Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Statistics

Bachelor Thesis

Comparative assessment of unemployment rate development in the Czech Republic and the European Union

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BACHELOR THESIS ASSIGNMENT

Helena Rýparová

Economics and Management
Economics and Management

Thesis title

Comparative assessment of unemployment rate development in the Czech Republic and the European Union

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Objectives of thesis

The goal of the bachelor thesis is to evaluate the trend of unemployment rate development in the Czech Republic and the European Union. Assessment will be based on statistical analysis of time series.

Methodology

The main focus of the thesis will be a statistical analysis of unemployment. Thesis will contain statistical methods such as time series. Based on the analysis a forecast will proceed for the upcoming time periods.

The proposed extent of the thesis

30-40 pages

Keywords

Unemployment, labour market, regression, time series, trend, forecast

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Recommended information sources

FROYEN, R T. *Macroeconomics : theories and policies.* New York: Pearson/Prntice Hall, 2004. ISBN 0-13-143582-5.

HINDLS, R. *Statistika pro ekonomy.* Praha: Professional Publishing, 2007. ISBN 978-80-86946-43-6.

CHATFIELD, C. *The analysis of time series : an introduction.* Boca Raton, FL: Chapman & Hall/CRC, 2004. ISBN 1584883170.

JENKINS, G M. – REINSEL, G C. – BOX, G E P. *Time series analysis : forecasting and control.* Hoboken, NJ: John Wiley, 2008. ISBN 978-0-470-27284-8.

OTT, L. – LONGNECKER, M. *An introduction to statistical methods & data analysis.* Australia: Cengage Learning, 2016. ISBN 9781305269477.

ROMER, D. *Advanced macroeconomics.* Boston: Irwin/McGraw-Hill, 2006. ISBN 0-07-287730-8.

VEČERNÍK, J. *The Czech labour market: changing structures and work orientations.* Prague: Institut of Sociology, AS CR, 2007. ISBN 978-80-7330-132-3.

VLČEK, J. *Ekonomie a ekonomika.* Praha: ASPI, 2005. ISBN 80-7357-103-.

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Declaration

I hereby declare that I have worked on this thesis „Comparative assessment of unemployment rate development in the Czech Republic and the European Union“ by myself under the guidance of the supervisor of this bachelor thesis and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break copyrights of any third person.

In Prague, on 23rd of March 2020 _____

Acknowledgement

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Comparative assessment of the unemployment rate development in the Czech Republic and the European Union

Abstract

This bachelor thesis is dealing with development of unemployment in the Czech Republic as well as other states, which are a part of the Visegrad group and the European Union. The goal is to assess whether the trend is increasing, decreasing or remaining stable in the last ten years (2008 – 2018) and comparison between chosen areas – the European Union and the states of the Visegrad group, which are the Czech Republic, Slovakia, Poland and Hungary. The first part of the thesis includes a general concept of unemployment, the theoretical background of economic theory, definitions of terms, the explanation of statistical analysis used further on in the thesis and information about the structure of unemployment in individual observed areas. The practical part is focused on the application of statistical methods such as time series, decomposition of time series and correlation analysis. The output of the thesis is the forecast for the upcoming year. The results of the forecast show, that the unemployment rate in all the observed areas will keep on decreasing and indicate the lowest rates of unemployment in the past ten years. Based on the correlation analysis, the countries with the most similar development of unemployment rate were Poland and Slovakia. On the other hand, there was a low level of correlation between Hungary and the European Union.

Keywords: unemployment, labour market, regression, time series, trend, forecast

Komparace vývoje nezaměstnanosti v České republice a Evropské Unii

Abstrakt

Tato bakalářská práce pojednává o vývoji nezaměstnanosti v České republice jako člena Visegrádské skupiny ve vztahu k Evropské Unii. Cílem je analyzovat, porovnat a zhodnotit v období uplynulých deseti let (2008 – 2018), zda je trendová funkce klesající, rostoucí a nebo je stabilní. První část této bakalářské práce se zaměřuje na obecné pojetí nezaměstnanosti, vymezení souvisejících pojmů, seznámení se se statistickou analýzou časových řad a popisem struktury nezaměstnanosti ve zkoumaných oblastech. Praktická část se zaměřuje na využití statistických metod časových řad a korelační analýzou. Východiskem této bakalářské práce je prognóza pro následující rok. Na základě výsledků je předpokládáno, že míra nezaměstnanosti bude v následujícím roce klesat. Bude se jednat o nejnižší hodnoty míry nezaměstnanosti za posledních deset let. Na základě výsledků korelační analýzy byl u Polska a Slovenska zaznamenán velmi podobný vývoj v míře nezaměstnanosti. U Maďarska a Evropské Unie byla naopak zaznamenána nízká hodnota korelace v míře nezaměstnanosti.

Klíčová slova: nezaměstnanost, trh práce, regrese, časové řady, trendová funkce, předpověď

Contents

1 Introduction

Unemployment is a phenomenon and one of the many serious problems, which a lot of countries from the European Union deal with. To this day it is still a very monitored topic, especially after the economic and financial crisis in the year 2008. Primarily, the growth of the unemployment rate belongs to the most severe consequences of the crisis. It has uncovered the drawbacks of individual economies.

However, the question of unemployment is complex. It is the point where the demand, the candidates for job positions, and supply, the employers, meet. Both parties strive to get the maximum out of the deal. If the amount of job offers is high, the pressure is being brought up upon the applicants, who must lower their expectations and find themselves in an unfavorable position. This occasion affects frequently after the end of studies, whether it is elementary school, grammar school or university, where the person is looking for employment based on skills and education. Many of them must lower their requirements and accept the offers they get.

The development of the unemployment rate is one of the main social and economic problems of modern society. Everyone had experience with being unemployed. It could have been the personal experience, or it has been an experience of someone from the relatives. Neither way this life stage is accompanied by insecurity (unsure future, deficiency in finances, taking care of the family, suspension of career development) can negatively influence the next life experiences.

The Czech Republic, like other states of the Visegrad group, has gone a long way as well in its journey of transfer to the market economy. Nowadays the job market has become interconnected more than it has ever been. People are willing to move to a different area for a job. As one of the benefits, there is an ability to work from home, which is efficient especially for mothers on maternity leave. Corporate companies provide kindergartens in their facilities for women to maintain their positions. Women can this way balance their work and personal life. To showcase this statement Czech Republic, belongs to the country with the lowest unemployment rate in the whole European Union.

In the European context and considering the historical view, cultural view, level of economy and social welfare the states of the European Union are significantly heterogeneous. In the past decade the unemployment of the European Union has reached two-digit number and became a lasting problem of the European labor markets. European Union is looking for

long-term tools to help decrease the negative trend such as increasing the level of authority of European Union in social politics.

2 Aims and Methodology

2.1.1 Aims

The aim of the bachelor thesis is the assessment and comparison of the development of the unemployment rate in the states of the Visegrad group, which includes the Czech Republic, Slovakia, Poland and Hungary and the European Union. The evaluation is based on the statistical analysis of time series and a forecast for the upcoming year.

This bachelor thesis is divided into theoretical and practical part. Theoretical part covers the term unemployment, its impacts, its types, costs of unemployment and the labor market. Theoretical part also includes the explanation of the term natural rate of unemployment and the structure of unemployment in observed areas.

A research was made to collect the required information, which served as the main basis for the theoretical part. The main source of information was specialized literature and internet articles. For the practical part I gathered data from Eurostat.

2.1.2 Methodology

The practical part of the thesis uncovers the assessment and comparison of unemployment using statistical analysis of time series. Firstly, there will be a visual representation of the gathered data in order to determine the corresponding trend function. Pseudo – forecast is the next step in the time series analysis. Pseudo – forecast will determine whether the trend function is appropriate for forecasting for the upcoming year based on the relative error of forecast. Index of determination will be calculated in order to assess the quality of the function. Afterwards point estimate and interval forecast will be calculated.

2.1.2.1 Time series

A time series is a set of data gathered over time. Data is usually represented by numbers. Time series works with all sorts of data such as financial data, economic data, hydrological data, transportation data etc. (Palma, 2016). Data that form the time series are arranged chronologically.

From an economic point of view time series can be taken apart into components. Components of a time series model are:

- Trend (T)
- Periodic (P)
- Irregular (ε)

The trend represents the long-term tendency considering the average behavior of time series. Trend could be upward sloping, downward sloping or remaining stable. The purpose of decomposition is the easier identification of behavior of time series (for example, long-term growth) (Cipra, 1986). Periodic component of the time series demonstrates regular changes. It also represents the fluctuations around trend, where two phases interact – the phase of growth and the phase of decrease.

The representation of time series can be observed in an additive model:

- Additive model formula:

$$\hat{y}_t = T_t + P_t + \varepsilon_t, \text{ where } t = 1, 2, \ldots, n \quad (1)$$

According to the additive model, all components of time series are added together in order to acquire the value of the time series $\hat{y}_t$ (Anderson et al, 2014).

2.1.2.2 Characteristics of time series

Elementary characteristics of time series must be calculated and analyzed in order to define the trend of the function. One of the characteristics is a graphical representation of data with computation of statistical indicators. Visual representation of data shows the long–term tendency. The statistical indicators calculated will be arithmetical average, 1st difference, 2nd difference and chain base index. All of the mentioned are a part of characteristics of time series.

Arithmetical average is one of the basic characteristics of time series and descriptive statistics. It is one of the simple versions of the mean.

Arithmetical average is calculated as:

$$\bar{y} = \frac{\sum y_t}{n} \tag{2}$$

1st difference is calculated as:

$$\Delta_t^1 = y_t - y_{t-1} \text{ where t = 2,3, …, n} \tag{3}$$

2nd difference is calculated as:

$$\Delta_t^2 = \Delta_t^1 - \Delta_{t-1}^1 \text{ where t = 3,4, …, n} \tag{4}$$

Chain base index is calculated as:

$$k_t = \frac{y_t}{y_{t-1}} \tag{5}$$

(Hindls et al, 2006)

2.1.2.3 **Defining the trend**

In the process of defining the trend parameters of the function, the most used method is called the *least squares method*. However, this method is used only if the parameters in the function are linear. Hindls claims: „*This method has a number of advantages, it minimizes the dispersion of the residual component, it is relatively simple, numerically easy and follows some criteria of choosing the appropriate model of the trend, which are based on the residual sum of squares.*“ (Hindls et al, 2006) [own translation]

Sample standard deviation, as one of the parts of descriptive statistics, is used to explain the deviation among variables from the average value. Sample is used as an estimate of the population. It can only have positive values and has the same unit of measurement as the observed variable. Standard deviation is equal to the square root of variation, which calculates the variance of how far data are spread from the average value.

$$s_y = \sqrt{s_y^2} = \sqrt{\frac{\sum (y_t - \bar{y})^2}{(n-1)}} \tag{6}$$

(Hindls et al, 2006)

2.1.2.4 Index of determination

The assessment of the quality of the function and the goodness of fit is carried out through the index of determination. The indicator of accuracy shows the proportion of explained variation in our data.

Index of determination I^2 is calculated:

$$I^2 = 1 - \frac{\sum(y_t - \hat{y}_t)^2}{\Sigma(y_t - \bar{y})^2} \quad (7)$$

Where

y_t = ratio of unemployed individuals at period t

$\hat{y}_t$ = value of trend function

$\bar{y}$ = arithmetical average of unemployed individuals

Index of determination is defined in interval < 0;1 >, where values closer to 1 show a better quality model (Hindls et al, 2006).

2.1.2.5 Modelling of pseudo – forecast

Pseudo-forecast is used to evaluate the quality of the model for the upcoming forecast. The aim is to eliminate the last observation. Therefore, a new trend function will be created, and the upcoming period will be substituted. It is used for forecasting for the period, where the real values are known. Therefore, it is the comparison of the actual value and calculated forecast. The level of accuracy is evaluated through a relative error of forecast.

The relative error of forecast (r) is calculated through the following formula:

$$r = \left|\frac{P - A}{A}\right| \cdot 100 \quad (8)$$

Where

P= predicted value

A= actual value

2.1.2.6 Point estimate and interval forecast

Point estimate is a value, which represents an estimate of the future value considering time series. It is bounded by an error, so the final value cannot be taken with complete accuracy and exactness. However, the interval forecast, shows the top and the bottom line of the forecasted value (Cipra, 1986). It is represented by an interval, where the predicted value should be comprised.

Point estimate is calculated through the trend function by exchanging the value x by the upcoming t value. In this case t_{12} was used.

Interval forecast formula is the following:

$$P\left(\hat{y}_{t+i} - t_\alpha \cdot s_{\hat{y}_{t+i}} \leq y_{t+i} \leq \hat{y}_{t+i} + t_\alpha \cdot s_{\hat{y}_{t+i}}\right) = 1 - \alpha \qquad (9)$$

Where

$\hat{y}_{t+i}$… point estimate for (t + i)

t_α…critical value for Student's t – distribution for significance level alpha and (n-2) degrees of freedom ($t_{0.05\ (9)} = 2.262$)

$s_{\hat{y}_{t+i}}$… standard error of estimated values

This is also known as *prediction interval (PI)* (Montgomery, 2015).

2.1.2.7 Correlation analysis

In the first place, it is necessary to look into the relationships among residual parts, when examining the relationships between time series. The long – term tendencies can have similar stance. Moreover, the dependency of analyzed time series can be assumed, if there is a continuity among residual parts. While working with the additive model and looking for dependency, it is possible to correlate residuals (Hindls et al, 2006).

The residual formula for x is the following:

$$e_{x_i} = x_i - \hat{x}_i, i = 1,2, \dots, n \qquad (10)$$

The residual formula for y is the following:

$$e_{y_i} = y_i - \hat{y}_i, i = 1,2, \dots, n \tag{11}$$

It is calculated as the difference between the certain value of y_i and the corresponding value of $\hat{y}_i$ (Montgomery, 2015). Where into the original trend function corresponding i value is applied.

The correlation analysis is examining the strength of the dependency of the relationship between residuals x and y. The comparison will be based on the *coefficient of correlation*.

$$r_{e_y e_x} = \frac{s_{e_y e_x}}{s_{e_y} s_{e_x}} \tag{12}$$

Where

$s_{e_y e_x}$… sample covariance of residuals based on the formula:

$$s_{e_y e_x} = \frac{1}{n-1} \sum_{i=1}^{n} (e_{yi} - \overline{e_y})(e_{xi} - \overline{e_x}) \tag{13}$$

s_{e_y}, s_{e_x} … sample standard deviation of residuals for y and x

The coefficient of correlation is defined in the interval < -1;1 >, where the number is closer to 1, there exists a dependency among variables (Hindls et al, 2006).

3 Theoretical Part

3.1 Unemployment

All economies around the world experience an exigent problem called unemployment. It is a part of politics of all countries of the world and affects the daily lives of people. Not only lives of the unemployed. But in the era of market economy, where the labor market belongs, almost nobody can be sure about their occupational inclusion.

The economy affected the unemployment rate in the year 2009, where the consequences of the worldwide economic crisis kicked in. The crisis caused failure of smaller and bigger companies, which caused a rapid increase of unemployment. In such a high rate of unemployment it was unable to stabilize the economy in a short amount of time. Since there were the citizens of countries, who were not producing anything, the state did not gain profit and had to provide the support and the benefits. The effort of each state and company was to immediately create positions so that people can regain values and return to their lives.

Unemployment, it is the time when individuals are seeking for work without any luck. In order to define unemployment, there are two terms that need to be introduced. It is necessary to divide the population in economically active and economically inactive. Economically active are the employed and unemployed part of the population actively searching for jobs. Economically inactive are all individuals, who are not employed and are not searching for a new position (Klíma, 2006).

The extent of unemployment can be calculated through an indicator which is called the unemployment rate. It is calculated as a ratio of unemployed people to the labor force:

$$u = \frac{U}{L} \times 100 \text{ (in \%)} \tag{14}$$

where u is the unemployment rate
U is the number of unemployed workers
L is the labor force

According to Krebs, unemployed individuals are those, who are actively seeking work and are registered at the labor office (Krebs et al, 2005). The unemployment rate shows not only

the average figure for the whole country, but also for individual regions. For a more specific research of the labor market certain indicators are applied. Unemployment rate is calculated for particular groups such as men, women, according to the age groups, the level of education etc. (Jurečka et al, 2017).

3.1.1 Natural rate of unemployment

The natural rate of unemployment is a time of unemployment, where all segments of the labor market are in equilibrium. Some show a surplus in demand and job vacancies, the others surplus of supply and unemployment. It is dependent on specific factors of the job market such as the opportunity to create new work positions, the adaptability of workers (connected to their housing situation and the level of education), the ratio between frictional and seasonal unemployment, the duration of unemployment and also the possibility of retraining (Krebs et al, 2005). The term natural rate of unemployment has been evolving over time. Nowadays the term is connected to inflation rate development in economy.

The natural rate of unemployment is not invariable. It is different on an international scale and its rate is changing over time in the chosen country. There are factors influencing the rate such as the motivation of individuals in seeking a new job opportunity. Considering a high motivation of people, the natural rate of unemployment will be low. Individuals can be affected by many circumstances such as the pay packet or the corporate ladder. The higher ability of office to search and recommend job vacancies to the unemployed, the better awareness of the situation in the job market causing the natural rate of unemployment to decrease. Another factor is the duration and the level of job seeker's allowance. The longer the people gain the support the natural rate of unemployment will reach higher values. Lastly the demographic structure of the labor force plays a significant role in searching for a new job position. Demographic factors such as age, gender and education influence the employers in hiring new employees. In general, young and educated people have a higher chance of finding a new job. However, for the older age groups, also even for young people with a low level of experience, with a low level of education searching for a job vacancy is very difficult (Jurečka et al, 2017).

Phillip's curve represents the relationship between inflation and unemployment. This was established in the 1960s. The theory says that decrease of inflation causes increase of

unemployment and vice versa. In case that the economists could estimate the course of the Phillip's curve for the economy, they will obtain a curve, which shows possible combinations of inflation and unemployment. However, the subsequent progress showed, that these assumptions on how the economists would choose between inflation and unemployment were fallacious (Holman, 2005).

3.1.2 Types of unemployment

Over the time of analyzing unemployment, several types or categories have been established. It is possible to categorize them based on certain criteria. Individual types refer to main causes of unemployment and each type points out a different imperfection.

3.1.2.1 Based on duration

One of the characteristics of market economy is that it is always adapting to changing demand. An accompanying effect that comes with the alterations is the changes in the job market, where people enter unemployment and leave unemployment. Unemployment should be taken into consideration not only by the rate but also for the duration. In case unemployment is short term does not cause any major unpleasant feelings. The real problem is long-term unemployment. Long term unemployment can cause existential problems, loss of self-confidence and loss of qualification. The cause of long-term unemployment is among others is the economic situation and social benefits. These benefits lower the motivation for searching vacancies and lower the opportunity the adapt to the requirements of the labor market (Holman, 2005).

3.1.2.2 Based on causes

Krebs claims, there are three main types of unemployment. He describes them as frictional, structural and cyclical.

Frictional unemployment is happening ceaselessly due to transfer of workforce in between fields or locations. This type results from graduates looking for jobs, changes because of moving and people changing jobs in general. Also, women after maternity leave belong to the frictionally unemployed. It is closely connected to the life cycle. Always there will be a certain amount of people, who are unemployed. These people are seeking for jobs within

their fields with better working conditions and preferably higher income. This type has a temporary period and is considered voluntary (Krebs et al, 2005). Frictional unemployment is not a big threat to the economy. It would become a problem if the number of frictionally unemployed people, would keep increasing and they would not be able to find a job for a longer time. The state is trying to avoid these cases by providing information about job vacancies.

Structural unemployment is related to the inconsistency between supply and demand of labor force in individual sectors of the job market. In some branches of the job market the demand is increasing, where on the other hand in some the demand is decreasing and causes unemployment (Krebs et al, 2005). There can be a surplus of welders and technicians and lack of nurses or caretakers. The change of the structure of the economy can be stated as a cause of this issue. This effect can be on a national scale or only in specific regions, where its economy is going through severe structural changes and coming about to deadening of technical fields. Technological progress is another reason of the structural unemployment. The development of robotic causes the living labor force to be substituted by the work of machines. Structural unemployment tends to be very dissimilar among regions and tends to last longer than frictional. For that reason, it is difficult to align job vacancies with the qualification requirements of applicants. The solution to this type of unemployment is the retraining of individuals in new fields in order to be employed. Due to the fact this type of unemployment is considered to have the most severe consequences for the economy (Jurečka et al, 2017).

Cyclical unemployment is related to the economic cycle. It is dependent on macroeconomic indicators that increase or decrease over time (Reif, 2015). It is developed when overall demand for jobs is low. As a result of decline of productivity, unemployment rate is increasing in all areas (Krebs et al, 2005). Cyclical unemployment is increasing during recession, while during the phase of expansion it is decreasing. The length of this unemployment is variable and is influenced by the current stage of the economic cycle. The consequences affect the whole economy (Jurečka et al, 2017).

There is one more type of unemployment that occurs occasionally. It is called seasonal unemployment. In the labor market there are fields that offer vacancies only in certain times of the year and are influenced by the four seasons. The economy is expecting this form of

unemployment. Affected fields usually prosper during the year, so that the employees can afford to be unemployed for some time. The most affected fields are civil engineering, agriculture and touristic services (Jurečka et al, 2017).

3.1.2.3 Based on voluntariness

Another way to differentiate unemployment is voluntariness. There are two types of categories – voluntary and involuntary.

Voluntary unemployment is a situation, where the number of unemployed individuals is smaller or equal to the number of job vacancies (Klíma, 2006). It is usually caused by people transferring from one job to another. Voluntarily unemployed individuals prefer to spend their free time doing hobbies, study or other activities before work with the current wage scale. They can also be frictionally unemployed. The period voluntary unemployment depends on the alternatives of earnings the citizens have. One of the alternatives could be considered the unemployment benefits provided by the state. If the unemployment benefits are low and the period, they are provided is short people are motivated to find a new job quickly. This causes the voluntary unemployment to be low (Holman, 2005).

Involuntary unemployment is a situation that occurs when the number of job vacancies is smaller than the number of job applicants. Aggregate demand for job offers is smaller than the aggregate supply of work (Klíma, 2006). Involuntary unemployment is caused due to the poor economic situation – unfavorable composition of the job market, low number of job offers or lack of job vacancies in specific fields. This type of unemployment has worse effects the voluntary unemployment. Whereas a voluntarily unemployed person has to decline offers that do not satisfy their needs, an involuntarily unemployed person does not have to chance to choose whether they want to accept the job offer or not. He/she is willing to work for a smaller wage but still has no luck in finding it. Another negative consequence is that it affects people that do not have the chance of alternatives, because retraining or finding other sources of earnings are extremely difficult (Holman, 2005).

Minimum wage is another cause for unemployment. The government determines the minimum wage and the employers cannot pay a smaller wage than the one established by the government. It brings out unemployment in particular fields of the job market, where the

wages are set low (Holman, 2005). Unemployment which is brought up by the minimum wage is involuntary because the dismissed workers would be willing to work for low wage, but the companies cannot pay out these salaries.

There is obstacle in defining the voluntary and involuntary unemployment. Groups of people, who are truly voluntary unemployed, apply at the job center mainly for the unemployment support and the possibility of a job offer coming. And then they under not specified circumstances they turn down the offers or they accept the job offer only for a short period of time.

3.1.3 High – risk groups

The growth of unemployment is caused by the segmentation on the job market. It is well known that all groups of society are not threatened in the same way and their position is not stable. The opportunity of being employed depends on factors such as education, age, gender, health situation and qualification. Krebs claims there are the following high – risk groups:

- Women
- Juveniles and fresh graduates
- Handicapped individuals
- People, who are just about to enter retirement

Unemployment strikes out mostly people with lower level of education and qualification. It is also dependent on the location (Krebs et al, 2005). The most important is the period because the longer it is remaining, the worse the impacts can get.

Women

A disadvantage of women, which is affecting their lower employment, is primarily caused by maternity leave. Their position on the job market is, compared to men, less stable. It is one of the weakest spots of the labor market. For example, the gender representation on the labor market until the year 2008 was dominated by men in the Czech Republic. Temporary increase of proportion of women employed is caused by the loss of occupation of men, who were working in fields mainly employed by men during crisis.

In 2012 the situation returned to the pre-crisis conditions meaning the women were in surplus considering unemployment (MPSV, 2013). The disadvantage of women on the job market can be expressed in several levels. Primary the threats of women on are their disadvantage due to motherhood and due to taking care of close ones (for example: parents) especially in their retirement age. The position of women on the job market is also influenced by the cultural and social traditions in individual countries.

Juveniles and fresh graduates

After the economic crisis broke out the most threatened groups were young people and people right before their retirement. These groups were spotted to have the highest increase of unemployment.

Low employment of juveniles is connected to their disadvantaged position on the labor market but also their low economic activity. High-risk juveniles are considered mainly middle school graduates. University graduates belong to the more successful on the labor market for their mobility and creativity. This fact shows that employers prefer individuals with higher education, considering the situation, when there is a surplus of labor force. The problem of juveniles entering the labor market is the lack of practical experience.

The differences among individual countries of the European Union are significant. Youth unemployment is alarming in Greece and Spain, where it is attacking nearly 40%. Around 30% of youth unemployment is in Cyprus, Portugal and France. Czech Republic has achieved the position, where it holds the lowest youth unemployment rate in the EU. This fact is caused by the level of education and the level of economy (Dias, 2018).

Handicapped individuals

In the past years the number employed of handicapped individuals has been increasing coming hand in hand with their recent coming to the fore. A significant problem of this group includes the assumptions of the employers. A high level of demotivation with constant lack of success with finding a job and long-term unemployment is the problems these people are struggling with. The difficulty is not the handicap itself but the associated low level of education. Additionally, the issue with age here takes its role. Heart illness, spine problems or mental problems are burden to most of these people.

People, who are just about to enter retirement

The elderly is the group of people that are affected by their health issues and lack of adaptability to changing conditions in the working environment. The position of elderly in the job market is inconvenient for them due to the lack of offers with part-time contract. According to the rising number of older people, the situation should be solved within years. Early retirement is a cause of higher unemployment of older groups of people (MPSV, 2013). In the last decade, the employment of women rapidly increased. The growth of employment of women has been faster than employment of men. The economic influence of women in need of extra earnings especially after the reforms of countries related to the social system. Some level of impact can also play the increasing flexibility of job positions.

3.1.4 Costs of unemployment

Costs of unemployment are related mainly to cyclical unemployment. Unemployment benefit helps people without a job with problems connected to the loss of income. Costs also refer to the employed individuals via insurance payments in unemployment. One of the costs of unemployment is the loss of aggregate output and retirement pension. It is the value of output, which the unemployed would produce if he/she was working. Another type of unemployment cost is loss of value of human capital. Human capital represents a value of education and gained knowledge and abilities of an individual. If unemployment lasts a longer period, the value of human capital is decreasing. Last but not least the increase of criminality is one more cost of unemployment. If people cannot make money legally, some of them will get involved in making money through criminal offence. Lastly there is the loss of dignity, which affects those, who are long-term unemployed and causes pressure to the whole family (Liška et al, 2004). The ideal solution is the elimination of impacts, which cause a high rate of unemployment. Lowering the level of administrative burden imposed on businesses, improving the environment among entrepreneurs, lowering labor costs and making the legislation a bit flexible could all a potential help to the unemployed. However, this needs to be done on a national level, not across the European Union.

3.1.5 Impacts of unemployment

In general, unemployment is considered a negative phenomenon. There is not one point of view, that all types of unemployment are bad for the society. From the economic point of

view the reaction might not be clear. In real life the negative aspects of unemployment predominate. Two points of view of impacts are defined by Klíma.

Firstly, the social impacts which affect the behavior, social life, and mainly the social situation of the unemployed and their families. Long-term unemployment leads to loss of qualification. Unemployment means the loss of monthly income and living of the security benefits. It is leading to a decrease of living standard because the security benefits do not compensate the whole amount of the previous income (Klíma, 2006). Unemployment has also a big influence on the stress level, social tension, sickness rate, higher level of criminality rate and the number of suicides.

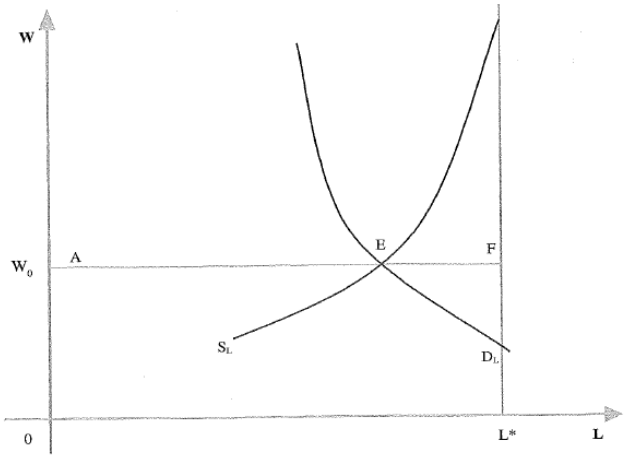
On the other hand, unemployment does not exclude an active and healthy lifestyle, calm relationships within the family and maintenance of stable time management. It always depends on how the individual will face the situation. Some people tend to deal with unemployment better than others. In general, the people who deal with it in a shorter amount of time are those, who are flexible and unemployed for a short period (Krebs et al, 2005).

Secondly, there comes a time in the economic cycle, where there cannot be any more job vacancies created for those, who want to work. This leads to unutilized labor force which results in significant losses within the products and services (Klíma, 2006).

3.2 Labor market

Labor belongs to the primary factors of production. It is a purposive and deliberate activity. Nevertheless, it depends on the person's mental and physical abilities. Households stand on the side of supply and companies take the part of demand (Klíma, 2006). Equilibrium on the job market is affected by the cost of labor meaning the wage. The presence of unemployment is demonstration of inconsistency between the supply and demand of labor. It is also affected by the imperfections on the labor market.

Figure 1 Labor Market and Unemployment



W = hourly rate
W_0 = a level of hourly rate
AE = employment
EF = voluntary unemployment
S_L = labor supply
D_L = demand of labor
L* = economically active population
L = amount of labor
E = equilibrium

Source: Klíma, 2006

Labor market is heading towards equilibrium and maintains its position in similar way as the commodity market. Imbalance of the job market is a temporary occasion, which is eliminated by the shifts of the wages. Figure 1 is showing the labor market. The real hourly wage is indicated on the vertical axis and the amount of labor on the horizontal axis. The real hourly wage rate is the average for different branches of the job market. The point E in the graph represents the equilibrium of the job market, where the labor demanded is equal to the labor supplied. The wage, which is set in with the equilibrium is called a balanced wage (Holman, 2005).

The imbalance on the job market can be eliminated by the movement of the real wage. It could be considered that the equilibrium would go a little higher, in that case there would be a surplus considering a higher hourly wage. This occurrence is called unemployment. However, the competition among people would push the wage lower until the point, where unemployment would disappear (point E). On the other hand, if the equilibrium went lower in the graph it would cause shortage of labor. The competition among companies would raise the wages which would lead to higher amount of labor supplied. Companies would be forced to lower the amount of labor demanded. The increasing of wage would end whenever the point W_0 would be reached, where the labor demanded would be equal to labor supplied (Holman, 2005).

A method to lower the level of unemployment is the support of smaller and middle-sized businesses. These companies can absorb a part of the unused labor force. Another way is to

help with the accessibility of housing, provide financial support with possibility of moving from one place to another due to change of job.

In order to increase the flexibility of the job market a new term has been established. *Flexicurity* is a combination of words *flexibility* and *security*. This new term expresses seeking balance of the flexibility of the job market, which lowers the level of unemployment and increases the security of the workers. It is a combination of actions supporting the abilities of participants in the labor market to adapt to its changes and tools, which create the basic social securities. In specialized literature it is also possible to come across the term *employability*, which expresses the ability to get employed on the job market. A person is employable, when the individual is able to acquire a new position, stay employed and deal with changes coming from the working environment (Jurečka et al, 2017).

3.3 **European Union**

Over the years, long term unemployment is a feature that was true to type for Europe. This did not appear so substantially among other resembling economies. One indication of long-lasting unemployment of individuals is that Europe offers a range of benefits for the long-term unemployed people. Up to four times longer is the duration of benefits compared with for example the United States (Symes, 1995).

There were a few indicators affecting this phenomenon. One of them was high costs for labor force. A social problem caused mostly by high wages and high levies for insurance. Inconsistency between supply and demand on the job market. The level of education does not correspond with the needs of the job market. A limiting factor is the level of education provided in individual states. At last the progress the technology has made. Job positions are being cut down due to the technological progress. Although the growing sector with services and also the so called fourth sector (research, science, education) is unable to create the necessary number of positions to align with those that are being removed. There was a low level of flexibility on the European labor markets. However, the European Union has reached its lowest rate of unemployment in ten years. Such a low value was last seen just before the financial crisis in 2008. Nowadays economies around Europe prosper. Almost all of countries of the European Union have witnessed a decrease in unemployment rate after the end of Europe's recession (Flores, 2019).

Europe's aims and goals called *Europe 2020 Strategy*, which is a strategy for European Union for the upcoming ten years. Among research and development, education and climate change, unemployment is one of the top issues to be on the list. In general, it is necessary to point out that the issue of unemployment is a very discussed topic. The goal is for there to be at least 75% of the population between the ages 20-64 employed (Eurostat, 2019).

3.4 Visegrad Group

Visegrad group is a regional formation of four post – communist central European states: Czech Republic, Slovakia, Poland and Hungary. The group was established in Hungary at Visegrad castle in 1991. The goal was to provide safety at a time of political instability after the events that happened in the year 1989. At the beginning of the last decade of the previous century these countries went through a transformation of economy. This transformation touched among other mainly propriety relationships, where the socialist ownership was privatized into the private sector. After these countries got back on their feet the cooperation has gotten more intense (Schreier, 2015). Countries of the Visegrad group were striving for entrance to the European Union. The countries saw their engagement as a next step to overcome obstacles with Europe and to achieve a higher level of mutual support. Their aim was reached in the year 2004 when they became members of the European Union. It is necessary to point out that the Visegrad group did not come into existence as an alternative to help create a better integration of Europe. The main goal is to contribute in creating a safe architecture of Europe, which is based on functional cooperation. All activities of the Visegrad group lead to increasing stability in central Europe (Visegrad Group, n.d.).

3.4.1 Czech Republic

The Czech Republic has experienced a change from the heavy industry, agriculture and mining in the last years of the previous century, which made an impact on the level of unemployment. The most threatened regions in the long term lie in the north of the Czech Republic. The problem was remaining even though the government was trying to equalize the differences among regions. Fulfilling these aims was and still is difficult because each region is specific for its economic, social and demographic circumstances. The unbalance of regions is influenced by the structure of supply of job vacancies. Another factor influencing the disparity is the level of education in each specific region.

On the contrary Prague and its surroundings did not experience heavy industry issues, their focus is based on tourism. Prague has one of the lowest unemployment rates in the Czech Republic (Miskolczi, 2010).

Employment in the Czech Republic reached its peak in the year 2008. The economics slowed down after the arise of the economic crisis. In addition, the structure of unemployment changed due to an increase in the number of entrepreneurs overall in the labor force. Moreover, the labor force transferred from the second sector to the third sector. The labor market also reacted to the change by the modification of the structure of commitment. There has been an increase in the number of contracts for a defined period of time and also part – time contracts. This effect could be the aim of the labor market for a higher level of flexibility. On the other hand, this form of employment gives the employees insecurity and other negative consequences. The economic crisis also affected the income of foreign labor force (MPSV, 2013).

As a follow – up to the strategy Europe 2020, Czech Republic managed to raise its employment of the 20 – 64 age group up to 79.9% in the year 2018 mainly because more women and older age groups were employed. Another aim of the Europe 2020 was the decrease of the youth unemployment by one third (approximately to 12.2%) and also the decrease of the unemployment of the individuals with low expertise by one fourth (approximately to 18.8%). In 2018 the youth unemployment decreased to 6.7% and individuals with low expertise decreased to 10.7% (MPSV, 2019).

In general, the Czech Republic has been facing the lowest unemployment rate in the European Union. According to the analysts, there is no way for it to decrease even more. As an example, in September 2018 the number of people without a job dropped to 201 900, which is the lowest September value since 1996. Employers showed high interest in laborers in the building construction field, cleaners, truck drivers, cooks and warehousemen. The average age of an unemployed individual was 42.1 years. There are mainly people with low level of education – mainly those who finished primary and secondary school. One-fourth of job applicants were unemployed longer than one year. The average length of unemployment was 510 days (ČTK, 2019).

3.4.2 Slovakia

Unemployment has started to appear in Slovakia after the year 1989. Until then the regime was working on full employment. The year 1989 was a transition to a labor market, where job applicants are hired based on the demand. Several decades later Slovakia has been struggling with long term unemployment in regions. The eastern part of Slovakia is attacking 30% rate of unemployment. This is caused by a low level of demand for job positions and small amount of job vacancies. The government has launched incentives such as the social benefits to help eliminate the conditions that increase the unemployment rate. Slovakia wants to prevent long term unemployment and support the regions with a higher level than 20% by creating new job vacancies and helping with funding companies. Nevertheless, there are differences in regions and there is a low level of mobility (Harumová, 2016).

According to the prime minister, Slovakia is doing very well in decreasing unemployment, decreasing the number of people, who receive social benefits and decreasing the number of the long term unemployed. The development of unemployment in Slovakia will depend on how the European economy will manage. The analysts claim that the unemployment rate will go down in a slower pace than in the previous years because of the slowdown of the German economy and the fact that there is shortage of qualified individuals. The number of vacancies remains high especially in the eastern Slovakia (SME, 2020).

3.4.3 Poland

Poland has come a long way since the change of the regime. Unemployment has been fluctuating and people have been working mainly in the industrial sector. Although, Poland has been recognized as one of the states of the Central Europe, who have been leading in entrepreneurship after the transformation. This fact caused a positive impact on the Polish labor market (Pizzati, 2002).

The structure of the employed population in regions was an issue brought up by the methodology of Polish statistical office. The most pleasant results were in the capital city Warsaw and in the south-eastern part of Poland (Statistics Poland, 2019). The small cities and rural areas in the north and east parts of Poland have been struggling with unemployment. The northern part of Poland is affected by seasonal unemployment. This is one of the severe problems of the labor market.

Youth unemployment in Poland is a major problem between the ages 25-34, which was the largest group of unemployment with a percentage of 28% of the total number of the unemployed in the year. Overall, the majority of the people, who are registered at the labor office are those, who achieved only a low level of education. The structure of education is different between women and men. The percentage of women, who completed the secondary and tertiary education is higher than men's making it 56.2 %. On the other hand, men reached 36% (Statistics Poland, 2019).

3.4.4 **Hungary**

Hungary, as all the states in the Visegrad group, has experienced a major transition after the transfer to market economy in the previous century. Since then the labor market has been shattered. One of the main consequences was a regional disparity in the unemployment. It was also caused by the dissimilarity in the wages among regions. Regions located in the east of Hungary along the borders with Ukraine have the worst rated job vacancies market. The highest rates of unemployment are found in villages and low density of settlement. In these rural areas there is a poor level of infrastructure, low level of education and a small presence of services. The region including Budapest has the lowest rates of unemployment rate (Pizzati, 2002). Hungary is split into two parts. The one, which is closer to Austria, benefits from the advantage of having Austria as a neighbor. The transport infrastructure from the central region to Austrian cities are accessible. Therefore, people use them for commuting for jobs in Austria.

Labor market and economy have been affected by the economic crisis. Unemployment increased and people lost their jobs. The adjustment made right after the crisis was the ability to work part-time. Among many the corollaries were a reduction of costs such as social benefits, cancelling of thirteenth salary, adjustments in the level of taxes. A program to raise the employment called "*Pathway to Work*" has been established. Its target group has been the people, who are unemployment for a longer period than 12 months. After a few years the program has been discontinued (Kierzenkowski, 2012).

In Hungary, the unemployment rate in the year 2018 continued to decrease. However, the decrease was less substantial than in the previous years. One of the reasons is that people were dismissed from labor due to convenient economy activity and processes and dissolution

of job positions. Demographic issues also resulted in a shift in the labor supply. The unemployment rate in the year 2018 reached 3.7%, which is considered a historic low. It was one of the lowest values of all European Union. Two regions in the northwest of the country reported unemployment rate at 2%, which could be considered as full employment. Considering the Europe 2020 plan, Hungary achieved a very pleasant result of 74.4% employed individuals between the ages 20-64 (Hungarian Central Statistical Office, 2019).

4 Practical Part

4.1 Assessment of the unemployment rate

In order to start with the evaluation of the unemployment, necessary data must have been gathered, which are shown in Table 1. Each country has a statistical office, where among other indicators the unemployment rate is calculated. This data provides information about the national job market, but also a comparison on an international level. The rate of unemployment is being calculated on a national level among Europe. The level of unemployment of each nation is gathered by an institution called Eurostat (Jurečka et al, 2017). There is a small difference in how the unemployment rate is calculated in the European Union. Eurostat is using a methodology for calculation of the rate of unemployment only it compares the unemployment rate between the ages 15 and 74. European statistical office uses a harmonized unemployment rate (Eurostat, n.d.). Czech Statistical Office is calculating the *general rate of unemployment* using the methodology released by the *International Labor Office*. It calculates the ratio of the unemployed and the economically active between the year 15 and 64 (Holý, 2012).

Table 1 Unemployment rates in observed areas

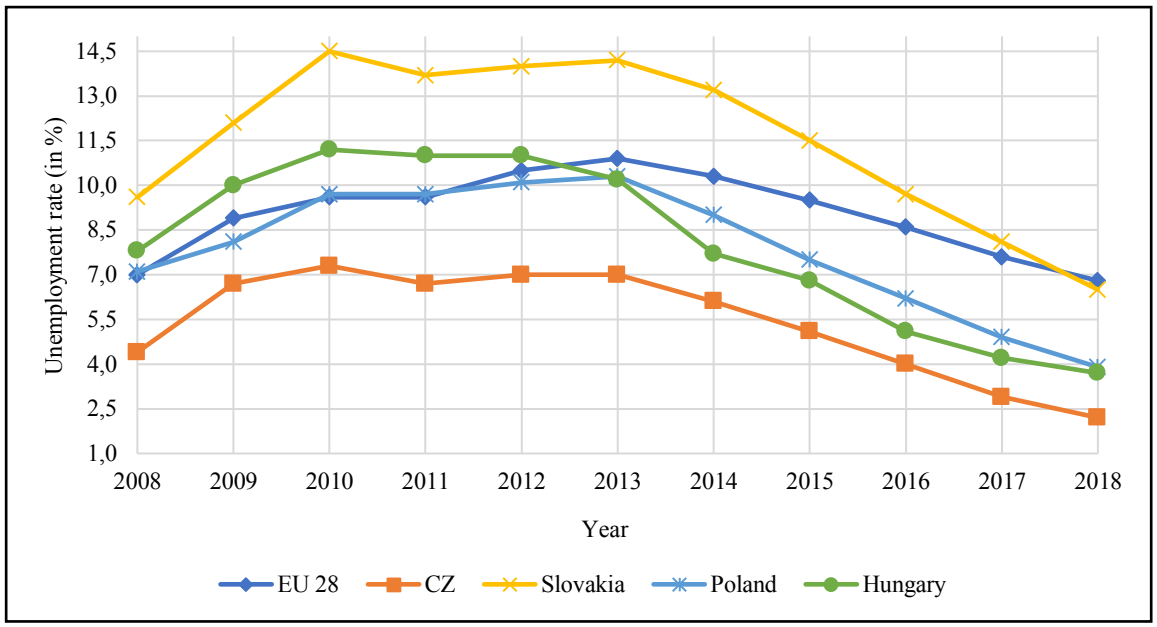
Year	Unemployment rate (in %)				
	EU	**CZ**	**Slovakia**	**Poland**	**Hungary**
2008	7.0	4.4	9.6	7.1	7.8
2009	8.9	6.7	12.1	8.1	10.0
2010	9.6	7.3	14.5	9.7	11.2
2011	9.6	6.7	13.7	9.7	11.0
2012	10.5	7.0	14.0	10.1	11.0
2013	10.9	7.0	14.2	10.3	10.2
2014	10.3	6.1	13.2	9.0	7.7
2015	9.5	5.1	11.5	7.5	6.8
2016	8.6	4.0	9.7	6.2	5.1
2017	7.6	2.9	8.1	4.9	4.2
2018	6.8	2.2	6.5	3.9	3.7
Average	**9.0**	**5.4**	**11.6**	**7.9**	**8.1**

Source: Eurostat, own calculations

4.2 Time series analysis

The first step of the time series analysis is to get an overview of the process. One of the fundamental methods of defining the trend is to get a visual representation of the data using graphs (Hindls et al, 2006).

Figure 2 Unemployment rate development 2008 - 2018



Source: Eurostat, own processing

From Figure 2 we can see the development of the unemployment rate in individual countries in the years 2008 - 2018. All economies have reacted to the crisis in a way that unemployment attacked high levels in the following years. After the year 2013 unemployment started to drop in all observed areas and reached the lowest levels in the past decade.

The Czech economy has reached its peak in the year 2008 in employment when the unemployment was at 4.4%. Unemployment rate growth in the following years was a consequence of the economic crisis. After the year 2013 it started to fall and ended up being the lowest value in the Visegrad group and in the European Union which is 2.2%.

In Slovakia unemployment started to adjust and slowly fall in the year 2013. It has reached its highest peak in the year 2010 with 14.5%. Women are more affected by unemployment than men.

After the year 2008 unemployment in Poland started reaching a higher level until the year 2013, where the economy started to grow and prosper. These light consequences of the crisis are caused by the pre-crisis arrangements made by the Polish government. Lowering taxes, investing in infrastructure and even organizing the European championship in football all helped to raise the unemployment level (Potužáková, 2012). Women are more threatened by the unemployment.

In Hungary, as in other countries there was a higher level of unemployment due to the financial crisis. In Hungary, men were affected more than women. This is caused by the decline in industrial production. Unemployment reached its peak in the year 2010 with 11.2%. In the year 2015 reached a point where the unemployment level was below the year 2008, the year of the crisis.

4.2.1 Characteristics of time series

The following tables show the elementary characteristics of the observed time series for each area. The tables show the unemployment rate for each year, the differences and chain base index. The first column of the 1st difference shows the change between the observed and the upcoming period. 2nd difference illustrates the absolute growth or stifling of the time series. The chain base index also called as the coefficient of growth shows the proportion between two periods (Hindls et al, 2006).

4.2.1.1 European Union

Table 2 Elementary characteristics of time series - European Union

Year	EU (in %)	1st difference	2nd difference	Chain base index
2008	7.0	-	-	-
2009	8.9	1.9	-	1.27
2010	9.6	0.7	-1.2	1.08
2011	9.6	0.0	-0.7	1.00
2012	10.5	0.9	0.9	1.09
2013	10.9	0.4	-0.5	1.04
2014	10.3	-0.6	-1.0	0.94
2015	9.5	-0.8	-0.2	0.92
2016	8.6	-0.9	-0.1	0.91
2017	7.6	-1.0	-0.1	0.88
2018	6.8	-0.8	0.2	0.89

Source: Eurostat, own calculations

Table 2 shows the characteristics of the time series such as the differences and the chain base index. The highest value reached in the 1st difference was in the year 2009, where it reached the value 1.9. There was no change in the unemployment rate in the years 2010 and 2011. The year 2010 has shown the highest 2nd difference with the value of negative 1.2. In the observed period the chain base index is decreasing and there are no divergences.

4.2.1.2 Czech Republic

Table 3 Elementary characteristics of time series - Czech Republic

Year	CZ (in %)	1st difference	2nd difference	Chain base index
2008	4.4	-	-	-
2009	6.7	2.3	-	1.52
2010	7.3	0.6	-1.7	1.09
2011	6.7	-0.6	-1.2	0.92
2012	7.0	0.3	0.9	1.04
2013	7.0	0.0	-0.3	1.00
2014	6.1	-0.9	-0.9	0.87
2015	5.1	-1.0	-0.1	0.84
2016	4.0	-1.1	-0.1	0.78
2017	2.9	-1.1	0.0	0.73
2018	2.2	-0.7	0.4	0.76

Source: Eurostat, own calculations

Table 3 shows the elementary characteristics of time series regarding the unemployment rate in the Czech Republic, where considering the 1st difference the highest growth of unemployment was in the year 2009, where it reached the value 2.3. There is zero difference in the year 2013. The unemployment rate remained the same in the year 2012 ad 2013. The most significant difference in the 2nd difference column was in the year 2010, where the unemployment rate slowed down by 1.7 and then two years later increased up to 0.9. The chain base index remains quite stable except for the year 2009, where it reached 1.52. The upcoming year the chain base index followed the pattern of unemployment rate and has been decreasing.

4.2.1.3 Slovakia

Table 4 Elementary characteristics of time series - Slovakia

Year	Slovakia (in %)	1st difference	2nd difference	Chain base index
2008	9.6	-	-	-
2009	12.1	2.5	-	1.26
2010	14.5	2.4	-0.1	1.20
2011	13.7	-0.8	-3.2	0.94
2012	14.0	0.3	1.1	1.02
2013	14.2	0.2	-0.1	1.01
2014	13.2	-1.0	-1.2	0.93
2015	11.5	-1.7	-0.7	0.87
2016	9.7	-1.8	-0.1	0.84
2017	8.1	-1.6	0.2	0.84
2018	6.5	-1.6	0.0	0.80

Source: Eurostat, own calculations

Table 4 shows the differences and chain base index for Slovakia. In the year 2009 the 1st difference reached its highest value 2.5 and then the following year 2010, where it reached the value 2.4. The most substantial difference in the 2nd difference column was in 2011, where the unemployment rate decreased to 3.2 and then the next year it increased up to 1,1. The following values are quite stable. The chain base index remains steady with its highest value 1.26 in the year 2009 and the lowest 0.80 in the year 2018.

4.2.1.4 Poland

The following Table 5 shows the elementary characteristics of time series concerning the unemployment rate in Poland. The highest value in the 1st difference column was in the year 2010. The unemployment rate remained the same in the years 2010 and 2011, where there is a zero representing no difference in two years. As the unemployment was decreasing the 1st difference column is showing negative values from the year 2014. In the 2nd difference column, the striking difference could be seen in the year 2011, where the unemployment slowed down to -1.6 and then in the year 2012 it reached a positive value 0.4. The chain base index remains stable the whole observed period.

Table 5 Elementary characteristics of time series - Poland

Year	Poland (in %)	1st difference	2nd difference	Chain base index
2008	7.1	-	-	-
2009	8.1	1.0	-	1.14
2010	9.7	1.6	0.6	1.20
2011	9.7	0.0	-1.6	1.00
2012	10.1	0.4	0.4	1.04
2013	10.3	0.2	-0.2	1.02
2014	9.0	-1.3	-1.5	0.87
2015	7.5	-1.5	-0.2	0.83
2016	6.2	-1.3	0.2	0.83
2017	4.9	-1.3	0.0	0.79
2018	3.9	-1.0	0.3	0.80

Source: Eurostat, own calculations

4.2.1.5 Hungary

Table 6 below illustrates the differences and the chain base index of time series of the unemployment development in Hungary. The highest value in the 1st difference column was reached in the year 2009 with the value 2.2 and also in the year 2014 where the difference was negative 2.5 due to the fact, there was a drop in the unemployment rate. In the 2nd difference column, the most significant difference was in the years 2014 and 2015, where the unemployment was slowing down by a negative 1.7 and then elevated up to positive 1.6.

Table 6 Elementary characteristics of time series - Hungary

Year	Hungary (in %)	1st difference	2nd difference	Chain base index
2008	7.8	-	-	-
2009	10.0	2.2	-	1.28
2010	11.2	1.2	-1.0	1.12
2011	11.0	-0.2	-1.4	0.98
2012	11.0	0.0	0.2	1.00
2013	10.2	-0.8	-0.8	0.93
2014	7.7	-2.5	-1.7	0.75
2015	6.8	-0.9	1.6	0.88
2016	5.1	-1.7	-0.8	0.75
2017	4.2	-0.9	0.8	0.82
2018	3.7	-0.5	0.4	0.88

Source: Eurostat, own calculations

4.2.2 **Defining the trend**

Due to the graphical representation of data in the graph, trend lines for each observed area have been set due to the function trendline in MS Excel. The development of unemployment corresponds the most with the polynomial trendline of 2nd degree, therefore a parabolic function. This trend is also suitable for forecasting. Based on the trend functions in Table 7, values of the trend function are calculated along with the corresponding t period.

Table 7 Trend functions for each observed area

Area	Function	I^2
European Union	$y = -0.1434x^2 + 1.633x + 5.8236$	0.948
Czech Republic	$y = -0.1315x^2 + 1.2103x + 4.1764$	0.921
Poland	$y = -0.176x^2 + 1.7046x + 5.7315$	0.954
Slovakia	$y = -0.2325x^2 + 2.3257x + 8.2964$	0.948
Hungary	$y = -0.1582x^2 + 1.2279x + 7.9715$	0.886

Source: own calculations

4.2.3 **Pseudo - forecast**

This part is dealing with forecast for the states of the Visegrad group and the European Union. A method called a pseudo-forecast is used, where the original time series is cut down by one time period (1 year) and the corresponding t period is set into the trend function. This method is used to assess whether the function is suitable for forecasting based on the relative error of forecast.

Table 8 is showing the calculated values for the pseudo-forecast method for the year 2018. The index of determination shows a very good quality model. The range of relative error of forecast is from 1.87% to 5.78%, which provides a base for forecast for the upcoming year. The arithmetical average was calculated for the whole model.

Table 8 Forecast accuracy

Area	Pseudo forecast y_{11}	Relative error of forecast y_{11}	Index of determination	Arithmetical average
EU	5.95	5.93%	0.9499	9.00
CZ	0.73	1.87%	0.9223	5.40
Slovakia	4.70	5.78%	0.9451	11.60
Poland	2.20	3.34%	0.9672	7.90
Hungary	0.46	3.58%	0.9203	8.10

Source: own calculations

4.2.4 Forecast for 2019

Table 9 shows the calculated values of forecast for the year 2019 within observed areas.

Table 9 Point and interval estimate

Area	Point estimate 2019	Interval estimate 2019		Standard deviation sy	Standard deviation sy_{t12}	Arithmetical average
		min	max			
EU	6.0	4.3	7.6	1.40	1.59	9.00
CZ	1.5	0	3.6	1.80	2.05	5.40
Slovakia	4.9	2.1	7.7	2.72	3.23	11.60
Poland	2.9	1.3	4.5	2.17	2.52	7.90
Hungary	2.9	0.4	5.3	2.83	3.08	8.10

Source: own calculations

4.2.5 Correlation analysis

The following Table 10 shows the correlations between observed areas during the inspected period. Residual values for each area are calculated and shown in Appendix 1. The highest level of similarity in the development can be found between Slovakia and Poland, where the value reached 0.985 and it is considered as a high dependency. Second highest dependency is between the Czech Republic and Slovakia. On the contrary the lowest level of dependency was found between European Union as a whole and Hungary.

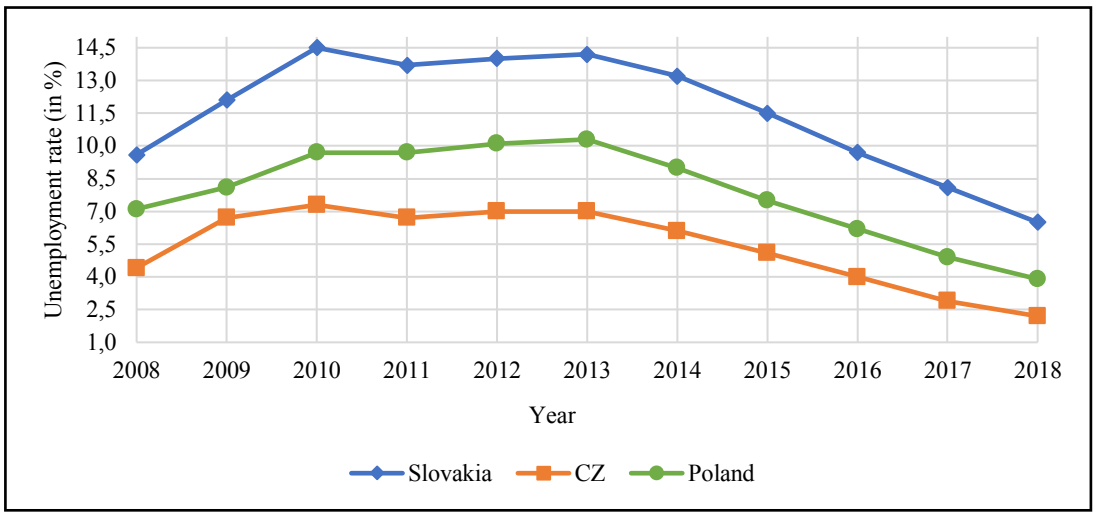
Table 10 Correlation analysis

Area	EU	CZ	HU	PO	SL
EU	1	0.842	0.697	0.876	0.906
CZ	0.842	1	0.958	0.971	0.979
HU	0.697	0.958	1	0.934	0.914
PO	0.876	0.971	0.934	1	0.985
SL	0.906	0.979	0.914	0.985	1

Source: own calculations

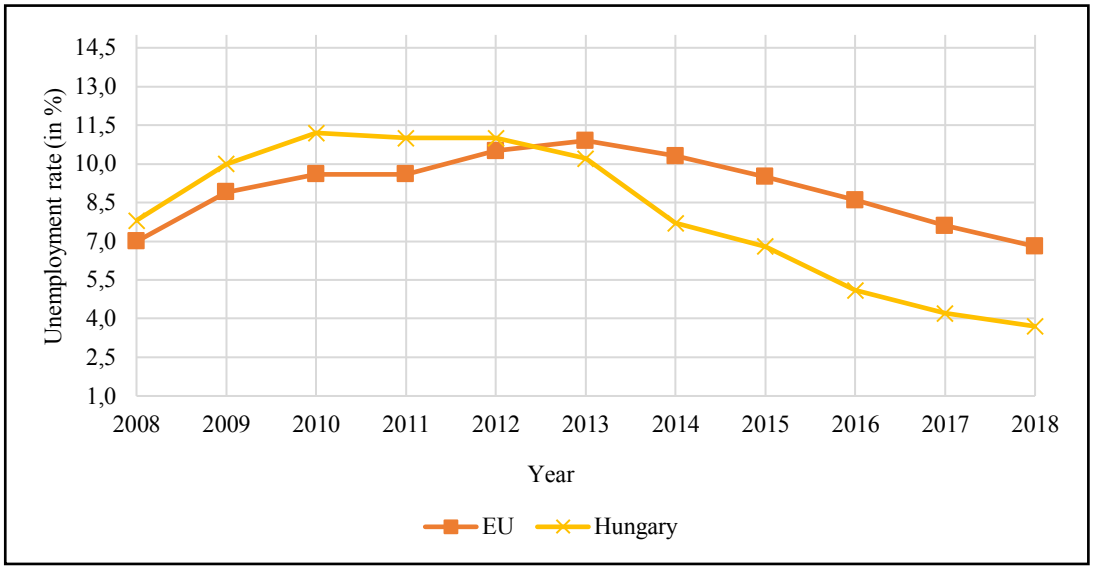
Figure 3 shows the visual representation of time series, which correlate among each other the most.

Figure 3 Highest correlated time series



Source: Eurostat, own processing

Figure 4 Lowest correlated time series



Source: Eurostat, own processing

The Figure 4 is a showing the time series of observed areas that correlate the least.

4.2.6 **Development of unemployment**

The forecast for the upcoming year 2019 has been calculated as a point estimate and as an interval estimate with a 95% probability. In all observed areas, the unemployment will be decreasing.

Table 11 is a representation of time series with the forecast for the year 2019. In the first row of 2019 the point estimate is stated, where the interval forecast is shown in the second row of 2019.

Table 11 Unemployment rate development and forecast for 2019

Year	Unemployment rate (in %)				
	EU	**CZ**	**Slovakia**	**Poland**	**Hungary**
2008	7.0	4.4	9.6	7.1	7.8
2009	8.9	6.7	12.1	8.1	10.0
2010	9.6	7.3	14.5	9.7	11.2
2011	9.6	6.7	13.7	9.7	11.0
2012	10.5	7.0	14.0	10.1	11.0
2013	10.9	7.0	14.2	10.3	10.2
2014	10.3	6.1	13.2	9.0	7.7
2015	9.5	5.1	11.5	7.5	6.8
2016	8.6	4.0	9.7	6.2	5.1
2017	7.6	2.9	8.1	4.9	4.2
2018	6.8	2.2	6.5	3.9	3.7
2019	6.0	1.5	4.9	2.9	2.9
2019	4.3 – 7.6	0 – 3.6	2.1 – 7.7	1.3 – 4.5	0.4 – 5.3

Source: Eurostat, own calculations

5 Results

With the arise of the global economic crisis the unemployment rates in all the countries started to rise. The Czech Republic, as the only one in our observed countries, was able to maintain its position and keep its unemployment rate below the average of the European Union.

Since the year 2013, the unemployment rate has started to decrease in all countries of the European Union. European economy has shown favorable results in the last year of 2018. The number of people employed was higher than ever before. It is expected to maintain its development. On the other hand, there have been 16.9 million people, who were unemployed. According to the statistics, it is 1.9 million people less than in the year 2017 (Eurostat, 2019). Since the year 2014 there have been over 12 million of new job vacancies created. The unemployment dropped to 6.8% and youth unemployment is at its level just like before the crisis in 2008 (European Commission, 2019). A certain level of

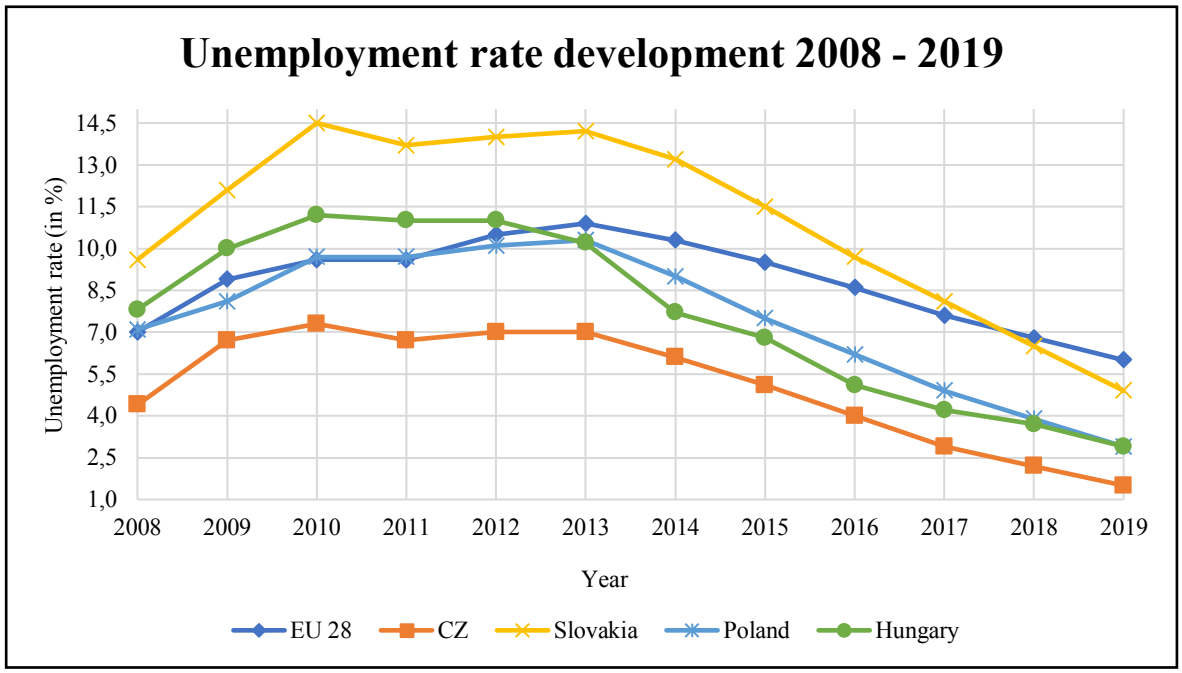
unemployment will always be present on the labor market at any time. A part of the long term unemployed, who either chose to live a different lifestyle or living off with social benefits, find this way suitable for them. Another group of people is structurally unemployed, which means the job vacancies do not correspond with their education and field. Although the qualification does not have to meet ends with the requirements and expectations of the employers. Additionally, in the job market there are individuals, who are leaving their old job and transferring to a new job and those, who are entering the job market. Especially students and women coming back from maternity leave.

Overall, the decrease and increase of unemployment were developing similarly in all the observed countries with a small deviation. The unemployment of the Czech Republic remains under the average of the European Union and belongs to the lowest among all states.

5.1 Forecast prediction for the year 2019

A forecast for the upcoming year 2019 was calculated using the point and interval estimate method. The graphical representation of the development can be observed in Figure 5.

Figure 3 Unemployment rate development and forecast for 2019



Source: Eurostat, own calculations

As mentioned in the methodology the interval estimate is more reliable because it gives a range of where the forecast can be set. Therefore, it is giving us a more realistic point of

view of the upcoming situation. However, the value for unemployment is one value and not an interval, it is suitable to expect the middle value of the interval. On the contrary, the economic indicators influencing the unemployment are not considered in the calculations.

To summarize, the prosperity of economy in the European Union is expected to proceed. Although, the growth should continue at a slower pace than expected and also more slowly than in the previous years. The ongoing decrease in the unemployment rate among all observed states causes a tighter labor market. Further declines of unemployment rate call for a higher supply of labor. As a result, there has been an increase especially in migration in the recent years. Employers have already started noticing the availability of labor and are preparing for upcoming shortages (European Commission, n.d.).

6 Conclusion

The goal of the bachelor thesis was to evaluate the development of the unemployment rate in the European Union and the Czech Republic among other states of the Visegrad Group. The key concept of the first part of the thesis is to explain and clarify terms regarding unemployment. Furthermore, this part is looking into the structure of unemployment in each observed area.

The unemployment rate of the Czech Republic was compared not only with European Union but also with other states of the Visegrad group. Each state uses a relatively different methodology in how they measure unemployment. However, Eurostat uses harmonized unemployment rate. My main concern was to evaluate and analyze the unemployment in the long-term. The position of the Czech Republic has been the strongest compared to the whole Europe. The Czech Republic has been maintaining its position with the lowest unemployment rate and it is expected for the unemployment in the Czech Republic to reach even a lower value.

The second part of the bachelor thesis is dealing with the assessment of the unemployment rate, its development and comparison among observed areas. The decomposition of the time series was one of the components, where the elementary characteristics for each observed area have been processed. In all the observed states the most substantial shifts have been in the year 2011. Moreover, the parameters of the function for each area have been set, which describe the function well. In order to start with forecasting method a pseudo-forecast was analyzed. Lastly, the correlation analysis was processed and there was found high correlation between the Czech Republic and Slovakia and the Czech Republic and Poland. The lowest level of correlation was found between Hungary and the European Union.

In general, it is necessary to point out that the issue of unemployment is a very discussed topic as it is a part of plan Europe 2020. The unemployment rate is planned to be even decreasing as helping the high-risk groups such as young individuals and older age groups.

7 References

Literature:

1. ANDERSON ET AL, David *R*., 2014. *Statistics for Business and Economics*. Third Edition. Centage Learning EMEA. ISBN 978-1-4080-7223-3
2. CIPRA, Tomáš, 1986. *Analýza časových řad s aplikacemi v ekonomii*. 1. Prague: SNTL/Alfa. ISBN 99-00-00157
3. HINDLS ET AL, Richard, 2006. *Statistika pro ekonomy*. 7. ed. Prague: Professional Publishing. ISBN 80-869-4616-9
4. HOLMAN, Robert, 2005. *Ekonomie*. 4. Prague: C. H. Beck. ISBN 80-7179-891-6
5. JUREČKA ET AL, Václav, 2017. *Makroekonomie*. 3., aktualizované a rozšířené vydání. Prague: Grada Publishing. Expert (Grada). ISBN 978-80-271-9265-6
6. KLÍMA, Jan, 2006. *Makroekonomie* / Jan Klíma. 1. Prague: Alfa Publishing. ISBN 8086851273
7. KREBS ET AL, Vojtěch, 2005. *Sociální politika*. 3. Prague: ASPI. ISBN 80-7357-050-5
8. LIŠKA ET AL, , 2004. *Makroekonomie*. 2. ed. Prague: Professional Publishing. ISBN 80-864-1954-1
9. MONTGOMERY, Douglas C., Cheryl L. JENNINGS a Murat KULAHCI, 2015. *Introduction to time series analysis and forecasting*. Second edition. Hoboken, New Jersey: John Wiley & Sons, Incorporated. ISBN 978-111-8745-113
10. PALMA, Wilfredo, 2016. *Time series analysis.* 1. Hoboken, NJ: John Wiley & Sons, Incorporated. ISBN 978-111-8634-349
11. PIZZATI, Lodovico a Bernard FUNCK, 2002. *Labor, employment, and social policies in the EU enlargement process: Changing perspectives and policy options*. Washington, D.C.: World Bank. ISBN 08-213-5008-0
12. POTUŽÁKOVÁ, Zuzana, 2012. *Trhy práce ve státech visegrádské čtyřky a ekonomická krize*. Prague: VŠE: Acta Oeconomica Pragensia. ISBN 0572-2043
13. REIF, Mark R., 2015. *On Unemployment: A Micro-Theory of Economic Justice.* 1. New York: Palgrave Macmillan. ISBN 9781137550002
14. SCHREIER, Christian, 2015. *25 Years After: Mapping Civil Society in the Visegrád Countries*. Berlin/Munchen/Boston: Walter de Gruyter GmbH. ISBN 9783110509380

15. SYMES, Valerie, 1995. *Unemployment in Europe: Problems and Policies*. 1. New York: Routledge. ISBN 9780203197677

Internet sources:

1. ČTK, 2019. *Nezaměstnanost stagnovala na 2,7 %, podle analytiků poroste* [online]. [Accessed on 2020-01-02]. Available at : https://www.ceskenoviny.cz/zpravy/nezamestnanost-stagnovala-na-2-7-podle-analytiku-poroste/1806599
2. DIAS, Joana, 2018. *CR YOUTH UNEMPLOYMENT RATE HITS LOWEST LEVELS SINCE 1993* [online]. [Accessed on 2020-01-19]. Available at: https://www.jobspin.cz/2018/02/cr-youth-unemployment-rate-hits-lowest-levels-since-1993/
3. European Commission: *EU in the year 2018* [online], 2019. Luxembourg: Publications Office of the European Union [Accessed on 2020-01-14]. DOI: 10.2775/954927 Available at: https://op.europa.eu/en/publication-detail/-/publication/913ec5cf-30d8-11e9-8d04-01aa75ed71a1
4. European Commission: *European Economic Forecast: Spring 2019* [online], n.d. Luxembourg: Publications Office of the European Union [Accessed on 2020-02-24]. DOI: 10.2765/05897. ISSN 2443-8014. Available at: https://ec.europa.eu/info/publications/european-economic-forecast-spring-2019_en
5. Eurostat: *Europe 2020 headline indicators* [online], 2019.[Accessed on 2020-02-21]. Available at: https://ec.europa.eu/eurostat/statisticsexplained/index.php/Europe_2020_headline_indicators
6. Eurostat: *Glossary:Unemployment* [online], n.d. [Accessed on 2020-02-23]. ISSN 2443-8219. Available at: https://ec.europa.eu/eurostat/statisticsexplained/index.php/Glossary:Unemployment
7. Eurostat: *Unemployment statistics and beyond* [online], 2019. [Accessed on 2020-02-21]. ISSN 2443-8219. Available at: https://ec.europa.eu/eurostat/statisticsexplained/index.php/Unemployment_statistics_and_beyond

8. FLORES, Antonio a Jens Manuel KROGSTAD, 2019. *EU unemployment rate falls to near pre-recession low*. Pew Reseach Center [online] [Accessed on 2020-01-02]. Available at: https://www.pewresearch.org/fact-tank/2018/07/18/eu-unemployment-rate-nears-pre-recession-low/
9. HARUMOVÁ, Anna, 2016. *Inclusive Labor Markets as a Solution of Long Term Unemployment in Slovakia* [online]. Mediterranean Journal of Social Sciences. [Accessed on 2020-02-02]. ISSN 2039-2117. Available at: https://pdfs.semanticscholar.org/0662/1a42967dd6bc082cc7d454dbbbfe9812cf15.pdf
10. HOLÝ, Dalibor a Viktorie PLÍVOVÁ, 2012. *Společná tisková zpráva Českého statistického úřadu a Ministerstva práce a sociálních věcí ČR: Změna výpočtu ukazatele registrované nezaměstnanosti*. Prague. [Accessed on 2020-01-30]. Available at: https://www.czso.cz/csu/czso/zmena_vypoctu_ukazatele_registrovane_nezamestnanosti20121107
11. Hungarian Central Statistical Office: *Labour market trends, Quarters 1–4 2018* [online], 2019. [Accessed on 2020-02-23]. Available at: http://www.ksh.hu/apps/shop.kiadvany?p_kiadvany_id=1043292&p_temakor_kod=KSH&p_lang=EN
12. KIERZENKOWSKI, Rafal, 2012. *Towards a More Inclusive Labour Market in Hungary* [online]. No. 960. OECD Economics Department Working Papers. Paris: OECD Publishing [Accessed on 2020-01-30]. ISSN 18151973. Available at: https://doi.org/10.1787/18151973
13. MISKOLCZI, Martina, 2010. *Trends in Unemployment in the Czech Republic and Regions*. IDIMT. [Accessed on 2020-01-26]. Available at: http://idimt.org/wpcontent/uploads/proceedings/IDIMT_proceedings_2010.pdf#page=222
14. MPSV: *Analýza vývoje zaměstnanosti a nezaměstnanosti v roce 2018* [online], 2019. [Accessed on 2020-02-23]. Available at: https://www.mpsv.cz/documents/20142/848077/anal2018.pdf/760053b9-9f64-b616-5453-2447ee935b7e

15. MPSV: *Koncepce politiky zaměstnanosti 2013 - 2020* [online], 2013. [Accessed on 2020-02-23]. Available at: https://www.esfcr.cz/file/8987/
16. SME: *Nezamestnanosť na Slovensku prvýkrát klesla pod päť percent* [online], 2020. [Accessed on 2020-02-23]. Available at: https://ekonomika.sme.sk/c/22124897/nezamestnanost-na-slovensku-prvykrat-v-historii-klesla-pod-pat-percent.html
17. Statistics Poland, 2019. *The demand for labour in 2018 [online]*. [Accessed on 2020-02-21]. ISSN 1642-4425. Available at: https://stat.gov.pl/en/topics/labour-market/demand-for-labor/the-demand-for-labour-in-2018,1,13.html
18. Statistics Poland: *Registered unemployment I–IV quarter 2018* [online], 2019. [Accessed on 2020-02-24]. ISSN 1897-3671. Available at: https://stat.gov.pl/en/topics/labour-market/registered-unemployment/registered-unemployment-iiv-quarter-2018,2,34.html
19. Visegrad Group: *About the Visegrad Group* [online], n.d. [Accessed on 2020-01-22]. Available at: http://www.visegradgroup.eu/about

8 List of Figures, Tables and Appendices

8.1 List of Figures

8.2 List of Tables

8.3 List of Appendices

9 List of Abbreviations

EU	European Union
CZ	Czech Republic
HU	Hungary
PO	Poland
SL	Slovakia
MPSV	Ministerstvo práce a sociálních věcí / Ministry of Labour and Social Affairs

10 **Appendix**

Appendix 1 Correlation analysis

Year	EU	Trend EU	r EU	CZ	Trend CZ	r CZ	PO	Trend PO	r PO	SL	Trend SL	r SL	HU	Trend HU	r HU
2008	7.00	7.31	-0.31	4.40	5.26	-0.86	7.10	7.26	-0.16	9.60	10.39	-0.79	7.80	9.04	-1.24
2009	8.90	8.52	0.38	6.70	6.07	0.63	8.10	8.44	-0.34	12.10	12.02	0.08	10.00	9.79	0.21
2010	9.60	9.43	0.17	7.30	6.62	0.68	9.70	9.26	0.44	14.50	13.18	1.32	11.20	10.23	0.97
2011	9.60	10.06	-0.46	6.70	6.91	-0.21	9.70	9.73	-0.03	13.70	13.88	-0.18	11.00	10.35	0.65
2012	10.50	10.40	0.10	7.00	6.94	0.06	10.10	9.85	0.25	14.00	14.11	-0.11	11.00	10.16	0.84
2013	10.90	10.46	0.44	7.00	6.70	0.30	10.30	9.62	0.68	14.20	13.88	0.32	10.20	9.64	0.56
2014	10.30	10.23	0.07	6.10	6.21	-0.11	9.00	9.04	-0.04	13.20	13.18	0.02	7.70	8.82	-1.12
2015	9.50	9.71	-0.21	5.10	5.44	-0.34	7.50	8.10	-0.60	11.50	12.02	-0.52	6.80	7.67	-0.87
2016	8.60	8.91	-0.31	4.00	4.42	-0.42	6.20	6.82	-0.62	9.70	10.40	-0.70	5.10	6.21	-1.11
2017	7.60	7.81	-0.21	2.90	3.13	-0.23	4.90	5.18	-0.28	8.10	8.30	-0.20	4.20	4.43	-0.23
2018	6.80	6.44	0.36	2.20	1.58	0.62	3.90	3.19	0.71	6.50	5.75	0.75	3.70	2.34	1.36