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EX-PRISONERS AND THE LABOUR MARKET IN THE CZECH REPUBLIC

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Ex-Prisoners and the Labour Market in the Czech Republic

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Abstract:
This study investigates the effect of ex-prisoners on the unemployment rate at times of low rate of unemployment as well as examines the effect of the unemployment rate on the recidivism rate in the Czech Republic during the period 1992-2018. The Czech Republic has a significant issue with the extensive scale of its prison population, which places a great burden on the Czech economy. Ex-prisoners also represent a cost for the state as they receive social benefits. Another big concern in the Czech Republic is the recidivism rate which reaches huge values every year, ranging from 57% to 75% in the period 1992–2018. To prevent recidivism, it is important to reintegrate released prisoners back into society. In this study, I use the data provided by the Prison Services Yearbooks as well as the data from the Czech Statistical Office. The results indicate no significant effect of released prisoners on the unemployment rate. Further, the results show that when there is a 1% rise in the unemployment rate, it causes an almost 1.1% rise in the recidivism rate.

JEL: J7, J21, J65
Keywords: unemployment rate, ex-prisoners, recidivism rate, Czech Republic, regions

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1 Introduction

There is no doubt that reintegration to the labor market is the most crucial part after a person is released from prison. However, it is extremely challenging (Bushway *et al.*, 2007). Chances of finding a job are significantly lowered for people imprisoned in their past, which makes the reintegration process even harder as was shown in many studies (Apel & Sweeten, 2010; Kling, 2006; Pager, 2003; Western & Pettit, 2000). A study by Ramakers *et al.* (2012) claims that the high recidivism rate is caused mainly because of the impossibility of reintegration. Following Dušek (2015) and Bareš & Mertl (2016), the key to reintegration into society and prevention of recidivism is employment. Generally speaking, the impossibility of integration into the labor 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 the state. According to Dušek (2015), prison is the most severe but also the most expensive punishment. These costs also derive from losses in the labor force and a heightened criminal environment. It is necessary to stop this vicious circle. It is important to integrate released prisoners into the labor market as soon as they are released from prison. The recidivism rate is a big concern in the Czech Republic. It reaches huge values every year, ranging from 57% to 75% in the period 1992–2018, meaning that more than half of released prisoners end up in a prison again each year. The highest value was recorded in 1992 and the lowest value in 1997. From the year 1998 onward, it has always been above 60% 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.

According to Becker (2010), social interaction determines to what extent the individual will be reintegrated into society or to what extent they are met with rejection and labeled as social deviants. 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 shock after being released from prison. For example, in Denmark, the prison system works on a basis of open prisons, where prisoners prepare their meals, wear their clothes, and leave the prison every day. As a result, they maintain time management skills, which considerably eases the process of reentering society and has led to lower recidivism rates (Reiter *et al.*, 2016).

The company LMC, a leader in the labor market and education in the Czech Republic, published a study that maps the approach of employers to candidates with a criminal record in 2015. 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 that they do not employ ex-prisoners at all. Most often this is because it allegedly contradicts the rules and regulations of the company. Another reason provided was the insufficient previous experience or that candidates with a record do not stand up to the competition. Only 22% of examined companies said that they employ ex-prisoners. 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. 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 using them, indicating that subsidies are not the primary motivation for employers (Media, 2015).

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 the severity of the new penal code has resulted in a steady increase in the prison population by 2,000 prisoners per year. This has led to a rise in the state budget expenditure by approximately 660 million CZK per year. Most studies dealing with the topic of employment of released prisoners feature qualitative analysis based on questionnaires. Bareš & Mertl (2016) 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 organization helps those in need to find jobs. The findings presented in the study are based on an analysis of a total of five workshops run by Rubikon over three 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. Results from their analysis are biased 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. The results show that the demand for (prison) labor is particularly strong in those fields to which the major part of ex-prisoners professional profile correspond to (i.e. manual work).

A study by Biedermanová & Petras (2011) examines the effectiveness of programs provided by prisons that help with social rehabilitation. They tested the effectiveness of 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 analysis hypothesized 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.

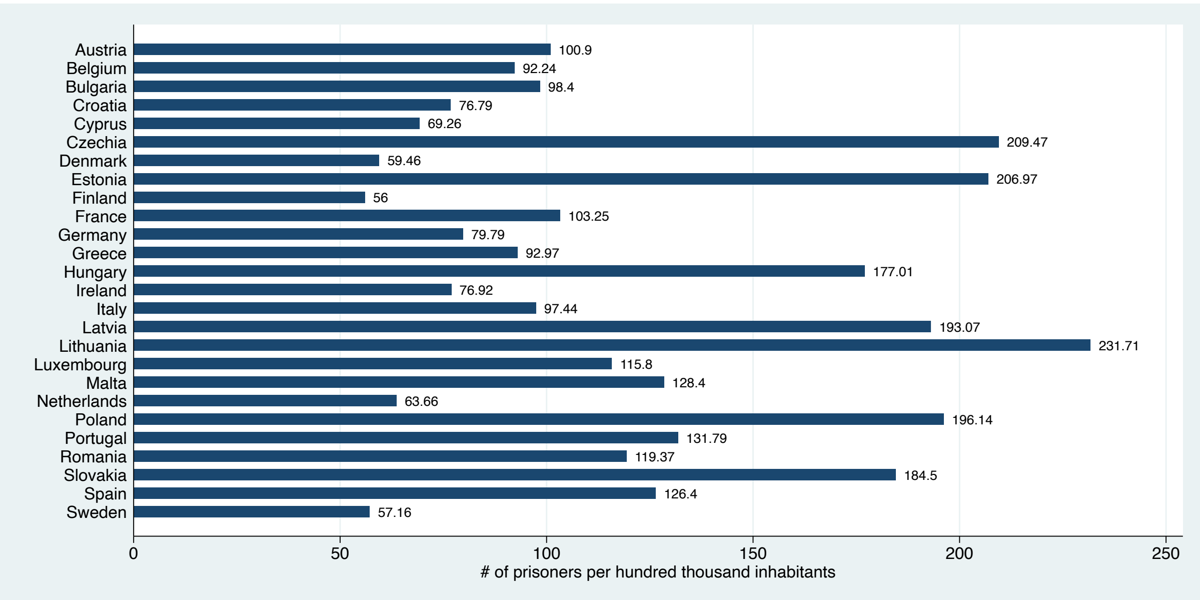
According to Mezník *et al.* (1995), to facilitate the job search post-release, an emphasis is also placed on educational activities during the period of incarceration since most prisoners have not completed primary school before beginning their sentence. Educational activities are mainly meant to train 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. 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.

It can be seen, that most studies about Czech ex-prisoners are based on qualitative analyses. This study will differ from them as the analysis will be quantitative. Our hypotheses, 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. The remainder of the paper is structured as follows: Section 2 gives an introduction to the data used for analysis. It includes a detailed description of the variables. Section 3 describes the methodology used. Section 4 presents the results and discussion. Finally, Section 5 concludes the paper.

2 Dataset

The total number of prisoners held in Czech prisons is 22,159 in 2017. In comparison with the other EU countries, the Czech Republic ranks 7^{th} for the highest total number of prisoners. Compared to Slovakia this number is more than twice as high (2,21 to be precise). Moreover, the Czech Republic has the second largest prison population in relation to overall population size with 209.47 prisoners per 100,000 inhabitants in 2017 among EU states. More prisoners per 100,000 inhabitants are recorded only in Lithuania. Slovakia has 184.5 prisoners per 100,000 inhabitants in 2017, which is about 12% less than the Czech Republic.[1] Figure 1 shows the actual number of persons held in a prison per hundred thousand inhabitants in 2017 across EU countries (for those with data available). The lowest ratios of prisoners per 100,000 inhabitants in 2017 were recorded in the northern states such as Finland, Sweden, Denmark, and Netherlands.

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



Source: Eurostat.

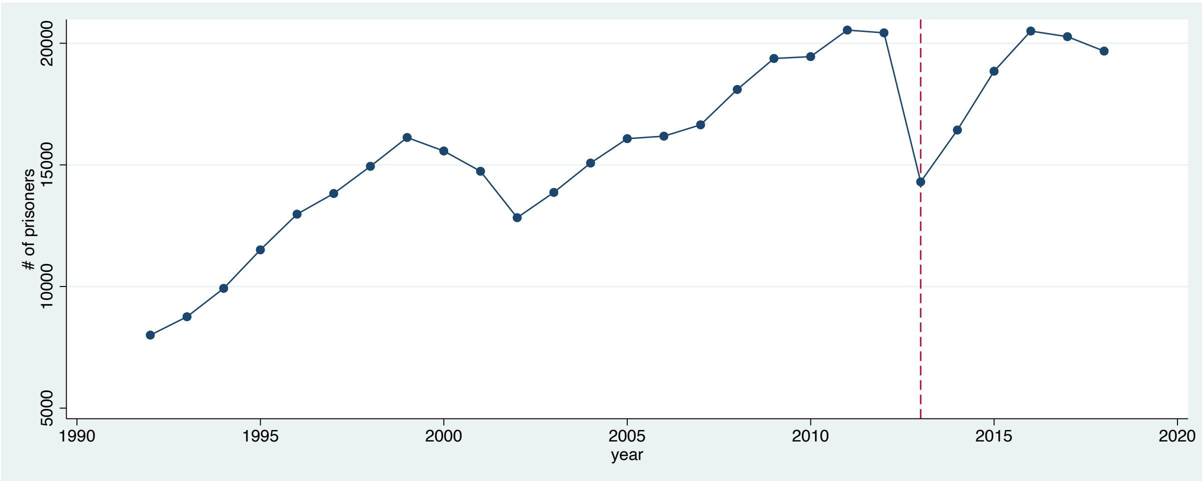
The data from Eurostat differs from the data used in this study. Eurostat includes in its evaluation the number of prisoners who are in a custody (i.e. conviction status has yet to be determined), in addition to those officially convicted for a crime. In this study, I focus only on those who have completed their sentence and those who are in the process of serving a sentence upon their conviction. I do not consider those who are accused and are in a custody and then

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

subsequently released. This exclusion is applied mainly because of insufficient data availability. 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 a custody at all, it will not be the subject of matter of this study. In this study, the term prisoner is used only for those who were actually convicted and the term ex-prisoners designates those after their release.

Figure 2 represents the actual number of prisoners held in Czech prisons up to December 31st in the respective year. As you can see, there is an increasing trend in the number of prisoners until 2016, after which there is a slight year-to-year decline except for the years 2000–2002 and 2012–2013. The drop that occurred in 2013 (represented by a dashed line) was caused by a proclamation of amnesty by former president Václav Klaus. During the amnesty in 2013, 6,471 prisoners were released – convicted as well as accused (PSCR, 2013).[2]

Figure 2: Actual number of persons held in Czech prisons over the years 1992–2018



Source: The Yearbooks of the Prison Service of the Czech Republic.

The cause of the decline in the period 2000–2002 is explained by a combination of fewer people being 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 (PSCR, 2002). That being said, the highest peak was reached in 2011 with 20,541 prisoners. This increasing trend in the number of prisoners translates to increased costs for a state. However, ex-prisoners

[2]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 prisoners due to amnesty was 6,443.

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.

2.1 Data Collecting and Cleansing

The data were collected from different sources for the Czech Republic as well as its regions for the period 1992-2018. The main data sources used were the Statistical Yearbooks of the Prison Service of the Czech Republic, which are publicly available on the Prison Service website, `vscr.cz,` for the years 1999–2018. The remaining data for the years 1992–1998 was provided in person by Lucie Mäsiarová, Head of the Central Evidence Department of Prisoners in the Czech Republic. The Statistical Yearbooks provide several indicators; however, they are not fully comparable as I am combing 27 years of data. The indicators received from the Statistical Yearbooks are the number of released prisoners (only for some of the years), the number of incoming prisoners, the number of convicted persons divided by age, the recidivism rate, and the length of the sentence. These variables are measured every year on December 31^{st}. For the years 2014–2018, monthly data are available through prisons on the number of convicted persons held in a certain prison. Thus, I create a variable of the number of convicted persons by region.

The Czech Statistical Office (CZSO) is the second source of the data used in this study. The CZSO is a publicly available online database on the website `czso.cz`, which provides statistical information specifically for the Czech Republic. The indicators used from the CZSO database are the unemployment rate (yearly and monthly, for the Czech Republic as well as for individual regions), the inflation rate, and the death rate (by age groups). The employment rate of ex-prisoners is not registered by any office in the Czech Republic. The organization Rubikon provides data on ex-prisoners. As the organization helps those in need find jobs, the data is employment-based. However, those data would bias the results as Rubikon is approached by individuals who are much more motivated and interested in finding and keeping a job.

Other variables taken into account are dummies for proclamations of amnesty and post-crisis years. The dates of 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 prisoners were released. The last variable 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.

The Statistical Yearbooks report how many prisoners are in the prison for the first time, for the second time, etc. From this information, I compute the recidivism rate ($recr_t$) as:

$$recr_t = (1 - firsttimers_t) * 100, \tag{1}$$

where the variable $firsttimers_t$ 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*. Firstly, 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:

$$relpris_t = pris_{t-1} + newpris_t - pris_t, \tag{2}$$

where the variable $relpris_t$ stands for the number of released prisoners in the year *t*, $pris_t$ is the number of prisoners held in the year *t*, $pris_{t-1}$ is the number of prisoners held in the year *(t-1)*, (i.e. the year prior), and the variable $newpris_t$ stands for the number of new prisoners who came in the year *t*. This formula is used only for a few years and it is consistent with the values stated by the Statistical Yearbooks of Prison Service.

To obtain the total number of working age ex-prisoners, I substruct the inactive part from the above-mentioned formula. In the Statistical Yearbooks, the age group range is over 10 years, so I take working age ex-prisoners to only be those between the ages of 15 and 60 years old. The data concerning 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. There are no exact numbers for sentencing lengths, only ranges. Thus, I 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 a 200-

month long sentence. For the people sentenced for the rest of their lives, the sentence will be understood as 220 months long. The weighted average of the length of a sentence is consistently 4 years during the selected period, the sole exception being the year 2013, when the average length was 5 years. In this context, I assume every incarcerated person is 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, I will also distribute the year 2013 by the year *(t-4)*.

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

$$relprisact_t = relprisactplus_t * (1 - dtr_t), \tag{3}$$

where $relprisact_t$ is the variable for the number of released prisoners in the working age lowered by the death rate in the year t, $relprisactplus_t$ 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).

3 Methodology

I present two types of regressions, time series and panel data regressions. Firstly, I estimate the effect of ex-prisoners on the unemployment rate and the effect of the unemployment rate on the recidivism rate in the Czech Republic covering the years 1992-2018. Secondly, the relationship between the recidivism rate and the unemployment rate is also estimated monthly by regions during the period 2014-2018.

3.1 Time Series regression models

The model which estimates the effect of ex-prisoners on the unemployment rate is described by the following equation:

$$unmplrt_t = \beta_0 + \beta_1 * relprisact_t + \beta_2 * recr_t + \beta_3 * amn_t + \beta_4 * prisact_t + \beta_5 * infl_t + \beta_6 * crisis_t + u_t, \quad (4)$$

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. Variable $relprisact_t$ is a previously defined variable that represents the number of working age released prisoners (lowered by death rate) in the year t, amn_t is a dummy for a proclamation of amnesty in the year t with values 1 for the years 1993, 1998 and 2013, 0 otherwise. The variable $prisact_t$ is the number of working age incarcerated persons in the year t, $infl_t$ 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), and u_t is an error term. The second model depicts the effect of unemployment on recidivism. That is, whether lower unemployment lowers recidivism. It is formulated as:

$$recr_t = \beta_0 + \beta_1 * unmplrt_t + \beta_2 * relprisact_t + \beta_3 * prisact_t + \beta_4 * crisis_t + u_t, \quad (5)$$

where are all variables described above.

To even start with time series regressions, I have to make the data stationary. I run the ADF and the KPSS tests as they form a complementary pair when testing stationarity. More about the stationarity, the ADF test, and the KPSS test can be found in subsection Appendix.1.

Table 1 depicts the results of the ADF & the KPSS tests run on original variables, 1^{st} difference of variables and 2^{nd} difference of variables. The results differ a lot between those two tests. For the original variables of the dataset, the ADF test shows that all of them are non-stationary with a significance level of 5%. The null hypothesis is not rejected because their p-values are higher than 0.05. At 1^{st} difference, the null hypothesis is rejected only for variables of amnesty and inflation. Thus, we also run it on 2^{nd} difference of the series, which results in a rejection of the null hypothesis for all variables. That is, all variables are stationary at 2^{nd} difference of the series. The number of released prisoners within working age has no available data for the whole period, therefore the ADF test cannot be used. For corroboration and because of the data unavailability for the number of released prisoners within working age, we perform the KPSS test. The results suggest that the number of prisoners within working age and inflation are stationary in their 1^{st} difference and that all other variables are stationary originally.

Table 1: Stationarity testing of dependent and independent variables by ADF and KPSS tests

	ADF			KPSS		
	Original	1^{st} Diff.	2^{nd} Diff.	Original	1^{st} Diff.	2^{nd} Diff.
unemployment rate	-1.128	-3.520	-4.600	0.251	0.340	0.029
	[0.902]	[0.061]	[0.010]	[0.100]	[0.100]	[0.100]
released prisoners	–	–	–	0.365	0.066	0.029
(active age)	–	–	–	[0.100]	[0.100]	[0.100]
recidivism rate	-3.095	-2.884	-4.378	0.184	0.271	0.049
	[0.154]	[0.235]	[0.010]	[0.100]	[0.100]	[0.100]
prisoners	-3.102	-3.589	-4.494	1.090	0.091	0.031
(active age)	[0.067]	[0.010]	[0.010]	[0.100]	[0.100]	[0.100]
inflation	-2.059	-5.179	-6.305	0.947	0.063	0.085
	[0.152]	[0.051]	[0.010]	[0.010]	[0.100]	[0.100]
amnesty	-3.474	-4.443	-4.740	0.140	0.037	0.071
	[0.550]	[0.010]	[0.010]	[0.010]	[0.100]	[0.100]
crisis	-2.191	-3.400	-4.359	0.151	0.037	0.025
	[0.500]	[0.077]	[0.010]	[0.100]	[0.100]	[0.100]
$N = 23$						

P-values in the square brackets.

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. To avoid non-stationarity, I use the 2^{nd} difference of all variables in Equation 4 and Equation 5.

After the regression, I test the model for homoskedasticity, normality, and autocorrelation by the Breusch-Pagan test for heteroskedasticity (hereafter BP test), the Shapiro-Wilk test (hereafter SW test), and the Durbin-Watson Test (hereafter DW test), respectively. More about the tests is in subsection Appendix.1.

3.2 Panel data regression models

As there are only 23 observations in my time series dataset (23 years across the Czech Republic), I perform also the regression of panel data. Because the data regarding released prisoners is not available in detailed form, I focus only on the relationship between the recidivism rate and the unemployment rate. Also, I reformulate the model. I have data for 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:

$$recr_t = \beta_0 + \beta_1 * unmplrt_t + \beta_2 * chng_{t-3} + \beta_3 * infl_t + u_t, \tag{6}$$

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, $recr_t$ is the recidivism in the year t, both expressed in absolute values, and $infl_t$ is inflation in the month t.

I provide a comparison between pooled OLS, FE (fixed effects), and RE (random effects) regression models. In subsection Appendix.2, one can find the description of the models as well as the description of the tests used for the evaluation of models (F-test, Breusch-Pagan Lagrange Multiplier test, and Hausman test). Then I test for heteroskedasticity and serial correlation using the BP tests and the Breusch-Godfrey/Wooldridge (hereafter BGW test), respectively. 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. For consistency, region-clustered standard errors will be performed as regions are the cross-sectional component of our model (Wizard, 2018).

4 Results

4.1 Czech Republic

Table 2 depicts the results from the model stated by Equation 4. My assumption of the negative effect of the number of released prisoners on the unemployment rate is not supported. The estimate of the number of working age released prisoners equals $9.906 * 10^{-7}$ with standard error $1.030 * 10^{-6}$. In other words, if one more prisoner is released, the unemployment rate is expected to rise. This relationship is possibly driven by the inclusion of those people in the labor force after they are released. However, the effect is extremely small and insignificant. Thus, there is no effect of the number of released prisoners on the unemployment rate in the Czech Republic in the period 1992-2018.

Table 2: Time Series Regression Results – unemployment rate in the Czech Republic

	Dependent variable: unemployment rate
released prisoners (active age)	0.000
	(0.000)
recidivism rate	0.257*
	(0.145)
prisoners (active age)	0.000***
	(0.000)
inflation	-0.001*
	(0.001)
amnesty	0.007
	(0.006)
crisis	0.016**
	(0.006)
constant	-0.000
	(0.002)
Observations	23
R^2	0.672
Adjusted R^2	0.549
Residual Std. Error	0.009 (df = 16)

Robust standard errors in parentheses.
The second difference of all variables.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The most significant effect has the number of working age prisoners. The more people in working age are imprisoned, the rise in unemployment occurs. That is possible if the majority of those imprisoned were employed prior to their conviction. If an imprisoned person was unemployed prior to the conviction, there should be a decrease in the unemployment rate as an imprisoned person is excluded from the labor force. Another important variable is the dummy variable, which represents the post-crisis years. When a crisis occurs, the unemployment rate is expected to rise. Some effect occurs also with inflation and recidivism. The relationship between the rate of inflation and the unemployment rate can be easily described by the Phillips curve. Concerning the recidivism rate, higher recidivism results in a rise in unemployment, which can be explained in the same way as the effect of the number of working age prisoners on unemployment. The high R^2 is possibly caused by a relatively high number of variables yet a low number of observations. The model depicted inTable 2 seems to be overfitted.

Table 3 represents the effect of finding a job on the recidivism rate stated by Equation 5. My assumption, that finding a job helps prevent recidivism rate is confirmed. The results indicate that a 1% increase in the unemployment rate results in approximately a 1% increase in the recidivism rate. The negative relationship between the number of working age incarcerated persons and recidivism could be explained as the more prisoners are imprisoned, the less of them can recommit a crime and return to prison. A dummy variable for crisis reveals a surprising result, opposite to the 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 of working age shows no effect.

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

	Dependent variable: recidivism rate
unemployment rate	1.034***
	(0.283)
released prisoners (active age)	-0.000
	(0.000)
prisoners (active age)	-0.000***
	(0.000)
crisis	-0.027***
	(0.009)
constant	0.000
	(0.003)
Observations	23
R^2	0.742
Adjusted R^2	0.685
Residual Std. Error	0.015 (df = 18)
F Statistic	12.957*** (df = 4; 18)

Robust standard errors in parentheses.
The second difference of all variables.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The homoskedasticity assumption is satisfied in both linear regressions as the null hypothesis was not rejected by the BP test. The normality assumption is satisfied by the performance of the SW test for which the null hypothesis was not rejected. The autocorrelation test suggests that in the first model (Table 2), a negative autocorrelation between adjacent residuals was detected. In the second model (Table 3), 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. The results of all tests can be seen in Table A1.

4.2 Regions

As the previous analysis is made only with 23 observations (23 years across the Czech Republic), I perform a more detailed analysis of the relationship between recidivism and unemployment with 780 observations (in terms of the region with monthly data for the years 2014-2018). As was discussed in subsection 3.2, I work with an adjustment of the number of incarcerated persons by month, understood as the modification of the labor force, lagged by 3 months. From the BP test, the presence of heteroskedasticity was detected as the null hypothesis was rejected, while the BGW test shows that serial correlation is present. All results are depicted in Table A2. For consistency, I present region-clustered standard errors as regions are the cross-sectional component of our model.

Table 4 depicts results of pooled OLS, FE, and RE regressions with robust standard errors (clustered at the regional level). The dependent variable is the recidivism rate. The independent variables are unemployment, the change in the prison population 3 months ago, and inflation. One can observe that pooled OLS and RE regressions have the same estimators. In this case, the negative variance estimation for the unobserved effect is set to zero, meaning that RE becomes pooled OLS. When testing which model is the best, we use the LM test, the F-test, and the Hausman test. The LM test suggests that RE is more suitable than Pooled OLS. Subsequently, the F-test proposes that FE is preferred over Pooled OLS. Finally, the Hausman test implies that the most efficient Model is FE.

Table 4: Comparison of the OLS, FE and RE regressions

Dependent variable: recidivism rate			
	OLS	FE	RE
unemployment rate	0.673***	1.079***	0.673***
	(0.029)	(0.053)	(0.029)
change	0.000	-0.000**	0.000
	(0.000)	(0.000)	(0.000)
inflation	1.379***	0.983***	1.379***
	(0.202)	(0.040)	(0.202)
constant	0.614***	–	0.614***
	(0.002)	–	(0.002)
Observations	780	780	780
R^2	0.448	0.672	0.448
Adjusted R^2	0.445	0.666	0.445
F Statistic	209.543***	521.753***	628.628***
	(df = 3; 776)	(df = 3; 764)	

Robust standard errors in parentheses (clustered at the regional level).
Second difference of all variables.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

My expectation from the beginning that an increase in unemployment results in an increase in recidivism is now confirmed. One can say that when there is a 1% rise in the unemployment rate, it causes an almost 1.1% rise in the recidivism rate. I include inflation in my model to have a representative macroeconomic indicator. In the period 2014-2018, inflation had an increasing trend, while recidivism had a decreasing trend because it reached its peak in 2013 after the proclamation of amnesty in January. Recidivism is a response to a change in inflation after some time, rather than immediately. The effect of the variable of an adjustment in the number of prisoners is understood as one additional prisoner held in prison results in lower recidivism (after three months), which aligns with common sense.

5 Conclusion

This study aimed to investigate the relationship between the unemployment rate and ex-prisoners. The extreme number of incarcerated people and rates of recidivism in the Czech Republic is an issue that can't be neglected. I research the relationship between the unemployment rate and the recidivism rate, in addition to the relationship between ex-prisoners and the unemployment rate. The results show that the effect of the number of released prisoners on the unemployment rate is negligible. However, I find 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 study 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 labor 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 labor force to prisons and the reduction in state expenditure from 1,200 CZK per day per prisoner to 130 CZK, for which a prisoner contributes 50 CZK (Česká justice, 2018). In the present day, 144 sentenced persons are monitored with the electronic monitoring system.[3]

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

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Appendix

Appendix.1 Time series regression tests

Stationarity It is important to first make time series data 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, 2015). According to Wooldridge's definition, the stochastic process x_t: t = 1, 2, ... is stationary if for every collection of time indices $1 \leq t_1 < t_2 < ... < t_m$, the joint distribution of $(x_{t1}, x_{t2}, ..., x_{tm})$ is for all integers h $\geq$ 1 the same as the joint distribution of $(x_{t1+h}, x_{t2+h} ..., x_{tm+h})$. The sequence x_t: t = 1, 2, ... is id. Basically, x_t has the same distribution as x_1 for all t = 2, 3, ... 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_{t2}) < ∞], 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, 2015). After the credibility that came with a Nobel Prize in Economics for Edward Prescot's Real Business Cycle Theory in 2004, Carlaw *et al.* (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 trends 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, 2020). This study 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 form a complementary pair as their hypotheses are opposites. Surely, they differ in the OLS regressions and statistics, but their hypotheses are the subject of a matter for the result. The ADF test, as defined by Dickey & Fuller (1979), has the null hypothesis that the 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 the presence of a 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 *et al.* (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.

Homoskedasticity The homoskedasticity assumption is defined by Wooldridge (2015) as $Var(u|x_1, ..., x_k) = \sigma^2$. 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 $Var(u_t|x_t) = \sigma^2$, where x_t stands for $(x_{t1}, x_{t2}, ..., x_{tk})$. For testing if heteroskedasticity is present, the Breusch-Pagan test for heteroskedasticity (BP test) is used, which was introduced by Breusch & Pagan (1979). Heteroskedasticity is present if the variance of errors from 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, meaning heteroskedasticity is present. For a p-value above the significance level, the homoskedasticity assumption holds.

Normality Normally distributed error term is defined by Wooldridge (2015) as: The population error u is independent of the explanatory variables $x_1, x_2, ..., x_k$ and is normally distributed with zero mean and variance σ^2: $\mathbf{u} \sim \mathbf{N(0, \sigma^2)}$. For Time Series, the definition is modified and presented as the errors u_t are independent of X and are iid as N(0, σ^2). Testing normality will be performed by the Shapiro-Wilk test (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. Conversely, if the p-value is above this significance level, the sample is normally distributed.

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 (DW test) is used to test the autocorrelation in residuals. There are two assumptions of the DW test, the first being that the errors are normally distributed with zero means, 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).

Table A1: Testing time series regressions

	Model 1	Model 2
Studentized Breusch-Pagan test	2.7754	2.1783
	[0.7346]	[0.703]
Shapiro-Wilk normality test	0.93712	0.97045
	[0.1558]	[0.6999]
Durbin-Watson autocorrelation test	2.5593	2.8808
	[0.9595]	[0.9906]

P-value in square brackets.

Model 1 refers to the regression in Table 2.

Model 2 refers to the regression in Table 3.

Appendix.2 Panel data regression tests

As there are several options for how to estimate Panel Data, it is necessary to choose the 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. The pooled OLS estimator ignores the panel data structure. Since the expectation of these effects is that they are non-zero, the homoskedasticity, autocorrelation even the exogeneity assumption could be disrupted. This is 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 the 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 & Basel, 2011).

I provide all three possible models. I then test them and make a decision on which model is the best fit based on whether the estimates are consistent and effective. 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. 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.

Table A2: Testing FE model

	FE
Studentized Breusch-Pagan test	89.413
	[0.000]
Breusch-Godfrey/Wooldridge test for serial correlation	702.65
	[0.000]

P-value in square brackets.

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