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Charles University

MASTER THESIS

2021

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Charles University



Effect of Recession on Labor Market Outcomes of College Graduates in the Czech Republic

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Master Thesis

Prague 2021

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Academic year: 2020/2021

Bibliographic Note

PAVLOVA, Margarita. *Effect of Recession on Labor Market Outcomes of College Graduates in the Czech Republic*. Prague 2021. 72 pages. Master thesis. Center for Economic Research and Graduate Education, Charles University.

Thesis Supervisor: Prof. Ing. Štěpán Jurajda, PhD

Abstract

This paper examines the effect of graduating from college during a recession on labor market outcomes in the Czech Republic, where tertiary education is mostly state-funded. I focus on workers who entered the labor market during 2006-2015, a period including the financial crisis and recession of 2008 and the subsequent recovery period. As an indicator of economic conditions, I use overall and youth unemployment rates. I find that an increase in the unemployment rate by 4 percentage points is associated with approximately a 8% reduction of annual earnings in the first year after graduation. Additionally, I study two channels of earnings' reduction: the probability of being employed and probability of being employed in a "college" occupation after graduation. Both probabilities diminish significantly with an increase in unemployment rates. Overall, my results demonstrate that graduation at the time of recession has a significant negative impact on labor market outcomes of workers.

Abstrakt

Tato práce zkoumá vliv absolvování vysoké školy během recese na uplatnění na trhu práce v České republice, kde terciální vzdělání je převážně financováno z veřejných rozpočtů. Zaměřuji se na pracovníky, kteří vstoupili na pracovní trh v období 2006-2015. Období zahrnuje finanční krizi v roce 2008 i následnou obnovu. Jako indikátor ekonomických podmínek využívám míry nezaměstnanosti mladých. Zjišťuji, že zvýšení nezaměstnanosti o 4% je přibližně spojeno s 8% poklesem ročních výdělků během prvního roku od absolvování. Dále zkoumám dvě možná vysvětlení nižších výdělků: pravděpodobnost být zaměstnán a pravděpodobnost být zaměstnán v absolvovaném oboru. Obě pravděpodobnosti se významně snižují se zvýšením nezaměstnanosti. Mé výsledky ukazují, že absolvování v době recese má významný negativní vliv na uplatnění na trhu práce.

Keywords: Business Cycle, College Graduates, Cohort Effects

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Acknowledgement

I would like to express my gratitude to my supervisor Prof. Ing. Štěpán Jurajda, PhD, for his patient guidance and helpful comments.

I would also like to thank my family and friends for their emotional support.

Project of Master Thesis

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Academic year: 2020/2021

Topic: Effect of Recession on Labor Market Outcomes of College Graduates in the Czech Republic

Motivation

Over the last decade, overall and youth unemployment rates in the Czech Republic have significantly decreased (OECD, 2020), which is associated with economic growth that started in 2014. However, youth unemployment (for workers aged 15-24) remains almost doubled the overall rate (OECD, 2020), which can indicate that the youth group of the population is more sensitive to economic conditions. Devereux (2002) finds that graduates entering the labor market during economic growth have a higher chance to find a job that is appropriate for their level of education than cohorts who graduated during the recession. Altonji, Kahn, and Speer (2014) suggest that this difference in chances can be the reason for a worse career start for people who graduated in bad economic conditions. That could cause fewer future promotions and career opportunities, and in the long-run perspective could lead to significant earning losses. Furthermore, Oreopoulos, Von Wachter, and Heisz (2012) find that the low-paying first job is one of the sources of persistent reduction of earnings for male college graduates in Canada.

Besides, there are substantial differences across the fields of study. According to Altonji, Kahn, and Speer (2016) probability of finding an appropriate initial placement is not the same across majors even under good economic conditions since the disbalance between labor demand and supply exists for some of them. Moreover, the field of study heterogeneity could be caused by different requirements for a future job. Practical skills are much more valuable for some majors, while deep theory understanding is appreciated more for others. Such heterogeneity can lead to the different effects of the recession on the earnings of graduates both in the long- and short-run term.

This study is in line with the research of Altonji, Kahn, and Speer (2014) who analyze the effect of graduation during the recession on the US data and find that the entering labor market in bad economic conditions causes significant earning reduction compared to in good times. However, there is no analogous research on European data. Some studies analyze the significance of conditions for transition and different types of unemployment across Europe. However, most of them concentrate on countries in which education is costly, while in economies with state-funded education, the effect can be different. Therefore, I will attempt to estimate the impact of entering the labor market during the recession on the earnings controlling on the field of study in Europe and using panel data for the Czech Republic.

Contribution

There is a wide range of studies focusing on the employment of graduates in Europe. However, to the best of my knowledge, there are no studies with longitudinal analysis of graduates aged 20-35, although the influence on them is assumed to be more significant. My contribution to this gap will be in performing a study of the impact of economic conditions at the moment of entering the labor market and field of study on the labor market outcome (annual earnings and employment) for workers aged 20-35 by using panel microdata.

Methodology

I will use data from the European Union Labor Force Survey (EU LFS) and European Union Statistics on Income and Living Conditions (EU-SILC) for 2006-2019. LFS is a household survey that contains information including age, gender, education level, economic activity, and occupation of individuals from all EU countries. EU-SILC contains questions regarding the annual earnings, attained level of education, detailed worked information, which LFS does not contain. I will use a sample of 20-35 aged workers in the Czech Republic.

In line with the previous research (Kahn, 2010; Altonji, Kahn, and Speer, 2016),

I will use the overall unemployment rate in the graduation year as an indicator of the entry economic conditions, cohort effect, and age. Also, I will include in the model interactions of this variable with each other to allow the effect of conditions changes with the years after graduation. For the estimation of the econometric model, I will use a model with fixed effects on the field of study.

Thus, I will estimate the model in which the dependent variable is the annual earnings of graduates and probability of being employed and regressors are the overall unemployment rate, age, fixed effects on the majors, and the set of control variables (gender, ethnicity, quadratic in age).

Outline

1. Introduction: motivation for the study
2. Literature review: briefly outline of the relevant studies
3. Description of data (EU-LFS)
4. Methodology
5. Results: discussion of received esteems
6. Conclusion

List of academic literature:

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Introduction

Fluctuations in business cycles play a crucial role in the income of individuals. Understanding this role is essential for determining the welfare consequences of recession for society. According to Becker (1967), the first years after graduation are very important for the future income of individuals since it is a time of accumulating human capital from labor experience. Therefore, recent graduates are especially sensitive to economic fluctuations because the number of vacancies decreases during the recession, which is associated with an increase in overall and youth unemployment. Consequently, graduates can face a lower probability of finding a job match appropriate to their level, or spend more time being unemployed. With higher probability, They might match to jobs, for which they will be overeducated (Devereux, 2002) than their more fortunate colleges, or to occupations that do not value their higher education and do not pay a wage premium for it (“non-college” occupations). Such a situation can cause negative consequences not only for individuals but also for society and the economy of the country through significant efficiency losses.

From one perspective, recent graduates can change their workplace for a better one during the first few years without significant losses of experience and, consequently, of earnings (Topel and Ward, 1992). However, according to Kahn (2010), a poor early start might leave graduates in firms with fewer career opportunities and result in long-term income disadvantages. Altonji, Kahn, and Speer (2016) also show that this effect varies across college majors. Moreover, this effect might vary across countries since the structure of the field-of-study

can differ significantly because of the historical background or education funding. Most of the studies in this field are dedicated to the USA, Canada, and the UK. However, these countries all have student-paid fees, while the effect for countries with state-funded education can differ. Sievertsen (2016) shows that entering the higher education market in countries with state-funded education during high unemployment has very low alternative costs due to fewer vacancies on the labor market. This pattern will likely not be the same for countries where the cost of education is so high that individuals with lower abilities cannot afford to obtain it. At the same time, efficiency losses for countries with a public education system might be significantly higher. This can happen because the state finances education for fields in which there is an oversupply of workers and then underfinances fields with undersupply, which might increase labor market imbalance.

The system of education in the Czech Republic is mostly state-funded at all levels including tertiary education. Although the fraction of 25-64 year-old tertiary-educated adults is growing consistently, from 14% in 2008 to 24% in 2019 (OECD, 2019), this level is still below the OECD average (39%). Based on the experience of other countries, this fact can predict future expansion of the tertiary education system and an increasing number of skilled workers, which is usually translated into an increase in the productivity level, which adds policy relevance to my study. However, according to the OECD (2019), Czech workers with higher education have rather insignificant advantages in employment: their employment rate is only 4 percentage points higher than for adults without tertiary education. In addition, for young educated workers aged 25-34 years old, the employment rate is 2 percentage points lower than for workers of the same age with upper secondary education.

This paper studies the consequences of graduating from university during poor economic conditions in the Czech Republic, where education in Czech is mostly state-funded. I analyze the labor market outcomes of college graduates as

a function of economic conditions at time of graduation. I use the unemployment rate in the graduation year as an indicator of economic conditions and annual earnings, probability of being employed, and probability of being employed in a “college” occupation as labor market outcomes. I define occupation as “college” if workers in this occupation receive at least a 10% wage premium for their college education. Specifically, I examine workers who graduated in the 2006-2015 period: before, during, and after the global financial crisis of 2008, when there was a high level of unemployment around the world. For the analysis, I use the Czech part of the European Union Statistics on Income and Living Conditions (EU-SILC) and the European Union Labour Force Survey (EU-LFS), containing information from 2005 to 2019. These two datasets contain a different set of variables for the analysis. The EU-SILC contains questions regarding annual earnings, level of education attained, and detailed worker information, while the EU-LFS contains information on the year of graduation, field of study, and employment status. Therefore, this paper contributes to the existing literature by estimating the effect of the recession on the labor market outcomes for graduates in a country with a publicly-funded higher education system and exploring new labor market outcome in this strand of literature, namely, probability of being employed in a “college” occupation.

I find that graduating from college in a time of higher unemployment is associated with significant earnings losses for the average graduate. Annual earnings diminish by around 8% in the first year after graduation, with an increase in the youth unemployment rate of four percentage points. This finding is consistent with existing literature: the effect approximately the same as in Altonji, Kahn, and Speer’s (2016) estimate but smaller than Kahn’s (2010) findings.

Furthermore, I examine the channel through which this decline in earnings operates by focusing on employment and employment in the “college” sector. I find that an increase in the youth unemployment rate leads to a 0.001 decrease

in the probability of being employed and a 0.0018 decrease in the probability of being employed in the “college” sector, both of which are statistically significant. These results are robust to different forms of the model specification.

The remainder of the paper is organized as follows. Chapter 1 discusses the existing literature closely related to this topic. Chapter 2 describes the data used for analysis and empirical models used to estimate the effect of recession on labor market outcomes. The results of the estimation of the impact and robustness-check are presented in Chapter 3. The last section concludes.

Chapter 1

Literature Review

1.1 Effect of Business Cycle Fluctuations on Labor Market Outcomes of Young Workers

Different theories suggest different expectations of the effect of the recession on future labor market outcomes. According to one theory, young workers can change their workplace for a better one during the first few years without significant losses of experience and, consequently, of earnings. Topel and Ward (1992) show, using longitudinal data on the US market, that highly mobile recent graduates will hold seven jobs during the first ten years after graduation, which is about two-thirds of their career total. This change of jobs can be even more beneficial due to growth in wages. Moreover, Andersen et al. (2017) find that younger workers recover more quickly from business cycle shocks than older workers, while employment rates of older workers might be permanently affected by business cycle fluctuations. In such a situation, it is possible that there will be no long-term impact of the recession at graduation on future labor market outcomes.

From a different perspective, due to the lack of work experience, young workers, in general, can be more affected by changes in economic conditions in the labor market. Using Danish register data for young and old workers of all ed-

ucation levels, Andersen et al. (2017) examine whether cohorts can be permanently affected by separating exogenous and endogenous sources of persistence and controlling for the impact and duration of business cycle shocks. They find that young workers tend to be more sensitive to business cycle fluctuations than older workers (although they recover more quickly). Furthermore, their evidence demonstrates that some cohorts have become lost because of experiencing adverse shocks at young ages. “Lost cohorts” they define as a cohort that experienced a negative employment shock and have never recovered from it, demonstrated by a permanently lower employment rate.

Heckman and Borjas (1980) study whether experiencing unemployment can increase the probability of being unemployed in the future. To analyze this dependence, they decompose it into four different effects. The first, Markovian dependence, reflects the probability of being unemployed in a current state conditional on the state from the last period. The second, “occurrence dependence” describes the number of previous states of unemployment before entering the current state. “Duration dependence” captures the effects of time periods spent in an unemployed state on the current unemployed state. The last effect, lagged duration dependence, describes the overall time spent in the unemployed state up until the current one. Based on this decomposition, they conclude that the identification conditions for each type of the dependence are different.

Using Heckman and Borjas’s (1980) methodology to analyze dynamics in the Danish labor market between employment, unemployment, and out of the labor force status, Lesner (2015) finds that labor market history affects the transitions between labor market states and indirectly influences wages. The author split the state dependence into the occurrence and lagged duration dependence, which affect transition rates through the wage. The results show that external employment shocks cause strong negative long-term effects on the employment rate, while employment programs lead to positive benefits for the long-term un-

employed. Therefore, for graduates, longer periods of unemployment can have lasting negative consequences on their labor market state.

Although young workers in general form a group which is very sensitive to business cycle fluctuation, there is a still more vulnerable part of the group who are more likely to be out of the labor force in the case of recession, specifically, high school graduates. Speer (2016) focuses on the effect of recession for this type of graduates in the period of 1979-2010 in the USA. Since an individual can choose when to leave high school and enter the labor market, the problem of endogeneity in estimation appears. To address this issue, the author uses the instrumental variable approach by instrumenting the unemployment rate of the actual year of entering the labor market with the unemployment rate in the year when the individual was supposed to leave high school, and then estimating the model for wages, full-time and part-time weeks worked, and total hours worked during the first year after leaving the school. According to the estimation, in the first year after leaving workers experience a 6% reduction of wages, an increase in time for finding both full-time and part time jobs, and a 28% decrease in total hours worked. However, this effect is not persistent and disappears after the first year of working.

In a similar setup, Genda, Kondo, and Ohta (2010) examine the effects of entering the labor market during a recession on employment status and future earnings for Japanese and American men and find long-lasting negative effects of the unemployment rate at graduation for less-educated Japanese men. At the same time, the effect for less-educated American men is temporary and smaller in size, which is consistent with Speer's (2016) findings. This is explained by the school-based feature of the hiring system in Japan, which facilitates loss of employment opportunities for less-educated individuals. Regarding the effect on earnings, it is significantly negative in both countries, but also stronger in Japan: 4.6% in Japan and 1.5% in the USA for high-educated individuals.

Furthermore, the effect of entering the labor market can differ across labor market structures. Fernández-Kranz and Rodríguez-Planas (2018) consider the labor market in Spain, which has a dual system of job protection. This is represented in the existence of permanent contracts, which makes firing costs very high. The authors focus on male high school, vocational training, and college graduates entering the labor market between 1980 and 1992. According to their estimation, graduates entering a rigid and segmented labor market during a recession have persistent earning losses, especially if they do not hold a college degree. Specifically, annual earnings of high-school, vocational training, and college graduates decrease by 9.6%, 12.5% and 6.4%, respectively. This finding is consistent with Genda, Kondo, and Ohta's (2010) result for Japan. Although the effect of the graduation during a recession on annual earnings is still negative, the authors claim that such a result is driven by other forces than the reduction in the US graduates' earnings. Specifically, they show that the reduction in earnings is mostly explained through an increase of probability of being unemployed and probability of being employed with a non-permanent contract (with no-firing costs).

To construct a more general picture of differences in effects across different levels of education attained, Liu, Salvanes, and Sørensen (2014) examine how the effect of entering the labor market during the recession varies across education groups. They consider four groups: individuals without high school education, individuals who attained an academic and vocational high school diploma, and college graduates. Using the data for all residents in Norway aged 16-74 during the 1986-2010 period, the authors estimate the model with the logarithm of real earnings as the dependent variable and potential years of work experience and national unemployment rate at the time of graduation for each cohort as explanatory variables for each educational group. According to their estimation, an increase in the national unemployment rate has a negative impact on the

earnings of all educational groups, which remains during the next four years after graduation, except the academic high school group. For this group the negative effect lasts longer than five years.

Schwandt and Von Wachter (2019) examine the effects of entering the labor market in a recession on labor market outcomes for all young workers who entered the U.S. labor market (including college graduates) from 1976 to 2015. Their baseline model includes labor market outcome (annual earnings, wages, employment) as the dependent variable and state unemployment rate and potential experience as the regressors controlling on the year of graduation, state, educational group, and calendar year fixed effects. However, data used by the authors is cross-sectional, which creates some limitations for their estimation e.g. endogeneity of labor market entry because of potential migration or postponing the graduation. They address this issue by estimating a double-weighted specification, in which they weight state unemployment rate by the average state migration rate and average graduation rate. Comparison of the results from these two specifications demonstrates the absence of the endogeneity problem in the data that arises because of the similarity of the estimates.

Schwandt and Von Wachter (2019) find that all individuals entering the labor market in a recession face a significant decrease in earnings: a rise in the unemployment rate by 3 percentage points causes an approximately 11% reduction in earnings, which persists for at least 10 years. Moreover, the researchers show that the initial decrease is caused by declining hours worked and wage, while the effect in the long term is primarily because of decrease in wages. A comparison of different groups of young workers indicates that the impact is the largest for the groups of nonwhites and high school dropouts.

The studies discussed above did not distinguish between high school graduated men and women or focused mostly on men. However, women's responses

to bad economic conditions at the time of entering the labor market can be very different from men's, because they have a larger set of alternative uses for their time. Hershbein (2012) studies this issue on the USA data for a 15 year period. Women who graduate high school in an adverse labor market are less likely to be in the workforce for the next four years, in contrast to men. However, long-term effects are minimal and insignificant. Moreover, women temporarily substitute into home production if they graduate during recession, while men increase their enrollment to college as a short-run response to weak labor demand, but their wages are affected more than women.

However, earnings losses and a decrease in the employment rate are not only the problem of individuals, but they also cause significant welfare losses for a whole economy. To estimate the magnitude of these losses, Stuart (2019) considers children (ages 0-10), adolescents (aged 11-19), and young adults (aged 20-28) who experienced recession in 1980-1982 in the USA. As an estimation strategy, the author uses a difference-in-difference framework, in which the pre-treatment period is defined as years when the recession was less severe (measured as a decrease in the log of real earnings per capita during 1979-1982). Results of the estimation demonstrate that experiencing recession (10 percent decrease on real earnings per capita in the country) for those aged 0-13 leads to a 9.8 percent reduction of the probability of receiving a college degree, 3.5 percent decrease in income, and 8.7 percent increase in the probability of experiencing poverty in the future, while the effects for other age groups are statistically insignificant. On the aggregate level, the author presents losses of 0.2-0.5 percent of GDP and 0.6-1.3 percent of the number of people living in poverty in 2015.

1.2 Economic Conditions at the Time of Enrollment to College

Sievertsen (2016) shows that the college enrollment rate increases during high unemployment in Denmark. Barr and Turner(2015) find the same pattern in the U.S. data for the Great Recession. Therefore, the recession at the time of enrollment to college can influence individuals' career choices. Blom, Cadena, and Keys (2015) examine the U.S. data for 50 cohorts of college graduates and estimate their model for the share of major within each cohort, conditional on unemployment rate, major fixed effects, and quadratic time trends. According to this estimation, students enrolled during bad economic conditions tend to choose higher-paying majors, which also have better employment prospects. Furthermore, bad economic conditions contribute to women choosing male-dominated fields of study. This creates higher competition across students and can force them to invest more in human capital.

While Blom, Cadena, and Keys (2015) consider a long period of time, Liu, Sun, and Winters (2019), using the same data source, focus only on the effect of the recession in 2008. According to them, one feature of that recession was the force which drove it namely the financial crisis, which could change the attitude of future students and their expectations about the majors connected with business and finance. For their empirical evaluation, the authors use a linear probability model, in which the dependent variable is the probability of choosing a specific major. Regressors are the dummy for the period referred as "Great Recession" (including the financial crisis of 2008 and the slow recovery period until 2011), which is equal to 1 if the individual chose the college major during this period and 0 otherwise, set of demographic characteristics, and the time trend. According to the estimation, individuals tend to more often choose majors connected to STEM (science, technology, engineering, and mathematics), while the probability of obtaining a college degree in business decreases by 1.3 percentage points. Moreover,

this decrease is mostly forced by finance and management specializations, while changes in other related fields are not statistically significant.

As well as Liu, Sun, and Winters (2019), Goulas and Megalokonomou (2019) also consider the effect of the Great Recession (for the 2005-2011 period) on choices of majors in Greece. However, they analyze a higher number of fields-of-study, namely 22, not restricting the attention only on STEM. Estimating the model for the number of applicants for each major on the youth unemployment rate, the authors find that after a recession in 2008, demand for university degrees in general significantly increased. Specifically, the popularity of degrees in Psychology, Law, and STEM increased by approximately 15 applications on average. Moreover, the number of applications to Naval and Military Academies rose by around 35 units compared to the pre-recession time. At the same time, consistent with Liu, Sun, and Winters's (2019) findings, the number of applications for Economics and Management fields fell by 0.5%, which the authors connect to the higher insecurity rates of these majors during recession.

At the same time, if individuals enroll in college during a period of high unemployment, they will have few opportunities for internships and part-time jobs. Mukoyama, Patterson, and Şahin (2018) prove that, during recession, unemployed workers put more effort into their job search than in times of better economic conditions. This may force students to dedicate more time to study, invest more in their human capital, and improve their future outcomes.

Bicakova, Cortes, and Mazza (2021) find that cohorts enrolled during bad economic conditions are better qualified and have higher earnings than those cohorts enrolled in good economic times. They estimate the effect of fluctuations of business cycles on labor market outcomes on the UK data, which contains information about male individuals with a Bachelor's degree for the 1998-2016 period. For estimation, they use a very similar model to Altonji, Kahn, and Speer

(2016):

$$w_{it} = \alpha + \gamma X_{it} + \beta U_{c_i} + \lambda_1 a_{it} + \lambda_2 a_{it}^2 + \delta c_i + \tau_t + \epsilon_{it} \quad (1.1)$$

where w_{it} is a wage of individual i in year t ; a_{it} is individual's age, which captures a potential experience in this framework; c_i is the individual's year of college enrollment, which captures the cohort effects, τ_t is the calendar year fixed effects, which captures the current state of the business cycle; and U_{c_i} is the average national unemployment rate at the time of enrollment.

The results of this estimation indicate that the wage of cohorts who enrolled in college in bad times is approximately 3.6% higher on average. This result does not change after excluding individuals older than 35, who could already have labor experience before enrollment. To check whether this effect could be caused by high unemployment at graduation, they estimate Kahn's (2010) model, adding the variable of unemployment at the time of enrollment. From this specification, they found that the effect of unemployment at graduation on wage remains negative and significant, but their coefficient of interest also remains robust. This indicates that individuals enrolled in college during the recession have on average higher wages than individuals enrolled during the expansion of the economy. However, Bicakova, Cortes, and Mazza (2021) do not explore possible mechanisms (increase of competition, lack of part-time jobs, and change in attitudes) of this effect

However, an increase in competition is also connected to cohort size since the larger cohort is, the more applicants for a job/college there are. The effect of the birth cohort size on labor market outcomes is studied by Agarwal et al. (2021) in Singapore by using a difference-in-difference methodology in a natural experiment setting, based on the desire of Chinese parents to have a child born in the year of the Dragon. Researchers show that Chinese Dragon cohorts are approximately 2 percentage points less likely to be admitted to college, experience a 6.3% reduction of earnings compared to other Chinese cohorts and they are less

likely to work in higher-paid occupations. Moreover, this impact has a negative spillover effect on non-Chinese cohorts entering the labor market at the same time.

In contrast to Agarwal et al. (2021), Roth(2017) studies not the size of the entire cohort, but the size of the graduation cohort. This is also supposed to reflect the general size of population, but refers to a more relevant group for this research. The author uses a German framework for graduates in the 1999-2012 period and estimates the effect of the cohort size on the duration of a job search after graduation. Based on Agarwal et al.'s (2021) result, the effect of interest is expected to be positive, i.e. the larger cohort is, the longer is the search period for graduates because they suffer from higher competition on the labor market. However, the result is the opposite. Specifically, the rise of the size of cohort by one standard deviation reduces the duration of the job search by approximately 8 percent. This effect is significant only for a short period of time, namely, 6 months after entry into the labor market. After this time, the cohort size does not have an impact on the job search duration, which means that the cohort size (and increase of competition linked to it) can be the channel of the effect demonstrated by Bicakova, Cortes, and Mazza (2018).

1.3 Impact on Recent College Graduates

1.3.1 Effect on Earnings

Kahn (2010) claims that a poor start in the labor market leads to an imbalance in human capital accumulation. This imbalance causes lower productivity of less fortunate graduates due to longer periods of unemployment and investment of their time in poor job matches (on any level: from firm to specific tasks). To study this disparity at the task level, Gibbons and Waldman (2006) extend their model, which integrates job assignment, human capital acquisition, and learning (Gibbons and Waldman, 1999) by incorporating schooling and task-specific human capital. By task-specific human capital, the authors imply that the part of

the human capital an individual acquires on the job is specific to the tasks, not specific to the firm. Hence, when a worker has a new set of tasks, some of that worker's human capital is not used in the new job.

The basic model assumed that all firms are identical, and the only input is labor. A worker's career lasts T periods, with $T \geq 3$. Each worker i enters the labor market with a schooling level, denoted S_i , which can take any integer value between 1 and N . There is a positive number of workers at each value of S . A firm consists of two different jobs (1 and 2). If worker i is assigned to job j in period t , then the worker produces

$$y_{ijt} = d_j + G(S_i) + c_j(\eta_{it} + \epsilon_{ijt}) \quad (1.2)$$

where d_j and c_j are constants known to all labor market participants, $G' > 0$ and $G'' < 0$, ϵ_{ijt} is a noise term drawn from a normal distribution with mean zero and variance σ^2 . η_{it} is on-the-job human capital, which is defined as $\eta_{it} = \theta_i f(x_{it})$, where θ_i is the worker's ability to learn on the job and x_{it} is the worker's labor market experience prior to period t . Let η' denote the amount of on-the-job human capital at which a worker is equally productive at jobs 1 and 2. Then the efficient assignment for a worker with $\eta > \eta'$ is job 2, while the efficient assignment for a worker with $\eta < \eta'$ is job 1. Each worker's schooling level is known to all labor market participants when the worker enters the labor market.

Including the task-specific human capital allows the authors not to restrict the analysis to cases when all entry workers are assigned to the low-level job. In contrast, they analyze parameterizations where some entry workers are assigned to high-level jobs. In particular, a worker with the highest schooling level is assigned to the high-level job in the first period in the labor market if the state of the world is good. A worker with the lowest schooling level is assigned to the low-level job in the first period if the state is bad. This extension helps the authors capture cohort effects: a cohort that enters a firm at a low wage will earn

below-average wages years later. Thus, Gibbons and Waldman (2006) show that workers entering firms in worse economies start in lower-level jobs and therefore have lower task-specific human capital in more important jobs later.

To study the effect of imbalance of the human capital accumulation across firms Kahn (2010) examines the model of the wage as a function of economic condition at the time of graduation. As an indicator of economic conditions, she uses an annual average of monthly national unemployment rates and the state rate in the USA for the 1979-1989 period. To avoid possible discrimination and childbearing effects, she restricts the sample to white-male individuals with a college degree.

Oreopoulos, Von Wachter, and Heisz (2012) examine a Canadian dataset of over 20 years (from 1976 to 1999) of male college graduates to understand how short-term labor market conditions affect long-term earnings within and across firms, estimating a fixed effect model of the wage with the unemployment rate at the time of entering the labor market as regressors and fixed effects for year of graduation, year of potential labor market experience, and calendar year.

Altonji, Kahn, and Speer (2016) expand previous research for the USA by using more periods in the model – from 1974 to 2011, so they have several business cycles in the data and, consequently, greater variation for estimation. They use the modified Mincerian model for estimation:

$$Y_{ict} = \beta_1 X_{it} + \beta_2 U_c + \beta_3 U_c PE_{it} + \beta_4 U_c PE_{it}^2 + \beta_6 \beta_i^{major} PE_{it} + \beta_7 \beta_i^{major} U_c + \beta_8 \beta_i^{major} PE_{it} U_c + \gamma_{major} + \epsilon_{ict} \quad (1.3)$$

where Y_{ict} is a labor market outcome (annual earnings, wage rates, employment, full-time employment) of individual i , at the moment t from cohort c ; X_{it} is a set of standard control variables (ethnicity, race, etc.); PE_{it} is potential ex-

perience (years after graduation). and U_c is the deviation of the unemployment rate from the sample average (6.3 %) in the year of graduation, which measures the economic conditions at the time of entering the labor market. To address the fact that the effect of recession can differ across majors, they include fixed effects for majors in the model. Estimation of the model for different labor market outcomes allows the authors to explore the channels through which recession can affect the wealth of graduates.

Altonji, Kahn, and Speer (2016) and Oreopoulos, Von Wachter, and Heisz (2012) have rather similar results: bad economic conditions have a significant negative effect on the wage: a rise in unemployment rates by 5 percentage points implies an initial loss in earnings of about 9 percent, which halves within five years, and finally disappears within ten years. Kahn's (2010) results are even more persistent; she shows that the average wage loss in response to a 1 percentage point increase in the national unemployment rate for the first 17 years after college graduation is 4.4%, while the average for the state rates is 2.0%. So, according to Kahn (2010) losses in earnings remain for approximately 17 years after college graduation. However, the dataset used in this research is smaller than that used by Altonji, Kahn, and Speer (2016) and includes a very limited number of business cycles.

Altonji, Kahn, and Speer (2016) also study whether the effects of the adverse economic conditions differ across majors. They find that a major that typically earns one standard deviation above the mean (such as civil engineering or accounting), experiences only about half the earnings losses of a major that typically earns at the mean (journalism or engineering technology). The authors interpret this as an increasing earnings advantage for high-return majors graduating during the recession. This effect persists for seven years into a career. At the same time, graduates in fields that typically earn one standard deviation below the mean (fitness and nutrition, commercial art and design) have earnings

losses about 50 percent larger than those of the average major.

However, although the papers discussed above find that the effect disappears during several years after graduation, they do not analyze how it can affect labor market outcomes of middle-aged workers who experienced a labor market shock at a young age. Schwandt and Von Wachter (2020) fills this gap by analyzing among other things the effect of experiencing recession after graduation on annual earnings and employment of workers in their mid-forties in the USA and finds that negative effect of recession reappears in 15 years after graduation with around a one percent decrease compared to workers who graduated in good economic conditions. At the same time, the employment rate for “unlucky” workers has higher labor force participation. Thus, graduation in the time of recession causes a reduction of earnings with the increase of working hours for workers in their middle age.

Furthermore, college graduates do not only enter the labor market after graduation. Some of them choose an academic track, but they can still be affected by a recession. Van den Berge (2018) examines how the effects of recession differ between academic and vocational graduates based on the data from the Netherlands for 1996-2012 period. The author uses field-specific year-to year percentage changes in the employment rate as an indicator of economic conditions and estimates a model with fixed effects for potential experience (which is maximum 8 years in the sample analyzed), cohort, calendar year, and field-of-study. To address the potential selection problem of adjusting graduation year for better times, the author explores an IV setup and uses as an instrument the year of expected graduation. Based on this estimation, it was found that academic graduates experience stronger wage losses than vocational graduates: a 10% and 6% decline, respectively. However, the decline for vocational graduates is more persistent: the decrease for academic graduates persists for four years, while for vocational ones it lasts for at least eight years because, compared to academic

graduates, they remain longer in sectors that mismatch with their majors.

1.3.2 Channels of Influence

Overeducation

A longer period of unemployment and employment in an occupation that does not match with the level of education and/or skills attained could be sources of significant earnings losses can be both. There is a wide stream of literature dedicated to this topic of overeducation (overschooling). Usually, overeducation is defined as the difference between a worker's completed level of schooling and the level of education required for the job that the employee holds. In labor economics, it is a well-known fact that workers with better education have higher wages. However, this observation may not be true for overeducated workers (Duncan and Hoffman, 1981). By analyzing career effects of the US workers graduating during the 1982–1994 period, Clark, Joubert, and Maurel (2017) find a negative connection between being overeducated on entering the labor market and wages, which persists over approximately 12 years. Furthermore, experiencing overeducation in the past leads to an approximately 3.5% wage reduction for a non-overeducated worker. Authors claim that this can be an important channel of the decrease in earnings during the recession.

Additionally, according to McGuinness (2006), overeducation might be very costly not only for individuals who experience lower earnings but also for firms because of lower worker productivity (Tsang, Rumberger, and Levin, 1991) and for the economy in general as the potential of workers is not entirely used. Despite the rather consistent findings about the negative correlation between overeducation and earnings, some studies point out limitations, including unobserved variables and measurement errors, which could lead to bias in these results.

Usually in this stream of literature three possible methods are used to measure overeducation; all have some drawbacks. The first method is based on self-

assessment: workers report the schooling requirements for their job. According to Hartog (2000), this method is initially biased since respondents tend to overstate the requirements for their jobs in order to upgrade their social status. The second method uses information from job descriptions and occupational classifications. However, according to Leuven and Oosterbeek (2011) these classifications vary across countries due to the differences in the educational systems and can be inaccurate for one specific country. The last method proposed by Verdugo and Verdugo (1989) uses information from the already realized matches. The required amount of schooling for a worker is derived from the mean or the mode of schooling of all workers with the same occupation. Then the deviation from the mean score estimates overeducation. This last method is used by Summerfield and Theodossiou (2017) to study the effect of recession on the probability of being overeducated in a subsequent job.

Summerfield and Theodossiou (2017) focus on all graduates in Germany during the 1994 - 2012 period and estimate a model with the overeducation measure as a dependent variable and regional unemployment rate in the year of graduation as the main regressor. To address a potential problem of endogeneity, the authors also implement an instrumental variable method with the regional unemployment rate in the region of the graduate's location at the age 14 as an instrument. According to the estimation, the increase of unemployment causes a 1.6 percentage point increase in the probability for recent graduates of being overeducated for their first job. Moreover, this effect persists for 9 years after graduation. However, the method of defining overeducation used by the authors ignores the variation across jobs within one occupation, which can create significant bias in the estimation.

Thus, all three methods do not measure overeducation ideally and using them may cause measurement error bias with incorrect estimates of effect. To fill this measurement gap, Gottschalk and Hansen (2003) propose a model that allocates

college graduates into “college” and “non-college” occupations.

Gottschalk and Hansen (2003) develop the case of two sectors, in which output is produced by workers with and without a college education, with the following production functions:

$$Q_1 = F_1(K_1, \alpha_{1c}L_{1c} + \alpha_{1n}L_{1n}) \quad (1.4)$$

$$Q_2 = F_2(K_2, \alpha_{2c}L_{2c} + \alpha_{2n}L_{2n}), \quad (1.5)$$

where L_{jc} and L_{jn} are the number of workers in sector j with and without college education, respectively and α_j reflects the efficiency of workers, implying $\alpha_c > \alpha_n$. From the maximization of firms' profit:

$$W_{jc} = \alpha_{jc}F'_j \quad (1.6)$$

$$W_{jn} = \alpha_{jn}F'_j \quad (1.7)$$

Then, the demand for workers depends on the sector-specific prices for labor:

$$\frac{W_{jc}}{W_{jn}} = \frac{\alpha_{jc}}{\alpha_{jn}} \quad (1.8)$$

According to these definitions, a “non-college” job offers a low (or no) wage premium for college education. Since $\frac{\alpha_{jc}}{\alpha_{jn}}$ is the college premium, the sector with smaller $\frac{W_{jc}}{W_{jn}}$ is “non-college”.

Workers choose to work in a sector based on heterogeneous preferences and relative wages, which define the supply in the model:

$$\ln L_{1c} = \lambda_c + \beta_c \ln\left(\frac{W_{1c}}{W_{2c}}\right) \quad (1.9)$$

$$\ln L_{1n} = \lambda_n + \beta_n \ln\left(\frac{W_{1n}}{W_{2n}}\right) \quad (1.10)$$

Thus, this model implies that some college educated workers may work in the “non-college” sector in equilibrium, which was not captured by previous measurements. Then, using US data for 1982 - 1995, the authors estimate a standard Mincerian equation with a dummy variable for the college education to classify occupations into “college” and “non-college” and estimate the model of probability of college graduates being employed in a “non-college” occupation. In contrast to the previous literature, this research shows that the rate of college graduates in “non-college” jobs decreases during the period analyzed. This finding is also consistent with Ashworth and Ransom’s (2019) result, according to which the college wage premium had an increasing trend for 1950 - 1970 cohorts (authors define cohort as a year of birth) in the USA. However, Ashworth and Ransom (2019) also show that flattening followed this trend for the 1980s cohorts, which indicates that the college wage premium has an inconsistent trend, which changes over the business cycle.

Pertold-Gebicka (2010) uses Gottschalk and Hansen’s (2003) methodology to examine the allocation of college graduates across occupations in the Czech Republic. The main aim of this research is to estimate the connection of the number of college graduates in the labor market and the proportion of graduates working in “non-college” occupations. To empirically evaluate this effect, the author implements a two-step procedure, where the first step estimates the probability of being employed in “non-college” occupations after graduation from college, based on individual characteristics, and the second step is a weighted least squared regression connecting this probability with the number of workers in the labor market:

$$\text{1st step : } Pr(\text{nocollege}_{ikt}) = \delta_0 + X'_{ikt}\delta_1 + TD'_{kt}d + \xi_{ikt} \quad (1.11)$$

$$\text{2nd step : } \hat{d}_{kt} = \gamma_0 + \theta_1 \left(\frac{L_c}{L_c + L_n} \right)_{kt} + Y'_{kt} \theta_2 + \epsilon_{kt}, \quad (1.12)$$

where TD'_{kt} is a vector of year-district dummies. The author finds a negative effect of the number of skilled workers across districts of the Czech Republic, but positive impact in a within-district setup which, according to the author, could be caused by the delay in the reactions of firms to the changed demand.

At the same time, the demand for skills and skilled workers can change over business cycles. By analyzing the US labor market during the 1967-2017 period, Jaimovich and Siu (2020) show that job polarization (increase in employment in the tails of skill distribution and decrease in employment in the middle of skill distribution) is connected to a recession in an economy, specifically, 88% of middle-skilled job losses since 1980s occurred during the periods of recession. In addition, jobless recoveries (periods after recessions when an increase in aggregate output is not accompanied by an increase in aggregate employment) are observed only in middle-skill jobs, which disappear during recessions.

Based on these findings, Hershbein and Kahn (2018) examine how skill requirements (namely, education, experience, cognitive, and computer skills) vary during a recession in 2008-2010 in the USA by examining job vacancies posted. As was expected, they find that skill requirements significantly increase in areas that suffered the most from the employment shocks compared to the same areas before the recession and areas that experienced smaller employment shocks. Specifically, employers start to require, with 16% higher probability, a higher education qualification and labor market experience, and, with 10% higher probability, possess cognitive and computer skills. Moreover, even after recovery, when the economy returned to that of the pre-recession period, the increase in skill requirements to jobs persists until the end of the authors' observations (2015), which indicates a structural shift in labor demand for high-skilled workers and in production towards the high-skilled in areas with larger employment shocks

during the recession.

Heterogeneity of Employers

Oreopoulos, Von Wachter, and Heisz (2012) find that by decomposing earnings losses into their sources lasting reductions in the quality of employers can explain up to 50 percent of persistent earnings losses. For college graduates, both mobility toward better firms and recovery within firms are important in adjustment to poor labor market conditions. These patterns also differ by worker types. Graduates at the top of the wage distribution catch up within two to four years, mostly by moving to better firms.

Liu, Salvanes, and Sørensen (2016) study this match channel in more detail. Over the business cycle, and using Norwegian data for 30 years (from 1986 to 2007) they analyze the matching between heterogeneous skills within each cohort of graduates and heterogeneous demand for skills by hiring industries, and find that skill mismatch is an important mechanism behind the persistent career loss resulting from graduating during recessions. Mismatch in this study is defined as a match of a worker to an industry that does not value her/his skill and is parametrized using relative wage premia across college majors and industries. This result highlights the important role of employer quality and, consequently, initial job placement and ensuing job mobility for the careers of young college graduates.

One source of employers heterogeneity that can contribute to an existing mismatch is the size of firm (reflected by number of employees), since size can be an indicator of unobserved characteristics including career opportunities, productivity etc. Arellano-Bover (2020) examines how heterogeneity of firms in size affect labor market outcomes of young workers entering the labor market. The author focuses on Spanish young workers (high school, vocational, and college graduates) during the period from 1984 to 2015 and, implementing an instrumental variable

strategy, finds that the increase in logarithm of size of the first placement of a worker is associated with a 27% increase in cumulative income. Additionally, this effect is very persistent and influences subsequent job matches as well since workers matched to small firms are initially “lower” on the job ladder. Through the size of the firm, the researcher also explains approximately 10% of earnings’ losses forced by entering the labor market during a recession since under poor economic conditions workers are more likely to match with smaller firms.

Employment

At the same time, Altonji, Kahn, and Speer (2016) show that losses of income are a combination of the reductions of hours and wage rate, while the effect on the probability of being employed is almost insignificant. This fact indicates that the longer unemployment, which was proposed as the main channel of a recession’s impact, does not force a decrease in graduates’ income. They also find small negative impacts on occupation quality, measured by the earnings return to the occupation, but, in contrast to Oreopoulos, Von Wachter, and Heisz (2012), no effect on occupation match quality, measured by whether the occupation is typical for one’s major.

Rothstein (2021) examines early and middle career outcomes (specifically, employment rate) of the US college graduates in the period surrounding the Great Recession. By using monthly repeated cross section data, the author estimates the following baseline model:

$$Y_{satc} = \alpha + \gamma_a + \delta_c + \zeta_s + \rho\lambda(p_{satc}) + \epsilon_{satc}, \quad (1.13)$$

where Y_{satc} is the employment rate of graduates in state s at age a in calendar year t from cohort c , where cohort is defined as the year of entering labor market (graduation). However, since the author does not have information on the year of entering the labor market, it is defined as the year when the individual achieved the age of 22 (the standard age of graduation from college). γ_a is age

fixed effects and δ_c captures cohort effect, which is the effect of the main interest for the author. ζ_s represents state fixed effects and $\lambda(p_{satc})$ is inverse Mills ratio for the state-cohort-age attainment rate. This ratio is included as the selection correction to address the problem of graduation age, which can differ from 22 years. After the estimation of this specification, the author adds to the model calendar year fixed effects, different interactions of the state unemployment rate in the year of graduation with dummy on age group and the average unemployment rate across states.

According to the estimation, the employment rate declines: the cohort who entered the labor market in 2010 (just after the Great Recession) had a two percentage points lower employment rate than those before the recession. Furthermore, the cohort that entered the labor market in 2015 (after economic recovery) has an employment rate three percentage points lower than pre-recession cohorts. At the same time, the tendency for wages is different. Although, the cohort of 2009 had approximately two percent lower wages compared to earlier cohorts, the wages returned to the pre-recession trend without further decline in the post-recession period.

Another issue relating to employment is self-employment. On the one hand, a decrease in number of vacancies and increase in skill requirements might force graduates to create startups. On the other hand, adverse economic conditions increase uncertainty about new business and volatility of its returns, which can make self-employment less attractive. Beiler (2017) examines the decision of German graduates from 2003 to 2010 regarding being self-employed vary over the business cycle. Specifically, the author estimates starting and closing the entrepreneurship during the first four years after graduation conditional on growth of employment (i.e. year-to-year growth of number of workers in each industry). The results of this estimation indicate that with the increase of field-specific employment the share of self-employed workers also increases by approximately 30%

in the first year. This indicates that the “luckier” cohorts, i.e. cohorts graduated under good economic conditions are more likely to create startups than their counterparts.

At the same time, academic graduates with a PhD degree could still change their trajectories, which might be reflected in labor market outcomes. Passaretta, Trivellato, and Triventi (2019) study how the employment of PhD graduates changes over the business cycle, using the example of Italian cohorts in 2004-2008. The authors find that although during a recession employment rate of individuals with PhD degree does not change statistically significantly in comparison with the pre-recession period, they are less likely to stay in academia and with higher probability (10 percentage point increase) have fixed-term contract in occupations related to research outside academia.

To sum up, the literature on this topic shows robust evidence that entering the labor market during a recession, which is associated with a 4 percentage point increase of the unemployment rate, has a strong negative impact on the future earnings of recent graduates, which accounts for approximately 10 percent reduction of annual earnings and persists for at least seven years after the entering the labor market. It happens mostly because of a decrease in the probability of being employed after graduation, reduction of hourly wages, and lower quality of employer-employee matches. This diminishment of quality includes a higher probability of being overeducated for the first job and lower probability of being employed in a larger firm, which is associated with fewer future prospects. At the same time, if individuals enroll in college in adverse labor market conditions, their future income increases compared to those enrolling in good economic conditions.

However, these findings are relevant for countries with student-paid fees, in which selection to tertiary education might differ from the selection in countries with mostly state-funded higher education. Furthermore, although the reduction

of annual earnings is also expected, the channels of the effect can be different, e.g. studies discussed above by analyzing the effect on job matches after the graduation, do not examine the effect of recession on the probability of being employed in “college” occupation. Taken together, these facts leave room for future research and constitute the main contribution of this study.

Chapter 2

Data and Methodology

2.1 Data

2.1.1 Individual-level Data

There is no database for the Czech Republic that contains information regarding income, year of college graduation, and field of study in college at the same time. Therefore, I use two different datasets for the analysis: the European Union Statistics on Income and Living Conditions (EU-SILC) and European Union Labor Force Survey (EU-LFS).

Income data

The EU-SILC contains information on households and individual levels regarding income, poverty, social exclusion, and living conditions. Income, education, labor information, health, etc., are measured at the personal level, collected through personal interviews with respondents older than 16 in all European countries. The survey is conducted on an annual basis (from 2005) and uses an integrated (rotational) design, which is a combination of changing a part of the sample from one year to the next and leaving the remainder unchanged. This helps to avoid the problem of sample attrition. I use the information from this survey for the Czech Republic.

This dataset does not contain information regarding the year of graduation and field of study. However, it is possible to observe when an individual changes their highest attained level of education from upper secondary to tertiary, indicated by the year of graduation. Therefore, I leave only individuals who changed this status in the dataset. Due to this problem, the latest year available for me is 2006, since I cannot observe whether the person graduated in 2005.

The EU-SILC contains a question on personal income (in Euros), which includes wages and salaries paid in cash for time worked in the main and any secondary or casual job(s), bonuses, fees, etc. This measurement of income adjusted for the 2015 price level (using the CPI from the OECD database¹) is the dependent variable of the model. Analyzing the effect on annual earnings, I consider only employed individuals, who comprise around 65% of my sample with graduates' earnings. Following Altonji, Kahn, and Speer (2016), I focus only on "valid" earnings, which is 1000 Euro in 2015 prices. The descriptive statistics of the graduates' earnings for each year is presented in Table 2.1. According to Table 2.1, there were several falls in averages of annual earnings in 2009 and in 2014.

Figure 2.1 represents the changes of average annual earnings of graduates by gender in the Czech Republic in 2006-2019. Overall, it can be seen that earnings fell significantly for both genders in 2009, which is the year after the world financial crisis, and in 2014, which indicates that the drop in earnings' averages from Table 2.1 was not forced only by one group. An important feature is that, over this period, there was always an earnings gap between males and females, which was largest in 2008 and smallest after the drop of earnings in 2009. This indicates that there is gender discrimination on the labor market in the Czech Republic in terms of earnings.

¹<https://data.oecd.org/price/inflation-cpi.htm> last assessed 01/06/2021

Table 2.1: Annual earnings of graduates in Euro in 2006-2019 adjusted for the 2015 price level

	Mean	Min	Max
2006	19304.59	3403.381	109398.9
2007	25328.06	6671.66	92543.81
2008	57397.14	3435.141	215268.5
2009	9426.279	1458.331	71406.66
2010	12948.46	1114.221	94999.45
2011	21062.15	1052.937	166820.2
2012	36397.8	1236.705	421147.3
2013	15629.3	1004.68	188730.5
2014	3738.687	1004.612	18007.1
2015	3208.559	1019.298	34894.44
2016	7009.116	1127.522	16788.99
2017	22349	5680.093	54726.31
2018	19562.34	1061.442	51438.94
2019	26324.45	4884.177	41960.12

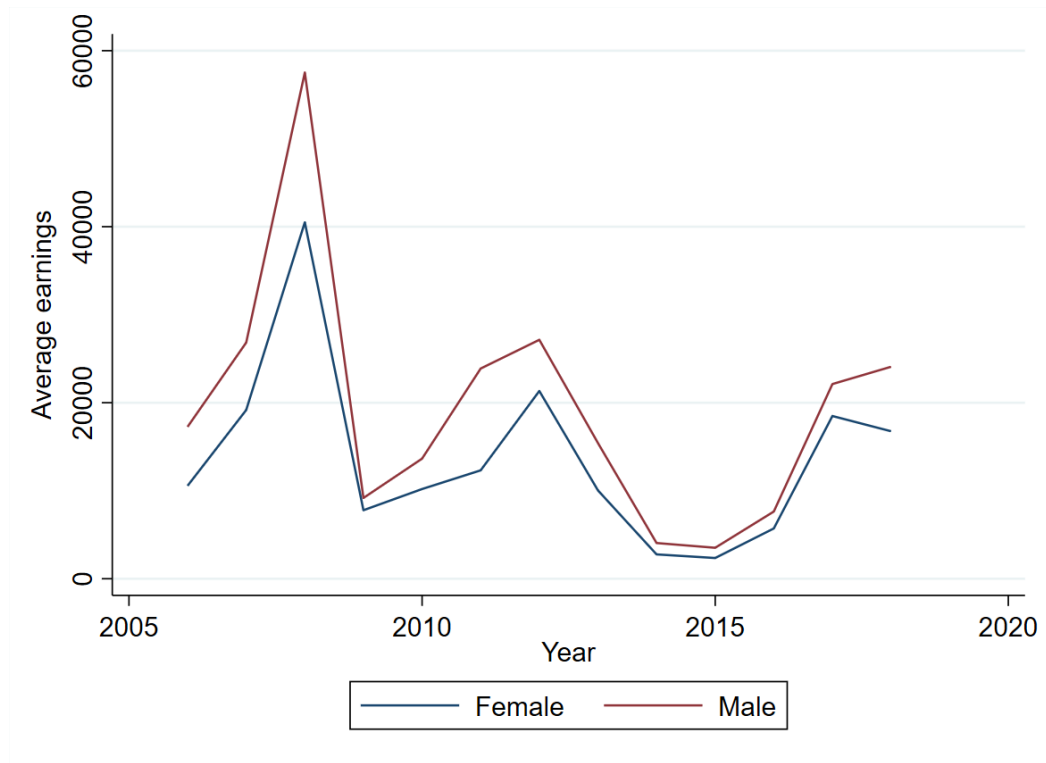
Note: The source of data is the EU-SILC. The statistics are presented for the sample of employed graduates in the Czech Republic not older than 35.

Employment data

The EU-LFS is a household survey that provides, for all EU countries, quarterly results on labor participation of people older than 15 and individuals not in the labor force. This dataset forms a representative sample, covering all occupations and industries. As for the SILC data, I use the Czech part of this database. The data collection, in general, started in 1983. However, for the Czech Republic, the latest data available is 1997, while, like the EU SILC, it becomes representative only in 2005.

The EU LFS contains information on the field of study, occupation, year of graduation, and employment status but does not contain variables for income.

Figure 2.1: Average annual earnings in Euro in the Czech Republic by gender in 2006-2019



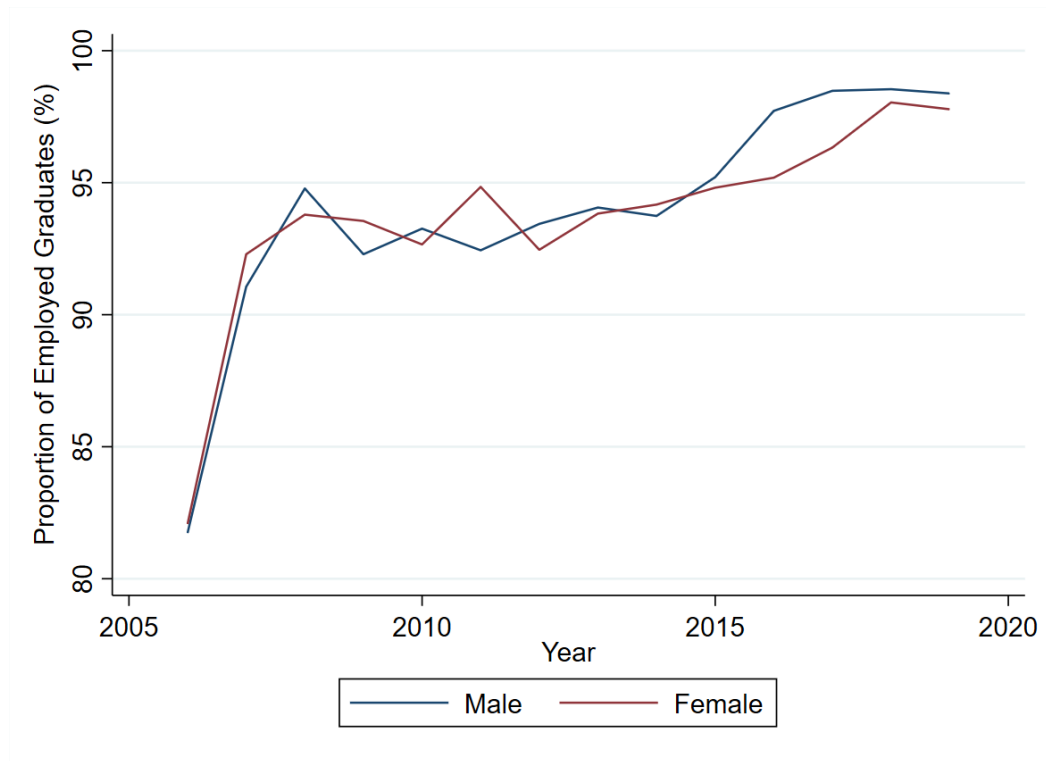
Note: The source of data is the EU-SILC. The picture presents trends for the sample of employed graduates in the Czech Republic not older than 35.

Therefore, I cannot use this dataset to analyze the impact of the economic conditions on earnings at the graduation year. However, I can estimate this impact on the probability of being employed after graduation. The employment rate of graduates by gender during 2006-2019 is presented in Figure 2.2.

According to Figure 2.2, trend in employment overall is increasing. However, there are periods with a decrease e.g. in 2009, which also corresponds to the drop of earnings from Figure 2.1. This could indicate that the probability of being employed might be a plausible channel for the earnings' reduction. It is worth noting that the trends for male and female graduates are very close and differ in values by maximum of 2-3 percentage points.

Initially, both datasets contained individuals who are included in the labor force, namely, those aged from 15 to 64. However, graduates older than 35

Figure 2.2: Proportion of graduates (%) employed in the Czech Republic in 2006-2019 by gender



Note: The source of data is the EU-LFS. The picture presents trends for the sample of graduates in the Czech Republic not older than 35.

are classified as non-standard since they already might have substantial working experience, and the effect of graduation in poor economic conditions for them will not be as significant as for younger cohorts. Therefore, I excluded them from the analysis.

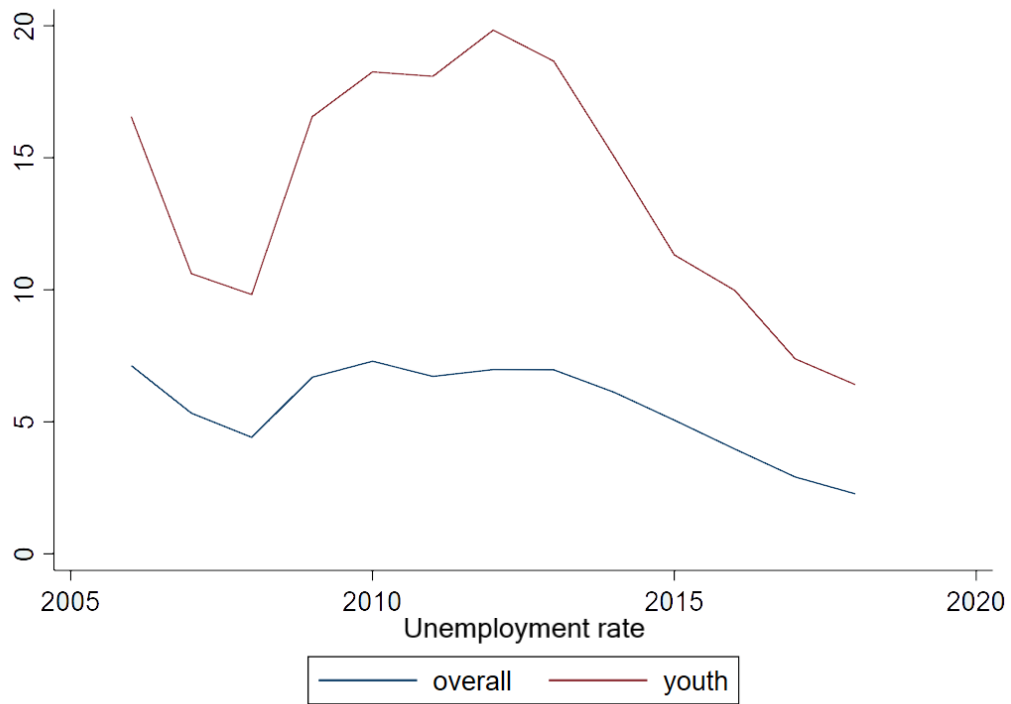
2.1.2 Macroeconomic Conditions at the Time of Graduation

As an indicator of economic conditions, I use the unemployment rate (both overall and youth) in the year of college graduation. The youth unemployment rate reflects the proportion of unemployed individuals aged 15-24 in the youth labor force. The overall unemployment rate is a share of all unemployed individuals in the labor force. The unemployment rate is a commonly used measure for economic conditions in the existing literature (Oreopoulos, Von Wachter, and Heisz, (2012), Altonji, Kahn, and Speer(2016), Bicakova, Cortes, and Mazza(2021)).

Data on the unemployment rates is from the OECD database².

Figure 2.3 plots trends of the youth and overall national unemployment rates in the Czech Republic for 2006-2019. According to Figure 2.3, both overall and youth unemployment rates in the Czech Republic had a downward trend in 2006-2008 with the lowest value in 2008, but then increased sharply in 2009 and remained on an upward trend until 2013. This was in line with trends in average graduate earnings.

Figure 2.3: Youth and overall unemployment rates in the Czech Republic in 2006-2019



Note: The source of data is the OECD database

2.2 Empirical strategy

2.2.1 Baseline model

In the literature, a labor market outcome is usually presented as a function of current labor market conditions, potential labor market experience, and the

²<https://data.oecd.org/unemp/unemployment-rate.htm> last assessed 30/06/2021

cohort of individuals. These three components cannot be identified separately in the model due to their connection. Specifically, cohort, which is the year of graduation with potential experience gives the current calendar year, which is used to control for current labor market conditions.

This problem is mostly solved by imposing restrictions on the cohort effect. Oreopoulos, Von Wachter, and Heisz (2012) firstly include a cohort trend in a linear and quadratic form, but then exclude it from their models, arguing that there can be a restriction of summing these effects to zero. Bicakova, Cortes, and Mazza (2021) include in their model a linear and quadratic forms of the cohort effect. Altonji, Kahn, and Speer (2016) and Kahn (2010) also do not control for cohort fixed effects in their models and state that including them does not affect their results.

The main focus of this research is the effect of economic conditions at graduation on labor market outcomes, namely earnings and employment status. Therefore, it is important for me to catch the cohort effect, where I define “cohort” as the year of graduation. However, labor market outcomes depend not only on the condition at graduation but also on the current conditions of the economy, which is indicated via the correspondence of changes in average earnings and the unemployment rate. Therefore, I need to account for the calendar year in the model. Adding these two effects into the model makes it impossible to identify the impact of potential experience (years since graduation). However, I can identify the age effect, since there is variation in the age of graduation. It also seems more reasonable to use age instead of potential experience because people could accumulate some experience before or during their time studying, which will be not captured just by years since graduation. Moreover, due to my data limitations, I do not have substantial variation in potential experience.

Following Bicakova, Cortes, and Mazza (2021), I assume a linear trend in the

long-term quality of the cohort and include it in a linear form instead of fixed effects, which would capture the effect of my main interest (unemployment rate), since it varies exactly by cohorts. Thus, the deviations of earnings of graduates over a business cycle around the long-term cohort trend define the cohort effect in my model. However, as a robustness check, I replace the linear cohort trend with a quadratic cohort trend following Oreopoulos, Von Wachter, and Heisz (2012).

Thus, I use the following specification to estimate the effect of the unemployment rate at graduation on labor market outcomes as a baseline:

$$Y_{it} = \alpha + \gamma X_{it} + \beta U_{c_i} + \lambda_1 age_{it} + \lambda_2 age_{it}^2 + \delta c_i + \tau_t + \epsilon_{it}, \quad (2.1)$$

where Y_{it} is labor market outcome measured in year t , for an individual i , U_c is the unemployment rate in graduation year, X_{it} is the set of control variables (which is reflected by gender and nationality), c_i is the cohort, defined as the year of college graduation for individual i , age_{it} is the age of the individual, and τ_t captures the calendar year effect (when the outcome is observed).

The main coefficient of interest is $\hat{\beta}$, which measures the impact of conditions on initial labor market outcomes (the year following graduation). As a robustness check, I use the overall unemployment rate in the year of graduation, replacing the quadratic functional form of age by age fixed effects (following Bicakova, Cortes, and Mazza's (2021) methodology), eliminating the cohort trend and replacing it with quadratic trend, and also adding fixed effects on the field of study. It is also worth noting that youth unemployment reflects a young group of people (aged 15-24) who are mostly unemployed, while by estimating the model for probability of being employed, I use employment for a different sample (aged 22-35). Thus, I do not use the same variable for both parts of the equation.

However, I only have information on the field of study to estimate the effect on the probability of employment, while in the model for earnings, this variable is

unobservable. To handle this issue, I replace the field of study fixed effects with the occupation fixed effects. However, this creates the problem of the possible selection into occupation based on unobservable characteristics, e.g., abilities. This could mean that the effect of the bad economic conditions (unemployment) will be captured only for individuals who were able to take a job in their field of study, i.e., for the best candidates, while other graduates could be hired in occupations for which they are overeducated. This could cause a loss of significance of the coefficient of interest or even a change in the direction of the impact of economic conditions.

To check whether this could be the case, I estimate the specification (2.1) for the probability of being employed in a “college” occupation. Such a division into “college” and “non-college” allows me to estimate the oversupply of college skills on the labor market. According to Gottschalk and Hansen (2003), “college” occupations value skills gained by workers in college, while “non-college” occupations do not value them. Therefore, when economic conditions worsen, graduates can still be employed, but not in the sectors for which they are valuable, due to the decreasing number of vacancies in the occupations corresponding to their field of study. In such a situation, the unemployment rate will negatively influence the probability of being employed in a “college” occupation.

2.2.2 Identification of “College” and “Non-College” Occupations

To divide occupations into “college” and “non-college”, I follow Pertold-Gebicka (2010) and Gottschalk and Hansen’s (2003) strategy. According to their approach, wages of college graduates in “college” occupations are higher than those of high school graduates in “college” occupations, and college graduates in “non-college” occupations. This can be detected through the wage premium paid to college graduates compared to workers with high school education only in each occupation, where both types of workers are employed.

Gottschalk and Hansen (2003) use the 10% level as the threshold for the wage premium of the U.S. college graduates i.e., they classify occupations as “college” if more educated workers have at least a 10% premium relative to less-educated workers. Pertold-Gebicka (2010), estimating the data for the Czech Republic, shows that increasing this level to 15% does not have an impact on the results. Therefore, I use a 10% premium threshold for my analysis.

If one category of workers dominates in an occupation (namely, contains more than 95% of all workers), this occupation is classified respectively to this prevailing type. However, there is no occupation in the Czech labor market, in which the fraction of college graduates is higher than 95% or even 85%. This fact was also shown by Pertold-Gebicka (2010). Therefore, I classify occupations in which more than 95% of workers have only a high school diploma as “non-college”, while “college” occupations are defined only through the wage premium.

To classify occupations based on the wage premium, I estimate the following equation for each 2-digit occupation ³ in which college graduates constitute at least 5% of the workforce:

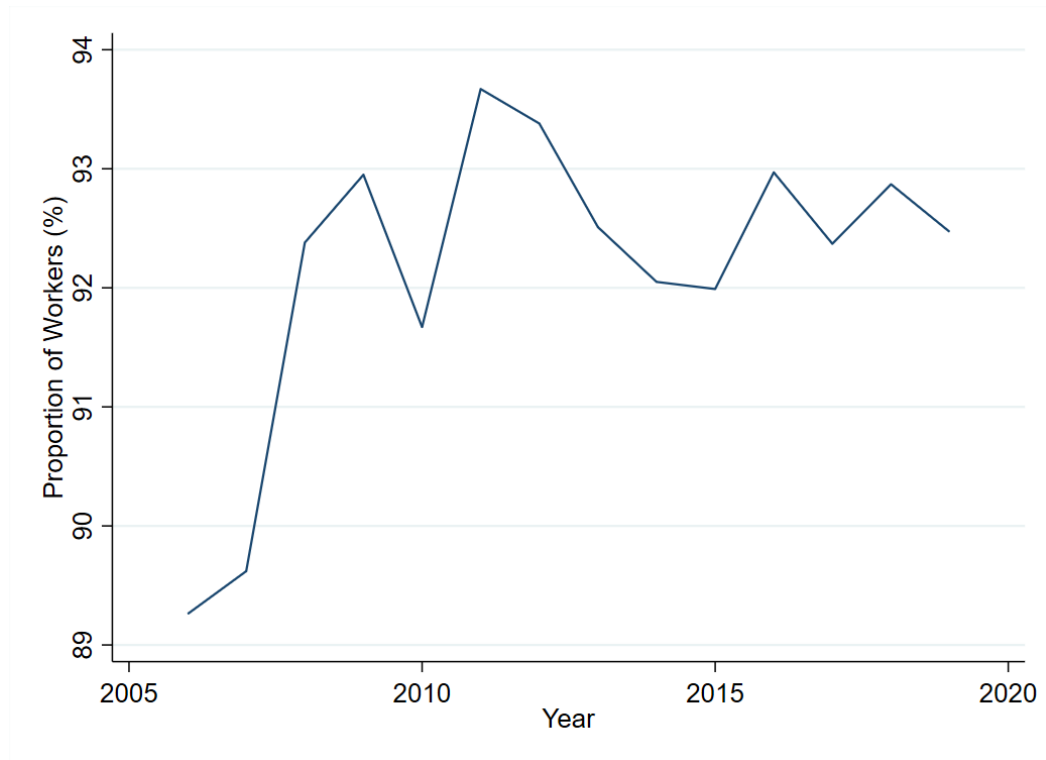
$$\ln Y_{ik} = \alpha + \beta_0 k \text{age}_i + \beta_1 \text{age}_i^2 + \gamma_k \text{coll}_i + \phi_k \text{gender}_i + \epsilon_{ik}, \quad (2.2)$$

where $\ln Y_{ik}$ is the logarithm of monthly earnings of the individual i in the occupation k , gender_{ik} is a dummy variable which is equal to 1 if the gender of the individual is male, and coll_{ik} is a dummy variable for obtaining college education. Therefore, the main coefficient of interest for classification (wage premium) is γ_k . If the hypothesis about $\hat{\gamma}_k > 0.1$ is not rejected on the 95% confidence level, this occupation is classified as “college”. Otherwise, the occupation is classified as “non-college”. The results of estimation for β 's, proportion of college graduates

³Since I have earnings only in one dataset (EU-SILC), which does not contain 3-digit occupation

in each occupation, and division by “college” and “non-college” occupations are presented in Appendix (Table A.1).

Figure 2.4: Proportion of graduates (%) in “college” occupations in the Czech Republic in 2006-2019



Note: The source of data is the EU-LFS. The graph presents trends for the sample of graduates in the Czech Republic not older than 35.

Figure 2.4 represents changes of proportion of graduates (in percentages) in “college” occupations for the 2006-2019 period. According to the graph, the overall proportion increases over time. The largest growth was in 2008, when the proportion of graduates rose from around 89% to approximately 93%. This increase also coincides with the decrease in the unemployment rates in 2006-2009. However, there are also tiny decreasing trends in shares of graduates in “college” occupations, for instance, in 2009-2010 (from 93% to around 91.5%) and 2011-2016 (from 93.5% to 92%). These tendencies also coincide with the increase in unemployment rates for this period, which could indicate that the economic conditions affect the probability of being employed in “college” sectors.

Table 2.2: Proportion of graduates (%) in “college” occupations by gender in 2006-2019

Year	Graduates in “college” occupations	
	Male	Female
2006	89.39	89.16
2007	91.32	88.10
2008	91.11	93.46
2009	92.33	93.56
2010	92.65	90.79
2011	93.58	93.73
2012	92.92	93.72
2013	91.60	93.23
2014	92.24	91.91
2015	90.23	93.36
2016	92.04	93.74
2017	92.06	92.64
2018	93.71	91.90
2019	92.19	92.81

Note: The source of data is the EU-LFS. The statistics are presented for the sample of employed graduates in the Czech Republic not older than 35.

Table 2.2 also represents the proportion of graduates in “college” occupations in the Czech Republic during the 2006-2019 period, but by gender. From this table, it can be seen that the increase in the proportion of all graduates in 2008 was forced by the share of females in “college” occupation. Specifically, the share of women in “college” sectors was more than 3 percentage points lower than that of men, in 2007. However, it suddenly rises from 88.10% in 2007 to 93.46% in 2008 and remains approximately equal to the male’s share (and sometimes larger) after this rise. This could have been forced by the overall increase in female employment in the labor market; however, according to Figure 2.2 there was no such spike in women’s employment as we can see for the employment in “college” occupations. This fact can indicate that the probability of being employed in “college” occupations for women can be higher than for men, demonstrating a negative sign for the male dummy, while for probability of being employed the gender will be statistically insignificant.

To sum up, I estimate the models as defined in specification (2.1) with three different dependent variables: annual earnings using the EU-SILC dataset, the probability of being employed, and the probability of being employed in the “college” occupation after graduation from college using the EU-LFS dataset. I define “college” occupation as an occupation which pays a college wage premium of at least 10%. I estimate the college wage premium based on specification (2.2) using the EU-SILC dataset. The results of these estimations and division into the “college” and “non-college” occupations are presented in Table A.1. As a robustness check, I replace the quadratic form of age with the age fixed effects, exclude the linear cohort trend and replace it with the quadratic cohort trend, and add major/occupation fixed effects.

I expect a statistically significant and robust negative effect of unemployment rates (both overall and youth) on all dependent variables. At the same time, the effect of gender might differ in the models, reflecting women’s lower annual earnings and the lack of discrimination in probability of being employed.

Chapter 3

Results and Discussion

3.1 Effect on Earnings

Table 3.1 reports the estimation results of the impact of graduating into a recession on earnings of the baseline model for the overall unemployment rate and youth unemployment. The coefficients of interest are negative and highly significant. They show that an increase in overall unemployment of one percentage point causes a 4.4% decrease in annual earnings in the first year after graduation. The same increase in the youth unemployment rate reduces annual earnings by 2% in the first year after graduation. To sense the magnitude of this result, if the youth unemployment rate increases by 4 percentage points, which is approximately one standard deviation in my sample and the level associated with recession, the annual earnings of this year's graduates will decrease by 8% in the first year after graduation. This finding is in line with Altonji, Kahn, and Speer's (2016) and Oreopoulos, Von Wachter, and Heisz's (2012) results, representing a roughly 10% reduction of earnings during a recession (associated with a 4 percentage points increase in the unemployment rate) in the first year.

Tables 3.2 and 3.3 report the robustness check estimation for the youth and overall unemployment rates, respectively. Firstly, I estimate the model with age fixed effects instead of a quadratic functional form. The coefficients of interest in these specifications remain negative and statistically significant. The reduction

Table 3.1: Annual earnings and unemployment rates at time of graduation

Outcome: Log annual earnings		
	Overall	Youth
Unemployment	-0.044** (-2.01)	-0.020*** (-4.83)
Age	0.261*** (13.11)	0.260*** (13.08)
Age ²	-0.004*** (-11.12)	-0.003*** (-11.09)
Cohort Effect	-0.021*** (-1.37)	-0.025* (-1.66)
Male	0.415*** (26.24)	0.415*** (26.22)
Observations	5428	5428
R ²	0.7283	0.7285

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The dependent variable for both specifications is a logarithm of annual earnings of graduates in Euros adjusted for the 2015 price level. The sample includes college graduates not older than 35. The data source is the EU-SILC. Both specifications include year fixed effects.

of earnings in this specification are in the same range: 1.8% and 4% for the youth and overall unemployment rates, respectively.

The second and third columns of Tables 3.2 and 3.3 present estimation results for the specification without including the cohort effect in the model and replacing it with the quadratic cohort trend. Since specification without cohort trend does not account for an important source of variation, which might be connected to the trend in unemployment rate, this result is expected to be biased. This explains the loss of the level of significance of the overall unemployment rate and a slight decrease in the effect to 1.5% from 2% and to 3% from 4% in the specifications without cohort trend. At the same time, replacing the linear cohort trend with the quadratic cohort trend also slightly decreases the coefficient in the model

with the youth unemployment rate to around 1.6%. However, all these estimates are quantitatively very close to each other and still remain statistically significant.

The last columns of Tables 3.2 and 3.3 demonstrate the results of estimating the model with the fixed effects for occupation. It was expected that the direction of the impact will change due to potential selection problem. However, it is still negative for both unemployment rate measures. Moreover, for the youth unemployment rate the effect is significant at a 10% level of significance and demonstrates an estimate that is close to the baseline specification: 1.2% reduction. Thus, these variations of the model prove that the results obtained are robust.

Table 3.2: Annual earnings and youth unemployment rate at time of graduation: robustness check

Outcome: Log annual earnings				
Youth unemployment rate				
	Age fixed effects	No cohort effect	Quadratic cohort trend	Occupation fixed effects
Unemployment rate	-0.018*** (-2.61)	-0.015** (-2.34)	-0.016** (-2.03)	-0.012* (-1.66)
Age		0.261*** (13.10)	0.364*** (10.39)	0.164*** (7.28)
Age ²		-0.003*** (-11.13)	-0.005*** (-8.96)	-0.002*** (-5.83)
Cohort Effect	-0.020 (-1.41)		-1.231 (0.09)	-0.031* (-1.56)
Male	0.418*** (26.49)	0.414*** (26.19)	0.335*** (19.88)	0.359*** (16.97)
Observations	5428	5428	5428	4096
R ²	0.7315	0.7284	0.7572	0.6950

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The dependent variable for all these specifications is a logarithm of annual earnings of graduates in Euros adjusted for the 2015 price level. As an indicator of economic conditions, the youth unemployment rate is used. The sample includes college graduates not older than 35. The data source is the EU-SILC. All four specifications include year fixed effects.

Overall, my results consistently indicate that the earnings of Czech workers graduating during poor economic conditions are lower than those of cohorts who

Table 3.3: Annual earnings and overall unemployment rate at time of graduation: robustness check

Outcome: Log annual earnings				
Overall unemployment rate				
	Age fixed effects	No cohort effect	Quadratic cohort trend	Occupation fixed effects
Unemployment rate	-0.040** (-1.84)	-0.031* (-1.56)	-0.040* (-1.45)	-0.025 (-1.12)
Age		0.261*** (13.12)	0.382*** (9.72)	0.164*** (7.28)
Age ²		-0.004*** (-11.14)	-0.006*** (-8.28)	-0.002*** (-5.83)
Cohort Effect	-0.017 (-1.13)		-5.637 (-0.37)	-0.030 (-1.46)
Male	0.419*** (26.51)	0.415*** (26.22)	0.378*** (19.80)	0.359*** (16.97)
Observations	5428	5428	5428	4096
R ²	0.7313	0.7282	0.7293	0.6949

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The dependent variable for all these specifications is a logarithm of annual earnings of graduates in Euros adjusted for the 2015 price level. As an indicator of economic conditions, the overall unemployment rate is used. The sample includes college graduates not older than 35. The data source is the EU-SILC. All four specifications include year fixed effects.

graduated during better economic conditions. Moreover, the effect is very close to that found by Oreopoulos, Von Wachter, and Heisz (2012) for Canadian workers and Altonji, Kahn, and Speer (2016) for American workers, but lower than the effect presented by Kahn (2010) for American workers who graduated in the 1980's recession, which showed a reduction of approximately 20%. This indicates that although there are significant data limitations, the results are reliable and confirm previous findings.

3.2 Effect on Employment

Table 3.4 reports the estimation results of the impact of graduating into a recession on the probability of being employed and being employed in the “college” occupation of the baseline model for the overall unemployment rate and youth

unemployment. The first two columns reflect the estimation with the youth unemployment rate as an indicator of economic conditions, while the last two reflect the estimation with the overall unemployment rate. Both coefficients of interest are negative and highly significant. According to them, an increase in the youth unemployment rate by 1 percentage point leads to a 0.0011 reduction of the probability of being employed and a 0.0018 reduction of the probability of being employed in an occupation with a wage premium for college education. The same increase in the overall unemployment rate reduces the chances of being employed and being employed in a “college” occupation, by 0.003 and 0.0055 respectively.

Table 3.4: Probability of being employed/being employed in a “college” occupation and unemployment rate at time of graduation

	Youth		Overall	
	Pr(“college”)	Pr(employed)	Pr(“college”)	Pr(employed)
Unemployment rate	-0.0018*** (-3.84)	-0.0011** (-2.31)	-0.0055** (-2.49)	-0.003** (-2.01)
Age	0.074*** (10.88)	0.039*** (8.32)	0.074*** (10.88)	0.039*** (8.32)
Age ²	-0.001*** (-9.84)	-0.00062*** (-7.90)	-0.001*** (-9.85)	-0.00059*** (-7.45)
Cohort effect	-0.009*** (-7.48)	-0.0086*** (-10.43)	-0.0095*** (-7.72)	-0.0089*** (-10.48)
Male	-0.027*** (-5.47)	-0.004 (-1.18)	-0.027*** (-5.47)	-0.004 (-1.17)
Observations	17990	17990	17990	17990
R ²	0.0280	0.0340	0.0279	0.0339

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The dependent variables are the probability of being employed and probability of being employed in “college” occupation (defined as having a wage premium for college education higher than 10%). The sample includes college graduates not older than 35. The data source is the EU-LFS. All specifications include year fixed effects and dummy for nationality (1 - for being Czech, 0 - otherwise).

Robustness checks of the results are presented in Tables 3.5-3.8. Table 3.5

reports the results of a robustness check for the model of the probability of being employed with the youth unemployment rate as the dependent variable. All specifications demonstrate a negative and quantitatively almost the same impact, specifically, an approximately 0.001 reduction of probability with the 1 percentage point increase in the unemployment rate at the 5% level of significance. The only coefficient, which is significant only at 10% level is from the specification without cohort trend, which, as was discussed in Section 2.2, can be explained through the loss of important source of variation of the dependent variable.

Table 3.5: Probability of being employed and youth unemployment rate: robustness check

Outcome: Probability of being employed				
Youth unemployment rate				
	Age fixed effects	No cohort effect	Quadratic cohort trend	Major fixed effects
Unemployment rate	-0.0011** (-2.30)	-0.0008* (-1.67)	-0.0011** (-2.32)	-0.0011** (-2.42)
Age		0.042*** (8.91)	0.039*** (8.32)	0.0408*** (8.74)
Age ²		-0.0006*** (-7.49)	-0.0006*** (-7.45)	-0.0006*** (-7.90)
Cohort effect	-0.0089*** (-10.75)		-4.748*** (-5.97)	-0.0087*** (-10.52)
Male	-0.004 (-1.17)	-0.004 (-1.03)	-0.004 (-1.31)	0.0024 (0.63)
Observations	17990	17990	17990	17990
R ²	0.0344	0.0281	0.0340	0.0387

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The dependent variable is the probability of being employed. The main regressor is the youth unemployment rate. The sample includes college graduates not older than 35. The data source is the EU-LFS. All specifications include year fixed effects and dummy for nationality (1 - for being Czech, 0 - otherwise).

The same pattern is presented in Table 3.6, which reflects the specification with the overall unemployment rate. Coefficients in the specifications with major fixed effects, quadratic cohort trend, and age fixed effects are quantitatively the same and all are statistically significant. However, the coefficient in the specifica-

tion without the cohort effect becomes positive and insignificant. This can occur because of same reason as in Table 3.5 for this specification: a significant part of the variation, which is important for dependent variable, is not included in the estimation.

Overall, the robustness checks show that the increase in the unemployment rate causes a robust decrease in the probability of being employed by 0.001 for the youth unemployment rate and 0.003 for the overall unemployment rate. This effect is much smaller than Oreopoulos, Von Wachter, and Heisz (2012) have found (-0.0098). However, the coefficient is statistically significant at at least a 5% level of significance, in contrast to Altonji, Kahn, and Speer (2016), who find the effect on employment insignificant. This indicates that in the Czech Republic, a decrease in the probability of being employed is a plausible channel of the reduction of graduates' earnings. It is worth noting that, as was expected, there is no effect of gender on the probability of being employed, i.e., women do not face discrimination in employment after graduation but experience it in terms of price for their labor (significantly positive coefficient for Male dummy in Table 3.1 and robustness checks to it).

Tables 3.7-3.8 demonstrate the robustness checks for models of the probability of being employed in the “college” sector. For the youth unemployment rate, the effect is significant and quantitatively the same in all specifications, except, again, the model without cohort trend, which demonstrates a bit lower impact compared to other specifications. Specifically, as in the baseline estimation, an increase in the unemployment rate by 1 percentage point causes a roughly 0.002 decrease in probability of being employed in “college” occupations.

For the overall unemployment rate, the effect is also negative in all specifications except the one discussed. The specification without a cohort effect represents the effect, which is not significant and quantitatively by 0.004 percentage

Table 3.6: Probability of being employed and overall unemployment rate: robustness check

Outcome: Probability of being employed				
Overall unemployment rate				
	Age fixed effects	No cohort effect	Quadratic cohort trend	Major fixed effects
Unemployment rate	-0.0030** (-2.01)	0.0009 (0.62)	-0.0030** (-2.01)	-0.0032** (-2.11)
Age		0.041*** (8.85)	0.039*** (8.32)	0.0408*** (8.73)
Age ²		-0.0006*** (-7.45)	-0.0006*** (-7.45)	-0.0006*** (-7.90)
Cohort effect	-0.0093*** (-10.80)		-4.691*** (-6.07)	-0.0089*** (-10.59)
Male	-0.004 (-1.17)	-0.004 (-1.04)	-0.004 (-1.17)	0.002 (0.64)
Observations	17990	17990	17990	17990
R ²	0.0343	0.0280	0.0359	0.0504

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: t statistics is in parentheses. The dependent variable is the probability of being employed. The main regressor is the overall unemployment rate. The sample includes college graduates not older than 35. The data source is the EU-LFS. All specifications include year fixed effects and dummy for nationality (1 - for being Czech, 0 - otherwise).

points less than the baseline estimation. This can happen because the probability of being employed in “college” occupations accounts for the positive trend in cohort quality, since employers choose to pay a wage premium for tertiary education only to the “best” candidates. Therefore, not accounting for the cohort effect at all leads to a partial decrease in the effect. However, as was discussed earlier, the specification without a cohort effect at all is likely to be biased, which can be confirmed by other robustness checks specifications.

It is also worth noting that, as was expected, in all specifications the coefficient for the male dummy is negative, which reflects the lower probability of being employed in the “college” sector after graduation from college for men. This can be explained by the fact that the popularity of some male-dominated majors increases across women during the recession (Blom, Cadena, and Keys

Table 3.7: Probability of being employed in a “college” occupation and youth unemployment rate: robustness check

Outcome: Probability of being employed in “college” occupation				
Youth unemployment rate				
	Age fixed effects	No cohort effect	Quadratic cohort trend	Major fixed effects
Unemployment rate	-0.0018*** (-2.65)	-0.0015** (-2.21)	-0.0018*** (-2.67)	-0.0016** (-2.35)
Age		0.077*** (11.31)	0.074*** (10.82)	0.074*** (10.85)
Age ²		-0.0011*** (-9.87)	-0.0011*** (-9.87)	-0.0011*** (-9.85)
Cohort effect	-0.0098*** (-7.98)		-3.374*** (-2.90)	-0.0091*** (-7.63)
Male	-0.027*** (-5.47)	-0.027*** (-5.37)	-0.028*** (-5.54)	-0.021*** (-3.92)
Observations	17990	17990	17990	17990
R ²	0.0287	0.0250	0.0284	0.0504

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: *t* statistics is in parentheses. The dependent variable is the probability of being employed in “college” sector (defined as having a wage premium for college education higher than 10%). The main regressor is the youth unemployment rate. The sample includes college graduates not older than 35. The data source is the EU-LFS. All specifications include year fixed effects and dummy for nationality (1 - for being Czech, 0 - otherwise).

(2015), Liu, Sun, and Winters (2019)). Therefore, the supply of female graduates in these fields (e.g. STEM) rises. At the same time, occupations associated with these fields pay a significant college wage premium. This might lead to the higher probability of women to be employed in “college” sectors, which together with the lack of (or slower) increase in corresponding supply across men causes a significant negative sign for the gender coefficient.

Thus, the robustness checks confirm the estimation of my baseline specification. Specifically, I find consistent and significant estimates for the reduction of probability of being employed in a “college” occupation during the recession, which account for a 0.008 decrease in probability with a 4 percentage point increase in the youth unemployment rate and a 0.02 decrease in probability with

Table 3.8: Probability of being employed in a “college” occupation and overall unemployment rate: robustness check

Outcome: Probability of being employed in “college” occupation				
Overall unemployment rate				
	Age fixed effects	No cohort effect	Quadratic cohort trend	Major fixed effects
Unemployment rate	-0.0054** (-2.50)	-0.001 (-0.51)	-0.0055** (-2.49)	-0.0046** (-2.13)
Age		0.077*** (11.27)	0.074*** (10.88)	0.074*** (10.85)
Age ²		-0.0011*** (-9.85)	-0.0011*** (-9.85)	-0.0011*** (-9.86)
Cohort Effect	-0.010*** (-8.21)		-3.466*** (-3.06)	-0.010*** (-7.80)
Male	-0.027*** (-5.46)	-0.027*** (-5.36)	-0.028*** (-5.54)	-0.021*** (-3.92)
Observations	17990	17990	17990	17990
R ²	0.0287	0.0247	0.0285	0.0504

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: *t* statistics is in parentheses. The dependent variable is the probability of being employed in a “college” sector (defined as having a wage premium for college education higher than 10%). The main regressor is the overall unemployment rate. The sample includes college graduates not older than 35. The data source is the EU-LFS. All specifications include year fixed effects and dummy for nationality (1 - for being Czech, 0 - otherwise).

the same increase in the overall unemployment rate.

To sum up, in line with the existing literature, my results demonstrate a significant negative effect on the labor market outcomes of graduates entering the labor market at the time of poor conditions. First of all, in the first year after graduation, individuals who entered the labor market during a recession associated with a 4 percentage point increase of the unemployment rate experience approximately a 10% reduction in earnings, which is consistent with the estimates from the literature. Although the evidence for some channels of this effect is controversial, I find that the reduction of probability of being employed is a plausible explanation of existing earnings’ reduction in the Czech Republic framework. The recession has a significant negative impact on this probability

for the Czech graduates. Additionally, this effect does not vary across genders in contrast to earnings, which indicate substantial gap between men and women.

Moreover, as the quality of job-worker match is classified as an important channel of the earnings reduction, I find that the probability of being employed in an occupation which pays a college wage premium is also affected by the conditions of the labor market at the time of entering it after graduation from college. Specifically, during a recession, this probability significantly diminishes, which might influence annual earnings not only in the first year after graduation, but also earnings in the long-term, which I cannot estimate due to existing data limitations. Thus, future research on this topic is needed.

Conclusion

Estimation of the impact of a recession on the welfare of individuals is impossible without understanding the effect of the recession on their labor market outcomes. The decisions individuals make during their studies and in the first few years after graduation regarding the investment of their human capital play a crucial role in their future income (Becker, 1967). Therefore, recent graduates are especially sensitive to economic fluctuations because the number of vacancies decreases during the recession, which is associated with an increase in overall and youth unemployment. Consequently, graduates can face a lower probability of finding a job match that is appropriate to their level, or spend more time unemployed. This causes negative consequences not only for individuals, but also for society and the whole economy of the country, through significant losses in efficiency. Moreover, efficiency losses for countries which are state-funded at each level of the education system might be significantly higher, because the state finances education for fields with an oversupply of workers and then underfinances fields with an undersupply, increasing imbalances in the labor market.

In this thesis, I study the labor market outcomes' consequences of graduating from university in poor economic conditions, specifically the high unemployment rate in the Czech Republic, a country with mainly state-funded tertiary education. Czech workers with higher education have quite insignificant advantages in employment: their employment rate is only 4 percentage points higher than for adults without tertiary education (OECD, 2019), which makes recent college graduates in the Czech Republic especially sensitive to business cycle fluctua-

tions. For the analysis, I use both the overall and youth unemployment rates as an indicator of economic conditions and annual earnings, probability of being employed, and probability of being employed in a “college” occupation (defined as an occupation with at least a 10% college wage premium for workers) as labor market outcomes. Most of the analysis pools information on the graduating cohorts of 2006-2015, which captures the period of financial crisis in 2008 and consequent years in the Czech Republic.

I find that poor labor market conditions at the beginning of the career lead to a decrease in labor market outcomes in the Czech Republic. For college graduates, on average, the reduction of earnings caused by a 4 percentage points increase in the youth unemployment rate is around 8% during the first year after graduation. Despite the relatively low number of observations compared to analogous studies for the USA and Europe, this result is consistent with the existing literature, showing a slightly smaller effect than the USA and Canada. In addition, recent graduates face a 0.001 lower probability of being employed and a 0.0018 lower probability of being employed in “college” occupations during the recession. These results are robust to the different specifications of the models. At the same time, due to existing data limitations, I cannot estimate the long-run effect of recession on earnings and other channels which can cause it, which leaves room for future research.

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Appendix A

Attachments

Table A.1: Occupation-specific percentage of college graduates, estimates of college wage premium, and classification into “college” and “non-college” occupations

Occupational group	% College	Premium	“College”
Chief executives, senior officials and legislators	52.31	0.262	1
Administrative and commercial managers	52.88	0.339	1
Production and specialized services managers	38.30	0.340	1
Hospitality, retail and other services managers	14.33	0.198	1
Science and engineering professionals	76.15	0.172	1
Health professionals	68.07	0.490	1
Teaching professionals	72.86	0.223	1
Business and administration professionals	60.87	0.242	1
Information technology professionals	70.73	0.234	1
Legal, social and cultural professionals	77.31	0.133	1

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Table A.1 – continued from previous page

Occupational group	% College	Premium	“College”
Science and engineering associate professionals	16.29	0.209	1
Health associate professionals	15.12	0.183	1
Business and administration associate professionals	27.39	0.212	1
Other associate professionals	19.11	0.208	1
Information and communications technicians	23.83	0.221	1
General and keyboard clerks	9.10	0.239	1
Customer services clerks	8.21	0.294	1
Numerical and material recording clerks	9.04	0.211	1
Other clerical support workers	14.29	0.291	1
Personal service workers	2.12	0.318	0
Sales workers	2.03	0.230	0
Personal care workers	3.74	0.203	0
Protective services workers	7.75	0.314	1
Market-oriented skilled agricultural workers	2.32	0.390	0
Market-oriented fishing and hunting workers	3.03	-0.092	0
Building and related trades workers	0.36	0.829	0
Metal, machinery and related trades workers	0.75	0.154	0
Handicraft and printing workers	2.22	0.401	0

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Table A.1 – continued from previous page

Occupational group	% College	Premium	“College”
Electrical and electronic trades workers	1.59	0.277	0
Other craft workers	1.37	0.214	0
Stationary plant and machine operators	0.59	0.421	0
Assemblers	0.59	0.356	0
Drivers and mobile plant operators	0.44	0.155	0
Cleaners and helpers	0.46	0.090	0
Agricultural, forestry and fishery labourers	0.67	0.388	0
Labourers in construction and transport	0.56	-0.050	0
Food preparation assistants	1.64	-0.366	0
Refuse workers and other elementary workers	1.29	-0.436	0