his life. Such types of hospitalizations are very specialized and not available in every "okres". It may explain the positive effect of this variable. The remaining two variables standing for the end of hospitalization influence medical tourism into other "okresy" in the negative way and the magnitude of the effect is lower. They are probably associated with the types of hospitalizations that are easily accessible.

Medical tourism into other regions ("kraje")

Table 5.10: Goodness-of-fit values for the model with "med_tourism2", hospitalizations

	Pseudo R^2	**Log likelihood Full model**	**Log likelihood Intercept only**	**Likelihood ratio χ^2**	**P-value**	**Count R^2**
2011	0.3061	-137296.61	-197876.116	121159.00	0	0.873
2012	0.3081	-135907.89	-196416.371	121016.95	0	0.870
2013	0.3078	-131396.52	-189826.165	116859.29	0	0.865
2014	0.3063	-128597.71	-185380.285	113565.15	0	0.864

Source: Author's computation

Table 5.10 presents the results of goodness-of-fit statistics for the model with "med_tourism" as the explained variable. All these values are greater than the same values in the model with "med_tourism2" as the dependent variable. It means that the model describing travelling into "kraje" is better fitted than the model explaining travelling into "okresy". The reported Pseudo R^2s are

greater than 0.3 for all the researched years. Both log likelihood values are again negative and increasing in time. The likelihood ratios χ^2 and p-values show that the model as a whole is significantly better than the model with an intercept only as the null hypothesis that all coefficients are simultaneously equal to 0 is rejected. The count R^2 reaches the values greater than 86 % for all years in the period of 2011-2014.

The results of the model are presented in Table 5.11 where the same as for the model with "med_tourism" is evaluated.

The results prove that all independent variables influence travelling for hospitalizations to other "kraje". The signs of the coefficients show us the same directions of effects of individual variables on medical tourism as in the model with "med_tourism" as the explained variable. The only variable with a different behaviour is "category_patient". Unlike the model for "med_tourism" where the effect was both positive and negative, the model with "med_tourism2" indicates the positive effect of the category of patient for all years 2011-2014. If we compare these results with our stated hypotheses, we discover that all of them holds and the unsure effects are clarified.

Table 5.12: Predicted probabilities of the model with "med_tourism2", hospitalizations

	Predicted probability
2011	0.16095926
2012	0.16401145
2013	0.17899576
2014	0.1825389

Source: Author's computation

Average marginal effects explain us how the individual independent variables affect the predicted probability of the whole model. Therefore, before the interpretation of results with the use of average marginal effects, we look at the values of estimated probabilities of the model for the years 2011-2014. Their values are presented in Table 5.12. The predicted probabilities for the whole model are counted such that all independent variables have exactly their mean value. As Table 5.12 shows, the predicted probabilities for the model with "med_tourism2" are much lower than for the model with "med_tourism". It confirms that the probability of travelling for health care into other "okresy" is higher than the probability of travelling for medical care into other "kraje". It corresponds with the total shares of medical tourism depicted in Figure 5.3 and Figure 5.4. Moreover, the values of predicted probabilities for individual years

Table 5.11: Results –"med_tourism2", hospitalizations 2011-2014

	Coefficients				Z statistics				P-value			
	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014
female	-.0823682	-.0951948	-.07752	-.1037004	-8.23	-9.49	-7.63	-10.10	0.000*	0.000*	0.000*	0.000*
age	-.0044483	-.006311	-.0095046	-.0092951	-19.17	-27.71	-42.28	-41.02	0.000*	0.000*	0.000*	0.000*
category_patient	.1696786	.2006031	.2097814	.2484371	27.22	32.20	33.31	38.87	0.000*	0.000*	0.000*	0.000*
nights_hosp	.0144549	.0149993	.0141183	.0135944	23.05	22.30	20.20	18.77	0.000*	0.000*	0.000*	0.000*
university_hospital	3.286235	3.277386	3.258932	3.256948	296.03	294.48	285.16	283.78	0.000*	0.000*	0.000*	0.000*
reason_end_inpatient	-.6301861	-.5777093	-.6083166	-.5464375	-17.30	-18.30	-19.93	-18.51	0.000*	0.000*	0.000*	0.000*
reason_end_institutional_acute	.3409962	.3836201	.3324557	.2634435	15.52	17.84	15.54	12.39	0.000*	0.000*	0.000*	0.000*
reason_end_death	-.336429	-.338438	-.3427457	-.3637176	-9.65	-9.73	-10.02	-10.41	0.000*	0.000*	0.000*	0.000*
number_sec_diagnosis	-.0765156	-.0815024	-.0596474	-.0494098	-37.14	-36.02	-24.69	-20.12	0.000*	0.000*	0.000*	0.000*
neoplasms_dis	.2493245	.4412242	.4733131	.4482766	12.79	22.48	23.12	21.29	0.000*	0.000*	0.000*	0.000*
eye_dis	.3474836	.3605529	.376681	.3078331	9.38	8.94	8.26	6.69	0.000*	0.000*	0.000*	0.000*
musculoskel_dis	.307722	.313531	.2907472	.3229955	16.52	16.59	14.58	16.32	0.000*	0.000*	0.000*	0.000*
perinatal_dis	.448709	.4957835	.6440559	.36729	10.29	10.43	14.58	6.96	0.000*	0.000*	0.000*	0.000*
malformation_dis	.8797346	.878462	1.03651	1.10484	11.57	11.35	12.14	12.41	0.000*	0.000*	0.000*	0.000*
influence_dis	.1994289	.2510977	.4281577	.3250276	10.61	14.50	26.08	19.66	0.000*	0.000*	0.000*	0.000*
constant	-2.151433	-2.133024	-1.989084	-2.07853	-112.90	-111.76	-104.45	-107.61	0.000*	0.000*	0.000*	0.000*
	Average marginal effects				Odds ratios							
	2011	2012	2013	2014	2011	2012	2013	2014				
female	-.0111482	-.0130836	-.0114116	-.0155115	.9209328	.9091958	.9254085	.9014953				
age	-.0006007	-.0008653	-.0013968	-.001387	.9955616	.9937088	.9905404	.990748				
category_patient	.0229153	.027505	.0308287	.0370714	1.184924	1.22214	1.233408	1.28202				
nights_hosp	.0019522	.0020566	.0020748	.0020285	1.01456	1.015112	1.014218	1.013687				
university_hospital	.6446358	.6434132	.6490647	.6491325	26.74199	26.50639	26.02173	25.97014				
reason_end_inpatient	-.069345	-.0659948	-.0744524	-.0693535	.5324927	.5611824	.5442663	.5790089				
reason_end_institutional_acute	.0509893	.0588498	.0535713	.0422594	1.406348	1.467588	1.394388	1.301404				
reason_end_death	-.0407252	-.0416063	-.0453114	-.0485344	.7143166	.712883	.7098187	.6950875				
number_sec_diagnosis	-.0103335	-.0111749	-.0087656	-.0073728	.9263385	.9217305	.9420966	.951791				
neoplasms_dis	.0361891	.0685483	.0789717	.0753962	1.283158	1.554609	1.605304	1.565612				
eye_dis	.0524005	.0553822	.0619753	.0503577	1.415501	1.434122	1.457439	1.360474				
musculoskel_dis	.0453244	.0469254	.0461962	.0524728	1.360323	1.368248	1.337426	1.381259				
perinatal_dis	.0698796	.0794051	.113989	.0611641	1.566289	1.641784	1.904188	1.443817				
malformation_dis	.1549647	.1565079	.2013748	.2197929	2.41026	2.407195	2.81936	3.018743				
influence_dis	.0285178	.0368714	.0700211	.0525502	1.220705	1.285436	1.534428	1.384069				
constant	-	-	-	-	.1163173	.1184785	.1368207	.125114				

* Significant at the 0.01 level

Source: Author's computation

indicate increasing trend of travelling for hospitalizations into other "kraje" in the period of 2011-2014.

Again, the average marginal effects in Table 5.11 show that the variable "university_hospital" influence the predicted probability of medical tourism at most in all years 2011-2014. The values of this effect are almost the same as in the model with "med_tourism" as the dependent variable. Moreover, university hospitals influence medical tourism positively. For all years, the predicted probability that the patient will travel for hospitalization is 0.64 larger for university hospitals than for normal hospitals. It shows that when the patients travel to university hospital out of their place of residence, they travel not only to another "okres", but also to another "kraj". It corresponds with our chosen data sample as for example the residents of Central Bohemia travel to university hospitals into Prague and the residents of Pardubice Region travel to the university hospital in Hradec Kralove Region. The same effect can be described with odds ratios that indicate us that the odds of travelling for health care into other "kraje" are 25 - 27 times (depending on year) greater for university hospitals than for normal hospitals.

Concerning the main diagnoses of hospitalizations used in the model, the results show that they influence travelling for health care positively again and that the diagnoses associated with congenital malformations and deformations indicate the highest magnitude of effect on medical tourism into other "kraje" regarding hospitalizations. These types of diagnoses need special service not available in every Czech "kraj", therefore the people requiring such types of treatments have to travel into other "kraje".

The magnitude of effects is for many variables almost the same as in the model with "med_tourism" as the explained variable. For example, the variable "age" has again the smallest impact on medical tourism. The value of odds ratio almost equal to 1 which confirms that age is not so important for medical tourism into other "kraje". When someone is ill and needs some specialized health care in another "kraj", they are able to travel there, sometimes with the help of their relatives.

The effects of variables "nights_hosp" and "female" are also very similar as in the model with "med_tourism". The values of average marginal effects and odds ratios tell us that the number of nights spent in hospital/university hospital has only a negligible and positive impact on travelling for health care into other "kraje". Therefore, the effect that the patient searches a specialized treatment in other "kraj" than her/his residence is greater, but only negligibly,

than the effect that the patient cannot travel because of the bad state of health. The effect of gender on travelling to other regions is approximately by 1 % lower than for travelling to other "okresy" in all years 2011-2014. The predicted probability of the whole model is by 1.1 - 1.5 % (depending on year) lower for females than for males. The odds ratios confirm the results. Therefore, men travel more into other "kraje" compared to women, but the difference is very low. Our hypothesis that men are more mobile than women is confirmed again.

If we compare the magnitude of the effect of the variable "category_patient" in the model with "med_tourism" and "med_tourism2", we notice a greater effect of this variable in the model with "med_tourism2" as the explained variable. The difference of the magnitudes of average marginal effects of the patient's category between the models with "med_tourism" and "med_tourism2"moves around 2 % in 2011, 2012 and 2014 and in 2013, the same difference equals 3.6 %. Therefore, the average category of patient influences travelling into other "kraje" more than travelling into other "okresy". It means that the patients with the worse state of health travel more into other "kraje" for hospitalizations. They probably need some specialized treatments that are not available in the "kraj" where they live. It corresponds with the large and positive effect of congenital malformations or deformations which may influence this result a lot.

If we focus how a hospitalization ends, we get the opposite outcome. Both the values of average marginal effects and odds ratios confirm that all reasons are larger in magnitude for the model that describes travelling into other "okresy" to obtain medical care there. The directions of all the effects are same as in the model with "med_tourism". These results tell us that the patients whose hospitalization ends with the transfer into institutional care on an acute hospital bed travel more into other "kraje" than into other "okresy" within the same 'kraj" of their residence. Additionally, the patients whose hospitalization ends with the transfer into inpatient care or with their death travel less into other "kraje" than into other "okresy".

5.7.2 Medical Treatments

Medical tourism into other districts ("okresy")

Table 5.13 introduces us goodness-of-fit statistics for the model where "med_tourism" is a dependent variable. The values of Pseudo R^2 for the years 2011-2014 are not so high as they do not exceed 20 % for any year. Both log

likelihoods of the model (the whole model and the model with an intercept) are negative for all years. The values of likelihood ratios χ^2 and p-values show that the whole model is significantly better than the empty model as the hypothesis that all coefficients are simultaneously 0 is rejected. The count R^2 move around 77 % for all researched years.

Table 5.13: Goodness-of-fit values for the model with "med_tourism", medical treatments

	Pseudo R^2	**Log likelihood Full model**	**Log likelihood Intercept only**	**Likelihood ratio χ^2**	**P-value**	**Count R^2**
2011	0.1637	-11371176	-13600000	4450134.16	0.00	0.774
2012	0.1700	-11485433	-13840000	4704208.06	0.00	0.771
2013	0.1778	-11670949	-14200000	5048430.04	0.00	0.771
2014	0.1934	-11525732	-14290000	5527976.54	0.00	0.776

Source: Author's computation

The results of the model describing travelling to "okresy" for medical treatments are presented in table Table 5.14.

The table consists of the coefficients deciding about the positive or negative effect on medical tourism, Z statistics and p-values reporting the statistical significance and average marginal effects and odds ratio that help us interpret the sizes of effects of individual variables on medical tourism to other "okresy".

P-values with Z statistics indicate the statistical significance for all variables used in the model. It proves that all variables of the model have at least some impact on medical tourism.

The signs of the coefficients tell that only some types of main diagnoses (neoplasms diseases, illnesses of the genitourinary system and symptoms) and university hospitals have a positive effect on travelling into other "okresy" in order to obtain a medical treatment there. Remaining variables influence medical tourism into other "okresy" negatively. These results confirm all our hypotheses and clarify the effects of the variables whose hypotheses are unsure. The signs of the coefficients are same for all years 2011-2014.

Before the interpretation of the magnitudes of effects of individual variables on medical tourism, we look at the predicted probabilities for the whole model, keeping all independent variables at their mean value. These probabilities are associated with average marginal effects that describe us how individual variables of the model affect the estimated probability of the whole model. Table 5.15 summarizes the predicted probabilities for the model with "med_tourism" as the dependent variable for all years 2011-2014. The in-

Table 5.14: Results –"med_tourism", medical treatments 2011-2014

	Coefficients				Z statistics				P-value			
	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014
female	-.039339	-.0407895	-.044353	-.0789919	-36.16	-37.80	-41.45	-73.28	0.000*	0.000*	0.000*	0.000*
age	-.0092178	-.0090567	-.0090976	-.0101942	-396.80	-393.11	-399.01	-441.58	0.000*	0.000*	0.000*	0.000*
neoplasms_dis	.6206503	.6061637	.5841719	.5226566	172.94	169.83	164.93	148.52	0.000*	0.000*	0.000*	0.000*
eye_dis	-.1298896	-.107228	-.0980297	-.1334831	-39.34	-32.78	-30.40	-42.28	0.000*	0.000*	0.000*	0.000*
ear_dis	-.1868141	-.1511773	-.1343804	-.2106114	-38.61	-31.30	-28.99	-46.17	0.000*	0.000*	0.000*	0.000*
musculoskel_dis	-.3577707	-.3765117	-.4010294	-.4481335	-171.19	-182.22	-195.41	-221.57	0.000*	0.000*	0.000*	0.000*
genit_dis	.3193079	.3054338	.2679875	.2212725	170.22	163.01	143.20	118.12	0.000*	0.000*	0.000*	0.000*
symptoms_dis	.5296972	.6163218	.6255364	.643811	237.32	285.64	298.30	302.25	0.000*	0.000*	0.000*	0.000*
injury_dis	-.3759128	-.3933144	-.4360284	-.5385268	-144.88	-152.35	-169.68	-211.33	0.000*	0.000*	0.000*	0.000*
influence_dis	-.1327082	-.157944	-.1543129	-.0973038	-96.06	-114.54	-112.57	-71.00	0.000*	0.000*	0.000*	0.000*
university_hospital	2.197325	2.019884	1.857795	1.789801	636.05	592.51	543.61	520.14	0.000*	0.000*	0.000*	0.000*
hospital	-1.611017	-1.749054	-1.886859	-1.915039	-1101.18	-1198.50	-1298.55	-1336.87	0.000*	0.000*	0.000*	0.000*
specialist	-1.484647	-1.602653	-1.749672	-1.795053	-969.02	-1048.58	-1145.45	-1188.11	0.000*	0.000*	0.000*	0.000*
GP	-1.767393	-1.825683	-1.965697	-2.559567	-906.27	-952.04	-1038.81	-1181.77	0.000*	0.000*	0.000*	0.000*
stomatology	-1.775233	-1.87855	-2.015097	-2.152678	-954.08	-1013.19	-1087.92	-1169.05	0.000*	0.000*	0.000*	0.000*
constant	.6452438	.8013893	.9884565	1.220617	364.53	451.75	555.65	675.81	0.000*	0.000*	0.000*	0.000*
	Average marginal effects				Odds ratios							
	2011	2012	2013	2014	2011	2012	2013	2014				
female	-.0079388	-.0084896	-.0094539	-.0168953	.9614248	.9600312	.9566162	.9240474				
age	-.001857	-.0018819	-.0019359	-.0021741	.9908245	.9909842	.9909437	.9898576				
neoplasms_dis	.1390763	.1384991	.1352977	.1204376	1.860137	1.833384	1.793505	1.686502				
eye_dis	-.0254507	-.02181	-.020481	-.027764	.8781924	.8983208	.906622	.8750423				
ear_dis	-.0360879	-.0304358	-.0278524	-.0430741	.8742575	.8596953	.8742575	.8100888				
musculoskel_dis	-.067123	-.0728927	-.0794181	-.0882067	.6992334	.6862511	.6696304	.6388194				
genit_dis	.0678799	.0665564	.0593106	.0487641	1.376175	1.357214	1.307331	1.247663				
symptoms_dis	.1165891	.1401266	.1446018	.1452027	1.698418	1.852103	1.869248	1.897501				
injury_dis	-.0699002	-.0754975	-.0852878	-.1033343	.6866622	.6748166	.6465994	.5836074				
influence_dis	-.026331	-.0322563	-.0323074	-.0205483	.8757206	.8538976	.8570039	.9072804				
university_hospital	.4999082	.4659547	.4336851	.4197913	9.000908	7.537452	6.409586	5.988259				
hospital	-.2702361	-.2992617	-.3276626	-.3327455	.1996844	.1739385	.1515471	.1473361				
specialist	-.2407781	-.2648765	-.2915374	-.297891	.2265823	.2013616	.173831	.1661187				
GP	-.2485079	-.2644069	-.2865764	-.328963	.1707776	.1611075	.1400582	.0773382				
stomatology	-.2551914	-.2753006	-.2964224	-.3091166	.169444	.1528116	.1333075	.1161727				
constant	-	-	-	-	1.906452	2.228635	2.687084	3.389279				

* Significant at the 0.01 level

Source: Author's computation

creasing trend of the individual predicted probabilities confirms the growing popularity of medical tourism to other "okresy" in the period 2011-2014.

Table 5.15: Predicted probabilities of the model with "med_tourism", medical treatments

	Predicted probability
2011	0.27967373
2012	0.29454183
2013	0.30710773
2014	0.30835422

Source: Author's computation

Based on the results in Table 5.14, the largest size of the effect is reported for the variable "university_hospital". It is the only type of medical facility that influences medical tourism positively. The values of average marginal effect exceed 0.4 for all years 2011-2014. It means that the predicted probability that the patient will travel for medical treatment into other district is more than 0.4 greater for university hospitals than for other types of medical facilities. We can explain the same effect with odds ratios as well. They indicate that for university hospitals, the odds of travelling for medical treatments into other districts are approximately 6-9 (according to the value of the particular year) times larger than for remaining medical facilities where the treatment could be provided. These values confirm that university hospitals significantly increase medical tourism in the Czech Republic.

Remaining four types of medical facilities used in the model influence medical tourism for treatments into other "okresy" in the negative way and the values of their average marginal effects are very similar. The highest negative average marginal effect is reported for normal hospitals. It can be explained by the fact that when people want to travel into hospital situated in other "okres" than where they live, they prefer university hospitals to normal hospitals. Therefore, while the university hospitals affect medical tourism positively, normal hospitals influence it negatively.

The results also show that age does not influence medical tourism too much. As the odds ratio equals almost 1, it means that the odds of travelling into other "okresy" are influenced very little by the variable "age". It influences medical tourism negatively, but very negligibly. It is reasonable as very old patients may not be capable of frequent travelling for medical treatments or they are not willing to travel with their relatives, who helped them before, anymore.

Gender affects medical tourism into other districts more than age, but the

magnitude of this effect is very low as well. It can be proved by the values of average marginal effects and odds ratios. Men are more likely to travel for health care into other "okresy", but the impact on the predicted probability does not exceed 1.7 % for any year between 2011 and 2014. However, our hypothesis that males travel more than females holds.

The size of effect of individual diagnoses used in the model is highest for the variables "neoplasms_dis" and "symptoms_dis". These diagnoses belong also to the diagnoses that have a positive impact on medical tourism into other "okresy". These types of diagnoses require a specialized treatment that is probably not available in every Czech "okres", therefore the people with such diagnoses travel for medical treatments into other "okresy". The neoplasms diagnoses include the health problems connected with malignant and benign tumors and the variable "symptoms_dis" stands for the variety of different symptoms that may cause some health problems in the future. On the other hand, the diagnoses with the highest negative impact on medical tourism to other "okresy" include the diagnoses of genitourinary and musculoskeletal system. The health service for these diagnoses is probably available in the places of patients' residence, therefore they do not need to travel to other "okresy" for these types of medical treatments.

Medical tourism into other regions ("kraje")

Table 5.16: Goodness-of-fit values for the model with "med_tourism2", medical treatments

	Pseudo R^2	**Log likelihood Full model**	**Log likelihood Intercept only**	**Likelihood ratio χ^2**	**P-value**	**Count R^2**
2011	0.2012	-8921775.3	-11170000	4493736.66	0.00	0.840
2012	0.2058	-9142846.1	-11510000	4738299.70	0.00	0.829
2013	0.2146	-9417335.4	-11990000	5144901.07	0.00	0.824
2014	0.2365	-9262765.1	-12130000	5738861.04	0.00	0.831

Source: Author's computation

Table 5.16 shows goodness-of-fit statistics for the model with "med_tourism2" as the dependent variable. All values of Pseudo R^2s are greater than in the the model describing travelling to other "okresy" as they all exceed 20 % . It means that this model is better fitted. Log likelihood values are again negative. The likelihood ratios χ^2 and p-values confirm that we can reject the null hypothesis that all coefficients are simultaneously equal to 0. Therefore, the model as a

whole is significant. The count R^2 reaches the values greater than 82 % in all researched years 2011-2014.

Table 5.17 summarizes the most important results for the model where "med_tourism2" stands as the dependent variable. Again, the coefficients, Z statistics, p-values, average marginal effects and odds ratios are presented there.

The values of Z statistics and p-values confirm that all variables individually are statistically significant, therefore they influence travelling for medical treatments to other "kraje".

The signs of the coefficients prove that the direction of effects of individual independent variables is the same as in the model where "med_tourism" is used as the explained variable. The diagnoses associated with neoplasms, genitourinary system and symptoms and also university hospitals influence medical tourism to "kraje" positively. Other variables employed in the model affect medical tourism negatively. The signs of the coefficients for individual variables are again same for all the researched years 2011-2014. The results comply with our stated hypotheses and they clarify the unsure effects.

Table 5.18 presents the predicted probabilities for the model for all years 2011-2014. They have been counted together with average marginal effects because of the definition of average marginal effects which describe the effects of individual variables used within the model on the estimated probability of the whole model. The values of estimated probabilities for travelling for medical treatments to other"kraje" are lower than for travelling for treatments to other"okresy". The highest predicted probability of the whole model was found for the year 2013 when the predicted probability of medical tourism reached 17.8 %. In 2014, it slightly decreased.

Table 5.18: Predicted probabilities of the model with "med_tourism2", medical treatments

	Predicted probability
2011	0.15930648
2012	0.16836521
2013	0.17820063
2014	0.1770944

Source: Author's computation

According to the results depicted in Table 5.17, the variable "university_hospital" has the largest impact on medical tourism to other "kraje". Nevertheless, it may be surprising than the trend decreases in time. It may be caused by the

Table 5.17: Results –"med_tourism2", medical treatments 2011-2014

	Coefficients				Z statistics				P-value			
	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014
female	-.0128678	-.0193376	-.0249483	-.0821044	-10.11	-15.48	-20.33	-66.24	0.000*	0.000*	0.000*	0.000*
age	-.0092544	-.0090903	-.009065	-.0105673	-341.06	-341.43	-347.10	-396.84	0.000*	0.000*	0.000*	0.000*
neoplasms_dis	.467687	.4506026	.4158921	.3217474	110.93	109.09	102.22	80.31	0.000*	0.000*	0.000*	0.000*
eye_dis	-.1743127	-.1528379	-.1536495	-.231663	-43.03	-38.43	-39.40	-60.60	0.000*	0.000*	0.000*	0.000*
ear_dis	-.1866362	-.151367	-.1442922	-.2550362	-31.35	-25.69	-25.63	-46.25	0.000*	0.000*	0.000*	0.000*
musculoskel_dis	-.4105758	-.4424369	-.4792162	-.5531948	-164.88	-182.21	-201.57	-237.92	0.000*	0.000*	0.000*	0.000*
genit_dis	.5211271	.4829583	.425986	.3580914	251.31	234.84	208.54	175.99	0.000*	0.000*	0.000*	0.000*
symptoms_dis	.8225904	.9221409	.92457	.93025	331.08	387.12	400.63	415.06	0.000*	0.000*	0.000*	0.000*
injury_dis	-.3312156	-.3708094	-.4569961	-.6125397	-102.96	-116.54	-144.72	-196.66	0.000*	0.000*	0.000*	0.000*
influence_dis	-.2103677	-.2494991	-.245951	-.1690141	-130.07	-156.06	-156.38	-107.84	0.000*	0.000*	0.000*	0.000*
university_hospital	1.928697	1.664305	1.456624	1.327622	735.94	655.18	576.65	526.22	0.000*	0.000*	0.000*	0.000*
hospital	-2.070331	-2.239195	-2.393283	-2.418977	-1121.08	-1221.51	-1335.23	-1394.47	0.000*	0.000*	0.000*	0.000*
specialist	-1.473662	-1.609997	-1.773685	-1.860748	-849.37	-938.00	-1048.46	-1125.03	0.000*	0.000*	0.000*	0.000*
GP	-1.577503	-1.635877	-1.800599	-2.724085	-719.46	-769.94	-869.28	-1018.48	0.000*	0.000*	0.000*	0.000*
stomatology	-1.66637	-1.798444	-1.976285	-2.207332	-771.90	-839.91	-931.59	-1051.97	0.000*	0.000*	0.000*	0.000*
constant	.0090778	.1892168	.4085521	.7457184	4.63	97.64	213.02	382.19	0.000*	0.000*	0.000*	0.000*

	Average marginal effects				Odds ratios			
	2011	2012	2013	2014	2011	2012	2013	2014
female	-.0017249	-.0027111	-.0036594	-.0120279	.9872146	.9808481	.9753604	.9211757
age	-.0012394	-.0012728	-.0013275	-.00154	.9907883	.9909509	.990976	.9894884
neoplasms_dis	.0724574	.0722851	.0687816	.051593	1.596298	1.569258	1.515722	1.379536
eye_dis	-.0220655	-.0203935	-.0214661	-.0314296	.8400342	.8582688	.8575725	.7932134
ear_dis	-.0234774	-.0201708	-.0201855	-.034248	.8297456	.8595322	.8656348	.7748885
musculoskel_dis	-.0488155	-.0546567	-.06147	-.0691949	.6632682	.6424689	.6192686	.5751095
genit_dis	.0804431	.076832	.069586	.0572747	1.683925	1.620862	1.531099	1.430596
symptoms_dis	.1385988	.1644607	.1705037	.1750024	2.276389	2.514668	2.520784	2.604212
injury_dis	-.0400475	-.0464233	-.0584758	-.0743987	.7180503	.6901755	.6331828	.5419727
influence_dis	-.0271676	-.0334753	-.0345434	-.0239436	.8102862	.779191	.7819605	.844497
university_hospital	.3944012	.3380256	.2953916	.2634398	6.880538	5.282002	4.291448	3.772064
hospital	-.2119181	-.2359844	-.2615376	-.2629358	.1261441	.1065442	.0913293	.0890126
specialist	-.1506482	-.1685437	-.1899643	-.1955314	.2290851	.1998881	.1697064	.1555563
GP	-.1411397	-.1516518	-.1694974	-.2074519	.20649	.1947815	.1651999	.0656062
stomatology	-.150276	-.1652596	-.1833832	-.1941812	.1889316	.1655564	.1385832	.1099937
constant	-	-	-	-	1.009119	1.208303	1.504638	2.107955

* Significant at the 0.01 level

Source: Author's computation

fact that normal hospitals improve services offered which approach the quality of medical service offered in university hospitals. Therefore, the people travel to university hospitals to other regions less. In 2014, the predicted probability of medical tourism was by 26.3 % greater for university hospitals than for other types of medical facilities. The same effect can be explained by the odds ratio with the value of 3.772.

As in the model with "med_tourism", the remaining medical facilities from the model indicate the negative effect on medical tourism for all years 2011-2014. If we compare the values of average marginal effects and odds ratios between the model with "med_tourism" and "med_tourism2", we find out that the negative impact on medical tourism is lower for travelling for medical care into other "kraje".The explanation for that may be following. When people search for a specialist/dentist/doctor in hospitals/GP, they look at their experience, at the recommendations of the others, etc. These specialists are probably not available in the "kraje" of patient's residence so much, therefore the patients are willing to travel to other "kraje" to obtain the medical service of high quality. Therefore, specialists/dentists/doctors in hospitals/GP do not have such a large negative impact on travelling into other "kraje" compared to travelling into other "okresy".

Both age and gender influence medical tourism to other "kraje" very negligibly and their effect is negative. If we compare the results for these variables with the results for the model describing travelling to other "okresy", we notice that the negative effect of age is almost of the same magnitude for both models and that a higher negative effect on medical tourism is reported for the variable "female" in the model with "med–tourism" as the explained variable. It means than women are more likely to travel to other "kraje" than to other "okresy".

Some diagnoses affect medical tourism into other "kraje" positively and the others negatively. The values of average marginal effects and odds ratios differ for some diagnoses compared to the model with "med_tourism" as the explained variable. The results from Table 5.17 show that the diagnoses associated with symptoms influence medical tourism into other "kraje" most from all diagnoses of the model. Average marginal effects and odds ratios for this diagnosis are even higher than in the model with "med_tourism". Every year between 2011-2014, the diagnoses linked to symptoms were increasing predicted probability of medical tourism into other "kraje" by 13% -17% (depending on year). Lower, but positive effects were proved for the diagnoses of the neoplasms diseases and diseases of genitourinary system. All these diagnoses require specialized med-

ical treatment and it is probably the reason why the patients travel to obtain this kind of treatment in other "kraj" than where they live. The diagnoses with the negative signs of coefficients can be probably treated effectively in "kraje" of patients' residence.

5.8 Robustness Check

As we analyze a large dataset, we also check if the results are not influenced by the number of observations only. There are several techniques how to verify it (Lin *et al.* 2013) .

For the purpose of this thesis, the method of sampling without replacement was used to check the robustness of our results. The random samples have been created from each evaluated dataset. This method of robustness check is described by Lemp & Kockelman (2012).

To keep the structure of our data, 50% samples were built for both hospitalizations and medical treatments for all years 2011-2014. The results of the logit models on these samples showed that the significance did not change for any independent variable used in the model. Also the magnitudes of effects measured by average marginal effects and odds ratios did not vary much.

Chapter 6

Conclusion

This thesis analyses medical tourism within a single country, the Czech Republic. Districts ("okresy") and regions ("kraje") are taken as the units where the people live and where they can receive medical care. This view on "medical tourism" is a brand new issue as, traditionally, "medical tourism" is understood as travelling from one country to another to receive a medical service. Therefore, this thesis brings a new conception of "medical tourism" in an international context. Moreover, there are only few empirical studies about "medical tourism" in the recent academic literature and this thesis is one of them. Within the Czech Republic, nobody has researched travelling for healthcare into "okresy" and "kraje" yet. This research may be helpful for health providers as it reveals the factors that influence travelling for health care within the Czech Republic.

The first section focuses on the theory about the Czech Republic and about the health care provided there. The second section investigates "medical tourism" in general. Firstly, it looks at the definition of "medical tourism" which is described differently by different authors. Based on the available definitions of this term, it was concluded that "medical tourism" can be defined as "traveling to other places/countries in order to get medical treatment". Secondly, this section reveals the main reasons why patients travel for health care. This is the question of many academic studies which proved that the most frequent reasons for "medical tourism" include lower costs, getting treatment that is not available in the home country, shorter waiting times, better quality and attractiveness of combination of vacation and medical treatment abroad. Then, the history and the increasing popularity of "medical tourism" is described. Some authors think that the globalization is the main reason for the

increasing trend of "medical tourism". People travel for health care because of the increasing trend of air travel, easier communication and also the freedom of travelling for education which may cause that well-qualified doctors and specialists provide health care in the countries with low incomes. Lastly, this section defines the meaning of "medical tourism" for this thesis. We investigate the Czech Republic and "okresy" and "kraje" are the units where the patients can travel to receive medical care. The patient can travel either to "okres" situated in "kraj" where she/he lives (which signifies travelling to other "okres") or to different "kraj" than her/his residence (which signifies travelling simultaneously to other "okres" and "kraj").

The third section of the thesis introduces academic literature dealing with "medical tourism". There exist many theoretical studies, but empirical studies are rather rare. The authors dealing with "medical tourism" empirically rely mostly on time-series data or panel data. Motivated by Jung (2006) who applied probability models to describe determinants of probability of transition between health states, in the empirical part, we aimed at finding determinants of the probability of travelling for healthcare within the Czech Republic. We analysed the data describing characteristics of individual hospitalizations and medical treatments in the Czech Republic to discover how these characteristics influence the probability that the patient will travel to other "okres" or to other "kraj" in order to obtain medical care.

The empirical research is described in detail in Chapter 5 of this thesis. Firstly, the chapter contains some information about data that we received from the Czech general health insurance fund (VZP) for the purposes of this thesis. We obtained pooled data for hospitalizations for the period 2009-2014 and single-year cross-sectional data for medical treatments for the same period of time. However, we discovered that the data have been collected properly since 2011. For the years 2009 and 2010, the number of observations for hospitalizations is much lower, therefore we cannot use these years for our main analysis, as these data could be skewed. Based on the preliminary analysis where we looked at "kraje" from which is it travelled most to other "kraje" and also at "okresy" from which is it travelled most to other "okresy", we decided to choose the data sample of five "kraje" from which it is travelled most to other "kraje" for hospitalizations/medical treatments. Therefore, the final data sample for hospitalization includes Central Bohemia, Karlovy Vary Region, Usti Region, Pardubice Region and Vysocina Region and the sample for medical treatments contains Central Bohemia, South Bohemia, Usti Re-

gion, Liberec Region and Vysocina region. These samples are analyzed for the period 2011-2014.

We estimated two logit models both for hospitalizations and medical treatments and for every year between 2011 and 2014. Dependent variables were binary and signified if the patient travelled to other "okres" (the first model) or to other "kraj" (the second model) to receive medical care. The independent variables differed for hospitalizations and medical treatments. The independent variables for hospitalizations included gender, age, the average category of the patient, the number of nights spent in hospital, a dummy variable for university hospitals, three different reasons of the end of hospitalization, the number of secondary diagnoses and the chosen diagnoses the patients were hospitalized with. The independent variables in the model dealing with medical treatments were gender, age, the selected set of diagnoses and five dummies standing for different types of medical facilities where the patients are treated (hospitals, university hospitals, GPs, specialists and dentists).

The core part of Chapter 5 evaluated the results for all models. Now, we will summarize the most important findings. The coefficients describing the goodness-of-fit of the model showed that the models are significantly better than empty models. Moreover, it was discovered that the models evaluating the factors influencing travelling into other "kraje" are better fitted than the models focusing on travelling into other "okresy". The results were presented in four tables (hospitalizations - travelling into other "okresy", hospitalizations - travelling into other "okresy", medical treatments - travelling into other "kraje", medical treatments - travelling into other "kraje") where coefficients, Z statistics, p-values, average marginal effects and odds ratios were shown.

All variables used in both models have an impact on medical tourism. University hospitals have the largest impact on medical tourism in all models in all the researched years 2011-2014. In the models describing travelling for medical treatments, university hospital was the only type of medical facility that had a positive effect on medical tourism. The reason may be that there are only 10 university hospitals in the Czech Republic. Moreover, they provide a large scale of treatments of many different specializations. Therefore, the patients travel there so much. University hospitals offer them health service not available in their place of residence. As the other types of medical facilities (hospitals, GPs, specialists and dentists) showed the negative effect on travelling for healthcare, it is believed that the patients are able to find these facilities in the places where they live.

The results also indicate that female and age have the negative, but very negligible effect on the probability of travelling to other "okresy"/"kraje" for health care. It means that patients travel for healthcare regardless their age and gender. The negative sign for the variable "female" was explained such that men are more mobile, therefore they travel more. However, this effect is small.

Regarding the individual categories of diagnoses, it was shown that all diagnoses from the hospitalization dataset (connected with neoplasms, eyes, musculoskeletal system, conditions in perinatal period and congenital malformations or deformations) influence medical tourism for hospitalizations positively. Therefore, it can be concluded that the patients search for these types of hospitalizations in another place than where they live a lot. Eye diagnoses and congenital malformations or deformations affect it at most. It is probably caused by the fact that these diagnoses require special treatment that is not available in every "okres" of the Czech Republic. For medical treatments, only the diagnoses associated with neoplasms, genitourinary system and symptoms affect medical tourism positively. As these types of diagnoses may cause very serious problems with health (cancer, infertility or serious illness), the people look for specialized treatments of a good quality in other "okresy"/"kraje" than where they live. It may be also associated with travelling for dialysis, a medical treatment that is necessary for some illnesses included in diagnoses of genitourinary system and that is available only in some places of the Czech Republic.

For hospitalizations, we analyzed the effects for the other variables as well. The number of nights spent in hospital influence medical tourism negatively, but the magnitude of the effect is very low. However, the effect of travelling for specialized treatments associated with more nights in hospital outweighed the effect that the patient cannot travel for healthcare because her/his state of health does not allow it.

The variable standing for the average category of patient showed the positive impact on medical tourism for most cases and the greater effect was recognized for the model describing travelling into other "kraje" to receive health care. This variable tells us about the state of health of the patient. The higher categories indicate the worse states of the patient. The results, therefore, proved that seriously ill patients travel for healthcare a lot, often probably with the help of their relatives/friends. They may require specialized treatments not available in their place of residence. Congenital malformations and deforma-

tions showed a large and positive effect on medical tourism. It corresponds with this finding.

The variable describing that the hospitalization ended because the patient was transferred into institutional care on an acute hospital bed was the only variable from a group of dummies standing for the reasons for the hospitalization end that showed the positive effect on medical tourism in the Czech Republic. It is probably connected with specialized treatments as well. Therefore, the effect is again positive.

After the evaluation of results, the robustness of our results was checked with the method of sampling without replacement. This technique confirmed the statistical correctness of the results.

To summarize the findings of the empirical analysis, it is important to mention at first that Czech patients travel for health care a lot. The most frequent reasons are that they need specialized types of treatments not available in their place of residence. As university hospitals of the Czech Republic offer complex medical service, people decide to choose them as a place of their medical treatment/hospitalization very often. As there are only ten university hospitals in the Czech Republic, the concentration of patients living in other places than where the university hospitals are situated is very high. With regard to the frequency of travels into university hospitals, it would be maybe efficient if there were more medical centers offering complex medical service in the Czech Republic. The idea for further analysis is, therefore, to concentrate the research on university hospitals only and to discover if opening of new medical centers would enhance Czech patients to travel even more than they travel now.

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Appendix A

Received Data Description

Table A.1: Medical treatments

Code	Variable	Description
ICP_KOD	Identification number of health provider	The coded number given by health insurance fund to identify health provider
ICP_UP	District of health provider	The coded number of the district where the health provider provides medical services
TYP_ZZ	Type of medical facility	The coded number of the type of medical facility (e.g. university hospital, hospital, sanatorium, day care center, etc.)
CP_KOD	Insured's identification number	The coded number of the insured person that enables to identify the patient, and therefore, to discover if the patient was treated more than once)
ROK_NAR	Year of birth	Patient's year of birth
POHLAVI	Gender	Gender of the patient ("M" for males and "Z" for females)
CP_UP	Insured's place of residence	The coded number of the place of residence where the patient lives at the time of the treatment
ODBORNOST	Expertise of heath provider	The code of the health provider's specialization (e.g. cardiology, psychiatry, neurology, geriatrics, rheumatology, etc.)
DG	Diagnosis	The code of the major diagnosis the patient was treated with (according to the international statistical classification of diseases)

Source: Author's creation

Table A.2: Hospitalizations

Code	Variable	Description
ID_HOSP	Identification number of hospitalization	The number of hospitalization provided by health insurance fund in order to be able to join he file with the second one where the secondary diagnosis is stated, if any
ICZ_KOD	Identification number of health provider	The coded number given by health insurance fund to identify health provider
ICZ_UP	District of health provider	The coded number of the district where the health provider hospitalizes the patient
TYP_ZZ	Type of medical facility	The coded number of the type of medical facility (e.g. university hospital, hospital, sanatorium, day care center, etc.)
CP_KOD	Insured's identification number	The coded number of the insured person that enables to identify the patient, and therefore, to discover if the patient was hospitalized more than once
ROK_NAR	Year of birth	Patient's year of birth
POHLAVI	Gender	Gender of the patient ("M" for males and "Z" for females)
CP_UP	Insured's place of residence	The coded number of the place of residence where the patient lives at the time of the hospitalization
ODBORNOST	Expertise of heath provider	The code of the health provider's specialization (e.g. cardiology, psychiatry, neurology, geriatrics, rheumatology, etc.)
HL_DG	Major diagnosis	The code of the major diagnosis the patient was hospitalized with (according to the international statistical classification of diseases)
VDG	Secondary diagnosis	The code of the secondary diagnosis, if any, of the hospitalized patient (according to the international statistical classification of diseases)
KOD_UKONCENI	Code of the end of hospitalization	The coded number telling the reason of the end of the hospitalization
DATUM_PRIJETI	Date of the hospitalization's start	The exact date when the patient was hospitalized
DATUM_PROPUSTENI	Date of the hospitalization's end	The exact date when the hospitalization was ended
OCENENI	Valuation of provided hospitalization	The price of hospitalization in Czech crowns
BODY_KATEGORIE	Points of the patient's category	The points that allow us to determine, into which category the patient belongs to

Source: Author's creation

Appendix B

Diagnosis description

- neoplasms_dis

The category "neoplasms_dis" includes various types of neoplasms problems.

- eye_dis

All the problems with eyes and adnexa are covered in the variable "eye_dis".

- ear_dis

The dummy "ear_dis" stands for the ear diseases such as "the disease of middle ear" and also for mastoid process illnesses.

- musculoskel_dis

Diseases connected with the musculoskeletal system plus connective illnesses are under the variable "musculoskel_dis".

- genit_dis

The variable "genit_dis" includes the illnesses of the genitourinary system.

- perinatal_dis

Diseases originated in the perinatal period are comprised in the category of "perinatal_dis".

- malformation_dis

"Malformation_dis" includes everything related to "congenital malformations, deformations and chromosomal abnormalities".

- symptoms_dis

The variable “symptoms_dis” contains all symptoms, signs and abnormal findings, either of clinical or laboratory character.

- injury_dis

All the injuries, poisonings or other problems caused externally are ranked to the variable “injury_dis”.

- influence_dis

Here are just factors examining the health status of the person.

For further details about the individual diseases contained in each of the mentioned categories, go to the website `http://apps.who.int/classifications/icd10/browse/2016/en`.