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Ex-prisoners and the Labour Market in the Czech Republic

Bachelor thesis

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Abstract

Unemployment rate is a key macroeconomic indicator of a state's prosperity. This study aims to investigate the effect of ex-prisoners on unemployment rate at times of low rate of unemployment. The subjects of interest are those released from prison upon serving their sentence and their integration into the labour market. Currently, formerly incarcerated individuals are often socially rejected and discriminated by the public, which usually results in their return to prison. Thus, as a means to prevent recidivism, it is important to reintegrate them back into the society. In this vein, this study also examines the effect of unemployment rates and ex-prisoners on the recidivism rate in the Czech Republic in 1992 to 2018. For the 2014 to 2018 period, it further investigates this effect (i.e. of unemployment rates and ex-prisoners on recidivism rates) by month across 13 regions (there is no prison in the Zlín region). It uses the data provided by the Prison Services Yearbooks, as well as data from the Czech Statistical Office and the Integrated Portal of the Ministry of Labour and Social Affairs for information specifically regarding the main macroeconomic indicators of the Czech Republic. The results of the various models run indicate no significant effect of released prisoners on unemployment rate. However, the prison population size (i.e. those not yet released) did show an effect on unemployment and recidivism rates. Results also indicate that the recidivism rate is affected by unemployment rate, with panel data analysis showing a higher and more reliable effect.

Keywords: unemployment rate, prisoners, ex-prisoners, recidivism rate, Czech Republic, regions

Range of thesis: 75 911 characters with spaces

Abstrakt

Míra nezaměstnanosti je jedním z klíčových makroekonomických ukazatelů, co se prosperity státu týče. Cílem této studie je ukázat, jaký efekt na míru nezaměstnanosti mají propuštění vězni v době nízké míry nezaměstnanosti. Bodem zájmu jsou tedy osoby propuštěné z výkonu trestu odnětí svobody a jejich integrace na trh práce. Tyto osoby většinou nejsou akceptovány společností a jsou diskriminovány ostatními, což většinou vyústí do znovu spáchání trestu a navrácení zpět do vězení. Aby se předešlo zmíněné recidivě, je důležité tyto osoby integrovat do společnosti. Bakalářská práce zkoumá efekt propuštěných osob z výkonu trestu odnětí svobody na míru nezaměstnanosti a následně efekt míry nezaměstnanosti na míru recidivy těchto osob v České republice od roku 1992. Navíc je zkoumán efekt změny stavu počtu vězňů a míry nezaměstnanosti na míru recidivy skrze 13 kraji (ve Zlínském kraji se nevyskytují žádné věznice) pomocí měsíčních dat v období 2014-2018. Studie používá hlavně data ze statistických ročenek Vězeňské služby ČR. Dále používá také volně dostupná data z Českého statistického úřadu a Integrovaného portálu Ministerstva práce a sociálních věcí, kde jsou k nalezení hlavní makroekonomické ukazatele České republiky. Výsledky nevykazují výrazný efekt propuštěných osob z výkonu trestu odnětí svobody na míru nezaměstnanosti. Nicméně ukázaly příznačný efekt na míru nezaměstnanosti a recidivy ze strany stále uvězněných osob. Dále bylo zjištěno, že míra recidivy je ovlivňována mírou nezaměstnanosti. Tento vliv byl nejvíce zpozorován ze zkoumání pomocí panelových dat.

Klíčová slova: míra nezaměstnanosti, vězni, ex-vězni, míra recidivy, Česká republika, kraje

Declaration of Authorship

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

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

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

Prague, 31 July 2019 **Klára Kantová**

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Bachelor's Thesis Proposal

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Notes: Please enter the information from the proposal to the Student Information System (SIS) and submit the proposal signed by yourself and by the supervisor to the Academic Director ("garant") of the undergraduate program.

Proposed Topic:

Ex-prisoners and the Labour Market in the Czech Republic

Preliminary scope of work:

Research question and motivation

As we know, growing unemployment rate is a worldwide problem. The question is, how could it get better? In my Bachelor Thesis, I want to show how countries can improve their unemployment rate thanks to the inactive part of population. I will focus on ways how to increase employment through the return of an inactive labour force on labour market.

The fact is that inactive part of the population does not affect the unemployment rate, since the ration depends on the number of unemployed people, employed people and the labour force. However, I would like to focus on the part of the population that is not included in labour force – the inactive people. Despite this fact, we can decrease the unemployment rate thanks to them. Integration of inactive people strongly depends on the social policies of each country. Social policy is concerned with societies in different countries dealing with human needs for security, education, work, health and wellbeing. Talking about child and family support, schooling and education, income maintenance and poverty reduction and, what is the most important for my thesis, unemployment support and training, pensions, health and social care.

People excluded from the labour market face barriers to participate. Social businesses are here to help them feel like normal non-handicapped people and try to involve them in basic activities. Social businesses are self-sustainable and independent of any donations. These organizations are not run for a profit but for a sustainable solution of the problem and that is why the potential gained profit is usually invested back into this business.

One of the groups excluded from the labour market are disabled people. There are two points

of view how countries look at this group. First one says that disabled person is just as productive and employable as anyone else. This opinion is held for example in Great Britain. In Germany, on the other hand, they claim that disabled people are not likely to be as productive as the others. The question is, which opinion is better for the country's future prosperity?

Contribution
The goal of my Bachelor Thesis is to introduce the problem of excluded people from the labour market. Point out the differences in social policies across the countries and refute the distorted view that disabled people are less likely to be productive than non-disabled ones. The aim of this work is to be aware of that the growing unemployment rate could be reduced by integrating disabled people to the labour force.

Methodology
I will use basic regression models according to Wooldridge to identify factors and policies increasing the employment rate of people excluded from the labour market.

Data
The main data sources will be the Eurostat database and Czech statistical office.

Outline
1. Introduction
2. Characteristic of social policies across EU countries
3. Social business
4. Czech Republic
5. Methodology
6. Data description
7. Conclusion
8. Literature review

List of academic literatures:

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Contents

List of Figures

List of Tables

Acronyms

ADF	Augmented Dickey-Fuller Test
BGW	Breusch-Godfrey/Wooldridge Test
BP	Breusch-Pagan Test
CZSO	Czech Statistical Office
DW	Durbin Watson Test
EU	European Union
Eurostat	Eurostat Database
FE	Fixed Effects Regression Model
GDP	Gross Domestic Product
id	identically distributed
iid	independently and identically distributed
KPSS	Kwiatkowski-Phillips-Schmidt-Shin Test
LM	Lagrange Multiplier
MLSA	Ministry of Labour and Social Affairs
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
RE	Random Effects Regression Model
Rubikon	Rubikon centrum, z.s.
SW	Shapiro-Wilk Test

Introduction

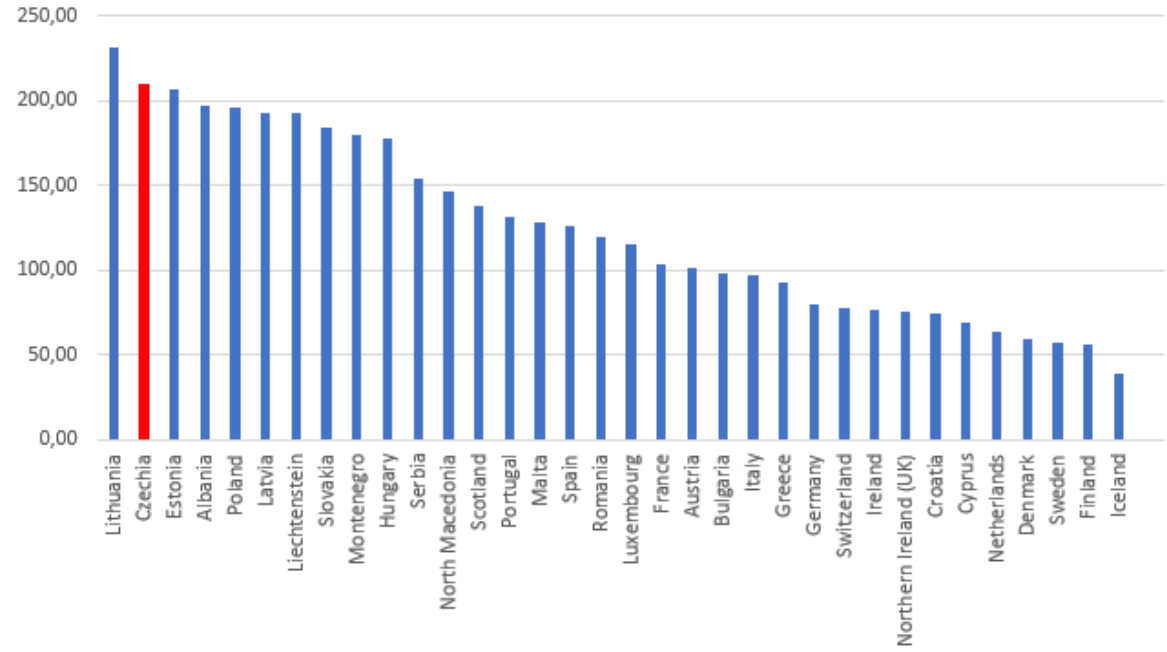
The Czech Republic has a significant issue with the extensive scale of its prison population. According to Dušek (2015), Czech prisons are overcrowded. This problem places a long-lasting burden on the Czech economy. An increase in severity of the new penal code has resulted in a steady increase of the prison population by 2,000 prisoners per year. This has led to a rise in the state budget expenditure by approximately CZK660 million per year.

The total number of prisoners held in Czech prisons was 22,159 in 2017. In comparison with the other EU countries, the Czech Republic ranks 7th for the highest total number of prisoners. Compared to Slovakia this number is more than twice as high (2,21 to be precise). However, to better understand the issue, a more suitable indicator would be the total number of incarcerated persons per hundred thousand inhabitants. That is, the statistic for the total number of prisoners on its own is misleading and does not provide any useful insight as population size varies across countries. In this vein, among EU states, the Czech Republic had the second largest prison population in relation to overall population size with 209.47 prisoners per 100,000 inhabitants in 2017. More prisoners per 100,000 inhabitants were recorded only in Lithuania. To compare, Slovakia had 184.5 prisoners per 100,000 inhabitants, which is about 12% less than in the Czech Republic.[1]

Figure 1 summarizes the aforementioned indicator of the actual number of persons held in a prison per hundred thousand inhabitants in 2017 across EU countries (for those with data available).

[1] Eurostat Database. Last data update on 27 June 2019. Most recent data for the year 2017.

Figure 1: Actual number of persons held in a prison per hundred thousand inhabitants in 2017



Source: Eurostat, own processing

For clarification, the Czech Republic column is red. As we can see in the Figure 1, the lowest ratios of prisoners per 100,000 inhabitants in 2017 were recorded in the north states such as Iceland, Finland, Sweden, Denmark and the Netherlands.

The data from Eurostat differs from the data used in this study. Eurostat includes in its evaluation of the number of prisoners those who are in custody (i.e. conviction status has yet to be determined), in addition to those officially convicted for a crime. For this thesis however, we will focus only on those who have completed or are in the process of serving a sentence upon their conviction. We do not consider those who were accused and in custody and then subsequently released. This exclusion is made to simplify the research and is applied mainly because of insufficient data availability. As the accused person becomes either a prisoner (convicted person) or he is released without serving a sentence, there is an easy way to obtain

the number of those who actually are serving their sentence. While there's no doubt it is more difficult to find a job for those who have spent some amount of time in custody than for those who have never been in custody at all, it will not be subject of matter of this thesis. For further understanding, in this thesis the term *prisoner* is used only for those who were actually convicted. The term *ex-prisoner* designates those after their release.

The following Figure represents the actual number of prisoners (not including the accused ones) held in Czech prisons up to the December 31st.

Figure 2: Actual number of persons convicted and held in a prison over the years 1992–2018

Source: The Yearbooks of the Prison Service of the Czech Republic, own processing

As we can see in Figure 2, there is an increasing trend in the number of prisoners until 2016, after which there is a slight year-to-year decline — with the exception of the years 2000–2002 and 2012. The drop that occurred in 2013 was caused by a proclamation of amnesty

by former president Václav Klaus. During the amnesty, 6,471 prisoners were released (convicted as well as accused persons).[2] The cause of the decline in the period 2000–2002 can be explained by a combination of there being fewer people transferred from custody to prison and an increase in the number of people conditionally released from imprisonment. In 2002, the number of convicted persons decreased by almost 2,000 compared to the previous year, which can be attributed to, among other factors, the higher number of alternative sentences imposed, instead of imprisonment.[3] That being said, the highest peak was reached in 2011 with 20,541 prisoners. An increasing trend in the number of prisoners translates to increasing costs for a state.

However, ex-prisoners represent a cost for the state as well. As ex-prisoners are not socially accepted and are discriminated against by employers (among others), many of them receive social benefits. It is therefore necessary to focus on both groups: prisoners and ex-prisoners.

This study examines the impact of ex-prisoners on the unemployment rate. As there is no data on the unemployment rate of ex-prisoners, the impact will be studied using the number of working-age ex-prisoners, the number of prisoners and recidivism rates. It is important to integrate released prisoners into the labour market as soon as they are released from prison. The recidivism rate is a big concern in the Czech Republic, where it reaches huge values every year, ranging from 57% to 75% in the period 1992–2018. The highest value was recorded in 1992 and the lowest value in 1997. From the year 1998 onward, it has always been above 60%

[2] The Yearbook 2013 of the Prison Service of the Czech Republic.
However, on the website of the Prison Service of the Czech republic www.vscr.cz/informacni-servis/amnestie/ they claim, that the number of released due to amnesty was 6,443.
[3] The Yearbook 2002 of the Prison Service of the Czech Republic.

reaching as high as 71% in 2013. The Prison Service of the Czech Republic attributes this 2013 recidivism peak to the proclamation of amnesty in January 2013.[4] High recidivism rate is caused mainly because of the impossibility of reclassification. Generally speaking, however, the impossibility of integration into the labour market as well as into overall normal life are driving forces behind the high recidivism rates, which in turn cause overcrowded prisons and consequently burdensome costs for state. These costs also derive from losses in the labour force and a heightened criminal environment. It is necessary to stop this vicious circle. As Dušek (2015) claims, prison is the most severe, but also the most expensive punishment. One possible solution could be to integrate them into the labour market. As soon as they have a job, they become much more socially accepted and there is a lower chance that they will recommit a crime. Our hypothesis, which will be tested, is that the increasing number of ex-prisoners causes a rise in unemployment rates and that the recidivism rate decreases as the unemployment rate decreases.

[4] The Yearbooks of the Prison Service of the Czech Republic.

1. Literature Review

Like any other market, the labour market depends on two forces – supply and demand. It is a place where supply and demand clash as in the classical market of goods and services. On the supply side are those who offer something, in the case of the labour market this refers to those who are willing to work. On the demand side lies those who are willing to buy something. In the labour market, this consists of employers (be it large companies or small business owners) who are willing to buy the work (Kuchař, 2007).

There are several factors affecting the labour market. Not only does the economic condition of a particular country play a role, but crises in large influential countries such as the US or Russia may also have a significant impact. An individual's job opportunities are highly variable based on differences in ability, education, prerequisites and challenges. Since the labour market supply and demand varies a lot, it is impossible to meet everyone's needs, thereby leading to unemployment. For instance, if an employer requires a certain level or area of education for a given job, anyone who does not meet their requirements is ineligible to apply for the position.

To a certain degree, unemployment is healthy for both the labour market and the economy as a whole. It represents competition in the labour market that, as in all other markets, helps maintain the quality and price of traded commodities at an optimum level. The reality, however, is that a healthy unemployment rate rarely occurs. In the case of full employment, companies will often lack efficiency because when everyone has a job, there is virtually no competition, leading to a decrease in both motivation and individual productivity. On the other hand, with rampant unemployment, countless qualified and experienced individuals are unable

to find work, which results in a slew of additional difficulties—both economic and psychological—such as a lack of financial stability and/or depression.

This is a general explanation of how a basic labour market works. As we are focusing on the ex-prisoner population, it is important to note that the labour market dynamics for this subset are quite different from those of the general population. Individuals with a criminal past are less attractive to employers, meaning they are in low demand in the labour market.

1.1. Integration of Formerly Incarcerated People into the Labour Market

People released from prison are among the most disadvantaged social groups with respect to integration into society and the labour market.

Following Bareš & Mertl's study (2016), the key to integration into a society and prevention of recidivism is employment. The goal of finding employment for ex-prisoners is highly socially advantageous as it is mutually beneficial for the employers, in the sense that they find the necessary labour force, and for those released from prison as they become significantly more socially accepted.

The above-mentioned study primarily focuses on the key characteristics of released persons (in terms of criminal past and/or work experience), employers (mainly their prejudices), and their interactions. While their research on employment outcomes of released persons, a crucial aspect of this thesis, is not exhaustive, their analysis still provides valuable insight into the traits that may often determine the employment of a formerly incarcerated person.

People released from prison have diverse characteristics. Bareš and Mertl divided former prisoners into three groups based on certain characteristics. The first was their criminal past, the second are their individual characteristics, and the third is their social situation. Criminal past is highly individual and is characterized by a number of other factors such as the nature of the crime(s), the number of crimes committed, the length of one's sentence, the type of prison, financial consequences stemming from imprisonment and/or reparations for the crime and so on. Individual characteristics are generally not related to criminal past; they are understood as work experience, current achieved practice, acquired knowledge, education and willingness to further education, work habits, motivation and soft skills. One's social situation after leaving prison is refers to their material background, property and housing situation, family background, debts, and liens.

According to Bareš & Mertl (2016), there are many obstacles ex-prisoners face in integrating into the labour market. Their punishment for a crime doesn't end with their release from prison; they carry the burden of being a convicted person for years – often for the rest of their lives. The study delineates two types of obstacles – structural barriers and systemic barriers. Structural barriers are formed mainly by preconceived notions and include, in particular, prejudice and mistrust. It is possible to overcome these barriers by more frequent contacts and interactions between the released individuals and employers. One of the most important systemic barriers is having the criminal record itself, which is what makes it particularly difficult to reintegrate and increases the likelihood of recidivism.

Most studies dealing with the topic of employment of released prisoners feature qualitative analysis based on questionnaires. Bareš & Mertl based their study on a combination of qualitative and quantitative analysis. They focused their work on people released from prison

who sought help from the organization Rubikon centrum, z.s. (hereafter referred to as Rubikon). The findings presented in the study are based on an analysis of a total of five workshops run by Rubikon over two years (2014–2016) and a survey they designed, for which employers were approached in order to learn how they evaluate the employment opportunities of ex-prisoners. Workshops consisted of three parts and two groups of participants. The first part was "Discussion with employers", the second and key part was "Rough Interview", and the final part, essential for data collection, was "Evaluation". One of the focus groups primarily consisted of employer representatives (HR) and the second group consisted of job seekers released from prison.

Results from their analysis are distorted by only using people who are actively cooperating and actively seeking a job as subjects. That is, they do not necessarily use a representative sample of all individuals that have been released from prison as those who approach Rubikon are likely much more motivated to find and keep a job.

According to Howard Becker (1966), social interaction, on both a physical and symbolic level, determines to what extent the individual will be reintegrated into a society or to what extent they are met with rejection and labelled as social deviants.

1.2. Social Rehabilitation and Activities That Help with Resocialization

It is important to focus on the reintegration of prisoners from the very beginning. One of the best approaches is to start with normal activities directly in prison, so that prisoners do not experience a shock after being released from prison.

For example, in Denmark the prison system works on a basis of open prisons, where prisoners prepare their own meals, wear their own clothes and leave the prison every day. As a result, they maintain time management skills, which considerably eases the process of re-entering society and has led to lower recidivism rates.[5]

A study by Biedermanová & Petras (2011) examines the effectiveness of programmes provided by prisons that help with social rehabilitation. They divided the activities within these programmes into five categories: work activities, educational activities, special education activities, hobbies and maintaining relationships outside of prison.

Work activities are mainly focused on creating or maintaining a habit of going to work as well as improving their earning potential after their release. According to them, large debts owed by prisoners are also a significant source of difficulty that could be lessened through work activities. The working convicts are able to pay possible child maintenance, the cost of serving the sentence or other debts incurred.

To facilitate the job-search post-release, an emphasis is also placed on educational activities during the period of incarceration since most prisoners have not completed primary school prior to beginning their sentence. Educational activities are mainly meant to train in certain crafts and administrative or technical professions. Much research shows that education in general subjects alone has little to no significant educational benefit to prisoners, which is why an emphasis has been placed on job fields that one can be trained in at any point in time (i.e. allowing prisoners to be trained in the field at later points in life) (Mezník, 1995).

[5] The Washington Post, *Denmark doesn't treat its prisoners like prisoners – and itś good for everyone* [online]. 2. 2. 2016. Available from: https://www.washingtonpost.com/posteverything/wp/2016/02/02/denmark-doesnt-treat-its-prisoners-like-prisoners-and-its-good-for-everyone/?noredirect=on&utm_term=.5ebdc7e8b35c

Special education activities are mainly for prisoners with mental and behavioural disorders, personality disorders or prisoners with mental retardation. As with any of the other program activities, their mission is to reduce the likelihood of recidivism among ex-prisoners and to help promote a safe society after their release (Biedermanová & Petras, 2011).

Especially in the case of unemployed convicts, hobbies are gaining importance. The purpose of leisure programs implemented in prison is to teach convicts how to actively and meaningfully spend their free time not only in prison as they complete their sentence, but particularly after their release. Ideally, by teaching them these new habits, the inmates will be less likely to recommit a crime by knowing how to more constructively spend their free time (Mezník, 1995).

The last type of activity observed by Biedermanová & Petras (2011), pertaining to 'external' relationships, is about creating, maintaining and strengthening the bonds of inmates with the outside world. Concretely, this means developing the knowledge and skills needed in civil society.

Biedermanová & Petras (2011) tested the effectiveness of the program 3Z by comparing the recidivism rates of two groups of convicts after their release. The program 3Z ("Zastav se, Zamysli se a Změň se", which can be translated as "Stop, Think and Change") is intended for inmates who are repeatedly imprisoned for property crimes. The hypothesis of the analysis was that "inmates who complete the program 3Z are less likely to relapse than the ones who do not complete the program". Surprisingly, the results of the analysis contrast with the hypothesis.

1.3. Relationship Between Employers and Ex-prisoners

The company LMC, a leader in the labour market and education, helps employers find qualified employees. On February 27th, 2015, a study that maps the approach of employers to candidates with a criminal record was published.[6]

According to this research, the situation after serving a prison sentence is very complicated. The number of jobs becomes limited for ex-prisoners as they are essentially excluded from getting decent (sometimes any) work. More than half, 55%, of employers said in the survey that they do not employ ex-prisoners at all. Most often this is because it allegedly contradicts with the rules and regulations of the company. Another reason provided was insufficient previous experience or that candidates with a record do not stand up to competition. Only 22% of examined companies said that they employ ex-prisoners, where they are recruited mostly as ordinary employees. In 58% of cases they are employed as manual workers. For specialist positions, ex-prisoners are recruited in only 4% of cases and it is in less than 2% of cases, that these candidates fill management positions or positions involving responsibility over property or finances. The main stated barrier to employing ex-prisoners is an insufficient track record of work habits, followed by the burden of potential personal difficulties of the ex-prisoner (such as liens or issues with housing), a lack of or outdated experience, and in the worst case, no experience at all.

Only 10% of companies that consciously employ ex-prisoners use subsidies from the Labour Office for these positions. Another 13% do not use them but would like to. The remaining 77% do not use them at all and do not even consider it, indicating that subsidies are

[6] *Ze šikmé plochy zpět do práce* [online]. 27. 2. 2015.
Available from: https://www.lmc.eu/cs/magazin/clanky/ze-sikme-plochy-zpet-do-prace/

not the primary motivation for employers. Rather, companies most often consider the advantage of employing ex-prisoners to be their gratitude and loyalty, their diligence, and in a few cases their willingness to work for lower wages.[7]

The relationship between employers and ex-prisoners is also investigated in the Statistical Survey made by Hana Charvátová, who is an employee at the Department of Employment of Prisoners within the Prison Service in the Czech Republic. The Statistical Employer Survey was held in May 2018 and is based on the responses of 137 employers to questions about employing ex-prisoners. In the year 2018 only 53.3% of the researched companies were employing ex-prisoners and to the question: "What is your willingness to employ persons with a criminal past in the future?" about 69.3% of the firms responded that they have no problem employing them, 27.1% responded that they would recruit these people only in exceptional cases and 3.6% would never employ them. This means that more than 30% of companies have a problem with employing ex-prisoners even at a time of low unemployment and the lack of a labour force. The reasons why the firms do not want to employ them are various, but the most common ones are no interest in employment (feigned interest because of the Labour Office subsidies), bad work habits, risk of recidivism and prejudices.

It can be seen, that most studies about ex-prisoners are based on qualitative analyses. This thesis will differ from them as the analysis will be quantitative.

[7] *Ze šikmé plochy zpět do práce* [online]. 27. 2. 2015.
Available from: https://www.lmc.eu/cs/magazin/clanky/ze-sikme-plochy-zpet-do-prace/

2. Dataset

This chapter describes the dataset used for the upcoming econometrical analysis. Data was collected from different sources to create the dataset, which was then cleaned by the thesis author. Using this dataset, we will test our established hypotheses.

The region of interest is the Czech Republic as a whole. Additionally, the author conducts analysis on prisoners by region because the results for the Czech Republic analysis are not convincing.

2.1. Data Unavailability

As the author hypothesises that there is an effect of the ex-prisoner population on the unemployment rate in the Czech Republic, the first variable the author looked for was the employment rate of ex-prisoners. However, it is not registered by any office in the Czech Republic.

The Ministry of Labour and Social Affairs (MLSA) offered the author data on incoming ex-prisoners for the years 2014–2018, but ultimately, even this did not include whether or not they found a job. The organization Rubikon also provides data on ex-prisoners. As the organization helps those in need find jobs, the data is employment based. However, the author chose not to use this data because it would bias the results as Rubikon is approached by individuals who are much more motivated and interested in finding and keeping a job.

The author also wanted to analyse the effect of the ex-prisoner population on employment by region. Unfortunately, data on ex-prisoners is not registered by region.

2.2. Collection

The main data source used were the Statistical Yearbooks of the Prison Service of the Czech Republic, which are publicly available on the Prison Service website, *www.vscr.cz*, for the years 1999–2018. The remaining data for the years 1992–1998 was provided in person by Lucie Mäsiarová, Head of Central Evidence Department of Prisoners in the Czech Republic. The Statistical Yearbooks provide several indicators; however, they are not 100% comparable as we are combing through 27 years of data. This is why the data has to be cleaned, as will be discussed in the next subchapter. The indicators received from the Statistical Yearbooks are number of released prisoners (only for some of the years), number of incoming prisoners and number of convicted persons divided by gender, age and education. These variables are measured every year on December 31st. Another important indicator collected from the Statistical Yearbooks of the Prison Service is yearly recidivism rate. The last variable used, which is also measured yearly, is length of sentence. For the years 2014–2018, there is monthly data available through prisons on the number of convicted persons held in a certain prison.

The Czech Statistical Office (CZSO) also provides indicators used in this thesis. The CZSO is a publicly available online database on the website *czso.cz,* which provides statistical information specifically on the Czech Republic. The indicators used from the CZSO database are unemployment rate (yearly and monthly, for whole of the Czech Republic as well as for individual regions), inflation and death rate (by age groups).

Another variable that is taken into account is a dummy variable for proclamations of amnesty. The dates of these amnesties were found on the website www.*tresti-rizeni.com*. They were proclaimed in 1993, 1998 and in 2013. In the year 1993 around 130 prisoners were released, in the year 1998 around 930 and in 2013, as was already mentioned, around 6,450.

Amnesties were proclaimed before the year 1993 as well, but this thesis is interested only in the period 1992–2018.

The last variable, crisis, is also a dummy variable, which marks post-crisis years. A value of 1 stands for the years 2009 and 2010, when the economy was affected by the 2008 financial crisis.

2.3. Data Cleansing

From the outset, the author made numerous corrections and adjustments and performed a number of computations on the original data that was collected.

The Statistical Yearbooks report how many prisoners are in the prison for the first time, for the second time, etc. The recidivism rate *(recr)* was computed from this information as

$$recr_t = (1 - first\ timers_t) * 100.$$

The variable *first timers* refers to those in a prison for the very first time in a given year *t,* as a percentage of all prisoners.

The essential variable, which has to be computed for our estimation, is the total number of working-age prisoners in the Czech Republic's population released in the year *t*. To estimate it, the variable of the number of released prisoners *(relpris)* has to be computed as the Statistical Yearbooks of Prison Service do not consistently provide it every year. The following formula will be used:

$$relpris_t = pris_{t-1} + newpris_t - pris_t,$$

where the variable $relpris_t$ stands for released prisoners in the year t, $pris_t$ is number of prisoners held in the year t, $pris_{t-1}$ is number of prisoners held in the year *(t-1)* (i.e. the year prior) and the variable $newpris_t$ stands for new prisoners who came in the year t.

Now, to obtain the total number of working-age ex-prisoners, the inactive part will be subtracted from the above-mentioned formula. In the Statistical Yearbooks the age groups range is over 10 years, so we take working-age ex-prisoners to only be those between the ages of 15 and 60 years old. As demographic data on age is only collected for incarcerated people, it is necessary to approximate it for released persons.

This will be achieved with the information on the length of the sentence. As we know only ranges and not the exact numbers for sentencing lengths, we will compute it using the upper limits of the ranges. The ranges are up to 3 months, from 3 to 6 months, from 6 to 9 months, from 9 to 12 months, from 12 to 24 months, from 24 to 36 months, from 36 to 60 months, from 60 to 84 months, from 84 to 120 months, from 120 to 180 months, above 180 months and for the rest of life. A sentence longer than 15 years will be considered as a 200-month long sentence. For the people sentenced for the rest of their lives the sentence will be understood as 220 months long. Unfortunately, this process will create some bias in our considered variable, but the bias will undoubtedly be lower than assuming a higher number than 220. The weighted average of the length of a sentence is consistently 4 years during the selected period, the sole exception being in the year 2013, when the average length was 5 years. In this context, we assume every incarcerated person to be released after four (in the year 2013 five) years for calculation purposes. In a similar vein, this leads us to consider a prisoner released in the year t to have been incarcerated in the year *(t-4)* (for the year 2013 it is *(t-5)*). Eventually, the number of released prisoners will be proportionally distributed over period t by the age

groups of prisoners in the year *(t-4)*. To simplify this assumption, we will also distribute the year 2013 by the year *(t-4)*. Moreover, we will do the same with the education demographics of prisoners.

Finally, we are able to subtract the inactive part (i.e. older than 60 years) from the variable. We will also take into account the death rate of people in this age group. The following formula depicts this assumption:

$$realprisact_t = relprisact +_t * (1 - dtr_t),$$

where $realprisact_t$ is the variable for the number of released prisoners in the working-age lowered by death rate in the year *t*, $relprisact+_t$ is the variable which tells us the total number of released prisoners in the working-age in the year *t* and dtr_t stands for the death rate in the year *t* (for those who are in the age category 15-60).

2.4. Unused Variables

Dividing the number of convicted persons or ex-prisoners by gender did not show any significant results This was also the case when division was based on education. Ultimately, the demographics will not be analysed. Prisoners and ex-prisoners will be taken into an account all together (separated neither by gender nor by education).

3. Methodology

In this chapter, the methodology used for estimating the effect of ex-prisoners on unemployment rate with Time-Series data is described. Firstly, the stationarity is described in detail as it is the main assumption of Time-Series modelling. Then two tests for stationarity, the Augmented Dickey–Fuller Test (hereafter ADF test) and the Kwiatkowski–Phillips–Schmidt–Shin Test (hereafter KPSS test), are explained. The models of interest are then identified, at which point they must be tested to see if they meet the conditions of homoscedasticity, normality and no serial correlation. Eventually, the relationship between the recidivism rate and the unemployment rate will be tested with Panel Data, which will be described as well. More specifically, the process for choosing the best model, determining which tests must be run and what to do if the test results show signs of inconsistency will all be explained.

3.1. Time-Series Regression Models

3.1.1. Stationarity

It is important to first make our Time-Series dataset stationary in order to avoid a spurious regression. A spurious regression is one in which the Time-Series variables are non-stationary and independent (Giles, 2007). Time-series data is usually affected by four main components: trend, seasonality, cyclicity and irregularity, which render Time-Series non-stationary. For understanding the relationship between variables through regression analysis, there must be some stability over time (Wooldridge, 2013).

According to Wooldridge's definition, the stochastic process $\{x_t: t = 1, 2, \ldots\}$ is stationary if for every collection of time indices $1 \leq t_1 < t_2 < \ldots < t_m$, the joint distribution of $(x_{t_1}, x_{t_2}, ..., x_{t_m})$ is for all integers $h \geq 1$ the same as the joint distribution of $(x_{t_1+h}, x_{t_2+h}, ..., x_{t_m+h})$.

The sequence $\{x_t: t = 1, 2, \ldots\}$ is id. Basically, x_t has the same distribution as x_1 for all $t = 2, 3, \ldots$. This definition of stationarity refers to the strict form of stationarity.

Covariance stationarity, presented as weak stationarity, is the above-mentioned stochastic process with finite second moments, i.e. $[E(x_t^2) < \infty]$, if (i) $E(x_t)$ is constant, (ii) $Var(x_t)$ is constant and (iii) for any t, $h \geq 1$, $Cov(x_t,x_{t+h})$ depends only on h and not on t (Wooldridge, 2013).

After the credibility that came with a Nobel Prize in Economics for Edward Prescott's Real Business Cycle Theory in 2004, Carlaw, Kosemplet & Oxley (2009) claim that it has been generally accepted that macroeconomic Time-Series data is stationary. However, they concluded from their analysis that further empirical methodology has to be developed to verify this statement.

Making the Time-Series stationary is a matter of Trend Stationary or Difference Stationary processes. The mean trend for these processes are deterministic and stochastic, respectively. Both eventually result in a stationary stochastic process. Unit root tests consider the presence of a stochastic trend in series (Hamilton, 1994). This thesis uses the Difference Stationary process.

The ADF and KPSS tests are the Unit Root tests that conclude whether the Time-Series is stationary or not. These two tests are both based on OLS regression and were chosen because they from a complementary pair as their hypotheses are opposites. Surely, they differ in the OLS regressions and statistics, but their hypotheses are subject of a matter for the result. Both are briefly described below.

The ADF test, as defined by Dickey & Fuller (1979), has the null hypothesis that series has the unit root, meaning the series is non-stationary. The alternative hypothesis, placed against the null hypothesis, is that there is no evidence of presence of unit root in the series. That is, the series is stationary. Basically, if the *p*-value is below the significance level $\alpha = 0.05$, the null hypothesis is rejected, and the series is stationary.

The KPSS test defined by Kwiatkowski, Phillips, Schmidt, & Shin (1992) has a hypothesis opposite to that of the ADF test. Under the null hypothesis, the series is stationary, while the alternative hypothesis finds the series non-stationary. In other words, the null hypothesis is not rejected at significance level 5% if the *p*-value is above this level. Thus, series is stationary.

3.1.2. Models description

The first equation depicts the effect of incarceration on the unemployment rate, including a variable for inflation in order to obtain unbiased estimators (zero conditional mean assumption has to be met). The equation is formulated as:

$$unmplrt_t = \beta_0 + \beta_1 * relprisact_t + \beta_2 * recr_t + \beta_3 * amn_t + \beta_4 * prisact_t + \beta_5 * Infl_t + \beta_6 * crisis_t + u_t,$$

where $unmplrt_t$ stands for the unemployment in the year *t* and the explanatory variable $recr_t$ stands for the recidivism in the year *t*, both expressed in absolute values, rather than a percentage, in order to simplify interpreting the result. Variables $relprisact_t$ and amn_t are previously defined variables that represent the number of working-age released prisoners (lowered by death rate) in the year *t* and a proclamation of amnesty in the year *t*, respectively.

The amn_t variable is a dummy variable with values 1 for the years 1993, 1998 and 2013 (as mentioned in chapter 2.2, amnesties were proclaimed these years), and 0 for the others. The variable $prisact_t$ is the number of working-age incarcerated persons in the year t and $Infl_t$ is the inflation rate in the year t. $Crisis_t$ is another dummy variable with values of 1 for the years 2009 and 2010 (as a result of the global financial crisis in 2008). The last variable, u_t, is an error term, which is assumed to be normally distributed, u ~ N (0, σ^2).

The second equation depicts the effect of unemployment and incarceration on recidivism. That is, whether lower unemployment lowers the recidivism. It is formulated as:

$$recr_t = \beta_0 + \beta_1 * unmplrt_t + \beta_2 * relprisact_t + \beta_3 * prisact_t + \beta_4 * crisis_t + u_t,$$

where all the variables are described above.

3.1.3. Homoskedasticity

The homoskedasticity assumption is defined by Wooldridge (2013) as $\mathrm{Var}(\mathrm{u}|x_1, \ldots, x_k) = \sigma^2$. In other words, the error u has the same variance given any value of the explanatory variables. In the case of Time Series Data, homoskedasticity restrictions are less harsh than those of the classical linear model. According to Wooldridge's definition, the errors are contemporaneously homoscedastic. That means $Var(u_t|\boldsymbol{x}_t) = \sigma^2$, where $\mathbf{x}_t$ stands for $(x_{t_1}, x_{t_2}, \ldots, x_{t_k})$.

For testing if heteroskedasticity is present, the Breusch-Pagan test for heteroskedasticity (hereafter BP test) is used, which was introduced by Breusch & Pagan (1979). Heteroskedasticity is present if the variance of errors from a regression is dependent on the

explanatory variables. The null hypothesis of homoskedasticity is placed against the alternative hypothesis, where heteroskedasticity occurs. The null hypothesis (variance unchanging in the residuals) is rejected for *p*-values below the significance level ($\alpha = 0.05$), meaning heteroskedasticity is present. For a *p*-value above the significance level, the homoskedasticity assumption holds.

3.1.4. Normality

Normally distributed error term is defined by Wooldridge (2013) as: The population error u is independent of the explanatory variables $x_1, x_2, \ldots, x_k$ and is normally distributed with zero mean and variance σ^2 : $u \sim N(0, \sigma^2)$. For Time Series, the definition is modified and presented as the errors u_t are independent of $\mathbf{X}$ and are iid as $N(0, \sigma^2)$.

Testing normality will be performed by the Shapiro-Wilk test (hereafter SW test), established by Shapiro & Wilk (1965). The null hypothesis states that the sample is normally distributed. The null hypothesis is rejected (tested data are not normally distributed) when the *p*-value is below the significance level $\alpha = 0.05$. Conversely, if the *p*-value is above this significance level, the sample is normally distributed.

3.1.5. Autocorrelation

Serial correlation, or autocorrelation, in residuals is the correlation between each term and its previous value. There is an assumption that errors in regression are independent.

The Durbin Watson Test (hereafter DW test) is used to test the autocorrelation in residuals. There are two assumption of the DW test, the first being that the errors are normally distributed with zero mean, and the second being that they are stationary. The Durbin Watson

statistic ranges from 0 to 4; for the value 2 there is no presence of autocorrelation, however, values close to 2 are satisfying enough. Points of concern should be values below 1 and above 3. Values above 2 represent a negative correlation between adjacent residuals, while values of the test static below 2 indicate a positive correlation (Field, 2009).

3.2. Panel Data Regression Model

In addition, the regression of Panel Data will be performed as the results from Time-Series Data are not convincing enough as there are only 23 observations. Thus, more detailed analysis will be performed. As data regarding released prisoners is not available in detailed form, the target group will be prisoners divided across 13 regions (the Zlín region has no prisons) over 5 years, 2014-2018, recorded monthly. That means 780 observations. The following equation depicts the relationship of interest:

$$recr_t = \beta_0 + \beta_1 * unmplrt_t + \beta_2 * chng_{t\text{-}3} + \beta_3 * Infl_t + u_t,$$

where $chng_{t-3}$ is the adjustment of the number of incarcerated persons in the month *(t-3)*. It reaches positive values when the number of prisoners is higher than in *(t-4).* The variable of adjustment is also a lagged variable by 3 months, as recidivism occurs within some time. The variable $unmplrt_t$ stands for the unemployment in the year *t* and $recr_t$ is the recidivism in the year *t*, both expressed in absolute values. $Infl_t$ is inflation in the month *t.*

3.2.1. Choosing the best Model

As there are several options for how to estimate Panel Data, it is necessary to choose the best and most suitable model. The choice will be made among the Pooled OLS, Fixed Effects (FE) and Random Effects (RE) regression models.

Pooled OLS gives efficient and consistent estimates if a cross-sectional or time effect does not exist. Basically, the pooled OLS estimator ignores the panel data structure. Since the expectation of these effects in our model is that they are non-zero, the homoskedasticity, autocorrelation even the exogeneity assumption could be disrupted. This is also why FE and RE will be used. If both effects (cross-sectional as well as time) are present, FE or RE is chosen. FE observes differences in intercepts across a group or time period (a dummy variable is part of the intercept). The cross-sectional effect is a random variable, which is allowed to be correlated with the explanatory variables. A disadvantage of this model is that after deduction of arithmetic means, the model will dispose of the time effects. On the other hand, a dummy variable in RE is part of the error component and RE examines differences in error variance components across a group or time period (Park, 2011). The cross-sectional effect is a random variable that is uncorrelated with the explanatory variables (Schmidheiny, 2018).

We begin by regressing all three possible models. We then test them and make a decision on which model is the best fit based on whether the estimates are consistent and effective. Eventually, the chosen model will be tested to see if the heteroskedasticity and the serial correlation of residuals is present.

To make such a decision, it is necessary to introduce the tests for choosing the best model. Firstly, a comparison of FE and Pooled OLS will be made using the F-test. In short, the null hypothesis prefers Pooled OLS (all dummy variables except for one are zero), which indicates that individual effects are not significant. When the null hypothesis is rejected, individual effects are significant, and FE is preferred. The Breusch-Pagan Lagrange Multiplier (LM) test helps decide between RE and Pooled OLS. The null hypothesis in the LM test

signifies that variances across entities are zero and that there are no significant differences across units. In a case where the null hypothesis is not rejected, Pooled OLS is preferred. Conversely, when there is evidence of significant differences across units, the null hypothesis is rejected and RE is chosen. Lastly, the Hausman test (Hausman, 1978) compares FE and RE. Basically, it tests if the unique errors are correlated with the regressors. The null hypothesis states that they are not correlated (it assumes that both, FE and RE, are consistent but RE is more asymptotically effective), and RE is preferred. If the null hypothesis is rejected, FE is preferred.

3.2.2. Testing

After selecting the model, tests for heteroskedasticity and serial correlation must be performed in order to avoid violating the Gauss-Markov assumptions for consistent estimates. The above-mentioned BP test (Chapter 3.1.3) will be used to test the presence of heteroskedasticity. To test serial correlation, the Breusch-Godfrey/Wooldridge (BGW) test for serial correlation in panel models will be used. The null hypothesis of the BGW test assumes that serial correlation is not present. Therefore, a rejection of the null hypothesis means that serial correlation exists in the model.

3.2.3. Robust Standard Error

If heteroskedasticity or serial correlation is present, the estimates are inconsistent. In such a case, it is necessary to compute robust standard errors to control for the violation of the assumptions. Clustered standard errors are a special type of robust standard errors, generally suggested when analysing panel data, FE model specifically. Clustered standard errors account for heteroskedasticity across clusters (individuals) of observation. For consistency,

region-clustered standard errors will be performed as regions are the cross-sectional component of our model.[8]

[8] Wizard: *About robust and clustered standard errors* [online]. 2018. Available from: https://www.wizardmac.com/help/stats/robust_se.html

4. Results

This chapter builds on the previous chapter, where previously mentioned assumptions, steps and tests will now be applied. Afterwards, performed analyses will be described. Our assumptions that a rise in the size of the ex-prisoner population has a negative effect on the unemployment rate in the Czech Republic and that finding a job decreases recidivism rates are discussed.

4.1. Czech Republic

4.1.1. Stationarity

In this subchapter the variables are examined for whether they satisfy the stationarity assumption at the significance level of 5%, or if a difference of the variables has to be applied.

Table 1 depicts the results of the ADF test run on original variables, 1st difference of variables and 2nd difference of variables of the Time Series data used to create the model. For original variables of the dataset the ADF test shows that all of them are non-stationary with a significance level of 5%, as the null hypothesis is not rejected because their *p*-values (in the square brackets) are higher than 0.05. At 1st difference, the null hypothesis is rejected only for variables of amnesty *(amn)* and inflation *(Infl)*. Thus, we also run it on 2nd difference of the series, which results in a rejection of the null hypothesis for all variables. That is, all variables are stationary at 2nd difference of the series. The number of released prisoners within working-age *(relprisact)* has no available data for the whole period, therefore the ADF test cannot be used.

Table 1: Stationarity testing by ADF test

Stationarity of independent and dependent variables by ADF test			
	Original	1st Difference	2nd Difference
unmplrt	-1.1276	-3.5204	-4.6
	[0.9021]	[0.06055]	[0.01]
relprisact	--	--	--
	--	--	--
recr	-3.095	-2.884	-4.378
	[0.1544]	[0.235]	[0.01]
Amn	-3.4735	-4.4427	-4.7391
	[0.06709]	[0.01]	[0.01]
prisact	-3.1025	-3.5892	-4.4941
	[0.1516]	[0.05095]	[0.01]
Infl	-2.0587	-5.1786	-6.3047
	[0.5501]	[0.01]	[0.01]
crisis	-2.1908	-3.4001	-4.3589
	[0.4996]	[0.07733]	[0.01042]

For corroboration, we perform the KPSS test as well (and because of unavailability of data for *relprisact*). Surprisingly, the results from the KPSS test differ considerably from those of the ADF test. Unemployment rate *(unmplrt),* number of released prisoners within working-age *(relprisact)*, recidivism rate *(recr),* amnesty *(Amn)* and crisis *(crisis)* are stationary in their original series, as they have *p*-values higher than 0.05. The number of prisoners within working-age *(prisact)* and inflation *(Infl)* are stationary in their 1st difference.

Table 2: Stationarity testing by KPSS test

Stationarity of independent and dependent variables by KPSS test			
	Original	1st Difference	2nd Difference
unmplrt	0.25098	0.33978	0.02896
	[0.1]	[0.1]	[0.1]
relprisact	0.36522	0.066335	0.029922
	[0.09215]	[0.1]	[0.1]
recr	0.18409	0.27144	0.048688
	[0.1]	[0.1]	[0.1]
Amn	0.14007	0.037037	0.071447
	[0.1]	[0.1]	[0.1]
prisact	1.0903	0.091436	0.030847
	[0.01]	[0.1]	[0.1]
Infl	0.94747	0.062972	0.085403
	[0.01]	[0.1]	[0.1]
crisis	0.15133	0.037037	0.024691
	[0.1]	[0.1]	[0.1]

For the following models, we must pick only one order of differencing, i.e. original, 1st difference or 2nd difference, for all variables in order to keep them interpretable. Considering that the original series is non-stationary, the KPSS test allows us to use the first difference for all variables, while the ADF test presents 4 of 6 variables as stationary only in their second difference, we pick the 2nd differences of all variables for the following analysis. Not only that, but they are even more stationary than in their first difference.

4.1.2. Models & Testing

The stationarity testing recognized some non-stationary variables, even in the first difference of the series. To avoid non-stationarity, all models used the 2nd differences of the variables (can be understood as difference-stationary series). Thus, the equations from Chapter 3.1.2. will be rewritten as

$$ddunmplrt_t = \beta_0 + \beta_1 * ddrelprisact_t + \beta_2 * ddrecr_t + \beta_3 * ddamn_t + \beta_4 * ddprisact_t + \beta_5 * ddinfl_t + \beta_6 * ddcrisis_t + u_t,$$

$$ddrecr_t = \beta_0 + \beta_1 * ddunmplrt_t + \beta_2 * ddrelprisact_t + \beta_3 * ddprisact_t + \beta_4 * ddcrisis_t + u_t,$$

where *dd* denotes the symbol for second difference.

Table 3 depicts the first equation and its relationship between the dependent and independent variables. As we can see, our assumption of the negative effect of the number of released prisoners on the unemployment rate is not rejected. The variable of the number of working-age released prisoners *(ddrelprisact)* equals $9.906*10^{-7}$ with standard error $1.030*10^{-6}$, meaning if one more prisoner is released, the unemployment rate is expected to rise. However, it is not statistically significant in the assumed model as the absolute value of the t-value is lower than 1.96. The most statistically significant variable in Table 3 is the number of working-age prisoners *(ddprisact).* Nevertheless, this result is surprising as the unemployment rate is expected to decrease with more people incarcerated (we suppose that after incarceration they are excluded from the labour force and that the crime is committed mostly by unemployed persons). However, it can be understood as the majority of those imprisoned were employed prior to their conviction. The second most statistically significant variable with a significance level of 5% is the dummy variable crisis *(ddcrisis)*, which represents the post-crisis years. When a crisis occurs, the unemployment rate is expected to rise. Another statistically significant variable is inflation *(Infl)*, which is not surprising. The relationship between the rate of inflation and the unemployment rate can be easily described by Phillips curve. However, its significance is within a level of significance of 10%. At the same level of significance is recidivism *(ddrecr)*. Higher recidivism results in a rise in unemployment, what can be explained in the same way as the effect of the number of working-

age prisoners on the unemployment. The variable of amnesty *(ddamn)* did not bear any significance at all.

The overall fit of the model is described by R^2, the coefficient of determination. The higher the value it reaches (max 1, min 0), the more significant the model is. It is the ratio of the explained variation to the total variation. However, it is not always true that the higher R^2 is, the better the model fits. The high R^2 in Table 3 (states that 67% of the variation in the unemployment rate is described by this model) could be caused by a relatively high number of variables yet a low number of observations. Moreover, the difference between R^2 and adjusted R^2 is caused by the addition of a statistically insignificant variable. However, the statistically insignificant variable is our point of interest, so it cannot be removed. In conclusion, Table 3 seems to be overfitted.

Table 3: Time Series Regression Results – unemployment rate in the Czech Republic

	Dependent variable:
	ddunmplrt
ddrelprisact	0.00000
	(0.00000)
ddrecr	0.257*
	(0.145)
ddamn	0.007
	(0.006)
ddprisact	0.00000***
	(0.00000)
ddInfl	-0.001*
	(0.001)
ddcrisis	0.016**
	(0.006)
Constant	-0.0002
	(0.002)
Observations	23
R2	0.672
Adjusted R2	0.549
Residual Std. Error	0.009 (df = 16)
F Statistic	5.465*** (df = 6; 16)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 4 represents the effect of finding a job on the recidivism rate, as well as the effect of number of released and imprisoned persons of working-age and post-crisis dummy variable. Our assumption, that finding a job helps prevent recidivism rate is confirmed. Unemployment rate *(ddunmplrt)* is shown as statistically significant with a 1% level of significance. The results indicate that a 1% increase in the unemployment rate results in a 1% increase in the recidivism rate. However, Table 4 likely suffers from omitted-variable bias as there is no data on the unemployment rate of ex-prisoners. Therefore, the unemployment rate for the entire population was included, which can be misleading in our model. The variable of the number of working-age incarcerated persons *(ddprisact)* is also statistically significant. The negative relationship could be explained as the more prisoners are imprisoned, less of them can recommit a crime and return to prison. A dummy variable for crisis *(ddcrisis)* reveals a surprising result, opposite to the author's expectation that in times of crisis, people commit crimes more. The discrepancy is likely because the recidivism is not recorded immediately, but with a delay as the conviction process takes some time. The variable for the number of released prisoners in working-age *(ddrelprisact)* is statistically insignificant again.

Table 4 also shows a high R^2 value, likely for the same reason as in Table 3. That is, a large number of variables but a small number of observations leads to skewed results. However, there is no big difference between R^2 and adjusted R^2 in Table 4 (compared to Table 3).

Table 4: Time Series Regression Results – recidivism rate in the Czech Republic

	Dependent variable:
	ddrecr
ddunmplrt	1.034***
	(0.283)
ddrelprisact	-0.00000
	(0.00000)
ddprisact	-0.00001***
	(0.00000)
ddcrisis	-0.027***
	(0.009)
Constant	0.0001
	(0.003)
Observations	23
R2	0.742
Adjusted R2	0.685
Residual Std. Error	0.015 (df = 18)
F Statistic	12.957*** (df = 4; 18)
Note:	*p<0.1; **p<0.05; ***p<0.01

The homoskedasticity assumption is satisfied in both linear regressions as the null hypothesis was not rejected. The results of the BP test can be seen in Appendix, Table A.1. Additionally, the normality assumption is satisfied by the performance of the SW test for which the null hypothesis was not rejected (Table A.2 in Appendix). Testing for Autocorrelation by the DW Test is reported in Table A.3. In the first regression (Table 3), a negative correlation between adjacent residuals was detected. In the second regression (Table 4), a relatively high negative autocorrelation was detected, when the value was close to 3. This is likely caused by a small sample size, which makes results from the regression skewed. For this reason, the conclusion will be predominantly based on the panel data regression.

4.2. Regions

As results from the previous analysis were not satisfying enough with only 23 observations, we will perform a more detailed analysis of the relationship between recidivism and unemployment in terms of region with monthly data for the years 2014-2018. However, the number of released prisoners is unavailable in detail in terms of region. Nevertheless, they did not show any effect in the earlier analysis. Thus, we work with an adjustment of the number of incarcerated persons by month, understood as the modification of the labour force, lagged by 3 months.

As was discussed in Chapter 3.2.1, the choice of which Model to use must be made. In the Table 5, Pooled OLS, FE and RE regressions can be found. The dependent variable is the recidivism *(recr)* and the independent variables are unemployment *(unmplrt)*, change in a prison population 3 months ago *(chng)* and inflation *(Infl)*. It can be seen that Pooled OLS and RE regressions have estimators with the same values. It can be caused by the negative variance estimation for the unobserved effect, in that case it is set to zero and then RE becomes pooled OLS.

In the LM test, the null hypothesis was rejected, thus, RE is more suitable than Pooled OLS. Subsequently, the F-test was performed, and the null hypothesis was also rejected, that is, FE is preferred over Pooled OLS. Finally, the Hausman test also results in the rejection of the null hypothesis with a *p*-value less than the significance level of 5%. This means that the most efficient Model is FE.

Table 5 also depicts the R^2 of the regressions. As there is a high number of observations, the high values of R^2 are not suspicious as they were in Time Series. Also, the values are comparable with adjusted R^2, which is even better.

Table 5: Comparison of the OLS, FE and RE regressions

Dependent Variable: recr Independent Variables:			Coefficient (Standard Error)
	OLS	FE	RE
unmplrt	0.673 ***	1.079 ***	0.673 ***
	(0.029)	(0.029)	(0.029)
chng	0.00000	-0.00000	0.00000
	(0.00001)	(0.00000)	(0.00001)
Infl	-1.379 ***	-0.983 ***	-1.379 ***
	(0.202)	(0.157)	(0.202)
Constant	0.614 ***	--	0.614 ***
	(0.002)	--	(0.002)
Observations	780	780	780
R^2	0.448	0.672	0.448
Adj R^2	0.445	0.666	0.445
F-statistic	209.543***(df = 3; 776)	521.753***(df = 3; 764)	628.628***
Note:	*p<0.1; **p<0.05; ***p<0.01		

From the BP test, the presence of heteroskedasticity was detected as the null hypothesis was rejected (Table A.4 in Appendix), while the BGW test shows that serial correlation is present (Table A.5 in Appendix). For consistency, the robust clustering of standard errors will be performed, and the results will be presented with robust standard errors with clusters of regions. The dependent variable and independent variables remain the same.

In Table 6, one can observe final estimates of the FE regression with clustered standard errors at the individual level (mentioned in brackets). Unemployment rate *(unmplrt)* and inflation *(Infl)* are statistically significant at a significance level of 1% as they were before the clustering. Our expectation from the beginning that an increase in unemployment results in an increase in recidivism is now confirmed. The relationship between recidivism rate *(recr)* and unemployment rate can be described as: when there is a 1% rise in the unemployment rate, it causes an almost 1.1% rise in the recidivism rate. Inflation also has a significant effect on the dependent variable, however the sign of the relationship is surprising. On the other hand,

recidivism is a response to a change in inflation after some time, rather than immediately, so it may be caused by previous changes in inflation. In the period 2014-2018 the inflation had an increasing trend, while the recidivism had a decreasing trend because it reached its peak in 2013 after the proclamation of amnesty in January. The variable of an adjustment in the number of prisoners becomes significant after clustering. Its significance is on the level of 5% and it can be described as one additional prisoner held in prison results in a lower recidivism (after three months), which aligns with common sense.

Table 6: Robust clustering of standard errors for FE

	Dependent variable:
unmplrt	1.079***
	(0.053)
chng	-0.00000**
	(0.00000)
Infl	-0.983***
	(0.040)
Note:	*p<0.1; **p<0.05; ***p<0.01

Conclusion

The aim of this thesis was to investigate the relationship between the unemployment rate and, initially, discriminated people. At first, the intended focus was to be on those with disabilities However, because data availability for this subset of the population was even worse than for ex-prisoners, the aim of this study slightly changed course from its initial intent. Ex-prisoners were chosen instead of disabled people. The choice was made because their discrimination in the labour market is comparable to, if not greater than, that of the disabled. Moreover, the extreme number of incarcerated people and rates of recidivism in the Czech Republic is an issue that can't be neglected, and which makes this theme unique.

Ultimately, this thesis primarily examined the relationship between the unemployment rate and the recidivism rate, in addition to the relationship between ex-prisoners and the unemployment rate. The Time Series data analysis provided some interesting results, however, they are not entirely reliable because we had a limited number of observations. On the other hand, on the panel data analysis we can build with certainty. The panel data model showed a significant relationship between the recidivism rate and the unemployment rate. If the unemployment rate increases by 1%, it will cause a rise in the recidivism rate by 1.1%.

The Czech Republic suffers from an immense prisoner population; consequently, prisons are overcrowded. It is necessary to reduce the number of incarcerated persons. The main assumption of this thesis for how to decrease the size of the prison population is through employment. The results showed that if the unemployment rate decreases, recidivism decreases. As the recidivism rate is from the year 1998 constantly over 60%, there is a lot of potential for improvement. The problem is that prisoners are discriminated against by employers and thus finding a job is a considerable struggle for them.

A reduction in the number of people imprisoned could also be achieved through the implementation of alternative sentences, which might not lead to as much discrimination in the labour market. In 2018, the use of ankle bracelets for prisoners was introduced in the Czech Republic. This has brought a slew of benefits — not losing members of the labour force to prisons and the reduction in state expenditure from CZK1200 per day per prisoner to CZK130, for which a prisoner contributes CZK50.[9] In the present day, 144 sentenced persons are monitored with the electronic monitoring system.[10]

The issue of the prisoner and ex-prisoner population is widespread and a difficult topic that can be studied from several viewpoints. Unemployment was chosen for this thesis because the author wanted to inspect how it is impacted by this part of the population as there are currently no studies that analyse this impact in the Czech Republic. However, data unavailability was a significant barrier to performing reliable analyses. Therefore, I would like to continue to pursue this line of research for my master's thesis, as the subject matter is incredibly interesting. In further study however, I would like to focus on state costs rather than on unemployment. If the use of ankle bracelets expands more, it will be interesting to also study their impact.

[9] Česká justice. *Ministerstvo v tichosti spustilo náramky pro vězně, zatím kontrolují 30 odsouzených* [online]. 21. 9. 2018. Available from: https://www.ceska-justice.cz/2018/09/ministerstvo-tichosti-spustilo-naramky-vezne-zatim-kontroluji-30-odsouzenych/

[10] The number of sentenced persons with ankle braceletes is up to 28. 7. 2019. Available from: https://naramky.justice.cz/144-2/

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Appendix

Table A. 1: Heteroskedasticity Testing – Time Series

Studentized Breusch-Pagan test	
Model	**BP [p-value]**
Model 1	2.7754 [0.7346]
Model 2	2.1783 [0.703]

Note: Model 1 refers to the regression in the Table 3: Time Series Regression Results – unemployment rate in the Czech Republic
Model 2 refers to the regression in the Table 4: Time Series Regression Results – recidivism rate in the Czech Republic

Table A. 2: Normality Testing – Time Series

Shapiro-Wilk normality test	
Model	**SW [p-value]**
Model 1	0.93712 [0.1558]
Model 2	0.97045 [0.6999]

Note: Model 1 refers to the regression in the Table 3: Time Series Regression Results – unemployment rate in the Czech Republic
Model 2 refers to the regression in the Table 4: Time Series Regression Results – recidivism rate in the Czech Republic

Table A. 3: Autocorrelation Testing – Time Series

Durbin-Watson autocorrelation test	
Model	**DW [p-value]**
Model 1	2.5593 [0.9595]
Model 2	2.8808 [0.9906]

Note: Model 1 refers to the regression in the Table 3: Time Series Regression Results – unemployment rate in the Czech Republic
Model 2 refers to the regression in the Table 4: Time Series Regression Results – recidivism rate in the Czech Republic

Table A. 4: Heteroskedasticity Testing – Panel Data, FE

```
        studentized Breusch-Pagan test

data:  FIXrec
BP = 89.413, df = 3, p-value < 2.2e-16
```

Table A. 5: Serial Correlation Testing – Panel data, FE

```
        Breusch-Godfrey/Wooldridge test for serial correlation in panel models

data:  recr ~ unmplrt + chng + Infl
chisq = 702.65, df = 60, p-value < 2.2e-16
alternative hypothesis: serial correlation in idiosyncratic errors
```