CHARLES UNIVERSITY

FACULTY OF SOCIAL SCIENCES

Institute of Economic Studies

Marie Ptáčníková

Occupational regulation and its influence on the labor market: evidence from reforms in the Czech Republic

Bachelor thesis

Prague 2017

Author: Marie Ptáčníková

Supervisor: Mgr. Barbara Pertold-Gebicka, M.A., Ph.D.

Academic Year: 2016/2017

Bibliographic note

Abstract

This thesis examines the impact of a 2004 reform that increased educational requirements for a regulated profession, namely nurses, on earnings level for both waged and salaried employees, and employment within nurse profession in the Czech Republic. Recently, a reform in the opposite direction regarding educational requirements for general nurses is in the approval process. It makes this analysis relevant. Similar country-based studies contracted by the European Commission regarding occupational regulation show mixed results, what additionally motivates this study. To identify effects of the reform a linear probability model and a difference-in-differences analysis were used. Empirical results suggest a negative effect on nurses' salaries with respect to doctors. In the case of wages, the effect appears to be fluctuating. As for the employment, a decrease in the probability of pursuing a nurse profession was identified for the years following the reform, but mostly insignificant. In general, this thesis shows that the reform had slightly negative short-term effect on nurses' earnings and employment levels. Due to few after-reform yearly observations it is challenging to make long-term conclusions.

Keywords

Abstrakt

Tato práce zkoumá dopad reformy z roku 2004, která zvýšila vzdělanostní požadavky pro vybranou regulovanou profesi, přesněji řečeno zdravotní sestry, na průměrný výdělek v platové i mzdové sféře a zaměstnanost zdravotních sester v České republice. V současné době je v procesu schvalování zákon, který navrhuje požadavky na vzdělání všeobecných sester snížit. To dělá tuto analýzu aktuální. Evropská komise provedla podobné studie, které se týkaly regulovaných povolání, v několika členských státech a výsledky těchto studií byly rozmanité, což dodatečně motivuje k této studii. K identifikaci efektů výše zmíněné reformy byl použit lineární pravděpodobnostní model a takzvaná difference-in-differences metoda. Empirické výsledky naznačují negativní dopad na platy sester v porovnání s lékaři, kteří byly použiti jako kontrolní skupina. Co se týče mezd, efekt je kolísavý. V případě zaměstnanosti byl zaznamenán pokles v pravděpodobnosti vykonávat profesi zdravotní sestry v letech po reformě, výsledky jsou ale převážně nesignifikantní. Obecně řečeno na základě výsledků této práce se zdá, že reforma měla mírně negativní krátkodobý efekt na průměrný výdělek zdravotních sester a zaměstnanost. Nicméně je náročné vyvodit obecné závěry jen několik let po reformě.

Klíčová slova

Regulovaná povolání, reforma, zdravotní sestry, platy, mzdy, zaměstnanost, Česká republika, analýza

Declaration of Authorship

1. The author hereby declares that she compiled this thesis independently, using only the listed resources and literature.

2. The author hereby declares that all the sources and literature used have been properly cited.

3. The author hereby declares that the thesis has not been used to obtain a different or the same degree.

Prague, May 15, 2017 　　　　　　　　　　　_____

　　　　　　　　　　　　　　　　　　　　　　　　　　Marie Ptáčníková

Acknowledgments

I would like to thank to my supervisor, Mgr. Barbara Pertold-Gebicka, M.A., Ph.D., for help with the topic and data. Moreover, I am grateful for her time, patience, expert advice and valuable comments during the whole process of writing the thesis. Finally, I am thankful to my family, especially to my mother, and friends for their support during my studies at IES.

Bachelor Thesis Proposal

Author:	Marie Ptáčníková
Supervisor:	Mgr. Barbara Pertold-Gebicka, M.A., Ph.D.
Language of the work:	English

Topic

Occupational regulation and its influence on the labor market: evidence from reforms in the Czech Republic

Topic characteristics

The aim of this thesis is to analyze how reforms of regulatory requirements (taking place mainly in 2004) for nurses and pedagogic workers influenced the number of people employed within these occupations in the Czech labour market and the number of students attending relevant high schools or universities in the Czech Republic. Besides, the change in earnings before and after the regulation will be compared and the potential trends will be explained. The change in legislation regarding an increase in educational requirements in 2004 is considered to be the key one.

The European Commission contracted similar studies in four European countries (Italy, Germany, Greece and the United Kingdom) to determine effects of the reforms from the economic prospective. The above-mentioned studies motivate to carry out analogical study for the Czech Republic. The research question is what effect the increase in occupation requirements in the Czech Republic has on the labour market, salary level and the participation within occupation.

Outline

- Introduction
- Changes in legislation
- Empirical model and data analysis
- Interpretation of results
- Conclusion

Sources

European Commission. 2015. "The Effects Of Reforms Of Regulatory Requirements To Access Professions: Country-Based Case Studies". Online. http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=8525&lang=en.

Ministry of Health. 2009. "Legislation Of Health Care Workers". Online. http://www.mzcr.cz/legislativa/obsah/pracovnici-ve-zdravotnictvi_1792_11.html.

Ministry Of Education, Youth And Sports. 2004. "Educational Staff Act". Online. http://www.msmt.cz/ministerstvo/zakon-o-pedagogickych-pracovnicich-a-o-zmene-nekterych-zakonu-1.

Ministry of Education, Youth and Sports. 2015. "Recognition Of Professional Qualifications: Database Of Regulated Professions And Professional Activities". Online. http://uok.msmt.cz/uok/ru_list.php.

Ministry of Labour and Social Affairs. 2016. "ISPV - Average Earnings Information System". Online. http://www.ispv.cz.

Wooldridge, Jeffrey. 2013. Introductory Econometrics: A Modern Approach. 5. ed. Engage Learning.

Contents

List of Tables

List of Figures

Chapter 1

1.1 Introduction

Occupational regulation includes many different forms and a wide range of regulatory instruments exists. Effect of regulation may take different directions and its impact is not clear because state and regulation is a complex system. From the perspective of a worker, regulation that takes form of a fee, for example, without anything in return may be clearly considered as a barrier to entry. On the other hand, requirement of higher education or qualification is rather an investment in human capital. Consider nurse profession. It may be beneficial for individuals pursuing the profession as well as for patients. Moreover, certain level of skills of nurses is required naturally because the health of a patient is crucial and the mission of the state is to ensure health and safety of citizens. Although for different occupations such a regulation may be unreasonable and quality may be reached through different instruments, e.g. ratings of services at the internet, it seems that nursing occupation is the type of profession where the state regulation is justified. However, its severity and flexibility is a matter of discussion. To inform this discussion an empirical analysis is performed to determine the effect of a 2004 reform that increased education requirements for nurses on the labor market in the Czech Republic, especially on the level of remuneration and employment within the nurse profession.

The aim of this thesis is to analyze the impact of a reform that intensified educational requirements for a specific regulated occupation in the Czech Republic, namely nurses. As the legislation amendment is considered the Act No. 96/2004 Coll., On Non-Medical Health Service Occupations (*Zákon o nelékařských zdravotnických povoláních č. 96/2004 Sb., ve znění pozdějších předpisů)*, as amended (hereinafter referred to as the law). The legislation is valid from May 3, 2004 and came into effect on April 1, 2004. The act changed the educational requirements for new entrants of nurse profession dramatically. Those entering a high school in 2004 or later were required to obtain a college or professional higher education diploma to pursue a nurse profession, while before the reform a medical high school diploma was sufficient.

The motivation for this study is the fact that the European Commission (2017) carried out analogous case studies of impacts of changes in regulation in different professions for

several countries. Policy makers are anxious to know the effects of such regulatory requirements. There are several reasons why it is interesting to investigate.

First, it may be because EU aims to high levels of employment according to the Treaty of Lisbon (European Union, 2007) and to eliminate unreasonable and discriminatory entry barriers according to the Directive 2006/123/ES. In other words, the EU wish to lower entrance requirements. Second, it simultaneously seeks to increase education levels among EU citizens and assure high quality service sector according to the Lisbon Strategy (European Parliament, 2000). Hence, it suggests that legislation might raise entry requirements. Third, licensing and other regulations are in existence because they provide a protection of society's health and safety (Kleiner, 2006). Next, it may ensure certain quality of service (Ministry of Education, Youth and Sports, 2008) – undoubtedly important in nurse profession. Unfortunately, quality levels of service provision are not analyzed in this thesis, mainly because measurement of quality is arguable. As the undertaken actions may be contradictory and the trade-off between those objectives is challenging, it is accurate to investigate the effects of policy changes.

As for the background, the Czech Republic joined the EU on May 1, 2004. Since then, Czech laws must be consistent with European legal framework, in our case with EU Directive 2005/36/EC covered by Directive 2013/55/EU which was one of the reasons why the law was adopted. According to it, tertiary education is required to pursue a nurse profession. The law should also ensure the education required by modern health care system and development in technology. Moreover, given the situation in the Czech health system (Prošková, 2011), the act arguably aimed to solve the long-term shortage in number of nurses which the Czech Republic faces. Policy makers probably believed that higher education requirements would eliminate the lack of nurses and motivated more individuals to pursue the professions as it is generally believed that more educated men tend to have higher income.

The structure of the thesis is as follows. It consists of two main parts – theoretical and empirical. The theoretical part starts in Chapter 2. It goes through literature and studies that investigated occupational regulation in different countries and highlights the main points and outcomes. Then, Chapter 3 contains a clear definition of regulated occupations in the Czech Republic. It also specifies in detail which occupations out of these are

investigated in subsequent analysis. Moreover, not only educational requirements to pursue nurse profession are included in Chapter 3.

Chapter 4 relates to the data and involves an introduction to empirical analysis. First, a methodology of analyses and assumptions are stated. Second, data description is done and main data limitations are mentioned. Then, regressions are run. Consequently, Chapter 5 provides a presentation and interpretation of results. It discusses the effect that the changes in occupation requirements had on the labor market, namely level of remuneration (salaries and wages) and employment within the nurse profession. Because the data is not detailed enough, the quantity of students at relevant high schools, higher schools and universities cannot be compared. Only aggregated[1] data is available which is not sufficient for the analysis (Data o studentech, poprvé zapsaných a absolventech vysokých škol, 2017). Last but not least, Chapter 6 including conclusion follows. The last Chapter also discusses a potential extension and suggests that a similar analysis can be done for another occupations experiencing change in requirements.

---

[1] There is data for all medical and non-medical study programs together, i.e. the data of individual programs at tertiary institutions is not available.

Chapter 2

2.1 Literature review

Certain literature regarding occupation licensing exists. Moreover, several studies at country levels were contracted to study economic effects of reforms of requirements to enter and pursue professions in European countries. To the best of my knowledge, there has not been any similar study in the Czech Republic yet. This chapter provides an overview of the studies that present change in regulation, various methods and approaches that were used to measure the impacts, and corresponding outcomes and findings.

Kleiner and Krueger (2013) conducted a study concerning occupational regulation in the US. Their study focused on what types of regulation requirements and government oversight might contribute to wage premium in U.S. labour market. They conclude that state licensing in the U.S. might restrict the supply of workers in regulated occupations which can be associated with higher remuneration. Moreover, they mention the data issues that limit number of analyses relating to occupational regulation in general.

Another study of Kleiner (2006) involves the U.S. and also EU. It is also centered around employment and earnings within regulated occupations. The author states that economists generally accept that licensing might limit labour supply and lead to higher wages in comparison to unregulated occupations. However, the wage effect of licensing is higher in the U.S. than in the EU. Also, he discusses that medical services belong to the most regulated occupations. He argues that it is one of the reasons of shortage of workers in those occupations. Furthermore, he generally states that regulation may provide protection to customers. Therefore, he points out conflicting views of achieved goals by regulation. Findings of both aforementioned studies are consistent.

When looking at the country-level studies (European Commission, 2017) mentioned in Chapter 1 that investigate the effect of change in regulation requirements in selected occupation, all states such as Austria, Greece, Germany, Italy, and Poland liberalized entry requirements for selected professions on which the studies were focused. Moreover, Poland clarified the criterion for the examined professions. On the contrary, licensing was

introduced in the UK. They all agree that investigation of regulation changes is not an easy task (not only due to data scarcity) and further analysis is needed.

As for the methodology, a difference-in-differences analysis is used to measure the effect on employment in Austria, Greece, Germany, and the UK. They all use control group that is believed to be as similar to the investigated occupation as possible. Moreover, the UK study uses the method to examine the effect on remuneration as well (Koumenta & Humphris, 2015). The same approach will be used in our case, see Chapter 4. As for the method used to study the effects of a reform on employment, the Italian study (Pagliero, 2015) estimates a linear probability model with dummy dependent variable that equals one if a person works in the selected occupation, as we will do.

Commenting on results of the aforementioned studies, in short, it may be partly concluded that liberalization might have a positive effect on the labor market and brought new firms or entrants. However, no common conclusion can be done generally. Austria's study highlights the mixed results. Similarly, the results for the two occupations for which the analysis in the UK was conducted are different. Licensing was introduced for nursery school workers and security workers. They examined the effect of the licensing on employment and earnings. The former group exhibits lower wages and negative effect on employment, the latter one experienced wage increase and there is no effect on employment. Therefore, the impact of stricter regulation changes in the Czech Republic is an interested case for investigation and will add an important voice to the discussion.

Chapter 3

In this chapter the theory and practice surrounding occupation regulation is discussed. First, the exact definition of regulated occupations is introduced. Next, the prevalence of regulated occupations in the Czech Republic is argued and comparison to other European countries is provided. Moreover, different types of regulation are discussed. As this thesis is centered around a change in occupation requirements for nurse professions, past and current requirements needed to pursue this profession are stated.

3.1 Definition of regulated profession

According to the general definition on the website of the Ministry of Education, Youth and Sports in the Czech Republic (hereinafter referred to as the Ministry; 2017), a regulated profession is defined as follows: "*A profession, professional activity or trade is regulated when there is a legislative regulation giving a condition under which the profession can be pursued. Without meeting these conditions (qualification, education, good repute etc..), the professional is not entitled to pursue the profession.*"

The online Database of regulated professions and professional activities (hereinafter referred to as the "database"; 2017) which is administered by the Ministry provides information on minimum requirements for all regulated professions. Unfortunately, no link to exact occupation classification codes that we use in our analysis is provided and occupational titles may differ between the database and the occupation classification used in this thesis. These are two of many reasons that complicate the orientation in occupational regulation and following analysis.

In the database, one can identify the following regulated units related to nurse occupations – midwife (173), nurse auxiliary[2] (198), nurse (303), and healthcare assistant (308). There are defined several non-medical health service occupations in the law from 2004 and the database is in accordance with them. Specifically, each occupation defined by the relevant article in the law belongs to one regulated unit in the database.

---

[2] Ošetřovatel (Article 36, Act. No. 96/2004 Coll., as amended; 2004) is not included as they can work only under the direct guidance and their competences are substantially low comparing to other nursing professions that are included in our analysis. Moreover, it does not have its own distinguishable code in KZAM and ISCO classifications.

As for the general requirements, the aforementioned ones need a proof of good character or repute and a requirement of physical or mental health (as also stated in the law). Both are needed for the majority of professions and professional activities recorded in the database. The exact list of nursing occupations that are included in our analysis will be provided later, see Table 1 in Section 3.3, along with other information.

For comparison with the EU about the number of regulated professions, according to the Ministry (2017), it states that each EU member state has the responsibility to regulate occupations and appropriate laws independently. Hence, the number of regulated professions differs among EU member states and the scope of regulation varies from state to state. More specifically, there are approximately 330[3] professions and professional activities regulated in the Czech Republic. As said earlier, the entire database is available online on the website of the Ministry. Comparing to the EU, the Czech Republic ranks among the member states with the highest number of regulated professions together with Poland and Slovakia, and with Hungary in the lead with 545 regulations ("Regulated professions database", 2017). Nevertheless, even though each member state has its own right to regulate occupations, professionals such as nurses, midwives, doctors or architects etc. are allowed to move freely within the EU ("Recognition of professional qualifications in practice", 2017). According to the Czech Database of regulated professions and professional activities, only nurses (303) can appeal for the EU professional card (Your Europe, 2017).

3.2 Types of regulations

To understand the context properly, information about types of regulations that exist is provided in this subsection. In general, there are 4 types of restrictions recognized. Originally, Kleiner (2006) distinguishes between 3 main types of occupational regulations – licensing, certification and registration. However, Koumenta et al. (2014) add fourth type – accreditation.

---

[3] This number may differ substantially. According to the Government of the Czech Republic (2015), it states that there are 396 regulated professions in the Czech Republic. Moreover, some professions are regulated at the European level, some at the state level. Furthermore, some professions may be divided in more detail in EU and in the database of the Czech Republic. The methodology varies as well. Also, the Czech database is said to be the most precise and accurate in compassion with other countries. Another source indicates a number of 215 regulated professions in the Czech Republic (Koumenta et al., 2014)

First, the strictest form is **licensing**. It is illegal for an individual to pursue the profession unless they fulfill certain criteria set by the state (typically educational requirements) and obtain a license. Second, a less strict form is called **certification**. When a person meets the standards predetermined by the state, they are entitled to use a title. In contrast to the case of licensed occupations, uncertified individuals may typically conduct occupation subject to certification, but they cannot use the title. Anyhow, individuals may certificate themselves on a voluntary basis. Third type of regulation is **registration**. Under registration, each individual has to provide some information (name, address, qualification) to a government agency and a fee is sometimes required. It is considered to be the least tough form of regulation as no educational requirements or skills are needed. Unfortunately, there is no central register and obligatory registration for all nurses in the Czech Republic. However, the World Health Organization would appreciate it (Mladá fronta, 2000). Such a thing would provide most ideal data for policy analysis of this occupation. (Kleiner, 2006)

The fourth type is **accreditation**. Individuals can demonstrate their competence by obtaining accreditation (Koumenta et al., 2014). For example, in our case, to become a nursing or midwifery professional (nurse or midwife with specialization) from a nursing and midwifery associate professional, to pass an attestation exam is needed (Institute of post-gradual education in health sector, 2017).

3.3 Education changes in nursing occupations

In this section, an overview of the previous requirements is discussed. Then, the change in educational requirements of nursing professions is provided. Hence, nursing occupations that will be analyzed hereafter will be mentioned. Before going on, it is important to say that the problematics and legislation are complex things and some simplification is done where possible or needed.

First, the following table, i.e. Table 1, presents the codes of nursing professions that are analyzed in this thesis. We jointly called them nurses in general. However, the classification is complicated. The table is incorporated to provide exhaustive division according to the classifications and to show how complex issue it is. Specifically, there are two types of classification, KZAM till 2010 and international ISCO from 2011. More

detailed explanation regarding the occupation classification and its limitations are discussed in Section 4.4. When comparing the aforementioned classifications to categories from the database (2017), the analysis is conducted for midwife (173), nurse (303), and health care assistant (308). Nevertheless, let us call them nurses for our purposes.

Table 1: Summary of codes and relevant nursing professions used in the following analysis

KZAM classification until 2010			ISCO classification since 2011		
Code	Name	Czech equivalent	Code	Name	Czech equivalent
3231	Nurses Responsible for General Care	Ošetřovatelé, všeobecné zdravotní sestry	2221	Nursing Professionals	Všeobecné sestry se specializací
3232	Female Nurses, Midwives	Ženské sestry, porodní asistentky	2222	Midwifery Professionals	Porodní asistentky se specializací
3233	Childcare Nurses	Sestry pro péči o dítě	3221	Nursing Associate Professionals	Všeobecné sestry bez specializace
3234	Psychiatric Nurses	Sestry pro psychiatrickou péči	3222	Midwifery Associate Professionals	Porodní asistentky bez specializace
3235	Nurses Responsible for Intensive Care	Sestry pro intenzivní péči	3256	Medical Assistants	Zdravotničtí asistenti (Praktická sestra[4])

Second, educational requirements are explained. To be precise, it is always assumed that schools and universities are accredited and nurses study in the corresponding field. Moreover, minimal education is taken into consideration, nobody claims that nurses cannot or do not have higher education than the law requires.

First of all, a comment on the requirements required before the law from year 2004 was passed is done. Until then, nurses (except for midwives) could perform their profession independently with a medical high school education and 3 years of practice under a supervision of an independent nurse. Hence, medical high schools were the main provider of education for nurses.

This was changed by the law that passed in 2004. Thenceforward, high medical schooling is not enough and nurses need higher education. It means that those who started a high school studies in 2004 need to continue their studies at higher medical schools[5] or colleges

---

[4] In the data provided by the Average Earnings Information System, the second/new name of Medical Assistants "Praktická sestra" has appeared in ISCO classification since 2011.

[5] The translation may vary. According to the database (2017), it is a higher paramedical college. However, according to a publication of the Ministry of Education, Youth and Sports (2011), they call it a tertiary professional school. Last

(to become a nurse, not medical assistant). Therefore, the first nurses with higher education entered the labour market in 2011 (4 years of high school plus 3 of higher education). Either a title DiS. from a higher medical vocational school or a bachelor's diploma in the corresponding field is needed. To explain, the title DiS (specialist with a diploma, in Czech *Diplomovaný specialista*) is a non-university degree obtained from a 3-year higher professional school in the Czech Republic since 1998 (Pravidla českého pravopisu, 2017). It provides qualification necessary for demanding professional activities. Only students with maturita exam can attend higher professional schools and universities.

As for the midwives, they needed a title DiS. to pursue their profession even before the law in 2004 (Ministry of Education, Youth and Sports, 2014). Under the legislation from 2004, they need a bachelor's diploma. It means that first midwives' graduates with bachelor's diploma exist from 2007. As regards Medical Assistants, this nursing occupation was firstly introduced in the law in 2004 following the example of EU. They can pursue their occupation with a medical high school education, however, always under the expert supervision of a general nurse or midwife (so their competence is lower). According to Regulation No. 144/2003 Coll., as amended, study program[6] Medical Assistant replaced the previous study programs at high schools since September 1, 2004. Therefore, medical assistants should be in existence in work since 2008[7] when they ended their studies. Unfortunately, our data on remuneration and employment does not contain any information about them before 2011.

To summarize the aforementioned information about current educational requirements according to the law and types of nurses, the following illustration is provided in Figure 1:

---

but not least, it may be translated as a higher vocational school or a higher professional school. Therefore, all of the aforementioned names may be used.

[6] According to the regulation, study program 53-41-M/001 Nurse (Všeobecná sestra) was moved to tertiary level education and at high medical schools it was replaced by program 53-41-M/007 Medical Assistant (Zdravotnický asistent) since September 1, 2004.

[7] However, few medical assistants might have appeared sooner, e.g., in 2007 (Pavlica, 2016). It may be caused by the fact that there is a possibility to become a medical assistant if having full high school education and an accredited qualification course for medical assistants after having competence to pursue nurse auxiliary profession (ošetřovatel).
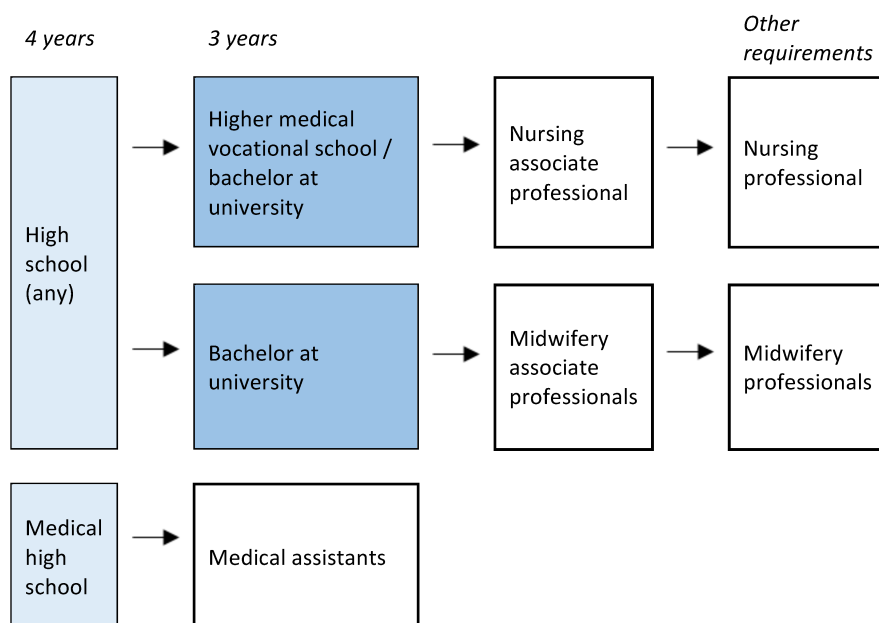
Figure 1: Current educational requirements

3.4 Other requirements in nursing occupations

In the previous subsection, higher requirements for education in nurse occupation were presented. However, there are several types of nurses and to pursue their professions, some of them require further documents or qualification. They will be presented in this subsection.

First, according to Section 96 a) in the law, nurses that obtained their professional or specialist qualification (competence) to pursue a particular nursing profession under the previous legislation, the new law cannot affect the competence their already achieved.

For nurses (except for medical assistants) that meet the requirements to pursue the profession according to the law (current or past) to become an 'independent nurse' and not to work under the supervision any longer, certificate (*Osvědčení k výkonu zdravotnického povolání bez odborného dohledu*; Public Administration Portal, 2012) issued by the Ministry of Health as stated in the law is needed. To obtain the certificate, a piece of evidence of confirming education and competence is required. Based on the previous facts, the certificate lies somewhere in between the aforementioned types of regulation – regulation and certification. It is obligatory for individuals who want to work independently without a supervision and a fee is required. However, there is no extra

education required. Moreover, there is a problem with translation from Czech language. Independent nurse with the certificate may use the title registered ("*registrovaná/ý*") and are entered in the Register. The certificate is valid for 10 years.

Second, as can be seen in the Table 1 in the beginning of this Chapter, there are associate professionals and professionals. To become nursing and midwifery professionals (nurse or midwife with specialization – 2221 and 2222) from nursing and midwifery associate professionals (3221 and 3222), respectively, they need to pass an attestation exam as already mentioned. It demonstrates special competence and experience.

Last but not least, to maintain nurses' knowledge up to date, a lifelong learning was introduced by the law in 2004. All health care workers have to restore, deepen and supplement their knowledge constantly. For such purposes, a credit system was established.

The law experiences some **amendments** continuously over the years and it is a lively process. The amendments are generally minor and their effect is rather negligible. However, in 2016, the Government Legislative Council of the Czech Republic (2016) adopted a draft of amendment to the Act that would change requirements noticeably. It suggested that the credit system controlling for lifelong learning will be cancelled and that the certificate to become an 'independent nurse' will be abolished as well. It also proposes annulling the Register for nurses pursuing their occupation without supervision. Furthermore, it indicates that Medical Assistant would be officially renamed to Practical Nurse (note: not General Nurse). Moreover, it suggests shortening of higher education that would newly last just one year for those who graduated from a medical high school (not any high school, those still need 3 years of higher education) and want to become a general nurse. Last but not least, a National Register for all nursing professions might be established. The last one mentioned would make future analyses on the topic apparently easier. According to the latest information, the amendment passed third reading in the Chamber of Deputies on April 26, 2017 and now it goes to the senate (Chamber of Deputies, 2017). The amendment is still not in force yet, it has to be approved by the Senate and President of the Czech Republic. The objective of the amendment is to contribute to the increase in the number of nurses. If approved, it would be effective from September 1, 2017.

Chapter 4

In this chapter, the practical part begins. It includes an introduction to the empirical analysis and problem description. Moreover, the methodology is presented and data is described. Last but not least, limitations regarding the data are discussed. Before moving on, discussion of potential effects of such regulation on earnings and employment of nurses will be presented and those predictions will be tested on our data.

Naturally, higher educational requirements mean that new potential entrants into nursing profession spend more time studying and start working later. As for the remuneration, to compensate the cost of studying and to appreciate the higher investment into human capital, i.e. more educated workers, higher remuneration may be expected. As regards employment, in the short run, there may be a gap of new entrants as the new individuals have to newly study longer according to the new law. Moreover, higher requirements typically reduce employment because they are considered as a barrier to entry. According to Kleiner (2006), one of the reasons of shortage of workers in medical services may be caused by the heavy regulation in those professions. This reasoning motivated the recently discussed amendments to the nursing profession regulation in the Czech Republic.

4.1 Problem description and objectives

The main objective of this work is to analyse the impact of higher educational requirements in nurse occupations on earnings and employment. The point of interest is to investigate the difference in earnings and employment once the higher education was introduced.

- Is there a significant difference due to the legislation change?
- What is the overall evolution of earnings in nursing profession? Are earnings of university graduates conducting the profession higher than earnings of employees with a high school diploma?
- Did the legislation have a positive of a negative effect on employment in nurse occupation?

As already noted, the law from 2004 increased educational requirements. In short, the most dramatic change is considered to be the shift of education from relevant medical high schools for nurses to 3-year programs at medical higher vocational school or 3-year bachelor programs at universities focusing on nursing in order to pursue nursing profession nowadays. As explained in detail in Section 3.3, a high school diploma from a relevant medical high school and several years of practice were sufficient to pursue a nurse profession (except for midwives) till the law in 2004 passed.

Since mid-2004, extra 3 years of schooling on top of high school education (not necessarily a medical one) are needed for those occupations. Entrants that started a high school in a school year 2004/2005 were obliged to continue their studies at a 3-year program at medical higher vocational school or a 3-year bachelor program at a university focusing on nursing. Thus, they graduated no sooner than in a school year 2010/2011[8] and started working in 2011. Therefore, the impact of the reform is in a sense lagged and real outcomes can be seen no sooner than in the second part of 2011. The main year of interest is the year 2011. However, it is not that easy and two more years may be noteworthy as already mentioned earlier. First, first midwives with bachelor's diploma appear from 2007. Second, as mentioned earlier, first medical assistants should exist since 2008. Hence, to analyze the impact of the legislation is rather an intricate problem than a straightforward task. Moreover, not only the aforementioned information but also data issues and availability makes the following analysis complex.

4.2 Methodology

4.2.1 Analysis on earnings

As mentioned earlier, the first goal of this thesis is to analyze the impact of a change in legislation regulating the nurse occupations on earnings (salaries and wages). According to Wooldridge (2013) and other studies mentioned in Chapter 2, an appropriate method in evaluating an impact of a policy change is a **difference-in-differences** (DiD) **analysis**. The DiD analysis may be used when an exogenous event, such as a policy change, affects the environment in which individuals act, what is exactly our case.

---

[8] Author's calculation

The DiD analysis relies on identifying two groups – treatment and control. It compares the evolution of the former one with respect to the latter one, before and after the legislation change, with the assumption that the control group allows to predict the evolution of the treatment group under the no reform scenario. Thus, both groups are required to fulfill the following characteristics. Both ought to be as similar as possible and follow the same trend in the pre-reform period. On the contrary, only the treatment group is considered to be affected by the law, not both of them. Then, the evolution of the treatment group in the post-policy period with respect to the control group is the point of interest. (Wooldridge, 2013)

In other words, the DiD analysis enables us to compare the path of remuneration over time for the treatment group with the one that it would have if no regulation changes were applied (control group). The concept assumes that the evolution of earnings of both groups is similar and therefore if any difference between those two appears, it is believed to be the effect of the regulation. (Wooldridge, 2013)

According to Mora & Reggio (2013), when the assumption of the same pre-reform evolution for treatment and control groups hold, the effect of a reform might be modelled using the following equation:

$$E(outcome \mid treatment)$$
$$= \delta_0 + \delta_p post\ reform + \delta_t treatment$$
$$+ \delta_{pt} post\ reform \times treatment$$

where δ_0 is an intercept and δ_n are slope parameters. The variables *post_reform* and *treatment* are dummy variables that equal one if true, zero otherwise. Parameter δ_{pt} identifies the impact of the reform. Clearly, when using data and the aforementioned equation, we get:

$$\delta_{pt} = E(outcome \mid treatment\ after\ reform)$$
$$- E(outcome \mid treatment\ before\ reform)$$
$$- [E(outcome \mid control\ after\ reform) - E(outcome \mid control\ before\ reform)]$$
$$= (\overline{y_{T,1}} - \overline{y_{T,0}}) - (\overline{y_{C,1}} - \overline{y_{C,0}})$$

where indices T and C represent the treatment and the control group, respectively and digit 0 and 1 represent the period before and after the legislation, respectively. (Imbens & Wooldridge, 2007). As the equation shows, averages can be used in this method. In this case, we use data on average earnings – wages and salaries.

Based on the aforementioned information, we need to choose two groups – treatment and control – with the desired properties. It is not an easy task. In our case, treatment group will contain all nurse professions jointly, mainly because of the change in classification that limits our data and subsequent analysis. As for the control group, we decided to use doctors. We did our best to choose the most appropriate control group. They fulfill the properties – it is a medical profession from health care sector, they were not affected by the law and appropriate data are available.

Regarding the same trend in the pre-policy period assumption, i.e. parallel path assumption, it is a core assumption in the difference-in-differences analysis. However, as Mora & Reggio (2013) argues, it might be often violated. Moreover, the authors introduce several more flexible methods, for example they claim that after-policy period may be further divided and more effects might be observed, i.e. short- and long-run effects. The aforementioned division of the after-policy period is used in the following analysis. Regarding the parallel path assumption, as we will learn later, the assumption in the pre-policy period does not hold in case of wages. However, it is met in case of salaries. In the latter case, classical analysis follows. In the former situation, the authors advise alternative methods. They propose the so called parallel growth assumption, i.e. recalculating the data to first differences (FD) and continuing in examining classical parallel path assumption, i.e. parallel path for outcome FD rather than for outcome levels. The examination of whether the parallel growth assumption is met will reveal that neither this assumption holds. Therefore, another method needed to be used. It turned out that in this case, percentage growths can be used and similar pre-policy evolution assumption seems to hold. The percentage growths are computed based on the following formula:

$$Percentage\ growth_t = \frac{(\overline{y_t} - \overline{y_{t-1}})}{\overline{y_{t-1}}} \times 100.$$

To comment on the choice of control and treatment group, certainly, it would be ideal and more precise to conduct an analysis separately for each nurse occupation. Unfortunately, it is not feasible due to a change in the code scheme – codes and naming. The change makes it impossible to connect individual codes of nurse professions before 2010 (KZAM classification) to those after 2011 (ISCO classification), as already mentioned and depicted in Table 1. Hence, all nurses are treated together in the treatment group. Moreover, doctors are used as the control group. This is shown in Table 2. More detailed explanation of the change in the classification will be provided later in this work.

Table 2: Overview of treatment and control group used in the following analyses

	KZAM classification until 2010	**ISCO classification** since 2011
TREATMENT GROUP	Nurses Responsible for General Care (3231)	Nursing Professionals (2221)
	Female Nurses, Midwives (3232)	Midwifery Professionals (2222)
	Childcare Nurses (3233)	Nursing Associate Professionals (3221)
	Psychiatric Nurses (3234)	Midwifery Associate Professionals (3222)
	Nurses Responsible for Intensive Care (3235)	Medical Assistants (3256)
CONTROL GROUP	Medical practitioners, except for dentists (2221)	Generalist medical practitioners (2211)
		Specialist medical practitioners (2212)

4.2.2 Analysis on employment

As already mentioned, the second goal of this thesis is to analyze the impact of legislation on employment within nurse profession. We are interested in comparing the employment levels of nurses due to the legislation change. For such purposes, it is possible to perform a regression analysis of event study type that is presented in this subsection. The analysis will reveal whether there is a significant change in a probability of pursuing nurse profession due to higher educational requirements. In the models, the following variables are included. The outcome variable (dependent variable) *nurse* will be regressed on control variables. Moreover, dummy variables representing years are added to the regression. They will provide the information of the interest.

One might suggest performing similar analysis to the one in the previous subsection. However, to eliminate the issues about control group, the regression analysis is chosen. In Appendix 1, though, a table providing the quantitative information about the number of nurses pursuing their profession in individual years computed from our data is attached.

There are two different analyses performed, first will use only usual type of dummies representing individual years. Second analysis will use also the dummy variables but moreover, it will use dummies representing a year when an individual started high school. Each analysis provides a little different information but both are interesting. However, the interpretation of results slightly differs.

To comment on the variables in general, first, the dependent variable is a dummy variable that equals one if an individual pursues nurse profession and zero otherwise (i.e. pursuing another occupation), similarly as in the Italian study (Pagliero, 2015). Second, the independent variables consist of control variables and dummies of years. The control variables serve to make the estimations more precise. They control for individual's characteristics that may influence the choice of occupation they pursue. Those are socioeconomic and work characteristics:

- Socioeconomic characteristics:
  - *age* – numerical value
  - *gender* – a woman takes value one and man takes value of zero
  - *marital status* – it equals one if a person is married otherwise it equals to zero, i.e. single, divorced and widowed
  - *nationality* – variable nationality equals to one if an individual is of Czech nationality, otherwise it equals to zero
  - *place of residence* – there are 8 parts of the Czech Republic according to the NUTS classification: Prague, Central Bohemia, Southwest, Southeast, Northwest, Northeast, Central Moravia and Moravia Silesia. Separate dummy variables representing a particular region are included in the analysis
- Work characteristics:
  - *education* – there are the following types of variables regarding education: no education, primary education (9 years of studying), high school education without maturita exam, high school with maturita, higher (tertiary) education. All of them are dummy variables that equal one if true and zero otherwise
  - *second job* – it equals one if an individual has a second job, zero otherwise

However, even though we try to include as many available variables in our model, there are naturally many other personal factors that influence choice of our profession, many of which are impossible to be measured at all. These are thus included in the disturbance.

As for the dummy variables of selected years, in the first analysis, the coefficients will show whether there is a significant difference in employment (probability of being a nurse) due to the legislation change or not. The most important are the coefficient of dummy variable of a year 2011 and of the following years. Moreover, as mentioned earlier, years 2007 and 2008 may also exhibit interesting findings. In the second analysis (hereinafter referred to as analysis of cohorts), the coefficients of years 2004 and onward are those of interest. They will show which cohorts (a year/class of high school entry) are affected by the legislation and which are not. In the analysis of cohorts, dummy variables representing individual years, i.e. years when the survey was conducted, are included but in contrast with the first analysis, they serve as control variables in this case. To conclude, as mentioned earlier, we are interested in different coefficients and different years in each analysis.

Taking into consideration available data, this all leads to the **linear probability models** (LPM) of the following forms:

$$
\begin{aligned}
nurse_{it} = \ & \beta_0 + \beta_1 woman_{it} + \beta_2 marital\_status_{it} + \beta_3 age_{it} + \beta_4 nationality_{it} \\
& + \beta_5 second\_job_{it} + \beta_6 prim\_educ_{it} + \beta_7 high\_school\_no\_maturita_{it} \\
& + \beta_8 hs\_with\_maturita + \beta_9 higher\_educ_{it} + \beta_{10} prague_{it} \\
& + \beta_{11} SW_{it} + \beta_{12} NW_{it} + \beta_{13} NE_{it} + \beta_{14} SE_{it} + \beta_{15} mid\_moravia_{it} \\
& + \beta_{16} moravia\_silesia_{it} + \delta_1 y2003_t + \delta_2 y2004_t + \delta_3 y2005_t \\
& + \delta_4 y2006_t + \delta_5 y2007_t + \delta_6 y2008_t + \delta_7 y2009_t + \delta_8 y2010_t \\
& + \delta_9 y2011_t + \delta_{10} y2012_t + \delta_{11} y2013_t + \delta_{12} y2014_t + \delta_{13} y2015_t \\
& + \{\delta_1 y\_2002_t + \delta_2 y\_2003_t + \delta_3 y\_2004_t + \delta_4 y\_2005_t + \delta_5 y\_2006_t \\
& + \delta_6 y\_2007_t + \delta_7 y\_2008_t\} + \varepsilon_{it}
\end{aligned}
$$

where β_0 is an intercept, β_s and δ_n are slope parameters and ε represents an error term. Index "i" represents an individual and "t" represents time period of survey when the data about individuals were gathered, i.e. years 2000 to 2015. The base group contains

individuals without education from Central Bohemia, years 2000 to 2002 and 1999 to 2001 in the analysis of cohorts. The variables in brackets are used only in the analysis of cohorts. In LPM the betas and deltas measure the change in probability of success when independent variable changes, ceteris paribus effect.

In the second version of the equation, i.e. **analysis of cohorts** – with the variable in brackets – based on the design of the model, only data on individuals who started their high school between years 1999 and 2008[9] are included. Moreover, more detailed explanation about how particular variables (coefficients of year of high school entry) were computed is provided. The data from the Czech Statistical Office contains information about age, however, a year when an individual started high school that is needed in the analysis is not available. Therefore, some extra computations were done. First, a year of birth[10] was computed: $year\ of\ birth = reference\ year[11] - age$. Then, a year of high school entry was computed: $year\ of\ high\ school\ entry = year\ of\ birth + 15$. The number 15 can be explained in the following way: it is assumed that individuals go to first grade when they are 6 years old – compulsory school attendance starts at the age of 6 in the Czech Republic (Ministry of Education, Youth and Sports (2011)). Primary school education takes 9 years. Therefore, people start high school studies at the age of 15. Some approximation was done, first, it depends on a month of birth to get the year of birth and second, children can go to first grade at the age of 7 in special cases.

Linear probability model (LPM) may produce predicted probabilities that are below 0 and above 1, therefore economists use binary response models to eliminate the undesirable properties. In our case, **probit** model of the following form will be introduced mainly to provide robustness check of the outcomes of the linear probability model:

$$P(nurse_i = 1|\ \beta_k X_{it}, \delta_m Y_t) =\ \Phi(\beta_0 + \beta_k X_{it} + \delta_m Y_t)$$

where "X" represents the vector of control variables, "Y" vector of dummies of years and Φ stands for standard normal distribution function.

---

[9] Individuals who started their high school studies later than in 2008 cannot finish their studies (4 years at high school and 3 years at tertiary institutions) and cannot appear in labour market till 2015, until when the data is available.
[10] It would be ideal to use the variable year of birth in the data from CZSO, however, it is not available for many individuals in the sample. Therefore, the year of birth was computed.
[11] In our analyses, separate datasets from years 2000 to 2015 from the CZSO are used. Reference year provides information about the year of survey.

The LPM will be estimated using ordinary least square (OLS). The probit model is estimated using maximum likelihood. Moreover, models will be estimated with the use of *wgtos*[12] so that it will represent whole population of the Czech Republic.

4.2.2.1 Assumptions

When performing any regression analysis and drawing inference, it is important to look at the dataset and models and check whether the assumptions for multiple linear regression analysis hold and therefore estimations produce intended outcome. According to Wooldridge (2013), the assumptions include linearity in parameters, random sampling, no perfect collinearity, zero conditional mean, homoscedasticity and normality.

As for the first and third one, it is satisfied thanks to the design of our model. Second holds thanks to data properties. Because of large size of our sample, according to Wooldridge (2013), zero conditional mean assumption may be replaced by its weaker form, i.e. zero mean and zero correlation assumption (zero correlation between any independent variable included in the model and the error term). Regarding this assumption, think about factors that are not identified by the variables present in the model, i.e. they are involved in the error term, and whether they may be related to the ones that are included in the model. In our case the unobservable factors that may exist are believed to be random and uncorrelated to those variables that are included in the model.

As for the homoscedasticity, i.e. constant variance of error term given the independent variables, this assumption is violated by definition because of the binary nature of our dependent variable in LPM (Wooldridge, 2013). Even Breusch-Pagan test will confirm presence of heteroscedasticity. To solve this problem in large samples, heteroscedasticity-robust standard errors (SE) will be introduced in order to provide asymptotically valid statistics and inference.

---

[12] Variable WgtOs is constructed in a way that there is assigned an amount of persons in the Czech population to every individual in the sample in each year according to the Labour Force Survey in the Czech Republic. Therefore, if a person in our sample is multiplied by WgtOs, we get an estimation that should represent whole population.

With regard to normality assumption for distribution of unobserved errors, it is particularly untenable because LPM has a binomial distribution by definition. However, our sample is large enough so asymptotic normality can be established using Law of large numbers (LLN) provided that previous assumptions hold (Wooldridge, 2013).

4.3 General data characteristics

4.3.1 Data on earnings

To compare earnings before and after the regulation for nurse occupations that were affected by the regulation and those what were not, data about remuneration of each type of nurse profession is needed during the observed period (a few years before and a few years after the regulation). Moreover, data about remuneration of doctors is required as well. It will serve as a control group in the following analysis, as mentioned earlier. Fortunately, such data is provided by Trexima at the Average Earnings Information System (ISPV – *Informační systém o průměrném výdělku*, 2017) website that is freely accessible online.

The data distinguishes wage sphere and salary sphere, called business and non-business sphere until 2010, respectively. Therefore, our analysis will be conducted for the two aforementioned spheres separately. The wage and salary sphere employees are remunerated by wage and salary according to the Labour Code, Section 109 (2) and (3) of Act No. 262/2006 Coll., as amended, respectively. According to the aforementioned section in the Labour Code, simply said, individuals working in a public sphere, i.e. state institutions are remunerated by salaries in contrast with people who work in institutions owned by private entities who are remunerated by wages. Even though the Labour Code distinguishes those two types of remuneration of employees, the law from 2004 affected all nurses independently of the sphere in which they work. As for the sampling method in the wage sphere, simple stratified random sampling without replacement is used. Relating to the source of data of the salary sphere, the Salary Information System (*Informační systém o platech, ISP*) run by the Ministry of Finance is used by ISPV.

Data on average earnings (wages and salaries separately) of each year's fourth quarter (Q4) is manually gathered and two separate datasets are created. For each dataset, the Q4

data is selected as the availability of other quarters varies. An average wage and salary[13] of the 4-digit code of occupations is used as our variable of interest. The Q4 data is selected manually from each year publication between years 2002 and 2015. A weighted average for the control and the treatment group was calculated.

As for the 4-digit code of classification that we use, unfortunately, it was subject to a change in 2010. KZAM classification that was used till 2010 was replaced by international ISCO classification in 2011. Inconvenience arising from this change is discussed more in detail in Section 4.4 Limitation and complexity.

4.3.2 Data on employment

For the analysis of impact of legislation on employment, microdata on individual level from the Czech Statistical Office is used. It is a national modification of European-wide Labour Force Survey (*Výběrové šetření pracovních sil*; CZSO, 2015). A representative sample from the whole Czech Republic is collected quarterly and one fifth of the sample changes every quarter. The data contains basic information of each individual such as age, gender, level of education, labour market position, ISCO classification indicating what type of occupation the individual pursues, place of residence, information about second job, etc.. The questionnaire is held in electronic form.

In the following analysis, the data of second quarter of each year from 2000 to 2015 is pooled together. The variables that are important and relevant are chosen and appropriate dataset is compiled. Regarding the type of our analysis, observations that comprise 4-digit ISCO code of occupations are chosen. In our model, the 4-digit code is used to assign a value one to the dependent dummy variable if individual works as a nurse, zero otherwise. Exact ISCO codes are shown in the Table x.

The Czech Statistical Office recoded the data retrospectively so that there is an ISCO code available even in 2010 data and sooner. Therefore, the problem regarding the change in classification that we face with data used for remuneration is eliminated. Unfortunately, the convertor is not available so it cannot be used in our previous data set used for earnings analysis.

---

[13] According to ISPV Methodology (2017), a gross wage/salary includes a wage/salary for the work, a wage/salary compensation and a remuneration for working readiness.

Looking at the sample, some **descriptive statistics** are presented. For our purposes, working individuals with ISCO code available are selected. There are 424 686 such observations between years 2000 and 2015 and based on author's computations, nurses represent approximately 2% of them each year. Using the weights, computed statistics can be extended to entire working population. On our data, we can verify the general belief whether nursing profession is a female profession or not. The weighted statistics computed from the data support the general belief that, indeed, it is a female profession – with only around 2% representation of men. Another interesting finding relates to the number of nurses per 1 000 habitants. Even though according to OECD (2017) there are approximately 8 nurses per thousand inhabitants, our data suggest that data there are nearly 10 of them. However, the methodology may differ and OECD data excludes midwives for example. Last but not least, Figure 2 reveals the trend in percent of nurses with higher (tertiary) education[14]. Evidently, there is an upward trend over the years.

Percent of nurses with higher education
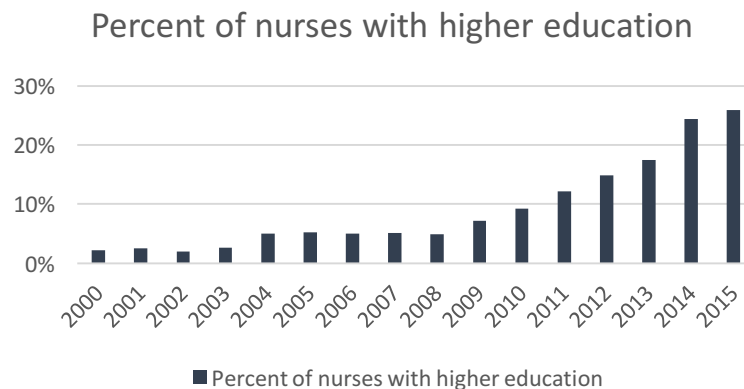
Figure 2: Evolution of the share of nurses with higher education

4.4 Limitations and complexity

In this subsection, information about data limitations will be discussed. Moreover, complexity and issues as regards the data will be included.

---

[14] According to the CZSO description available about the ISCED classification of educational levels on their website, both higher professional school graduates (ISCED 5) and university graduates (ISCED 6) are included. Information from the publication of Ministry of Education, Youth and Sports (2011) about Czech education system confirms it.

First, as for the salaries, they are subject to regulation within salary grades (*platová třída*) by the Government Regulation No. 564/2006 Coll., as amended. They reflect educational requirements and past experience by assignment of individuals to different salary grades with different remuneration. For instance, according to the achieved education and the aforementioned regulation, nurses start at grade 9 with comparison to medical assistants that start at grade 7. Regarding the wages, it is only limited by the minimum wage regulation. Therefore, the wages are affected by labour market forces more directly than salaries are. Moreover, according to the ISPV Methodology (2017), the population of the Average Earnings Information System of wage sphere was enlarged in 2011 and more subjects are included since then. They mention potential discrepancies, e.g. decrease in wage levels. To conclude, some distortion may appear due to the all aforementioned issues.

Second, some problems may arise due to the change in occupational classification in 2011, especially in the DiD analysis. Until 2010, there used to be a code scheme KZAM (Occupation Code (*Kód zaměstnání*)) in the Czech Republic. Since 2011, the ISCO-08 structure (International Standard Classification of Occupation) is used. The latter classification allows easier comparison of earnings among the European countries on occupation level. The transition between KZAM and ISCO classification is not one-to-one. Therefore, it may happen that individuals who used to be under the same KZAM code are under a slightly different ISCO code category now (ISPV, 2017). Moreover, naming and codes are different in the aforementioned classification. We face this problem most directly in the DiD analysis, however, all our results are unfortunately affected by it. As said earlier, that is one of the reasons why all nurses are treated together and doctors are used as the control group.

Originally, all nurse professions used to be classified in four-digit code scheme under Category 3 in KZAM classification. Later on, nurse occupations are split into two categories – Category 2 and Category 3 in ISCO classification. In general, Category 2 comprise *Professionals* and Category 3 *Technicians and associate professionals*. However, the fact that an occupation belongs to Category 2 or 3 does not explicitly correspond with the higher educational requirements. According to the law, there is a bachelor degree or graduation from higher vocational school required for all of the

selected nurse occupations in both categories, except for Medical Assistants (ISCO code 3256).

Despite the change in classification, the conclusion from the analysis is assumed to be reliable. It will be based on the overall comparison between the earnings (and employment) of nurse occupations due to the legislation change. Therefore, slight inaccuracies caused by the change in classification should not affect the results in general. Still, bear in mind when interpreting the results that certain incompatibility exists.

Third, there are some exceptions in the acts and legislation. Specifically, an undue harshness institute (*Institut odstranění tvrdosti zákona*) exists from 2011 (Amendment No. 105/2011 Coll., Article 91 b), 2011). Foreign minister can grant exemption to individuals with compelling reasons who apply for it on a case-by-case basis. It means that a few people may pursue professions even though their level of education is not as required. However, the number is negligible.

Chapter 5

5.1 Results

In this chapter, results of both analyses that were conducted are presented. First, the results of the difference-in-differences analysis treating the evolution of earnings (wages and salaries) will be discussed. Second, the econometric model that analyzed the labor market, i.e. employment within nurse professions, will be included. It is important to mention that when examining the results, the data availability and nature of data ought to be taken into consideration, e.g. the change in classification valid since 2011.

5.1.1 The impact of the reform on earnings

In this subsection, the results of the analysis of the impact of the change in legislation in 2004 on the evolution of earnings in nurse professions are presented. As said before, due to the change in the classification in 2011, it is not possible to paste together individual nurse occupations before 2010 and after 2011. Hence, we are not able to make the analysis for individual nurse occupations. Therefore, as said earlier, the following analysis uses all nurses together as the treatment group and doctors as the control group (also due to the law which affected all nurse occupations).

As mentioned earlier, the law and regulation affects both wage sphere and salary sphere equally. The wage sphere is additionally under the influence of minimum wage legislation and is more prone to supply and demand fluctuations. In contrast, the salary sphere is subject to government regulation within salary grades. Health professionals work in wage or salary scheme depending on the owner of the health facility they are employed in.

5.1.1.1 General results

To present the evolution of salaries and wages and general results of the DiD analysis, a graph with two y-axes with the same proportional scales is used. The left vertical axis represents all nurses and the right axis represents doctors. The graphs display the evolution of salaries and wages of treatment and control group, i.e. all nurses (blue line with a square) and doctors (dark grey line with a dot) between years 2002 to 2015. The graphs have several functions. They graphically show the evolution of remuneration and

also the direction of the results is visible. Moreover, they enable to visually evaluate whether the assumptions of the DiD analysis mentioned in previous chapter hold.

As for the **salaries**, the graphical analysis of evolution of salaries is depicted in Figure 3. As the graph suggest, till 2010, salaries of doctors and nurses follow an upward identical trend. Therefore, the parallel path assumption of the DiD analysis requiring the same trend in the pre-reform period is fulfilled. The graph enables to conduct a visual pre-analysis. Clearly, years[15] 2007 and 2008 do not exhibit anything special. However, the growth in salaries of nurses slowed gradually after 2011 with respect to doctors' salaries. Based on the results, it may be concluded that the legislation had a negative effect on salary levels in nurse profession.
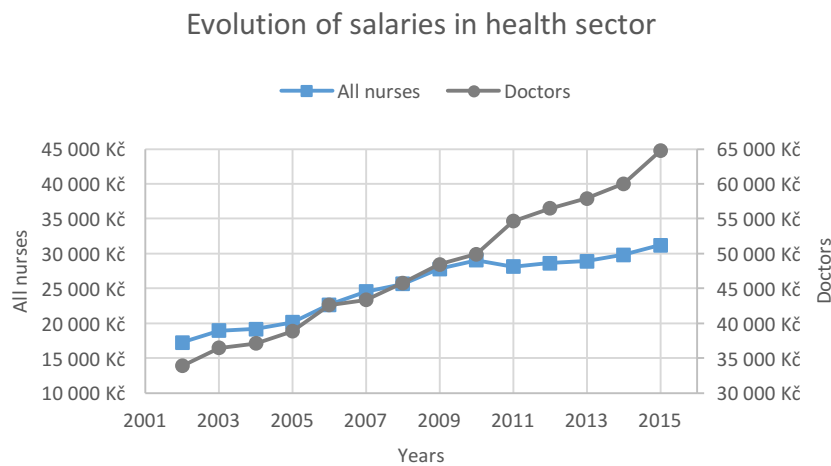
Figure 3: Evolution of salaries in health sector

As for the **wages**, the evolution of wages is shown in Figure 4. There is an upward trend for both nurses and doctors till 2010. However, in contrast to the salary sphere, it seems that the trends between doctors' and nurses' wages differ. As the graph shows, there was a faster growth of doctors' wages[16] with respect to nurses' wages. Therefore, the assumption of parallel path in the pre-reform period does not seem to hold. As mentioned in the methodology, an alternative way using first differencing, i.e. parallel growth assumption, may be used. This method was tested but, unfortunately, the assumption was

---

[15] As mentioned earlier, in 2007 first midwives with minimal bachelor's diploma education appear in workforce. In 2008, new potential nurses had to continue their studies at higher schools or universities and cannot go to work right after high school as before. Moreover, first medical assistants ended their studies in the aforementioned year.

[16] In the difference-in-differences analysis of wages, the quality of estimates varied and the evolution was unstable. Therefore, wages of doctors of each year are computed as an average of 3 subsequent years – previous, selected and following year.

not met either. At this stage, no conclusion about wages can be done. However, to be able to make inference, percentage growths are computed in the case of wages. The method will enable to provide numerical results in the following subsection. Anyway, the evolution of wages is depicted in Figure 4. It is consistent with the expected decline in wage levels due to the change in methodology (inclusion of more subjects) in wage sphere in 2011.
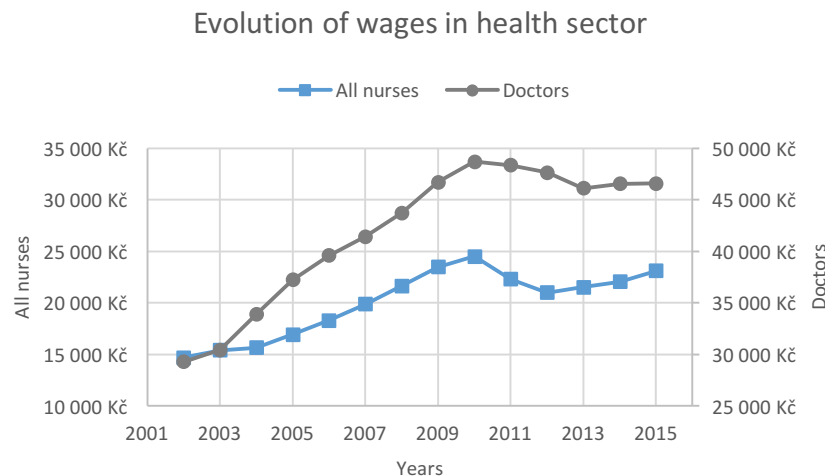
Figure 4: Evolution of wages in health sector

When comparing salary and wage levels in nurse profession in general, it is clear that workers remunerated by wages have lower remuneration in comparison with those who are remunerated by salaries.

5.1.1.2 Numerical results

In addition to previous analyses, a more detailed analysis of earnings is provided, i.e. some numbers are presented. The theory presented in Chapter 3 about the difference-in-differences (DiD) method is used and two regression analyses are performed. Doctors are used as the control group. In case of salaries, classical average salaries are used in computations, however, in case of wages, percentage growths are used.

First, results of **salaries** are revealed. Based on the methodology presented in Chapter 3, a regression is conducted. The results are presented in Table 3. The after-policy period was divided into 3 smaller periods, i.e. showing an immediate effect, average effect and

longer run effect. The last three coefficients in the table are those of interest. Based on the results, it is clear that that nurses would have earned this amount more if no legislation change had taken place. Specifically, nurses would have earned 7 486 Kč in the short run, 10 004 Kč more in mediate run and 14 537 Kč more over the longer time horizon with respect to doctors. The latter two coefficients are statistically significant, as depicted in Figure 3. Doctors serve as the control group and data on salaries of nurses and doctors from 2002 to 2015 are used.

Table 3: The impact of the legislation on nurses' salaries

The impact of the reform on salaries in nurse occupation

	Linear probability model, *Nurse's salary*		
Variables	**Coefficient**	**Standard error (SE)**	**Significance level**
post-policy period (2011)	12803	4712	*
post-policy period (2012-14)	16307	2980	***
post-policy period (2015)	22917	4712	***
nurse	-19033	2107	***
post (2011) ✕ nurse	-7486	6664	
post (2012-14) ✕ nurse	-10004	4214	**
post (2015) ✕ nurse	-14537	6664	**
Constant	41842	1490	***
N	28		
Adj. R-squared	0,895		

Note: *** p < 0,000; ** p < 0,001; * p < 0,01; . p < 0,05

Alternatively, the equation from Chapter 3 may be used directly. Then the difference-in-difference computation looks as follows: $\delta_{pt} = \left(\overline{y_{T,1}} - \overline{y_{T,0}}\right) - \left(\overline{y_{C,1}} - \overline{y_{C,0}}\right) = (22\,810 - 29\,114) - (41\,842 - 58\,149) = 10\,003\ K\check{c}$, due to rounding. The result is the same to one from the regression analysis. Moreover, this can be graphically displayed, see Figure 5. The hypothetic salaries (dotted blue line) are those that would have been observed if there had been no change in legislation. According to the results, the long run effect seems more substantial than the immediate one.
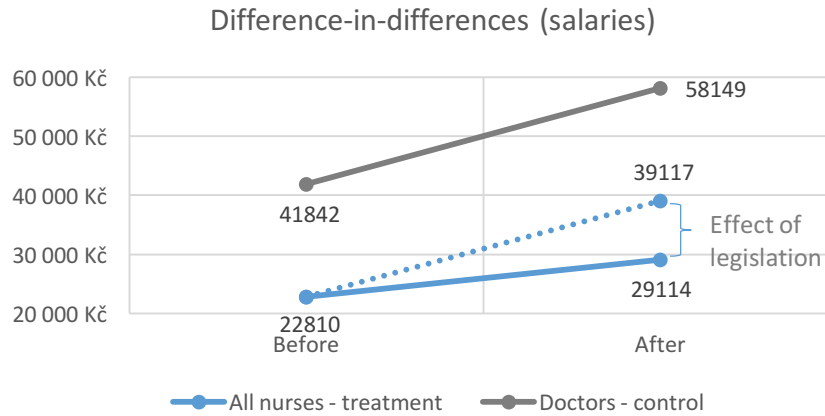
Figure 5: Difference-in-differences (salaries)

Based on all the aforementioned results, it may be concluded that nurse workers would have earned more if no legislation change had taken place.

Second, results of **wages** are provided. Analysis on wages is more complicated and is not as clear and straightforward as for salaries. As said earlier, an alternative method needed to be used. Therefore, percentage growths were computed in the case of wages. The evolution of percentage growth[17] of wages of nurses and doctors in the pre-policy period is shown in Figure 6, it seems parallel. Thus, numerical results similar to ones in the previous subsection may be provided for wages.
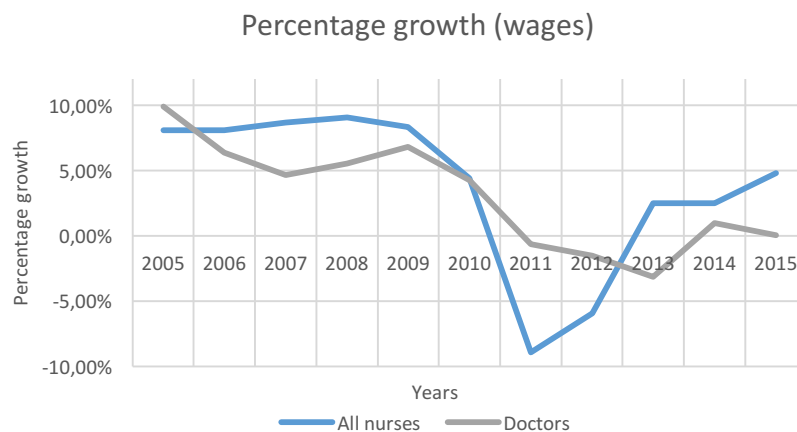
Figure 6: Percentage growth evolution (wages)

---

[17] Due to fluctuations, years after the year 2005 are taken. Since then the evolution of percentage growths stabilized. Those years, i.e. 2005 to 2015, are used in the following analysis. However, the period is very short and real trend might not be revealed. This fact needs to be taken into account when making inference. Moreover, the trend may be affected by a shock.

31

Table 4 reveals the results of impact of the legislation on wage levels. In this case, immediate and longer run effects are computed, i.e. the after-policy period was divided into two periods. Those two coefficients show the impact on wages due to the legislation. In contrast to salaries, the effect differs in the short-run and over longer time horizon. Based on the results, the coefficient of variable *post (2011-12) x nurse* shows that percentage growth of nurses' wages dropped by -7,85% in the short run with respect to control group. The point estimate is statistically significant. However, the coefficient of *post (2013-15) x nurse* exhibits opposite effect. Therefore, it seems that there was just a temporary decline in percentage growth in nurses' salaries and subsequent greater percentage growth might have tried to offset the previous drop. However, there are only a few years after the reform, so it is difficult to draw long-run conclusions.

Table 4: The impact of the reform on nurses' wages

The impact of the reform on wages in nurse occupation

Variables	Linear probability model, *Nurse's wage*		
	Coefficient	Standard error (SE)	Significance level
post-policy period (2011-12)	-7,33	1,48	***
post-policy period (2013-15)	-6,97	1,28	***
nurse	1,51	1,05	
post (2011-12) ✗ nurse	-7,85	2,10	**
post (2013-15) ✗ nurse	2,48	1,82	
Constant	6,24	0,74	***
N	22		
Adj. R-squared	0,872		

Note: *** $p < 0,000$; ** $p < 0,001$; * $p < 0,01$; . $p < 0,05$

When thinking about the results, the negative effect on salaries might be surprising. As mentioned in the beginning of Chapter 4, one might have expected an increase in remuneration when higher educational requirements are required rather than decrease in remuneration. Using common sense, this may discourage individuals who consider pursuing nursing profession – higher education is needed but it seems that there is no corresponding compensation.

When comparing our results to the UK results where licensing was introduced for nursery school workers and security guards, as mentioned in Chapter 2, wages went up for security workers but in case of nursery school workers, their wages experienced a negative effect as well. It supports the idea that the country-based studies are needed and the effect of stricter regulation can differ. Anyway, both the UK and the Czech Republic undoubtedly experienced a positive effect on workers' skill levels. This is depicted in Figure 2 from previous Chapter, Section 4.3 that shows an upward trend in number of nurses with higher education. It is in accordance with results of Koumenta et al. (2014) study that also argues that licensing affects skills positively.

5.1.1.3 Remuneration of individual nurse professions

In this subsection, a difference in remuneration between separate nurse profession is provided. It gives interesting information about the dispersion within nurse profession. Data from 2011[18] onward is used and displayed it the following figures.

Figure 7 and 8 show that individuals pursuing nurse profession who did not continue their studies after a high school have markedly lower salaries and wages nowadays, namely Medical Assistants (3256) who can as the only nurse occupation pursue the profession with a medical high school education[19]. However, their competence is lower and they can work under a supervision only. As depicted in the following figures, their number does not affect the overall weighted average remuneration of nurse profession (purple line). In this subsection, it may be concluded that more educated individuals tend to have higher income than those with lower education.

---

[18] Due to the classification change that took place in 2011, as said earlier.
[19] Medical high school or any high school and a special course (according to the law and database of regulated occupations).
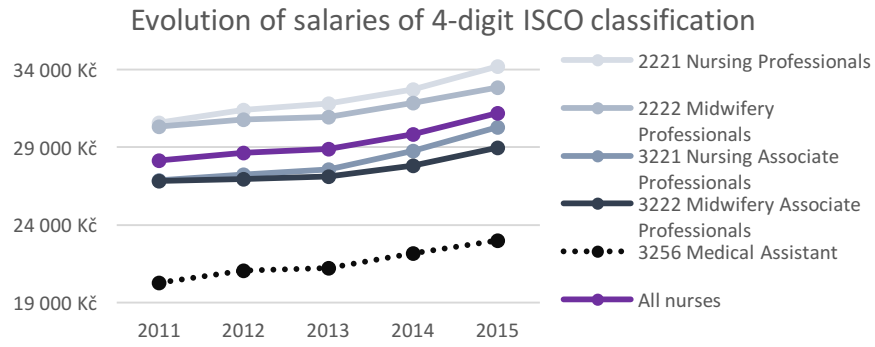
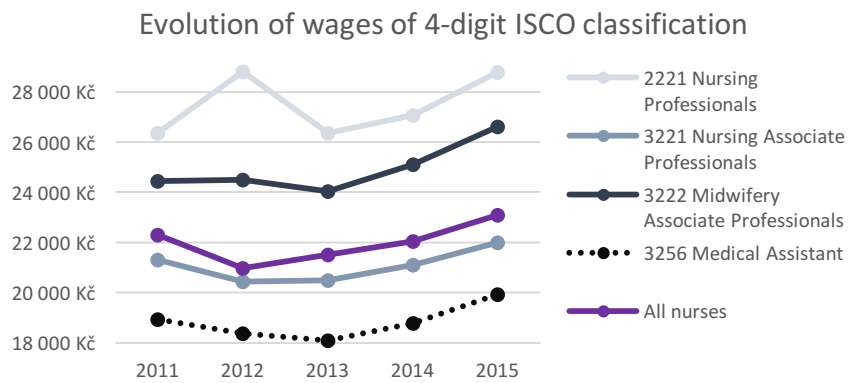*Figure 7: Evolution of salaries of 4-digit ISCO classification from 2011*

Figure 8: Evolution of wages of 4-digit ISCO classification from 2011

5.1.2 The impact of the reform on employment

In this subsection, the results of the two regression analyses that analyzed the impact of the reform on employment in nurse professions will be reported. Moreover, several comments will be provided. In the following regressions, the dependent variable equals one if an individual "i" is working as a nurse. The coefficients of dummy variables of years will show whether there is a significant effect of the legislation on the probability in pursuing a nurse profession. Other coefficients are used as control variables. Moreover, heteroscedasticity robust standard errors are computed.

5.1.2.1 Results of analysis on employment

This subsection provides results of the first linear probability model regarding employment, see Table 5. As said earlier, in this case, we are interested in the coefficients of years that indicate whether there was a significant change in probability of pursuing a nurse profession due to the reform, especially after 2011 (and years 2007 and 2008). Regarding the base group, as already mentioned, it includes individuals living in Central Bohemia without any education and years 2000 to 2002.

Commenting on the results, second and fifth column are the two of main interest. First, let us focus on the coefficient of year 2011 and onward. When looking at the values in the second column, it indicates that the probability of working as a nurse decreased with respect to base years in the periods after 2011, i.e. negative coefficients. Moving on to the fifth column, the coefficients of the variables are not statistically significant in most cases. Moreover, taking into account results of the probit model, i.e. coefficients in the last column, only the coefficient of year 2013 seems significant. Based on the results, even though the probability of being a nurse declined from 2011 onward, overall, the reform did not have a significant effect on labour market of nurse profession.

Moreover, the coefficient of *woman* is statistically significant and being a woman increases the probability of being a nurse, exactly by 0.0413. It is consistent with the finding that nurse profession is mainly female.

Table 5: Analysis of employment within nurse profession

The impact of the reform on the probability of working in nurse occupation

Variables	Linear probability model, *Nurse*				Probit model, *Nurse*		
	Coefficient	Standard error (SE)	Robust SE	Signif. level	Coefficient	SE	Signif. level
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
woman	0,0413	0,0004	0,0005	*** / ***	1,4927	0,0278	***
marital_status	0,0029	0,0005	0,0005	*** / ***	0,0741	0,0128	***
age	0,0000	0,0000	0,0000		-0,0005	0,0005	
nationality	0,0065	0,0020	0,0017	*** / ***	0,2306	0,0815	***
second_job	-0,0027	0,0014	0,0015	* / *	-0,0472	0,0391	
primary_educ	-0,0085	0,0233	0,0033	/ **	2,6265	0,1080	***
high_educ	0,0019	0,0233	0,0032		2,7775	0,0953	***
high_educ (maturita)	0,0425	0,0233	0,0033	* / ***	4,1075	0,0901	***
higher_educ	0,0089	0,0233	0,0033	/ **	4,1075	0,0901	***
prague	-0,0035	0,0009	0,0010	*** / ***	-0,0623	0,0254	*
SW region	0,0020	0,0009	0,0008	** / **	0,0609	0,0215	**
NW region	0,0038	0,0009	0,0010	*** / ***	0,0924	0,0242	***
NE region	0,0009	0,0008	0,0008		0,0285	0,0217	
SE region	0,0026	0,0008	0,0008	*** / ***	0,0652	0,0213	**
mid_moravia	0,0024	0,0009	0,0009	*** / **	0,0738	0,0235	**
moravia_silesia	0,0022	0,0009	0,0009	** / **	0,0737	0,0235	**
y2003	-0,0008	0,0010	0,0010		-0,0287	0,0262	
y2004	0,0003	0,0010	0,0010		0,0025	0,0257	
y2005	0,0013	0,0010	0,0010		0,0252	0,0249	*
y2006	0,0002	0,0010	0,0010		0,0044	0,0256	
y2007	-0,0001	0,0010	0,0010		-0,0028	0,0257	
y2008	-0,0026	0,0010	0,0010	*** / **	-0,0655	0,0263	*
y2009	0,0005	0,0010	0,0011		0,0150	0,0259	
y2010	0,0007	0,0010	0,0011		0,0249	0,0263	
y2011	-0,0001	0,0010	0,0010		-0,0023	0,0257	
y2012	-0,0010	0,0010	0,0011		-0,0155	0,0266	
y2013	-0,0024	0,0010	0,0010	** / **	-0,0537	0,0270	*
y2014	-0,0004	0,0010	0,0011		0,0118	0,0273	
y2015	-0,0020	0,0010	0,0011	** / *	-0,0225	0,0272	
Constant	-0,0243	0,0234	0,0037	/ ***	-7,2161		
N	424 562						
Adj. R-squared	0,044						

Note: *** p < 0,001; ** p < 0,01; * p < 0,05

Next, a discussion of significance of coefficients of years 2007[20] and 2008 may be provided. The former one is not even statistically significant. However, the latter one may be found interesting. The coefficient of year 2008 shows significant decrease in the probability of working in nurse profession. At first sight, this founding might seem consistent with our expectation of the gap in supply of new entrants into nurse professions due to the legislation[21]. However, coefficients of years 2009 and 2010 do not support our idea. It rather seems that an another logic behind this finding exists, e.g. medical assistants. Even though our data contain no record of medical assistants between years 2008 and 2011, one might connect this finding to them. In short, the law in 2004 firstly introduced them and corresponding study programs for them exist since 2004. However, there was not enough information about the new study programs for medical assistants starting in 2004 (Učitelské noviny, 2003) so maybe less individuals were interested to study it. Hence, there might have been less individuals who finished the high medical schools for medical assistants in 2008 and started working. However, the analysis of cohorts that follows does not seem to support this idea.

As for the probit model, it is intended to roughly check the LPM results. As Wooldridge (2013) suggests, the coefficients itself do not provide any information about magnitudes and further computations (for example average marginal effects) are needed. However, the sign and significance of the estimates of coefficients may be taken into account. It is clear that the results of both models are comparable.

Moreover, to check for the robustness, an analysis using all individuals (i.e. not only individuals with ISCO code available (employed), but also unemployed and inactive ones) was performed. The results are similar in their significance and signs and are provided in Appendix 2.

---

[20] According to the law, first midwives with bachelor's diploma start appearing in labour market since 2007.
[21] As we know, new potential entrants into nurse professions had to continue their studies to become a nurse at higher vocational school or in 3-year bachelor's program at university. Therefore, there is a 3-year gap from 2008 to 2011 in supply of new potential entrants because they cannot go to work right after high medical school as they did before (they theoretically can go to work after high school, but they can pursue profession of medical assistants only who have dramatically lower competences).

5.1.2.2 Analysis of cohorts

In this subsection, results of the analysis of cohorts are provided. In this analysis, the coefficients of usual years serve as control variables. The coefficients of years of high school entry are now those of interest, i.e. year of high school entry of 2004 (*y_2004* etc.) and onward. They will indicate if there was a significant change due to the reform in probability of pursuing a nurse profession of individuals who started their high school in particular years. As explained earlier, according to the law, individuals who want to become a nurse have to study 7 years after entering high school, therefore the last cohort takes individuals who started high school at 2008, so they can appear in labour market in 2015. Therefore, the period of the analysis is quite short and long run effects or patters cannot be precisely revealed in this case. However, the results are interesting. As regards to the base group, it is the same as in the previous analysis plus it contains individuals who started high school between years 1999 and 2001. The results are presented in Table 6.

Table 6: Analysis of cohorts

The impact of the reform on the probability of working in nurse occupation, analysis of cohorts

Variables	Linear probability model, *Nurse*			
	Coefficient	Standard error (SE)	Robust SE	Signif. level
woman	0,0422	0,0017	0,0019	*** / ***
marital_status	0,0093	0,0028	0,0036	*** / **
nationality	0,0085	0,0057	0,0055	
second_job	-0,0146	0,0074	0,0067	** / *
primary_educ	0,0178	0,0886	0,0156	
high_educ	0,0193	0,0885	0,0156	
high_educ (maturita)	0,0458	0,0885	0,0157	/ **
higher_educ	0,0492	0,0886	0,0159	/ **
prague	-0,0094	0,0034	0,0039	*** / **
SW region	-0,0009	0,0034	0,0032	
NW region	-0,0003	0,0035	0,0036	
NE region	0,0063	0,0032	0,0035	** / *
SE region	0,0033	0,0031	0,0034	
mid_moravia	0,0045	0,0034	0,0039	
moravia_silesia	0,0006	0,0034	0,0035	
y2003	0,0162	0,0177	0,0102	
y2004	0,0077	0,0162	0,0072	
y2005	0,0064	0,0154	0,0056	

y2006	0,0102	0,0150	0,0050	/ *
y2007	0,0098	0,0148	0,0047	/ *
y2008	0,0051	0,0148	0,0044	
y2009	0,0035	0,0147	0,0042	
y2010	-0,0039	0,0147	0,0036	
y2011	-0,0022	0,0146	0,0036	
y2012	-0,0001	0,0146	0,0037	
y2013	-0,0066	0,0146	0,0036	/ *
y2014	-0,0066	0,0146	0,0035	/ *
y2015	-0,0029	0,0146	0,0036	
y_2002	-0,0003	0,0027	0,0027	
y_2003	0,0040	0,0029	0,0033	
y_2004	0,0032	0,0031	0,0035	
y_2005	-0,0011	0,0035	0,0033	
y_2006	0,0004	0,0040	0,0040	
y_2007	-0,0102	0,0046	0,0025	** / ***
y_2008	-0,0030	0,0056	0,0044	
Constant	-0,0410	0,0899	0,0168	/ **
N	28 944			
Adj. R-squared	0,036			

Note: *** p < 0,001; ** p < 0,01; * p < 0,05

The above table shows that results of the regression. To comment on the estimates of the coefficients of the variables of years of high school entry, it is appropriate to present them graphically, see Figure 9. Even though the effect was somehow not it 2004 but one-year delayed, the values of estimates of probability of pursuing a nurse profession in the next years are rather smaller and the tendency seems negative. In other words, if an individual started their high school studies in 2005 for instance, it lowers the probability to pursuing a nurse profession by 0.0011. As for the significance, the only significant estimate of coefficient of high school entry is of 2007. However, the period is short and the following years of high school entry are not available, therefore we do not know whether the trend remains or not because individuals may get used to the new system and the probability of pursuing a nurse profession will rise again for next cohorts.

Estimates of coefficients of years of high
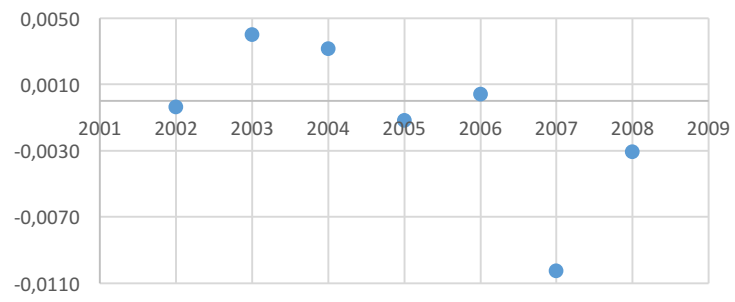school entry in analysis of cohorts

Figure 9: Coefficients in analysis of cohorts

Chapter 6

6.1 Conclusion

The aim of the thesis was to analyze the impact of a reform that increased educational requirements for a particular regulated occupation, more specifically nurses, in the Czech Republic on labour market outcomes, especially earning levels and employment within nurse profession. As said earlier, the Act No. 96/2004 Coll., as amended, that basically rose the required education for general nurses from high medical schools to tertiary institutions as covered in Chapter 3 in accordance with European legislative framework is the crucial one.

As theory mentioned in Chapter 2 suggests, regulation in medical services may cause shortage of workers but also protect society's health (Kleiner, 2006), and in general, licensing can lead to wage premium (Kleiner and Krueger, 2011). Furthermore, we mentioned a potential "supply gap" caused by the new requirement of tertiary education and expectations of higher earnings due to the legislation in the beginning of Chapter 4. However, regulation is a complex system, its extend is arguable and it is difficult to guess the outcome of such a regulation in advance. Therefore, we tried to evaluate the impact by conducting an empirical analysis to see the real impact.

This work also covered the occupational theory, problematics of type of nurses and the complexity of the legislative that is constantly in progress (Chapter 3). The latest amendment plans to shorten the higher education from 3-year studies to 1-year to become a general nurse. The work also included the introduction of medical assistants and their lower competences.

Two main separate analyses were performed – analysis on employment and earnings within nurse profession. A linear probability model with dummy dependent variable was used in analyzing the employment levels. A difference-in-difference analysis served in investigating impact on salaries and wages within nurse profession with use of doctors as control group. The aforementioned approaches were chosen in accordance to previous studies discussed in Chapter 2, Wooldridge (2013) and data availability. As for the data, micro data from the Czech Statistical Office (CZSO) was used for the former one and

publicly available data from the Average Earnings Information System website (ISPV) for the latter one.

We were interested in answering the questions presented in Chapter 4.1, i.e. if there is a significant difference due to the legislation; if there is any pattern in evolution of earnings and whether earnings of tertiary graduates are higher than those from high medical schools; and what effect there was on employment. As mentioned earlier, we were interested in year 2011 mainly, but also year 2008 showed interesting results. Moreover, in the analysis of cohorts, we were interested in year 2004 of high school entry and onwards.

First, the results of the difference-in-differences analysis differs for salaries and wages. In case of salaries, based on the results, it may be concluded that the legislation had a negative effect on salary levels of nurses with respect to doctors. On the other hand, conclusions in wage sphere is mixed. There was an immediate negative effect on nurses' wages with respect to doctors but a reverse tendency appears in the subsequent years. To sum up, it seems that if there had been no legislation change, nurses would have earned more with respect to doctors in salary sphere. In case of wages, it is not easy to draw any conclusions. However, limitations and data issues should be bear in mind when making inference.

Second, as concerns the difference in earning of high school graduates (Medical Assistants who can work only under a supervision) and the ones from tertiary institutions, data from 2011 onward shows that there is a difference in behalf of higher education.

Third, as for the employment, two analyses were performed. Based on the results of the first analysis regarding the probability of pursuing a nurse profession in selected years, the effect in 2011 and in the subsequent years is not statistically significant in general. However, the coefficients have mostly[22] negative signs which means that there is a decrease in the probability. Moving on to year 2008, new potential nurses had to continue their studies at tertiary institutions according to the new legislation. Moreover, first Medical Assistants started to appear in labour market in 2008. The coefficient of year

---

[22] The results of all regressions slightly differ.

2008 exhibits a significant decline in the probability of being a nurse. Although it may seem that there is the expected "supply gap", coefficients of years 2009 and 2010 are not in favour with this expectation. The year 2008 might be connected to chaos in 2004 with introduction of new study program Medical Assistant at high medical schools replacing the previous ones and certain uncertainty. The analysis of cohorts, however, does not seem to confirm such an idea.

The second analysis on employment – analysis of cohorts – provides slightly different information. In this case, the years of high school entry in 2004 and onward were those of interest. Its results argue a one-year lagged effect and that the probability of pursuing a nurse occupation declines for individuals who started to study high school in 2005 and later in comparison to individuals with earlier year of high school entry. However, the coefficients are not statistically significant but of 2007. As said earlier, the period of is quite short and the trend may change as people get used to the new system.

Overall, the results of analysis of employment do not suggest that legislation contributed positively to resolve the problem of lack of nurses in the Czech Republic. It may be related to the results on earnings that did not exhibit signs of an increase in earnings levels due to the legislation that requires higher education. However, new amendments to the law are in progress, so it might be interesting to monitor this affair henceforward.

Last but not least, our data demonstrates that nurse profession is mainly female occupation with around 2% of male representation. Next, the data shows that there is an upward trend in percentage of nurses with higher education. As mentioned earlier, it is in accordance with Koumenta et al. (2014) who argues that licensing has a positive effect on skill levels.

As all studies agreed on, this work also confirms that the lack of available data and other limitations are main restrictions in trying to perform such an analysis with certain precision (Kleiner and Krueger, 2011). Our analyses were limited by several facts. First, the change in classification from national KZAM classification to the international ISCO classification may have caused inaccuracies in comparison of earning levels over the years. Furthermore, it made it impossible to conduct analysis for individual types of nurse profession, e.g. individual classification codes. Therefore, all nurse occupations were

used aggregately. Moreover, the choice of control group in the difference-in-differences analysis is rather a tough decision than an easy task and it may have some influence on the results. The results of analysis on earnings might be affected by a particular dissimilarity of the treatment and control group and there might have been a certain shock in either group. Next, the trend might be rough because of the relatively short time period that is treated in the analysis. The trend can be affected by shocks as well. In addition, the aforementioned law does not contain exact link to the exact classification codes.

Last but not least, Medical Assistants and new law drafts enhances the complexity of the legislative and requirements for nurse professions. The legislation is a lively process and new amendments appear, therefore it may affect new potential entrants who consider studying and entering nurse profession negatively and cause uncertainty when competences and educational requirements are being discussed constantly. The Czech Republic might inspire itself with Poland where transparency in law motivated new individuals to entry particular occupation (Rojek & Masior, 2016).

In spite of the limitations and taking into account our data, we did our best to analyze the effects precisely to the extent possible. Potential extension to the analysis of employment in this work may relate to accounting for demand for nurses in labour market and comparing actual number of nurses not only the probability of pursuing a nurse profession. One might suggest taking into account workers who retire as well. To confirm the results, taking into account the evolution of wages and salaries in the health care sector might also be interesting. Moreover, it would be great if the micro data would contain information about remuneration for each individual or if there is a register for all nursing professions with all corresponding information. Also, the analysis of cohorts would be more precise if knowing the exact age of first class entry. In general, if better data available, the analyses might be more precise. Last but not least, to make more accurate conclusions and inference, longer post-policy period would be appropriate. However, because of the new amendment to the legislation, it seems that it will not be possible to do the analysis for longer period anyway.

Contribution of this work is that, as far as I am concerned, it is the first work of its kind in the Czech Republic. The topic of occupational regulation is interesting and such an analysis may be conducted for any occupation that will experience change in

requirements to pursue the occupation. This work, therefore, can serve as inspiration to future analogical studies concerning the analysis of an impact of a change in requirements on labour market outcomes.

References

Kleiner, M. M. (2006). *Licensing Occupations: Ensuring Quality or Restricting Competition?* Kalamazoo, Michigan, USA: W.E. Upjohn Institute for Employment Research.

Kleiner, M. M., & Krueger, A. B. (2013). *Analyzing the Extent and Influence of Occupational Licensing on the Labor Market.* Journal of Labor Economics, University of Chicago Press.

Koumenta, M., Humphris, A., Kleiner, M., & Pagliero, M. (2014*). Occupational Regulation in the EU and UK: Prevalence and Labour Market Impacts (Final Report)* [Online]. Retrieved April 29, 2017 from
http://www.busman.qmul.ac.uk/media/sbm/research/researchcentres/cred/impact-reports/Occupational-Regulation-Koumenta.pdf

Koumenta, M., & Humphris, A. (2015). *The Effects of Occupational Licensing on Employment, Skills and Quality: A Case Study of Two Occupations in the UK,* [Online]. Queen Mary University of London. Retrieved from
http://ec.europa.eu/DocsRoom/documents/13364/attachments/1/translations/en/renditions/native

Prošková, E. (2011). *Zdravotnická povolání.* Praha: Wolters Kluwer Česká republika.

European Commission. (2017). *The Effects Of Reforms Of Regulatory Requirements To Access Professions: Country-Based Case Studies* [Online]. Retrieved April 29, 2017, from
http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=9018

Pagliero, M. (2015). *The effects of recent reforms liberalising regulated professions in Italy,* [Online]. University of Turin & Carlo Alberto College. Retrieved from
http://ec.europa.eu/DocsRoom/documents/13362/attachments/1/translations/en/renditions/native

European Union. (2007). *Treaty of Lisbon: Amending the Treaty on European Union and the Treaty Establishing the European Community* (Vol. 2007/C 306/01) [Online]. Retrieved April 29, 2017, from
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:12007L/TXT

Directive 2006/123/EC Of The European Parliament And of The Council. (2006). Retrieved from http://eur-lex.europa.eu/legal-content/En/TXT/?uri=celex:32006L0123

European Parliament. (2000). Lisbon European Council 23 and 24 March 2000: Presidency Conclusions [Online]. Retrieved April 29, 2017 from http://www.europarl.europa.eu/summits/lis1_en.htm

Ministry of Education, Youth and Sports. (2008). Co je třeba vědět o systému vzájemného uznávání [Online]. Retrieved April 16, 2017, from
https://uok.msmt.cz/uok_doc/cz/Brozura_Co_je_treba_vedet_o_systemu_vzajemneho_
uznavani_odborne_kvalifikace_ve_statech_EU_(CZ).pdf

Data o studentech, poprvé zapsaných a absolventech vysokých škol [Online]. (2017). Retrieved April 16, 2017, from http://www.msmt.cz/vzdelavani/skolstvi-v-cr/statistika-skolstvi/data-o-studentech-poprve-zapsanych-a-absolventech-vysokych

European Parliament, Council of the European Union. (2005). Directive 2005/36/EC Of The European Parliament And of The Council (Covered By Directive 2013/55/EU). Retrieved from
http://eur-lex.europa.eu/legal-content/CS/TXT/?uri=celex%3A32005L0036

"Recognition of professional qualifications in practice" [Online]. (2017). Retrieved April 29, 2017, from https://ec.europa.eu/growth/single-market/services/free-movement-professionals/qualifications-recognition_cs

Ministry of Education, Youth and Sports. (2017). What is a regulated profession? [Online]. Retrieved April 29, 2017, from http://www.msmt.cz/eu-and-international-affairs/co-je-regulovana-cinnost-ci-povolani?lang=2

Ministry of Education, Youth and Sports. (2017). Recognition of Professional Qualifications: Database of regulated professions and professional activities [Online]. Retrieved April 29, 2017, from https://uok.msmt.cz/uok/ru_list.php

Government of the Czech Republic. (2015). Regulované profese v ČR a EU: Kvalitativní kontextové vyhodnocení a kvantitativní analýza nominální regulace [Online]. Praha: Úřad vlády ČR. Retrieved from https://www.vlada.cz/assets/evropske-zalezitosti/analyzy-EU/Analyza-regulovanych-profesi-v-CR-a-EU.pdf

Regulated professions database [Online]. (2017). Retrieved April 29, 2017, from http://ec.europa.eu/growth/tools-databases/regprof/index.cfm

Your Europe. (2017). European Professional Card - EPC [Online]. Retrieved April 29, 2017, from
http://europa.eu/youreurope/citizens/work/professional-qualifications/european-professional-card/index_en.htm

Institute of post-gradual education in health sector. (2017). Jak získat specializovanou způsobilost [Online]. Retrieved April 29, 2017, from https://www.ipvz.cz/nelekarsti-zdravotnicti-pracovnici/ziskavani-specializace/jak-ziskat-specializovanou-zpusobilost

Mladá fronta. (2000). Čím je regulováno povolání sester a porodních asistentek? [Online]. Retrieved April 29, 2017, from http://zdravi.euro.cz/clanek/sestra/cim-je-regulovano-povolani-sester-a-porodnich-asistentek-131780

Pravidla českého pravopisu. (2017). Diplomovaný specialista [Online]. Retrieved April 29, 2017, from http://www.jaknapsat.cz/neakademicke-tituly/

Ministry of Education, Youth and Sports. (2011). *The Education System in the Czech Republic* [Online]. Praha: CERMAT. Retrieved from http://www.msmt.cz/mezinarodni-vztahy/the-education-system-in-the-czech-republic?lang=1

Ministry of Education, Youth and Sports. (2014). Kdo je porodní asistentka a jak se stát porodní asistentkou? [Online]. Retrieved April 29, 2017, from http://www.mzcr.cz/dokumenty/kdo-je-porodni-asistentka-a-jak-se-stat-porodni-asistentkou-_9078_3076_3.html

Pavlica, M. (2016). Řízení lidských zdrojů ve zdravotnictví a firemní kultura [Online]. Retrieved April 29, 2017, from http://www.advanceinstitute.cz/images/stories/7.rocnik_2016-2017/7.r._kurzy_PREDNASKY/24.-26.11.2016_7.r./prezentace_1_3_pavlica_firemni_kultura_24_11_2016.pdf

Government Legislative Council of the Czech Republic. (2016). Legislativní rada vlády schválila návrh zákona o nelékařských zdravotnických povoláních [Online]. Retrieved April 29, 2017, from https://www.vlada.cz/cz/ppov/lrv/tiskove-zpravy/legislativni-rada-vlady-schvalila-navrh-zakona-o-nelekarskych-zdravotnickych-povolanich-144865/

Chamber of Deputies. (2017). Sněmovní tisk 880: Novela z. o nelékařských zdravotnických povoláních - EU [Online]. Retrieved April 29, 2017, from http://www.psp.cz/sqw/historie.sqw?o=7&t=880

Wooldridge, J. (2013). *Introductory Econometrics: A Modern Approach* (5. ed.). Cengage Learning.

Imbens, & Wooldridge. (2007). Difference-in-Differences Estimation [Online]. Retrieved April 29, 2017, from http://www.nber.org/WNE/lect_10_diffindiffs.pdf

Mora, R., & Reggio, I. (2013). *Treatment effect identification using alternative parallel assumptions* [Online]. Spain. Retrieved from http://e-archivo.uc3m.es/bitstream/handle/10016/16065/we1233.pdf?sequence=1&isAllowed=y

ISCO (International Standard Classification of Occupations) [Online]. (2017). Retrieved April 29, 2017, from http://www.ilo.org/public/english/bureau/stat/isco/

Czech Statistical Office (CZSO) [Online]. (2017). Retrieved April 29, 2017, from https://www.czso.cz/

CZSO. (2015). Výběrové šetření pracovních sil (VŠPS) [Online]. Retrieved April 29, 2017, from https://www.czso.cz/csu/vykazy/vyberove_setreni_pracovnich_sil

CZSO. (2016). Zaměstnanost, nezaměstnanost [Online]. Retrieved April 29, 2017, from https://www.czso.cz/csu/czso/cenik-informacnich-sluzeb-a-produktu-bwut?skupina=25

Public Administration Portal. (2012). Kvalifikace - Zdravotnické kvalifikace [Online]. Retrieved April 29, 2017, from https://portal.gov.cz/portal/obcan/situace/209/217/4737.html

OECD Data [Online]. (2017). Retrieved April 29, 2017, from https://data.oecd.org/healthres/nurses.htm

Učitelské noviny. (2003). Zdrávky se připravují na velký třesk [Online]. *Učitelské Noviny*, *2003*(37). Retrieved from http://www.ucitelskenoviny.cz/?archiv&clanek=4155

Rojek, M., & Masior, M. (2016). The Effects of Reforms liberalising Professional Requirements in Poland [Online]. Warsaw School of Economics. Retrieved from http://ec.europa.eu/DocsRoom/documents/20883/attachments/1/translations/en/renditions/native

Act No. 96/2004 Coll., On Non-Medical Health Service Occupations, as amended, 2004 § (2004).

Labour Code No. 262/2006 Coll., as amended, 2006 § (2006). Retrieved from http://www.mpsv.cz/files/clanky/3221/Labour_Code_2012.pdf

Amendment No. 105/2011 Coll. to the Act No. 96/2004 Coll., On Non-Medical Health Service Occupations, 2011 § (2011).

Regulation No. 144/2003 Coll., amending the Decree No. 354/1991 Coll., O středních školách, as amended [Online]. (2003). Retrieved April 29, 2017, from https://www.psp.cz/sqw/sbirka.sqw?cz=144&r=2003

Government Regulation No. 564/2006 Coll., as amended [Online]. (2006). Retrieved April 29, 2017, from http://www.mpsv.cz/ppropo.php?ID=nv564_2006

ISPV (Informační systém o průměrném výdělku) - Average Earnings Information System [Online]. (2017). Retrieved April 29, 2017, from http://www.ispv.cz

ISPV: Methodology [Online]. (2017). Retrieved April 29, 2017, from https://www.ispv.cz/en/ispv-results/methodology.aspx

List of Appendices

Appendix 1: Quantitative overview of number of nurses

In Table 7, detailed data regarding the number of nurses who pursue their profession in individual years are provided. All calculations are based on the data from the Czech Statistical Office that were used in our analysis on employment. Moreover, some extra information is provided in other columns, such as number of nurses per 1000 inhabitants according to our data with comparison to OECD (2014) etc.

Table 7: Quantitative overview of number of nurses in individual years and other selected information

Year	Number of nurses (weighted)	Number of female nurses	Percent of male nurses	Number of nurses to 1000 inhabitants	Number of nurses to 1000 inhabitants (OECD, 2014)	Number of nurses with higher education	Percent of nurses with higher education
2000	93443	91814	1,74%	9,10	7,61	2015	2,16%
2001	103497	101035	2,38%	10,12	7,85	2640	2,55%
2002	89728	87613	2,36%	8,80	7,99	1742	1,94%
2003	92717	91103	1,74%	9,09	7,98	2447	2,64%
2004	98072	96174	1,94%	9,61	8,11	4933	5,03%
2005	105232	102864	2,25%	10,28	8,11	5526	5,25%
2006	102372	99904	2,41%	9,97	8,07	5169	5,05%
2007	103888	101726	2,08%	10,06	8,03	5302	5,10%
2008	93389	91779	1,72%	8,95	7,97	4598	4,92%
2009	106893	104018	2,69%	10,19	8,09	7616	7,12%
2010	107004	104260	2,57%	10,17	8,1	9874	9,23%
2011	103071	101496	1,53%	9,82	8,03	12525	12,15%
2012	100122	98505	1,61%	9,53	8,06	14825	14,81%
2013	94835	93307	1,61%	9,02	7,99	16584	17,49%
2014	105569	103386	2,07%	10,03	7,93	25713	24,36%
2015	100359	98442	1,91%	-	-	26007	25,91%

Appendix 2: Analysis on employment including unemployed and inactive individuals

This section provides results of the analysis on employment that included also unemployed and inactive individuals. The results, especially the coefficients of dummy variables of years that are of our interest, and their significance levels and signs are similar to the ones when using the individuals with ISCO code. It serves as a robustness check for the results of the analysis, see Table 8.

Table 8: Analysis of employment within nurse profession including unemployed and inactive individuals

The impact of the reform on the probability of working in nurse occupation

| Variables | Linear probability model, *Nurse* | | | | Probit model, *Nurse* | | |
	Coefficient	Standard error (SE)	Robust SE	Signif. level	Coefficient	SE	Signif. level
woman	0,0207	0,0002	0,0002	*** / ***	1,3337	0,0268	***
marital_status	0,0056	0,0002	0,0003	*** / ***	0,2021	0,0114	***
age	-0,0002	0,0000	0,0000	*** / ***	-0,0075	0,0003	***
nationality	0,0060	0,0012	0,0012	*** / ***	0,2570	0,0756	**
second_job	0,0053	0,0010	0,0015	*** / ***	0,1975	0,0383	***
primary_educ	-0,0032	0,0026	0,0003	/ ***	2,6901	0,0971	***
high_educ	0,0010	0,0026	0,0003	/ ***	3,1294	0,0879	***
high_educ (maturita)	0,0275	0,0026	0,0004	*** / ***	4,3832	0,0830	***
higher_educ	0,0075	0,0026	0,0005	*** / ***	3,9028	0,0855	***
prague	-0,0020	0,0005	0,0006	*** / ***	-0,0468	0,0232	*
SW region	0,0010	0,0005	0,0005	** / *	0,0499	0,0197	*
NW region	0,0018	0,0005	0,0005	*** / ***	0,0791	0,0222	***
NE region	0,0002	0,0005	0,0005		0,0144	0,0199	
SE region	0,0009	0,0004	0,0005	** / *	0,0380	0,0195	
mid_moravia	0,0006	0,0005	0,0005		0,0334	0,0214	
moravia_silesia	0,0006	0,0005	0,0005		0,0393	0,0214	
y2003	-0,0005	0,0005	0,0006		-0,0269	0,0240	
y2004	0,0002	0,0005	0,0006		0,0019	0,0235	
y2005	0,0007	0,0005	0,0006		0,0186	0,0228	
y2006	0,0001	0,0005	0,0006		-0,0047	0,0234	
y2007	0,0000	0,0005	0,0006		-0,0032	0,0235	
y2008	-0,0014	0,0005	0,0006	*** / **	-0,0585	0,0241	*
y2009	0,0000	0,0005	0,0006		-0,0029	0,0236	
y2010	-0,0001	0,0005	0,0006		-0,0015	0,0239	
y2011	-0,0004	0,0005	0,0006		-0,0214	0,0234	

y2012	-0,0007	0,0005	0,0006			-0,0307	0,0242	
y2013	-0,0014	0,0005	0,0006	*** / **		-0,0583	0,0246	*
y2014	-0,0001	0,0005	0,0006			-0,0002	0,0247	
y2015	-0,0007	0,0005	0,0006			-0,0220	0,0247	
Constant	-0,0099	0,0028	0,0013	*** / ***		-7,4102		
N	823 792							
Adj. R-squared	0,035							

Note: *** p < 0,001; ** p < 0,01; * p < 0,05