**Mendel University in Brno**
**Faculty of Business and Economics**

# Sensitivity of unemployment rates over the business cycle

## DIPLOMA THESIS

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**Statutory declaration**

Herewith I declare that I have written my final thesis: “Sensitivity of unemployment rates over the business cycle“ by myself and all sources and data used are quoted in the list of references.
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**Abstract**

The objective of this thesis is to estimate the sensitivity of unemployment in different groups to a business cycle in chosen countries. Two main approaches applied in this thesis are multivariate regression analysis and sensitivity analysis. The results of regression analysis shown that unemployment groups responded to changes in the business cycle. The youth unemployment responded most sensitively, when business cycle declines.

**Keywords**

Unemployment, youth unemployment, business cycle, labour market, multivariate regression, sensitivity analysis, correlation analysis, Hodrick-Prescott filter.

**Abstrakt**

Cílem této práce je určit zda skupiny nezaměstnanosti, reagují citlivě na změnu hospodářského cyklu pro vybrané země. Mezi dvě hlavní metody použité v této práci je vícenásobná regresní analýza a analýza citlivosti. Výsledky regresní analýzy prokázaly, že všechny skupiny nezaměstnanosti reagují na změnu hospodářského cyklu. Nezaměstnanost mládeže, byla prokázána jako nejvíce citlivá, když dojde k poklesu růstu hospodářského cyklu.

**Klíčová slova**

Nezaměstnanost, nezaměstnanost mládeže, hospodářský cyklus, trh práce, vícenásobná regrese, analýza citlivosti, korelační analýza, Hodrickův a Prescottův filter.

# Content

# 1 Introduction

The last crisis hit labour markets in the European Union very hard. Labour markets remained intensely affected with weak growth of a business cycle, with long-term recovery process and with continuous high unemployment levels. Because Czech Republic entered the European Union in 2004 and committed itself to adopt common currency EURO it will be interesting to observe if countries in Euro-Area or countries out of it, cope with the crisis differently or similarly. If some economy is experiencing a lot of asymmetry in a business cycle, then it depends on if country is in Euro-Area or not. Because countries in Euro-Area cannot influence the output or price level by applying monetary policy, without influencing or worsening situation in other member states. Then these countries are dependent on how are the labour and wages flexible or on the governmental level through intervention in fiscal policy. Countries out of Euro-Area can easily adjust the price level to influence output by applying the monetary policy. We can see that a business cycle plays an important role in our thesis. Main assumption in here is the level of sensitivity represented by change of unemployment and by change of a business cycle. The unemployment behaviour over a business cycle is necessary with regard to policy implication and recommendation as it tells how strong the relationship between them is.

The reason why I am writing this thesis is to figure out how Czech Republic cope with last crisis comparing to chosen EU countries. The objective of this thesis is to estimate the sensitivity of unemployment groups to a business cycle. Main methods applied in this thesis are multivariate regression analysis and sensitivity analysis. The research should shed some light on how different unemployment groups respond to the changes in business cycle and which group is the most vulnerable. Because we are going to study labour markets it will be beneficial to look how unemployment responds on other major variables of labour market, such as are wage flexibility and inflation rate. The result should be commented and interpreted in line with stated objectives and research question of the thesis. Main concluding remarks are summarized in the conclusion. In addition, the labour market policy implication and recommendations are expected to lay the foundations of empirical results of the analysis.

# 2 Objectives

The objective of this thesis is to estimate the sensitivity of unemployment in different groups to a business cycle in chosen countries. The total unemployment, a long-term unemployment, unemployment by sex, by age, by educational attainment are the subjects of the analysis.
Results of this thesis should give us an answer to the research question:

- *How do the selected unemployment groups respond to changes in the business cycle and which group is the most sensitive?*

Following the research question, the hypothesis is that: *"The youth unemployment is expected to be the most sensitive to changes in the business cycle."*

According to results there will be given labour market policy implications and recommendations. As we are going to study labour market, we are given the opportunity to answer more questions than just unemployment sensitivity. We have determined two secondary research questions:

- *How do wages respond on unemployment, are they flexible?*
- *Is the inverse relationship of unemployment to inflation true?*

In this thesis chosen countries should be also compared among themselves to assess if Euro-Area or non-Euro-Area countries respond differently.

# 3 Methodology

The objective of this thesis is to estimate the sensitivity of unemployment in different groups to a business cycle in chosen countries. The research should shed some light on a question how the selected unemployment groups respond to changes in the business cycle. The hypothesis examined in this thesis is that the youth unemployment is expected to be the most sensitive and thus vulnerable during the recession phase.

The five chosen countries are Austria, Czech Republic, France, Hungary and Spain. The countries may be referred as follows: Euro area countries and non-Euro area countries. Czech Republic and Hungary are countries, that entered the European Union or EU in 2004 and haven't adopted Euro yet. Also these two countries can be referred as members of V4 or Visegrad group representing eastern economies. Austria, France and Spain are well developed countries of the EU, which have adopted Euro since the currency started. Austria became the important member state with very stable economy very quickly, considering it has one of the highest GDP per capita. France is the core and one of the founding countries of the EU. Spain represents one of the countries which were influenced the most by the last crisis. These countries will be studied closely within period 2004Q1 – 2015Q4.

Firstly, we want to determine the cyclical component of a business cycle by using detrending methods, namely the Hodrick-Prescott filter. Then we use the multivariate regression to measure the sensitivity of selected unemployment groups to GDP cyclical changes. To answer the research question, the unemployment groups should give us some light if and how they respond to a cyclical component of GDP. Secondly, after estimating the unemployment sensitivity we compare the results and evaluate our hypothesis.

Gretl software and Excel are used for econometric calculations for further explanation of the outcome.

## 3.1 Data

In this thesis there are used quarterly data, from 2004 to 2015 period, that are seasonally adjusted, only GDP is seasonally and calendar adjusted. The source of gathered data is Eurostat. Now we are going to focus on the data that were used for this thesis.

For measuring the cyclical component of a business cycle, there were used GDP and main components (output, expenditure and income). These data are measured at market prices, in millions of euro for each chosen country, *the national currency series are converted into euros using the irrevocably fixed exchange rate*. GDP is presented in chain-linked volume (2010). As it will be explained later in this chapter (Hodrick-Prescott filter), for our estimation we just need the cyclical component, which we will obtain by using natural logarithm on data and following by using de-trending technique.

The objective of this thesis is to estimate the sensitivity of unemployment. Therefore, unemployment is the main component of this thesis. For our research following groups of interest were selected: total unemployment rate, long-term unemployment rate, rate of male unemployment, rate of female unemployment, youth unemployment rate and unemployment rate of graduates. According to Eurostat, unemployed persons are all persons 15 to 74 years old (16 to 74 years old in Spain), who weren't employed for the period of reference week. Data show the numbers of persons unemployed in percentage of the labour force (15 to 74 years old, with exception of youth unemployment rate, where it is less than 25 years old). The long term unemployment rate is the percentage of unemployed persons more than 12 months in the total number of labour force. Only tertiary education (levels 5-8 according to ISCED11) is taken into account for graduates.

For further estimation in multivariate regression we also used inflation, nominal wage and real wage, because we assume that unemployment is affected by these variables.

Inflation is measured as the index of Harmonised Indices of Consumer Prices or HICP with reference to year 2010. HICP index was converted to annual rates of change for higher accuracy of regression model.

Nominal wage is measured as the Labour Cost Index or LCI, that measures the cost pressure resulting from labour. The LCI links to total average hourly cost of labour. The data on LCI are given as nominal value index with reference to year 2010. The LCI covers total wages and salaries for whole business economy. Similarly, as for HICP, data were converted to annual rates of change.

To obtain the real wage, there was used the formula, where LCI was divided by HICP and multiplied by 100% to receive the real wage index. For same purposes in case of LCI and HICP, the real wage was converted to annual rates of change.

## 3.2 Multivariate regression analysis

To estimate chosen variables in this thesis, the method of Multivariate regression analysis is used. This method fits well to our model, because in the thesis there are explained more than one dependent variables as a function of development in a group of other explanatory variables, through the analysis of the following equation:

$$Y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \dots + \beta_k X_{kt} + \varepsilon_t \qquad (t = 1, 2, \dots, T), (k = 1, 2, \dots, n)$$

$$\vdots$$

$$Y_{kt} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \dots + \beta_k X_{kt} + \varepsilon_t$$

Where:

$Y_{kt}$… the observation of the dependent variables
$X_{kt}$… the observation of the explanatory variables
$\varepsilon_t$… the stochastic error term
$\beta_k$… the regression coefficients
n… the number of observation

As was said in previous subchapters, the data were gather quarterly in time period 2004Q1 – 2015Q4 for regression analysis, it is therefore a time series, so T denote time in the formula above. (Studenmud, 2010)

## 3.3 Correlation analysis

The main goal of correlation is to determine the strength or degree of linear association between two variables using the correlation coefficient. As the correlation is between two variables, in our case between dependent variable Y and explanatory variable X, it can range in scale of (-1) to (+1). The positive range means that there is linear relationship, if it is negative the relationship is non-linear. In case that correlation is zero, we can see no relationship between variables. If independent variables have correlation coefficient bigger than 0.8, then it means that these independent variable are highly correlated and indicate presence of multicollinearity. (Gujarati, 2003)

## 3.4 Hodrick-Prescott filter

The Hodrick-Prescott filter is the decomposition procedure that may help us to obtain the cyclical component of business cycle, for smoother and more precise quantification of regression analysis. The examined time series are considered as the sum of cyclical and growth elements. Due to our data are seasonally and calendar adjusted the seasonal element has been already removed. According to Hodrick and Prescott (1997), their theoretical framework is given by time series $y_t$ which is the sum of a cyclical element $c_t$ and growth element $g_t$:

$$y_t = g_t + c_t \qquad \text{for } t = 1, \ldots, T.$$

Their concept assumed that cyclical elements are deviations from growth elements in long term period, which average nears to zero, which led them to the following problem:

$$\underset{\{g_t\}_{t=-1}^{T}}{\text{Min}} \left\{ \sum_{t=1}^{T} c_t^2 + \lambda \sum_{t=1}^{T} [(g_t - g_{t-1}) - (g_{t-1} - g_{t-2})]^2 \right\}$$

where $c_t = y_t - g_t$. The $\lambda$ parameter is a number bigger than zero which penalizes variability in the growth component in the time series. The bigger the value of $\lambda$, the smoother the final time series are. It is recommended to use $\lambda = 1600$ for quarterly data. For better decomposition procedure of Hodrick-Prescott filter, examined data should be in natural logarithm so the change in growth rate, relates to a growth rate.

# 4 Literature review

Past years have been devastating for significant part of labour force mainly for those who possess any disadvantage. The explanation for it is various, but mostly that labour markets haven't recovered yet from last crisis. This lacking of labour market outcomes of that part of labour force that can be attribute to a combination of insufficient aggregate labour demand and to higher responsiveness of marginal labour to cyclical circumstances. For those circumstances we have to apply different policy implications. Structural reasons indicate experience of missing policy reactions to stimulate it more or different labour supply. Cyclical reasons indicate to increase aggregate labour demand as the main challenge. (Rothstein, 2014)

Explanations of unemployment problem is provided by economic literature. Unemployment problem is identified variously, there are critics on the side of economic systems or on the side of unemployed workers. Mainly we can distinguish two approaches represented by the Neoclassical theory and the Keynesian theory of unemployment. The Neoclassical theory advocate that demand and supply for labour are key determinants of labour market. Where demand for labour is represented by negative function of real wage, meaning that decline in demand for labour is balanced by rise of real wage and opposite. On contrary supply for labour is represented by positive function of real wage, because if real wage decreases then workers will supply less labour. Intersection of these two curves determine the equilibrium of full employment and real wage. (Mouhammed, 2011)

On contrary Keynes opposed that this classical assumption of full employment is unrealistic. Solution for Keynesian full employment is to support aggregate demand, which was important in Keynes study of business cycle. In addition, Keynesian method is to target the unemployment through job creation, by closing labour demand gap. Some modern approaches of Keynes states, to produce full employment, the demand gap must be filled by an increase in investment spending or by an increase in government spending. The key element of this is to increase expenditures efficiently to support job creation to achieve full employment. But Keynes differ between effective demand and aggregate demand in applying towards full employment. The approach of Keynes's effective demand to determine full employment is impossible due to stimulus of aggregate demand. This is caused by economy structure, because closer is economy to full employment, the more expenditure creates inflation and disrupts distribution of income. (Tcherneva, 2008)

Last crisis has resulted in a significant rise in unemployment rate in most of developed countries. The crisis share on unemployment growth was mainly through decrease in output and investment connected with uncertainty. The hysteresis effect contributed to loss of attractiveness of unemployed and probably led to grow in long-term and structural unemployment. The young people and women with limited skills are at risk, because their participation rate mostly decline during recession. The short-term influence of crisis on unemployment rate is bigger in countries with more deregulated labour markets while medium-term effect is bigger in those countries with more regulated markets. (Bernal-Verdugo and coll., 2012)

## 4.1 Unemployment

The rate of unemployment describes what part of persons who would like to work don't have one. Typically, it means when business cycle slowdowns the unemployment rate rises. Unemployment together with gross domestic product and consumer prices evaluate the performance of the economy (Mankiw, 2002). First two mentioned are our key variables while assessing the sensitivity analysis.

According to Mankiw (2002) the labour force (L) consist of employed persons (E) together with unemployed persons (U). And its relationship may be written as that:

$$L = E + U$$

So then the unemployment rate is a ratio of unemployed persons and labour force.

$$U/L$$

Following figure will help us to better understand how works the transition of employed and unemployed persons, because labour force is expected to be fixed.

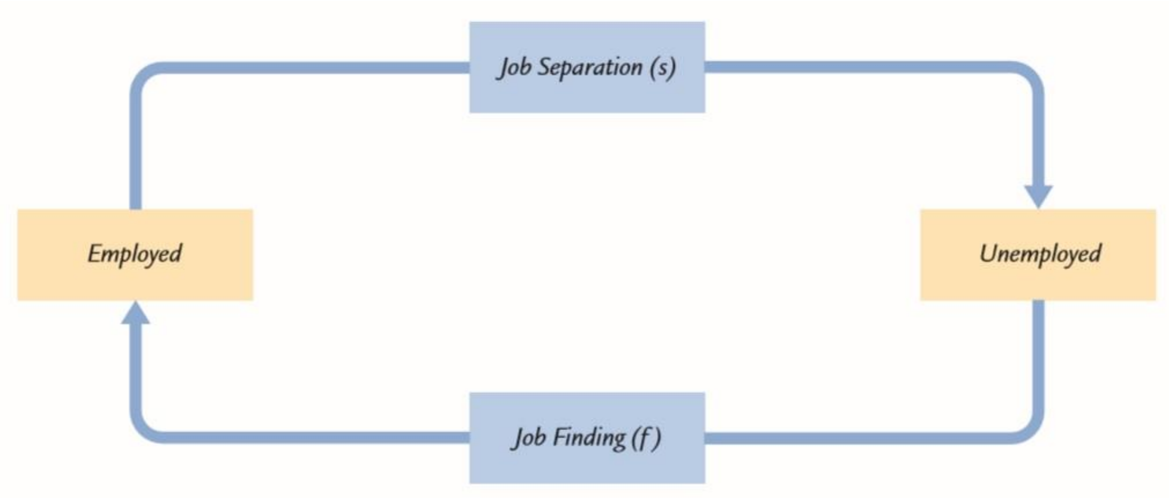


Figure 1. The Transitions between unemployed and employed persons, source: Adjusted by Author based on Mankiw (2002, p. 157)

This transition characterises the rate of unemployment that is determined by rates of job separation and by job finding. We have to denote that job separation is part of employed persons who lose a job and that job finding is part of unemployed persons who find a job. If unemployment remains stable, so there is neither increase of unemployment or decrease of unemployment, this condition means the labour market is in steady state. The number of persons finding jobs (f U) is equal to persons losing jobs (s E), so it may be written as follows:

$$f\,U = s\,E$$

To find steady state of unemployment rate we apply previous equation (E = L – U); where we can replace employment (E) for (L – U); where we get this formula:

$$f\,U = s\,(L - U)$$

To solve the rate of unemployment, we can divide both sides of formula by labour force (L) to get:

$$U / L = s / (s + f)$$

In this case unemployment rate lean on job finding (f) and job separation (s). From this condition we can easily imply, that with higher rate of job separation we will have higher unemployment rate. And if we have higher rate of job finding, the unemployment rate decreases.

Job duration is an important for possible policy implication, because it suggests the reasons for being unemployed. We differ if the unemployment is just temporary so it is short-term or if the unemployment takes longer time so it is long-term. In most of cases the unemployment is short-term, this type of unemployment isn't avoidable thus it is frictional unemployment. But in case of long-term unemployment, which takes many months, according to Eurostat (2016) it takes more than one year, so it is more likely structural unemployment. (Mankiw, 2002)

## 4.2 Problematic unemployment groups

In the German labour market was identified various problematic groups including females, unskilled workers, youth and old workers. Very problematic seems to be long-term unemployment and its behaviour over the business cycle. These groups indicate often some difficulties and thus they should be addressed by labour market policy. Also it would be quite informative to assess how this groups behaves over the business cycle. (Schmidt, 1999)

As Schmidt (1999) mentioned that females are one of problematic groups, we should not forget the other comparable group to them, which are males. Male and female unemployment respond differently to the business cycle. Jacobsen (2012) provides empirical results based on US database. Female unemployment was always above male unemployment in post-World War II. period. But since recession in 1980 the male rate risen above female rate. This gap between them shown very present with peak in 2010 since the crisis started in 2008, with difference of 2.2 %. Beyond that we must oppose that empirical evidence might differ for EU database compare to US evidence.

There are evidences of deep fall of Spanish employment rates after crisis in 2008. Spain rates of unemployment became more than twice bigger compare to EU's average. The highest statistics of unemployed persons were seen in Spain. There had been unemployed more than 20 % persons of Spanish nationality (Lacina, 2011). According to Eurostat (2016) the most affected group in Spain were young people. The rate of youth unemployment reached more 50 %. But this isn't something new for Spain. In early 90s Spain experienced 45 % youth unemployment rate, which fell till 2000 by half and after 2010 this rate was reached again. This development reveals as a pattern of turbulence, statistically evident across EU countries, which doesn't concern just Spain. The youth unemployment seems to be more sensitive to structural changes than other groups. (Dietrich, 2012)

Mankiw and Reis (2001) argued that it is not reasonable to anticipate that agents will update their information immediately. Then variables may respond differently and with delays, because the agent will update his expectations occasionally. This indicates that we may see different responds with possible time lags of chosen variables and affected groups across Europe.

## 4.3 Labour market programmes

According to Martin and Grubb (2001), based on OECD database the public expenditures on labour market programmes are significant shares of national budgets. The OECD separate expenditures on active or passive measures. The active consist of wide scope of policies targeted at improving the entry of unemployed persons to the labour market and to the jobs related to skills and function in the labour market. The passive measure is related to expenditures on income transfers, especially unemployment insurance and early pensions in retirement system. There are five main categories that covers active labour market programmes (ALMPs):

- Labour office
    - Job placement, counselling, information about free jobs on labour market
- Trainings
    - Expenditures on vocational training for unemployed persons
    - Expenditures on training for employed persons
- Young people measure
    - Training and employment programmes
    - Apprenticeship training for school leavers
- Subsidies
    - Hiring subsidies for employers
    - Endorsement and counselling for unemployed who starts entrepreneurship
    - Job creation in non-profit or public sector
- Programmes for handicapped persons
    - Programmes which hire handicapped persons directly
    - Rehabilitation programmes

## 4.4 Forms of labour market flexibility

Rodgers (2007) described, that the labour market flexibility may be described as an ability to adjust and to answer to a change. The flexibility is considered to be precondition for creation of employment. Flexibility dimensions are differently defined in literature.

- *Wage flexibility*, where diversity of institution and regulations can restrict wages variety. Typical example is institution of minimum wage or labour union activity.
    - Minimum wage is typical example of government rigidity, which wants to prevent that someone, mostly firms wouldn't define wages to low, therefore there is a legal minimum. Economists believes that institution of minimum wage is influencing mostly youth unemployment and unskilled workers. (Mankiw, 2002)
    - Labour unions according to Mankiw (2002) are who causes that wages inelastic. Labour unions influence wages to remain high, which then increases labour costs for companies due to they cannot hire more people thus it keeps unemployment rate at higher level. (Lindbeck and Snower, 2011)
- *Employment protection*
    - It defines sets of limitations for firms to lower wages or not to fire workers. It has double effect, it measures both inflows and outflows from employment. In following figure, you can see the employment

protection in 2015 across chosen countries. The indicator varies from minimally restricted (0) to maximally restricted (6).

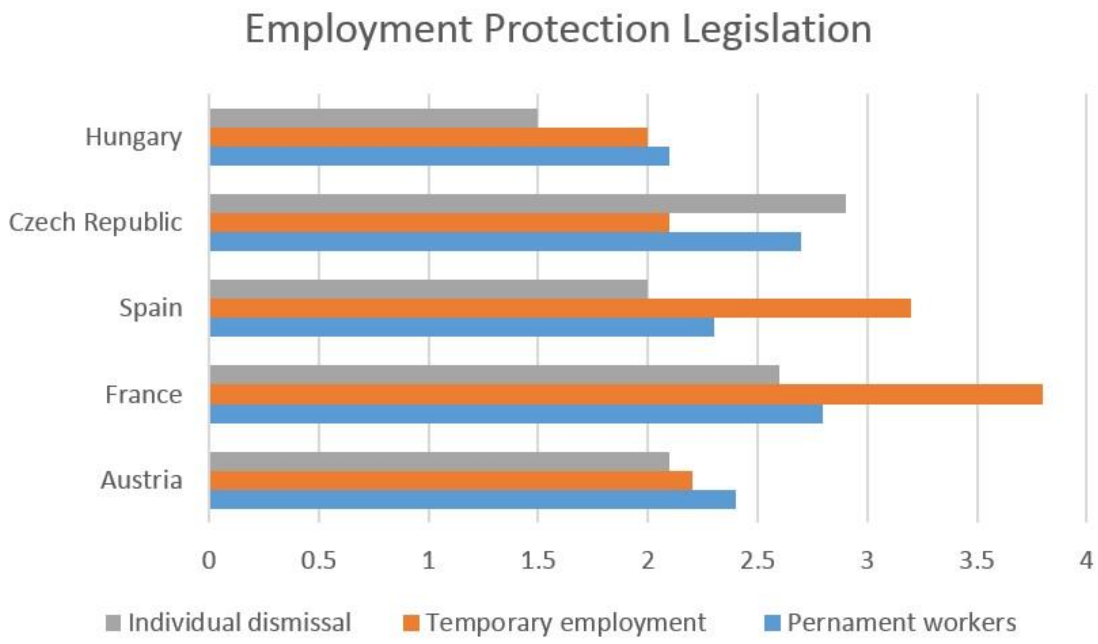


Figure 2. Employment protection in 2015, source: OECD (2016)

- Internal of functional elasticity, concerning the competence of firms to coordinate internal actions of production and labour, e.g.: *working time, job content, needed skills or technical change*
- *Supply side of flexibility*, where workers can demand higher flexibility in working time to satisfy their free/leisure time.

## 4.5 Determinants influencing unemployment

There are several reasons which may influence the unemployment rate, when in the labour market is disequilibrium where demand for labour does not meet supply for labour. Here you can observe some key elements which we observe as major factors in this thesis:

- Business cycle
- Nominal and real wage behaviour
- Inflation

### 4.5.1 Business cycle

In capitalist economies Lucas (1977) pointed, that aggregate variables experienced repeated deviations about their trend. Hodrick and Prescott (1997) pointed that these aggregate economic deviations in time series are referred as the business cycle. According to fact, that movements about long-term growth paths in gross domestic product can be characterize by a stochastic difference equation of very low order. These movements do not show consistency of either period or amplitude, which means that they do not feature the deterministic wave movements. (Lucas, 1977).

To determine trend and cyclical parameter we can apply filtering techniques such as is Hodrick-Prescott method described in methodology.

We have heard from Lucas what business cycle is and how to describe it, but now we have to found out how to describe the patterns in it. Burns and Mitchell gave an explanation of how they situated turning point in many series, which are reflection of an economic activity. These turning points defines particular cycles and information in it, which were processed into a single set of turning points that describe the reference cycle, which describes actually many cycles in time (Harding and Pagan, 1999).

Turning points consists of peak and trough, which represent the maximum and minimum points in business cycle. Two quarters of persistent decline in GDP is referred as recession and long continuing recession is referred as depression. This development in business cycle is the phase of peak to trough. If there is two quarters of GDP growth, the recession is terminated and then it is called expansion, which is the phase of trough to peak. In these two periods, this development can be followed by deflation in recession and by inflation in expansion (Harding, 2008).

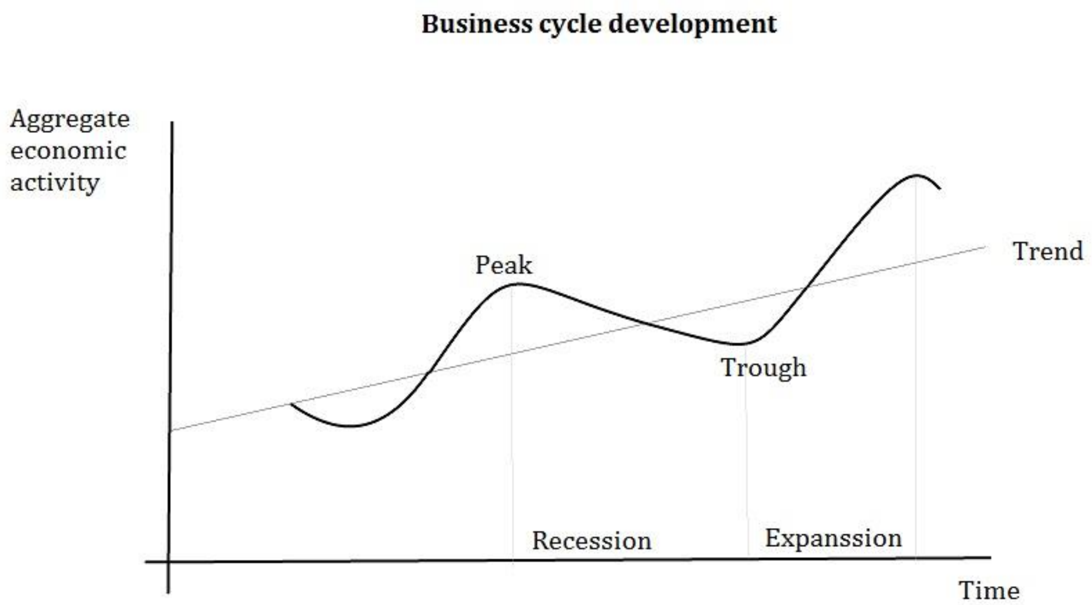


Figure 3. Business cycle development, source: based on literature review: 4.2.2 Business cycle

### 4.5.2 Nominal wage and real wage behaviour

Keynes assumed that nominal wages tend to increase or decrease with the level of output and unemployment. Here we have to distinguished whether the real or nominal wage reacts due to shifts in output and unemployment determined by effective demand or in case where shifts in nominal wage are not caused by shifts in effective demand. This shifts may be caused by wage bargaining. Whereas neoclassical economists claim that a decrease in nominal wage is connected with a decrease in unemployment. Keynes stated that increase of nominal wage flexibility would not lead economy towards full employment. He suggested that wage cuts are not the proper way how to restore full employment. (Meccheri, 2004)

Tobin stated that if central bank targeting low inflation rates, they may hamper the performance of labour markets. Because moderate inflation levels support the adjustment mechanism of relative wages if labour force is reluctant to nominal wage cuts. If an inflation rate is very low, decline in a nominal wage rigidity suggests higher wages and therefore higher unemployment. (Messina and coll., 2010)

According to Dickens and coll. (2006) some countries suffered from asymmetry in wage distribution, where one frequent asymmetry was that there were an evidence of wage freeze and lack of nominal wage cuts indicating a downward rigidity in nominal wage. The second asymmetry is a tendency for wage shifts to gather around of expected price inflation indicating a downward rigidity in real wage. Countries with bigger density of labour unions seems to have a robust relation to downward in real wage rigidity.

### 4.5.3 Inflation

In case of inflation we are interested for purposes of our thesis only for relationship between unemployment and price inflation or wage inflation, which is described by Phillips curve. Phillips curve explains negative relationship between inflation rate and the unemployment rate, implying that economy might face a trade-off between them. Some economists started to claim that a long-term trade-off between unemployment and inflation is unrealistic and therefore they claimed that Phillips curve must be vertical in long-term. In this case there exists an equilibrium of unemployment rate, called the natural rate of unemployment, that remain stable and irrespective to inflation rate. (Borjas. 2013)

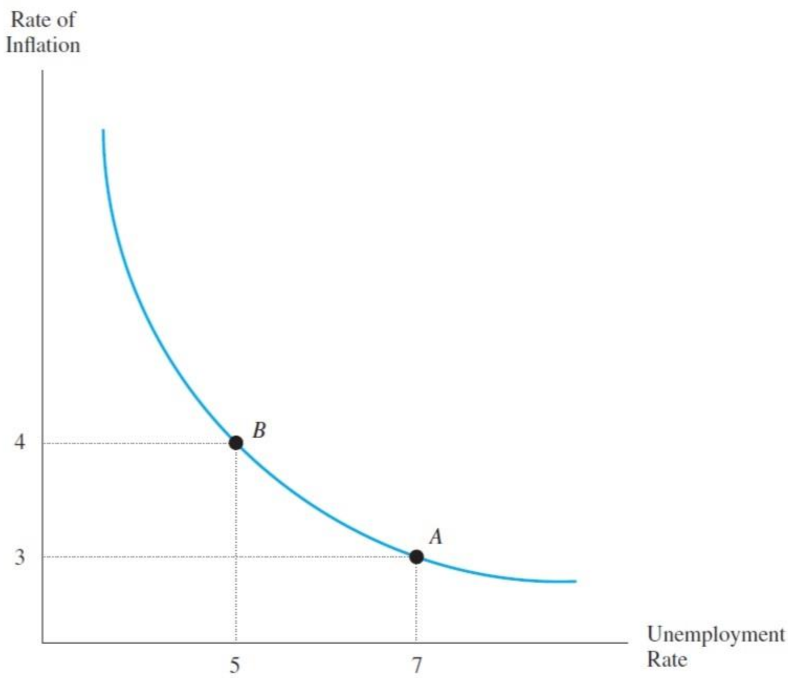


Figure 4. Phillips curve, source: Borjas 2013 (p. 533)

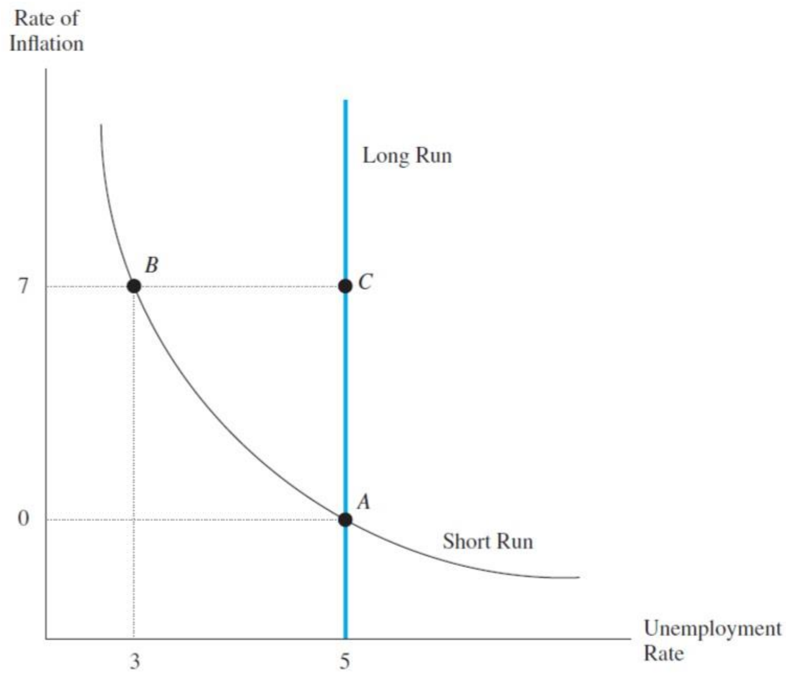


Figure 5. Long-term Phillips curve, Borjas, 2013 (p. 535)

In 70s when the economies were affected by inflation behaviour, the current wage shifts were influenced by past price and wage shifts, whereas the unemployment rate supplied only small contribution. When both unemployment rate and inflation rate in 1970s increased high above former historical trends, Anderson (1984) assumed that the unemployment rate is exogenous and independent of the inflation development. It was satisfactory to incorporate wages to traditional Phillips curve. The relationship is more meaningless that unemployment is affected by real wages. Because if inflation is in isolation, an attempt to increase prices through demand expansion to reduce unemployment rate would not result in inflation rise but with delay to increase unemployment. In this case the real wage relative to productivity behave as built in stabilizer due to inflation.

# 5 The analysis of unemployment sensitivity

The aim of this chapter is to estimate the sensitivity of unemployment for different unemployment structures in chosen countries mentioned in previous chapters. This part should give us some light how the unemployment reacts to changes in inflation, nominal wage, real wage and mainly in the business cycle. Main focus of this analysis will be on business cycle and unemployment relationship to answer on research question and hypothesis, what is the prime purpose of this thesis. Main analysis applied in this part will be multivariate regression analysis and sensitivity analysis.

The analysis is divided into five parts. Firstly, we perform the descriptive analysis to examine closely the data applied in this thesis. Before we apply regression analysis we provide model description with all variables and its hypotheses needed for successful determination of regression and sensitive analysis. We will also implement the correlation analysis to identify relationships between variables. In particular, we will be interested whether the independent variables are not highly correlated. Then we perform the regression analysis to identify how the unemployment respond to each variable. Following the results of regression analysis, we will be able to perform the sensitivity analysis based on resulting coefficients of business cycle to confirm or reject the main hypothesis. In the end of this chapter we briefly summarize the results of this analysis, with focus on regression and sensitivity analyses.

## 5.1 Descriptive analysis

Before we start with regression analysis itself, we take a closer look at the data. We observe the development of GDP, unemployment, inflation, nominal and real wage from 2004Q1 to 2014Q4 period. Data are compared graphically and statistically.

### 5.1.1 Development of business cycle

Firstly, we observe visually the development of business cycle in Figure 6 and 7 for chosen countries split in two groups: euro area and non-euro area and then we compare summary statistics of business cycle in the Table 1.

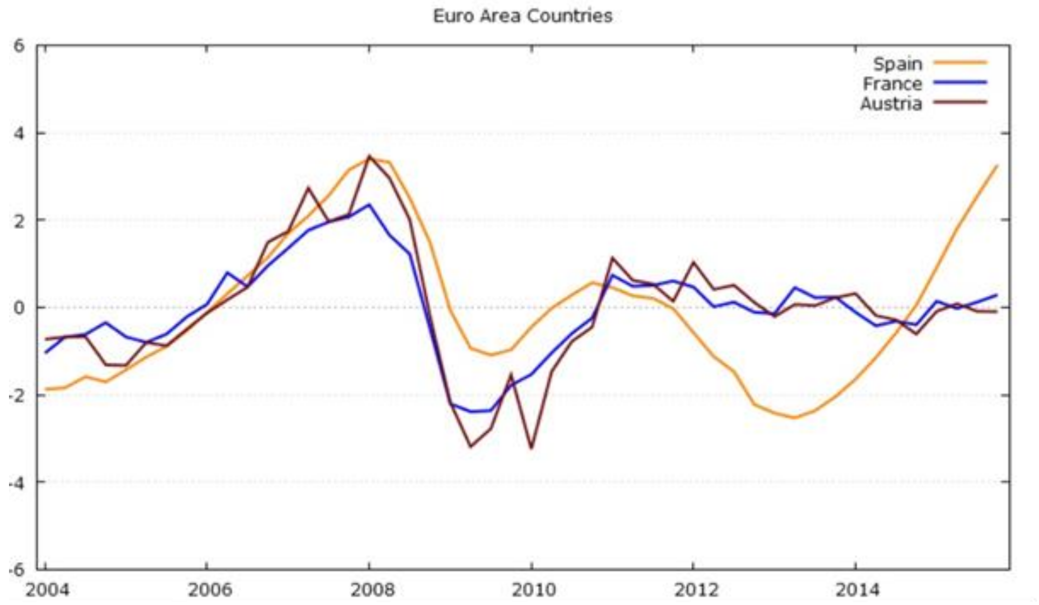


Figure 6. Business cycle development of EA countries, source: author's interpretation of Eurostat data

The Figure 6. shows the cyclical component of Euro Area Countries, namely for Spain, France and Austria. The vertical axis shows the % of cyclical component obtained by HP filter. The horizontal axis shows the reference period. Similarly, it will be for other figures in this analysis. As we can see, all countries faced similar development, but of course with some deviations. These countries faced a significant drop in 2008, which turned into recession. When drop reaches its minimum, it is called trough. The recession period reached its trough between years 2009 and 2010. We can see that Spain firstly experienced smaller drop than France and Austria. These countries were then experiencing recovery of its economies at the turn of years 2010 and 2011. But in the end of 2011 Spain was experiencing another drop, this time much deeper than in 2008. On contrary Austrian and French development remained more steady and its GDP growth was in range around zero till the end of reference period, this correspond to low standard deviation shown in Table 1. In the end of reference period Spain was experiencing the recovery followed by expansion period.

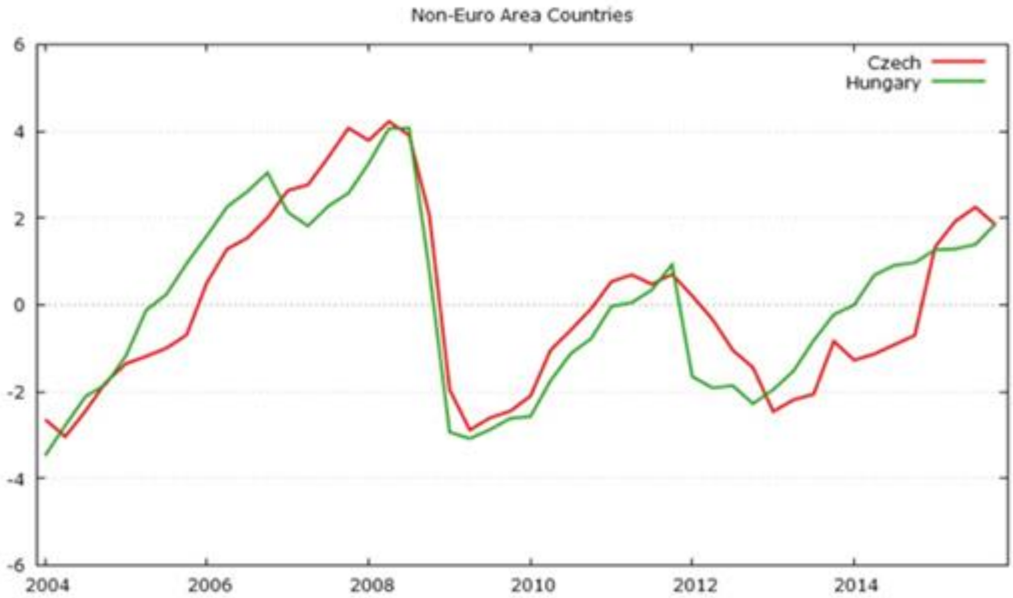


Figure 7. Business cycle development of Non-EA countries, source: author's interpretation of Eurostat data

Now if we look to the Figure 7. we can observe some similarities. There is drop for both countries followed by recession period with one difference. If we compare both figures, we can see that for Non-Euro Area countries, there is a lag in proximity of one year, before the drop started. Also the drop is much steeper. The trough was reached in 2009 till 2010, when in the end of 2010 these economies experienced very short recovery process. If we look at development of Spain together with Czech Republic and Hungary, since 2012 the development is much alike. To fulfil the analysis of business cycle development, we can observe the data shown in the Table 1.

Table 1. Summary statistics of business cycle development (%)

| | | Mean | Median | Minimum | Maximum | Standard deviation |
|---|---|---|---|---|---|---|
| **Euro area** | *Austria* | 9.83 | 9.75 | 7.5 | 12.5 | 1.04 |
| | *France* | 22.47 | 22.8 | 17.7 | 26.1 | 2.1 |
| | *Spain* | 36.46 | 39.75 | 17.3 | 56.1 | 14.63 |
| **Non-euro area** | *Czech Republic* | 16.45 | 17.85 | 9.5 | 21.1 | 3.58 |
| | *Hungary* | 21.87 | 20.2 | 13.6 | 28.4 | 4.38 |

Source: Author's calculations of Eurostat data

In the table above is shown the descriptive statistics in percentage points for business cycle. This statistic will help us to fulfil the findings discussed in last two paragraphs. What is important for us to look at, are the minimum and maximum values that correspond with the visual description. We can see that Hungary was experiencing the lowest point of trough of all countries. On contrary French minimum of trough was the highest. The maximum values show the numbers of peak, right before the recession in 2008. In that time Czech Republic was experiencing the expansion period, and its peak reached the highest value 4.224, which is maximum for our summary statistics. From the rest of results we can see that Czech Republic and Hungary have slightly negative values of its average business cycle development during reference period, also the standard deviation is higher compare to Euro-Area countries.

### 5.1.2 Development of youth unemployment

For our two groups we start examine the youth unemployment. The youth unemployment is identified for persons younger than 25 years old. For main hypothesis of this thesis, this group represents the most important one, because we would like to proof that it is more sensitive than other groups, which are examined in this thesis as well. In Figure 8. and 9. we can observe the development of youth unemployment and then we compare it together with summary statistics in Table 2.

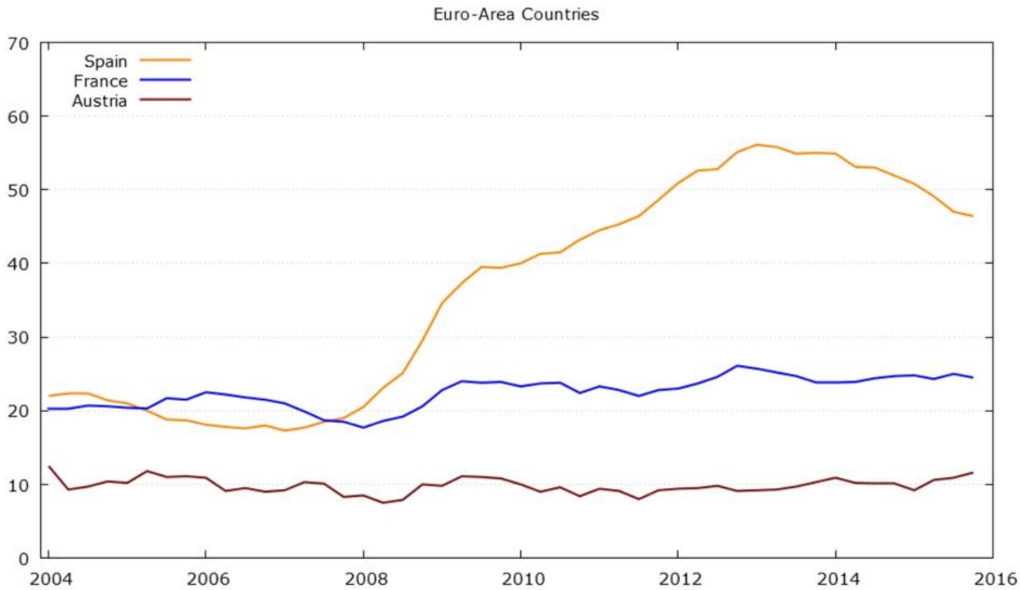


Figure 8. Youth unemployment development of EA countries (%), source: author's interpretation of Eurostat data

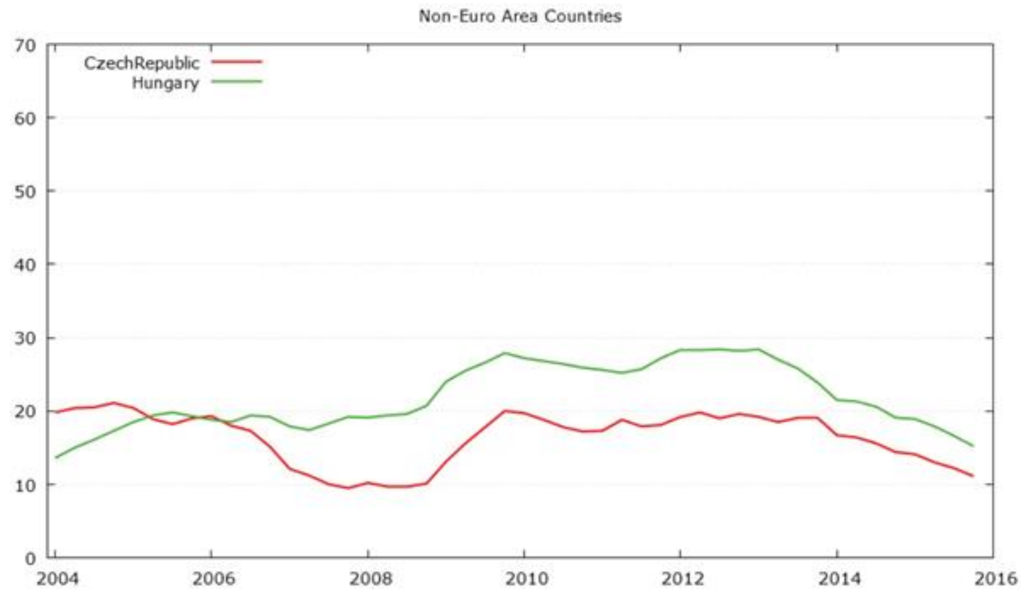


Figure 9. Youth unemployment development of Non-EA countries (%), source: author's interpretation of Eurostat data

In figures above we can see, that in period 2004 – 2008, the development is similar to all countries, the numbers kept in range between 10 – 20 %. In figure 8. you can see a reaction on crisis in 2008 where slight increase of youth unemployment rate for Austria and France, but for Spain the increase is huge. Around 2013 the youth unemployment rate in Spain reaches its maximum. For the rest of countries, the development remains similar. We can observe in Figure 9. that there is some delay compare to Euro-Area as reaction to crisis in 2008. This is similar to reaction of business cycle in figure 7. The lag is around one year. Now we will continue with summary statistics in table 2.

Table 2. Summary statistics of youth unemployment (%)

| | | **Mean** | **Median** | **Minimum** | **Maximum** | **Standard deviation** |
|---|---|---|---|---|---|---|
| **Euro area** | *Austria* | 9.83 | 9.75 | 7.5 | 12.5 | 1.04 |
| | *France* | 22.47 | 22.8 | 17.7 | 26.1 | 2.1 |
| | *Spain* | 36.46 | 39.75 | 17.3 | 56.1 | 14.63 |
| **Non-euro area** | *Czech Republic* | 16.45 | 17.85 | 9.5 | 21.1 | 3.58 |
| | *Hungary* | 21.87 | 20.2 | 13.6 | 28.4 | 4.38 |

Source: Author's calculations of Eurostat data

In table above we can see that Austria kept the lowest average of youth unemployment rate with lowest standard deviation, also they had the best results of all statistics. On the other hand, Spain has experienced the worst results for both groups. You can see that more than half of youth persons where unemployed. If we compare both groups, Spain has the worst results in all aspects. Czech Republic has comparable numbers with Austria and French together with Hungarian numbers are also comparable. But if we check standard deviations we can see that Austria and France have very close numbers and the same we can apply for Czech Republic and Hungary.

### 5.1.3 Development of unemployment of graduates

Now we take a look closely on graduates. According the Eurostat (2016) using the ISCED11 methodology, the persons in this group are educated on tertiary level (levels 5-8). In Figures 10 and 11 we can see visually the development of unemployment of graduates, which we will then compare with summary statistics in Table 3.

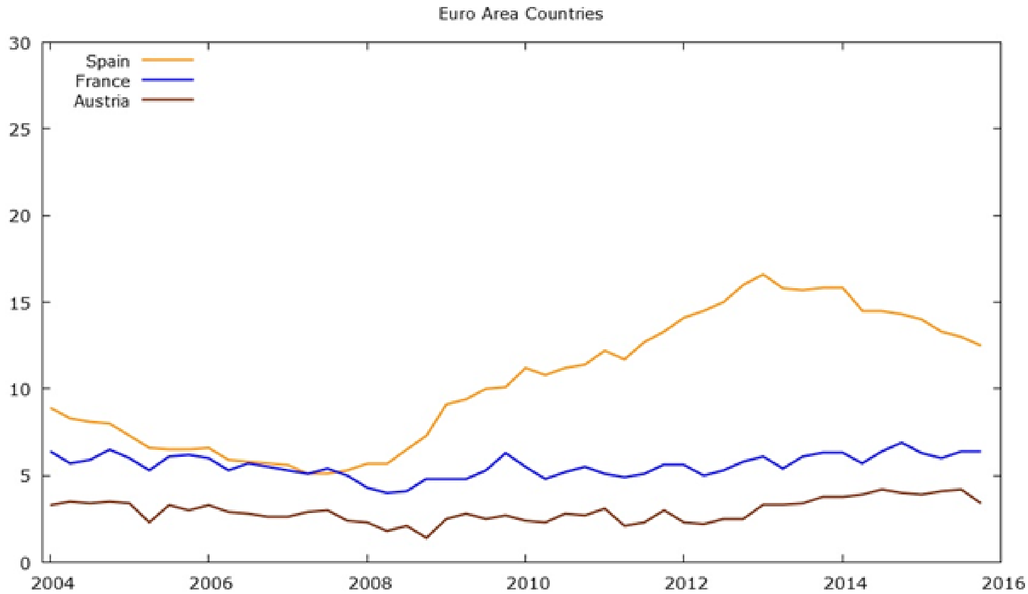


Figure 10. Development of graduates' unemployment of EA countries (%), source: Author's interpretation of Eurostat data

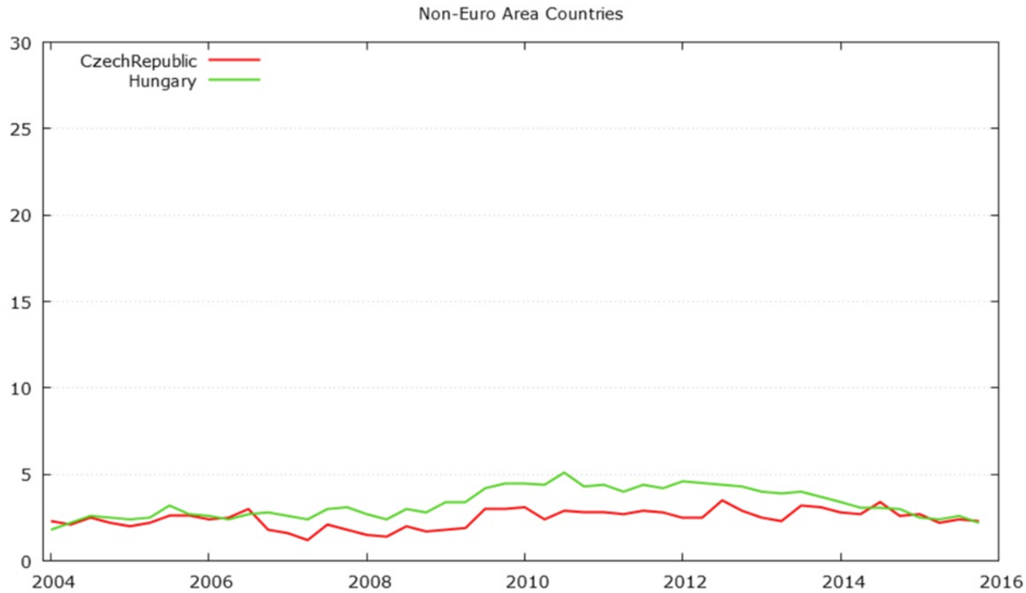


Figure 11. Development of unemployment of graduates for Non-EA countries (%), source: Author's interpretation of Eurostat data

In figures above, we can see that Austria, Czech Republic and Hungary were experiencing very similar development. The development range for these three countries is around 3 – 5 % in our reference period. In the beginning of our period Spain and its unemployment of graduates started to decrease from point nearing 9 %, close to year 2008 the unemployment dropped almost to 5 %. France experienced for whole reference period very steady development in range around 5 - 6 %. At the turn of 2008 to 2009 the graduates' unemployment slightly increased in all countries, as the crisis hit in this period, therefore Spain experienced very significant growth. Also we can observe that Austria and Czech Republic have very similar results via summary statistics and via visual development. Spain reached the maximum of its unemployment in 2013, according the Table 3 it was 16,6 % and since then the graduates unemployment started to decrease till the end of our reference period.

Table 3. Summary statistics of s unemployment of graduates (%)

| | | **Mean** | **Median** | **Minimum** | **Maximum** | **Standard deviation** |
|---|---|---|---|---|---|---|
| **Euro area** | *Austria* | 2.95 | 2.90 | 1.40 | 4.20 | 0.66 |
| | *France* | 5.57 | 5.55 | 4.00 | 6.9 | 0.66 |
| | *Spain* | 10.40 | 10.45 | 5.10 | 16.60 | 3.77 |
| **Non-euro area** | *Czech Republic* | 2.44 | 2.50 | 1.20 | 3.50 | 0.53 |
| | *Hungary* | 3.31 | 3.10 | 1.80 | 5.10 | 0.85 |

Source: Author's calculations of Eurostat data

From Table 3 we can see that all countries except Spain, have very low unemployment rates of graduates. The most appropriate result had Czech Republic with the lowest average and standard deviations. On the other hand, Spain had the worst results with the highest average and standard deviation. The rest of countries have standard deviation bellow 1.

### 5.1.4 Development of long-term unemployment

Now we will examine the development of long-term unemployment. It is the percentage of unemployed persons more than 12 months in total number of labour force. In figures 12, 13 and in Table 4 we observe the visual and statistical results.

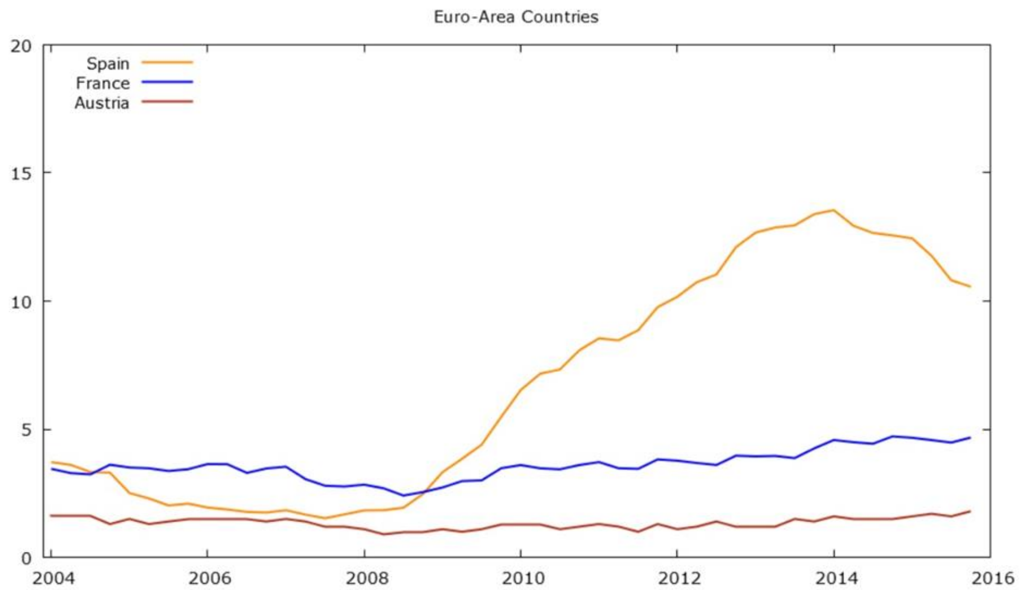


Figure 12. Development of long-term unemployment of EA countries (%), source: Author's interpretation of Eurostat data

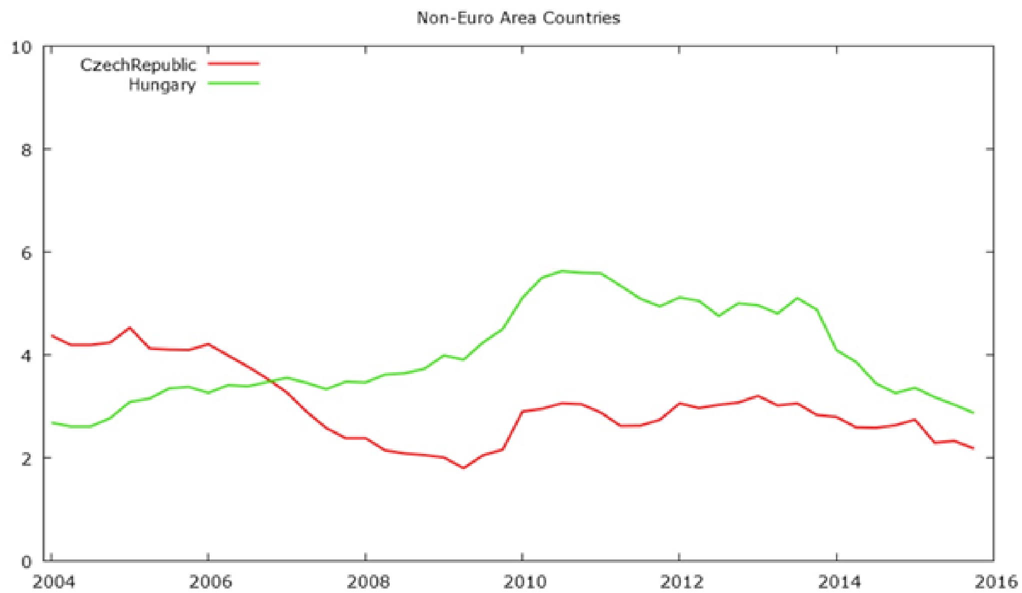


Figure 13. Development of long-term unemployment of Non-EA countries (%), source: Author's interpretation of Eurostat data

Last two figures show the development of long-term unemployment and due to the results we can observe that the long-term unemployment reacted similarly for some countries. If you look at the beginning of our period, you can compare the development with Spain and Czech Republic. The long-term unemployment for these two countries behave similarly, the rate is around 5 % and then is dropping until mid of 2008 for Spain, in case of Czech Republic it is until 2009, when the long-term unemployment starts to grow. After this point development starts to differ. Spain has like in previous cases enormous growth of its unemployment rate till 2014. In this period Czech Republic copies the development of Hungary, but with different percentage range. In 2013 we can see that these two countries experiencing decline of long-term unemployment. Regarding to Austria and France, their long-term unemployment behaves very steadily during our reference period. Again we see that some of those countries were affected by crisis in 2008, but in case of Czech Republic, Hungary and Spain, the effect of crisis is lagged.

Table 4. Summary statistics of long-term unemployment (%)

| | | **Mean** | **Median** | **Minimum** | **Maximum** | **Standard deviation** |
|---|---|---|---|---|---|---|
| **Euro area** | *Austria* | 1.34 | 1.30 | 0.90 | 1.8 | 0.21 |
| | *France* | 3.60 | 3.52 | 2.41 | 4.72 | 0.59 |
| | *Spain* | 6.67 | 6.00 | 1.53 | 13.55 | 4.46 |
| **Non-euro area** | *Czech Republic* | 3.01 | 2.90 | 1.80 | 4.53 | 0.73 |
| | *Hungary* | 3.99 | 3.63 | 2.61 | 5.63 | 0.92 |

Source: Author's calculations of Eurostat data

In Table 4 we can see, that Austria kept the lowest levels of summary statistics in all aspects. Except Spain all countries have very good levels of summary statistics, worth mentioning is that these countries haven't exceeded 6 % rate of long-term unemployment and its standard deviation is below 1. Like was mentioned in previous paragraph, Spain experienced very good period till 2008, when the rate was dropping and got to its minimum 1.53 %, which is the second lowest of observed data. After this development there was increase of the rate and reached its maximum 13.55 % in 2014.

### 5.1.5 Development of total unemployment

At this moment we look closely on development of total unemployment rate, which classifies unemployed persons as persons in age between 15-74 of all labour force, in case of Spain it is in age between 16-74. In figures 14 and 15 we can observe the visual development, after that we support it with summary statistics in Table 5.

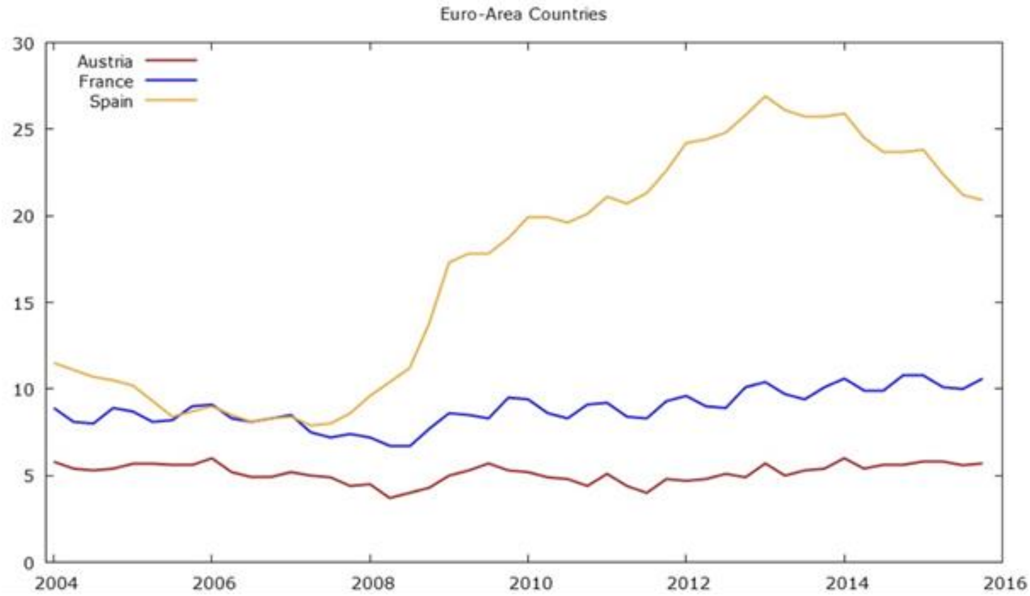


Figure 14. Development of total unemployment of EA countries (%), source: Author's interpretation of Eurostat data

In figure 14 we can see, that Austrian and French development is very stable, but in case of France the rate moves around 10 %, which is much higher. On contrary Austrian rate moves around 5 % rate According to Lobonte (2004) the natural rate of unemployment is in range of 4.5 – 6.9 %, then we can assume that Austria is very close to this range and keeps its unemployment close to natural rate. Then we can observe that Spain has experiencing very similar development of its rate in the beginning of reference period like in cases of long-term unemployment, graduates unemployment and youth unemployment. So we can assume that Spanish development behaves much alike. Also the rate of total unemployment reaches the maximum in 2013, and after that Spain has experiencing decline of its trend.

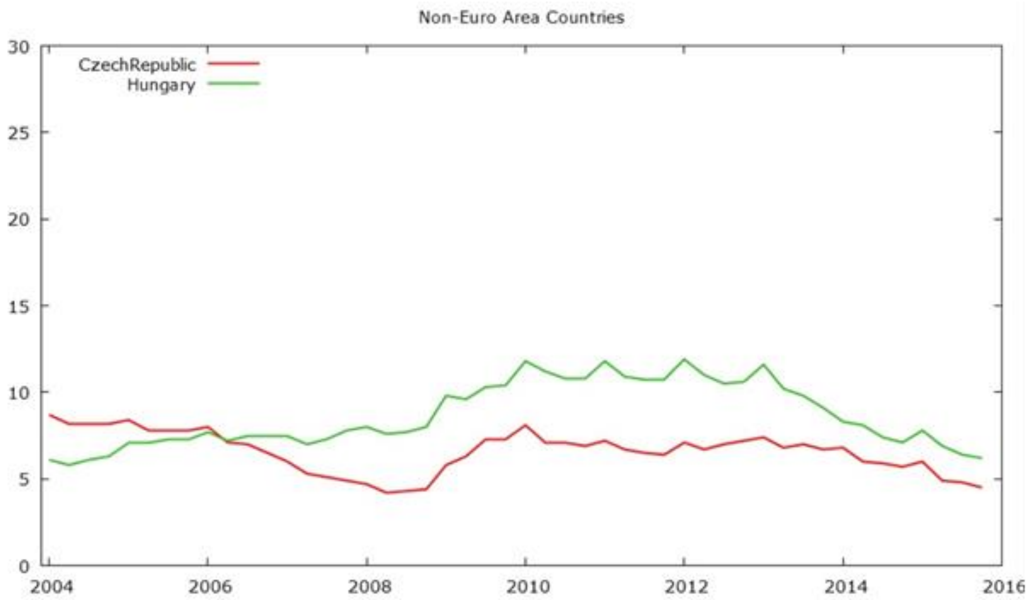


Figure 15. Development of total unemployment of Non-EA countries (%), source: Author's interpretation of Eurostat data

In figure 15, again we can observe very similar development like in case of long-term development for both countries. Czech Republic rate started to decline in beginning of period from point 8.70 %, which is the maximum rate via Table 5. This development was continuing till the beginning of crisis in 2008. On contrary Hungary experienced gradual growth of its rate. In recognized period for crisis in 2008 there is some lag again for total unemployment respond before it started to rise. But Hungary experienced higher rates of unemployment than in case of Czech Republic. In 2013 the unemployment rate stabilized and started to decline in both countries.

Table 5. Summary statistics of total unemployment (%)

| | | Mean | Median | Minimum | Maximum | Standard deviation |
|---|---|---|---|---|---|---|
| **Euro area** | *Austria* | 5.14 | 5.20 | 3.70 | 6.00 | 0.55 |
| | *France* | 8.88 | 8.90 | 6.70 | 10.80 | 1.05 |
| | *Spain* | 17.06 | 19.15 | 7.90 | 26.90 | 6.79 |
| **Non-euro area** | *Czech Republic* | 6.58 | 6.80 | 4.20 | 8.70 | 1.20 |
| | *Hungary* | 8.66 | 7.90 | 5.80 | 11.90 | 1.86 |

Source: Author's calculations of Eurostat data

From Table 5 we can complete the results discussed in last two paragraphs. Again we can see that Austria kept the lowest numbers of summary statistics, and as only country has standard deviation under 1 %. But other countries except Spain, has standard deviation also very low. We can see that France and Hungary have very similar statistics. Czech Republic has second best results and Spain the worst one. We can see that Spanish unemployment reached almost 27 % in its maximum point and if we look back to the long-term unemployment, we can see that long-term unemployment with rate 13.55 % which is its maximum as well. Then Spanish ration of long-term unemployment to total unemployment covers 50.3 %.

### 5.1.6 Development of male unemployment

In this part we take a look on development of male unemployment. In Figures 16 and 17 we can compare the visual aspect, and already it is obvious that curves for chosen countries in our two groups copy the development of total and long-term unemployment with similar range, so in this part we mainly focus on summary statistics in table 6.

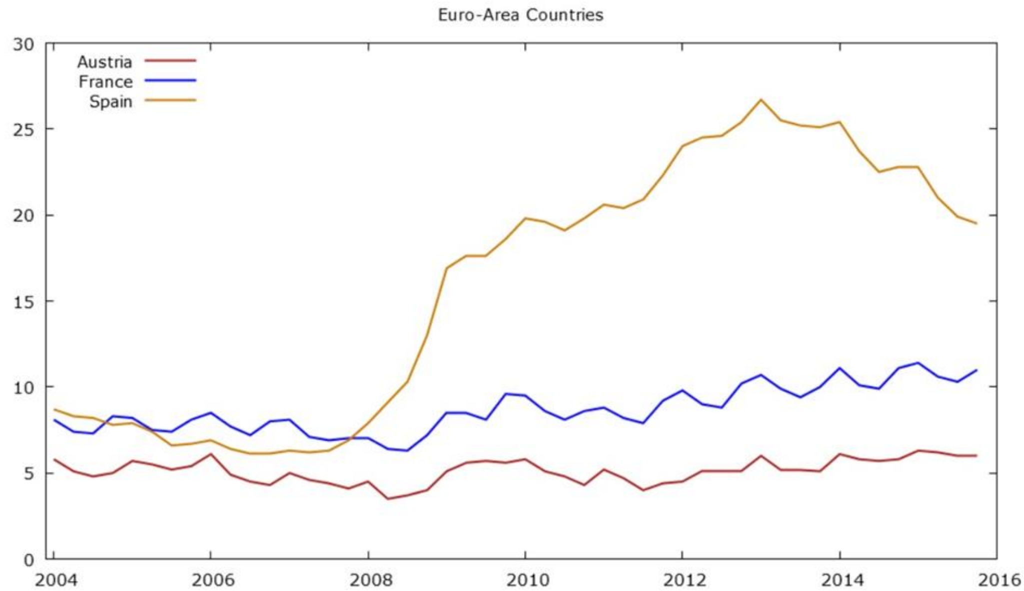


Figure 16. Development of male unemployment of EA countries (%), source: Author's interpretation of Eurostat data

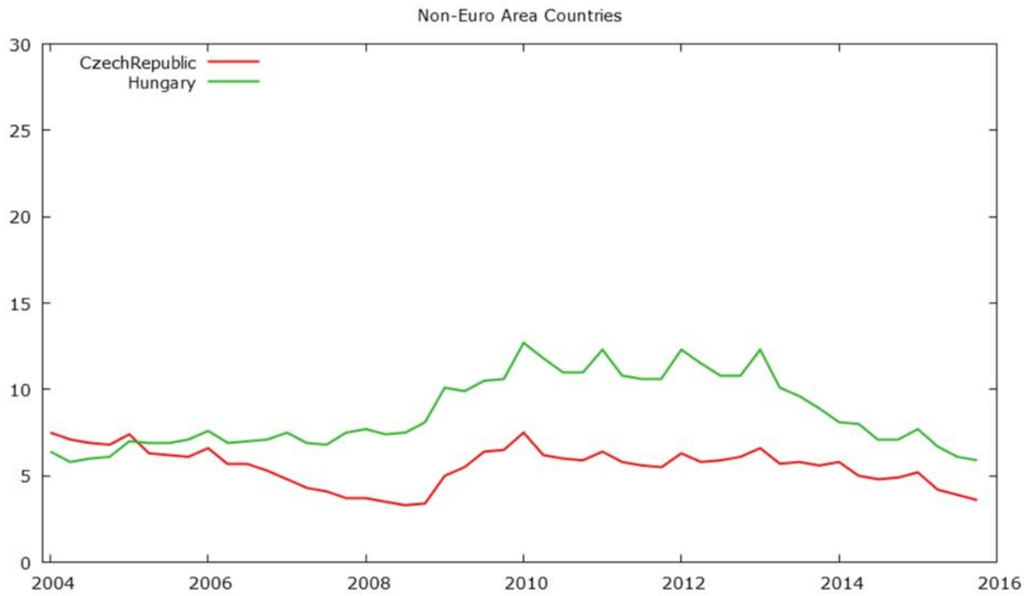


Figure 17. Development of male unemployment of Non-EA countries (%), source: Author's interpretation of Eurostat data

In Table 6, if we compare the results with summary statistics in Table 5 for total unemployment, we can see that results are slightly better for male unemployment, total unemployment has better results only for standard deviation. This results then implies that male unemployment isn't so sensitive to structural changes in economy than the total unemployment.

Table 6. Summary statistics of male unemployment (%)

| | | Mean | Median | Minimum | Maximum | Standard deviation |
|---|---|---|---|---|---|---|
| **Euro area** | *Austria* | 5.12 | 5.10 | 3.50 | 6.30 | 0.70 |
| | *France* | 8.68 | 8.50 | 6.30 | 11.40 | 1.35 |
| | *Spain* | 15.94 | 18.85 | 6.10 | 26.70 | 7.47 |
| **Non-euro area** | *Czech Republic* | 5.54 | 5.75 | 3.30 | 7.50 | 1.13 |
| | *Hungary* | 8.65 | 7.70 | 5.80 | 12.7 | 2.09 |

Source: Author's calculations of Eurostat data

### 5.1.7 Development of female unemployment

Now we will look on development of our last depend variable the female unemployment. In Figures 18 and 19 we can compare the visual aspect and we can see that curves for chosen countries in our two groups have much alike development of total, long-term and male unemployment, so in this part we will focus only on summary statistics in table 7.

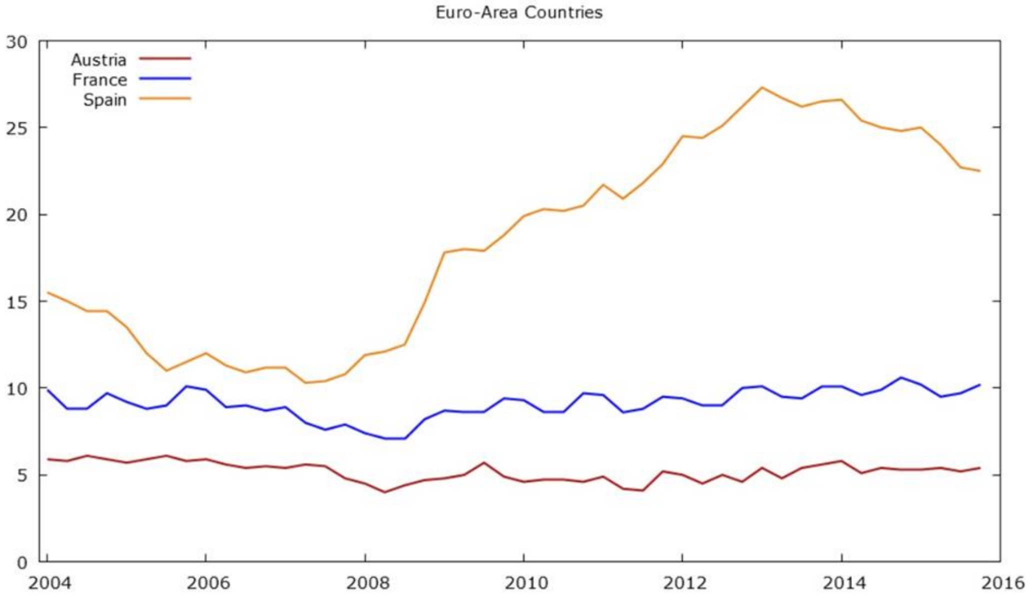


Figure 18. Development of female unemployment of EA countries (%), source: Author's interpretation of Eurostat data

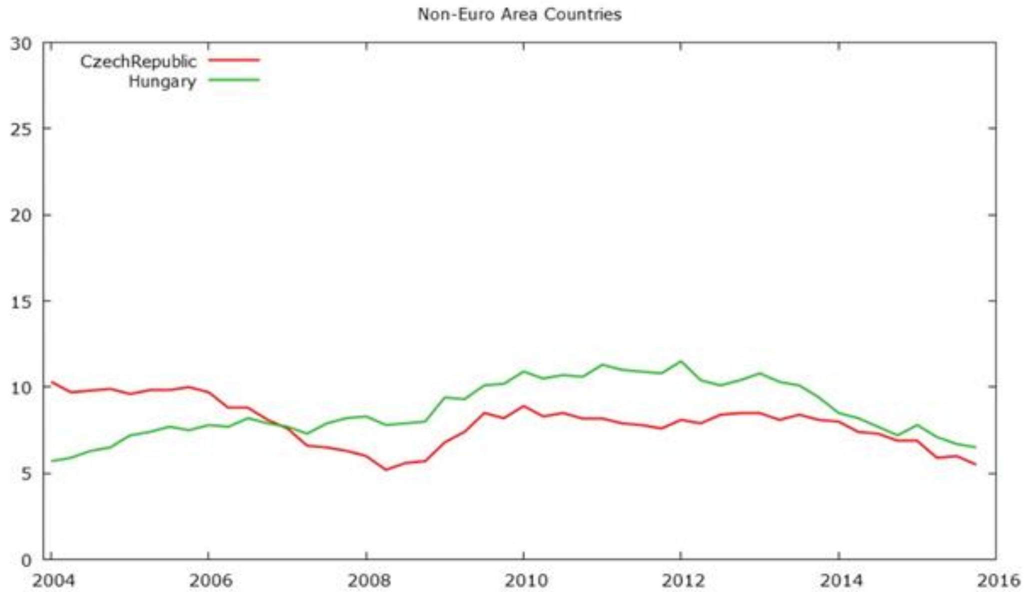


Figure 19. Development of female unemployment of Non-EA countries (%), source: Author's interpretation of Eurostat data

In Table 7, if we compare the results with summary statistics in Tables 5 and 6 for total unemployment and with male unemployment. We can see that results are slightly worse than in case of male and total unemployment. But we can observe in case of Austria and France that despite the averages rates which are better for males, the maximum levels plus minimum levels for Austria seems better for females. This results implies that female unemployment seems to be a bit more sensitive to changes in economy than total unemployment.

Table 7. Summary statistics of female unemployment (%)

| | | **Mean** | **Median** | **Minimum** | **Maximum** | **Standard deviation** |
|---|---|---|---|---|---|---|
| **Euro area** | *Austria* | 5.19 | 5.30 | 4.00 | 6.10 | 0.55 |
| | *France* | 9.11 | 9.10 | 7.10 | 10.60 | 0.83 |
| | *Spain* | 18.55 | 19.35 | 10.30 | 27.30 | 5.86 |
| **Non-euro area** | *Czech Republic* | 7.92 | 8.10 | 5.20 | 10.30 | 1.34 |
| | *Hungary* | 7.92 | 8.20 | 5.70 | 11.50 | 1.63 |

Source: Author's calculations of Eurostat data

### 5.1.8 Development of inflation

In this thesis the inflation is measured as the index of Harmonised Indices of Consumer Prices with reference year 2010. HICP index was transformed to annual rates of change for higher accuracy of regression model. And now we take a look for its development in chosen countries. Firstly, we observe the visual side to its development and then on summary statistics to complete results.

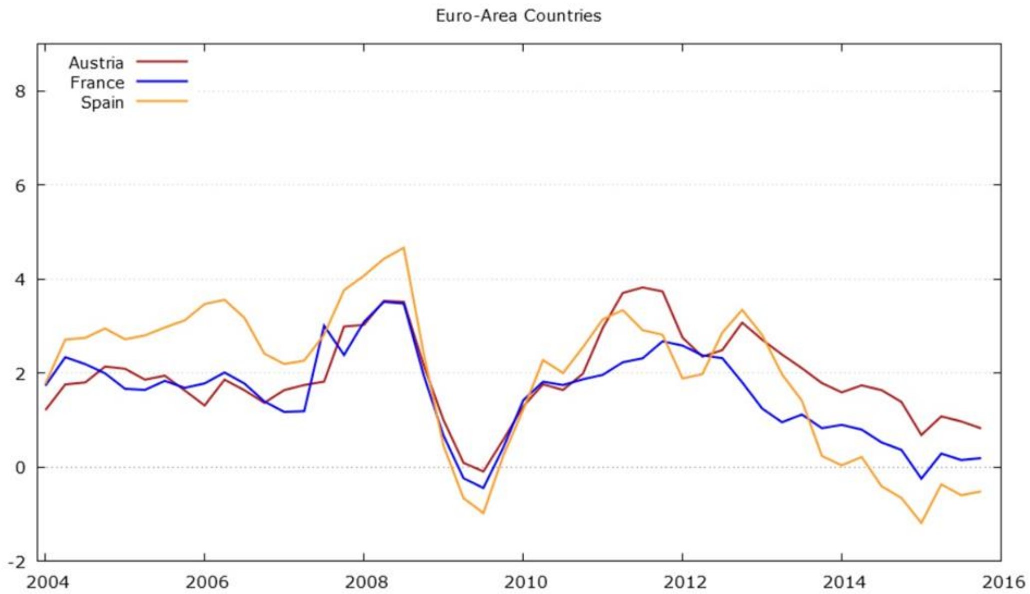


Figure 20. Development of inflation of EA countries (%), source: Author's interpretation of Eurostat data

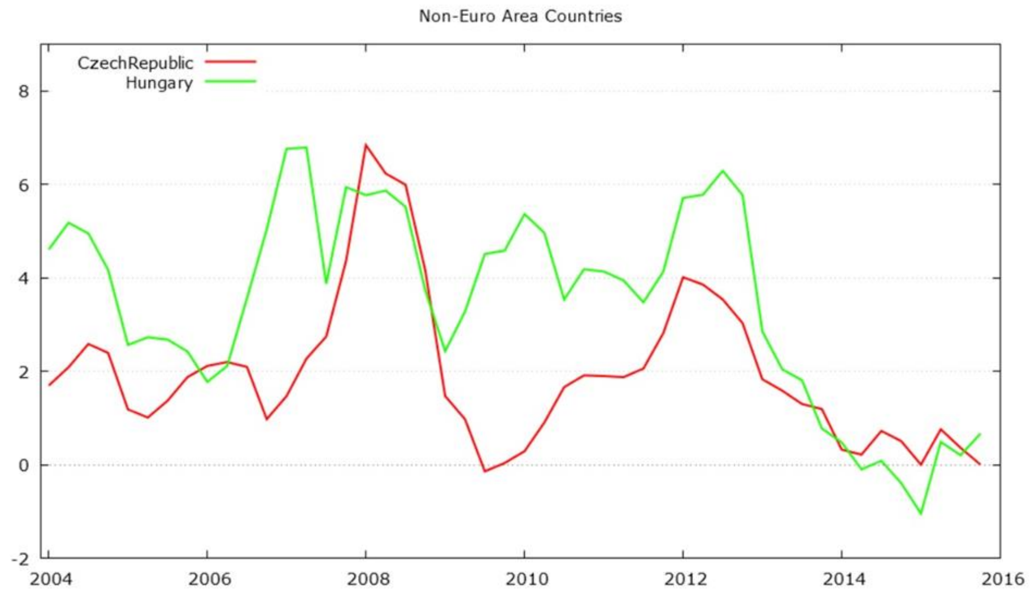


Figure 21. Development of inflation of Non-EA countries (%), source: Author's interpretation of Eurostat data

In figure 20 and 21 we can see that development for Euro-Area countries doesn't differ to development of Czech Republic inflation. Hungarian inflation developed differently. There are high inflation rates in years 2004, 2007, 2008, 2010, 2011 and 2012 for Hungary, since 2013 the inflation starts to copy the development of other countries. For the rest of four countries we can see that inflation increased one year before the crisis started and then in 2009 it started to decrease to a level which indicated a risk of deflation. But this period took only while and inflation started to grow till 2012. After that inflation was dropping slowly till the end of our reference period. In the end of our reference period we can see that the deflation risk appeared again, this time for all chosen countries.

Table 8. Development of inflation rate (%)

| | | Mean | Median | Minimum | Maximum | Standard deviation |
|---|---|---|---|---|---|---|
| **Euro area** | *Austria* | 1.94 | 1.79 | -0.10 | 3.82 | 0.91 |
| | *France* | 1.55 | 1.74 | -0.45 | 3.51 | 0.95 |
| | *Spain* | 1.94 | 2.41 | -1.19 | 4.66 | 1.56 |
| **Non-euro area** | *Czech Republic* | 1.97 | 1.76 | -0.14 | 6.84 | 1.61 |
| | *Hungary* | 3.46 | 3.80 | -1.05 | 6.79 | 2.08 |

Source: Author's calculations of Eurostat data

In table 8 above we can see that Euro-Area countries and Czech Republic have very similar results of summary statistics, the average rates are around 2% and standard deviations in range close to 1 - 1.5 %, which confirms our findings in Figures 20 and 21. We can observe that Spain, Czech Republic and Hungary experienced very high rates of inflation in our reference period. Also if you look in Table 8, all countries experienced negative rates of inflation, which means the risk of deflation actually appeared in those countries. The deflation nowadays is very present in most of Euro-Area countries.

### 5.1.9 Development of nominal and real wage

Nominal wage is measured as the Labour Cost Index and it is given as nominal value index with reference year 2010. It is total wages and salaries for whole business economy. Similarly, as for HICP, data were transformed to growth rates with reference year 2010. To obtain the real wage, it was used the nominal wage and the HICP index. Then the real wage index was transformed to annual rates of change. In this part we look at nominal and real wage together for chosen countries separately and then we compare the average growth rates of nominal and real wage in following figures.

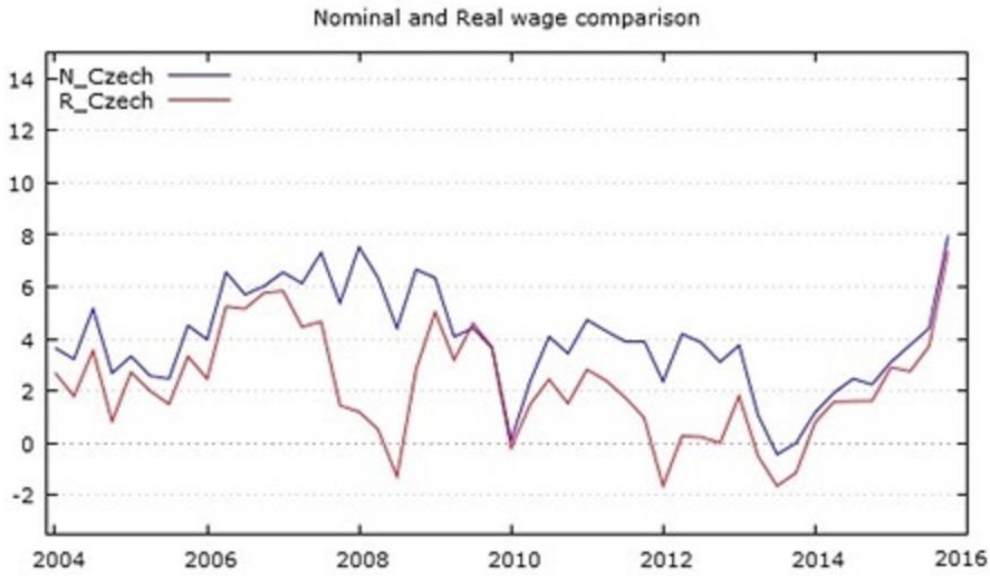


Figure 22. Development of nominal and real wage for Czech Republic (%), source: Author's interpretation of Eurostat data

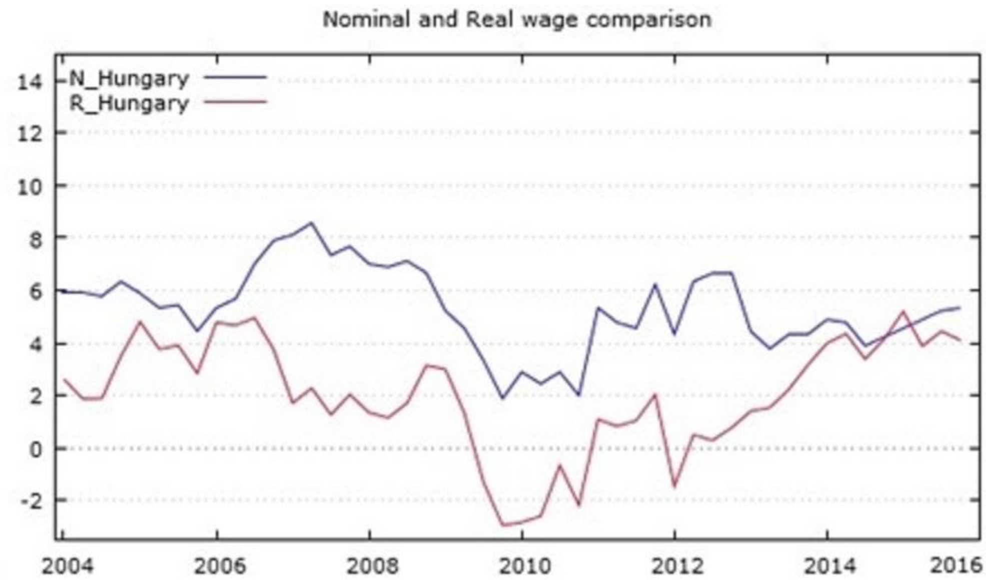


Figure 23. Development of nominal and real wage for Hungary (%), source: Author's interpretation of Eurostat data

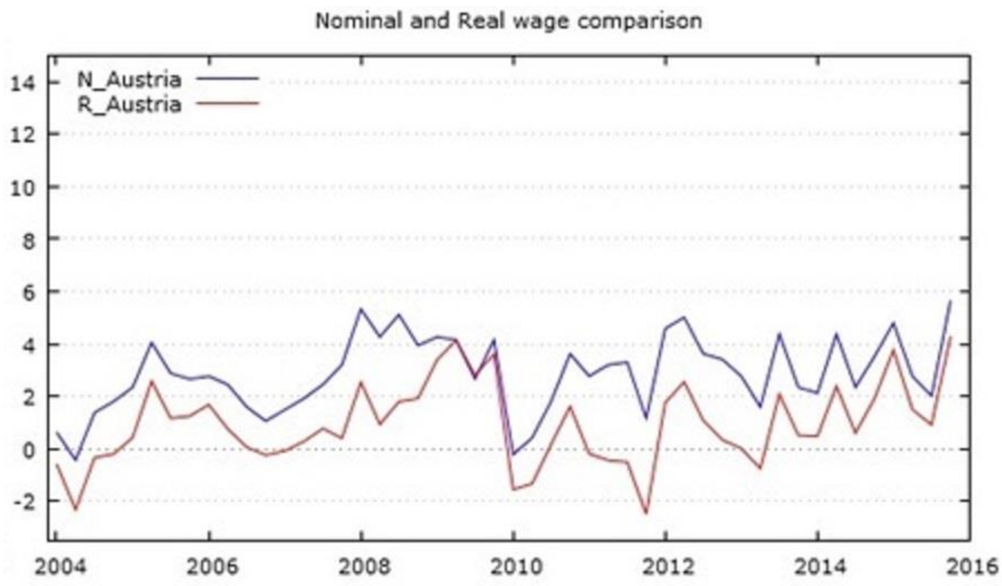


Figure 24. Development of nominal and real wage for Austria (%), source: Author's interpretation of Eurostat data

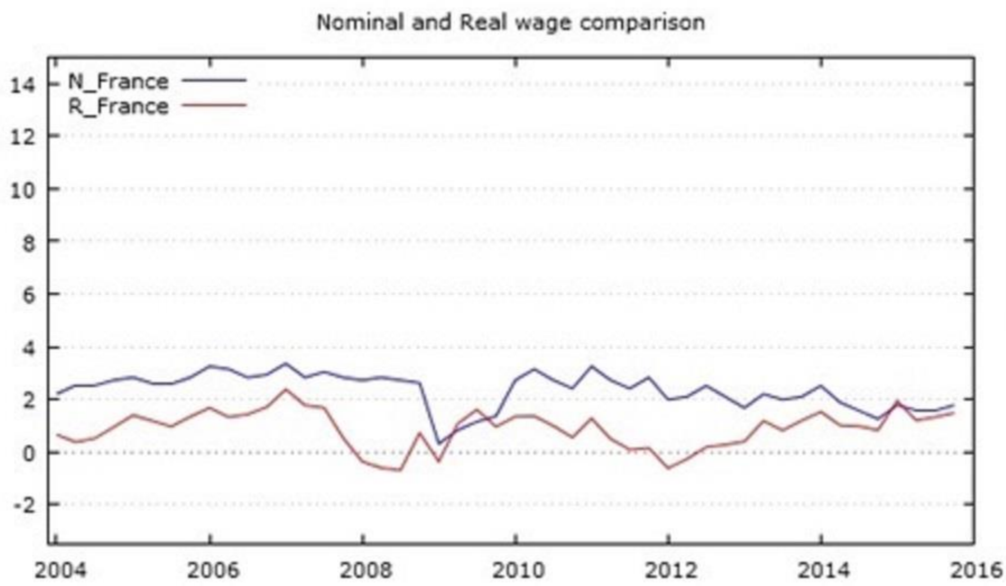


Figure 25. Development of nominal and real wage for France (%), source: Author's interpretation of Eurostat data

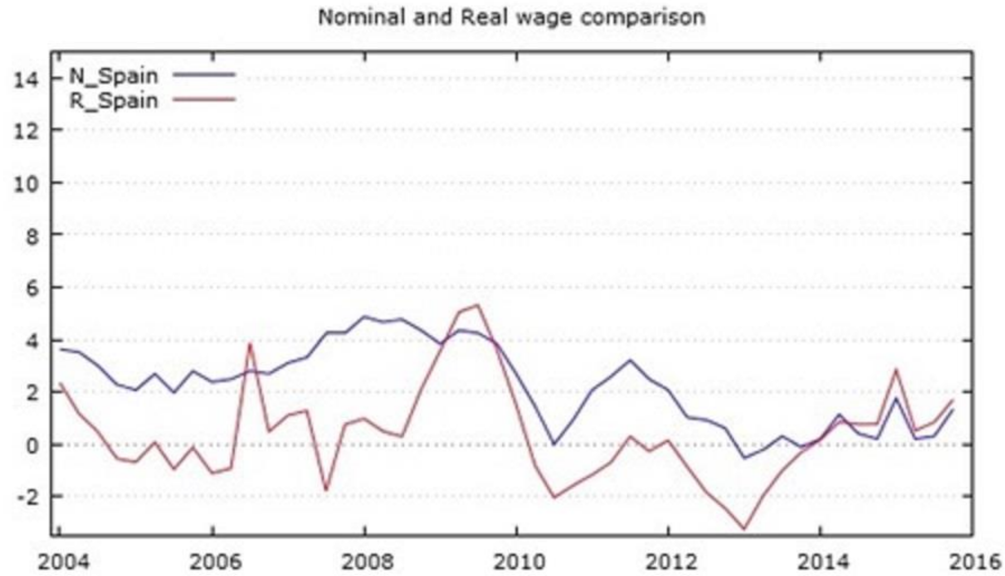


Figure 26. Development of nominal and real wage for Spain (%), source: Author's interpretation of Eurostat data

From figures 22 – 26, we can see the development for each country. In every chart we can see the development of nominal and real wage at the same time. We can observe that each country experienced negative values of real wage development. In case of Austria, Czech Republic and Spain, we can see that these countries experienced negative values of nominal wage as well.

If we look back to the Inflation development, we can see that in those periods when real wages got below zero, these countries experienced high rates of inflation. Also we can see that countries like Czech Republic, Hungary and Spain experienced decrease in real wages while their nominal wage grew. Development of all these countries reflects their economic situation described in this chapter.

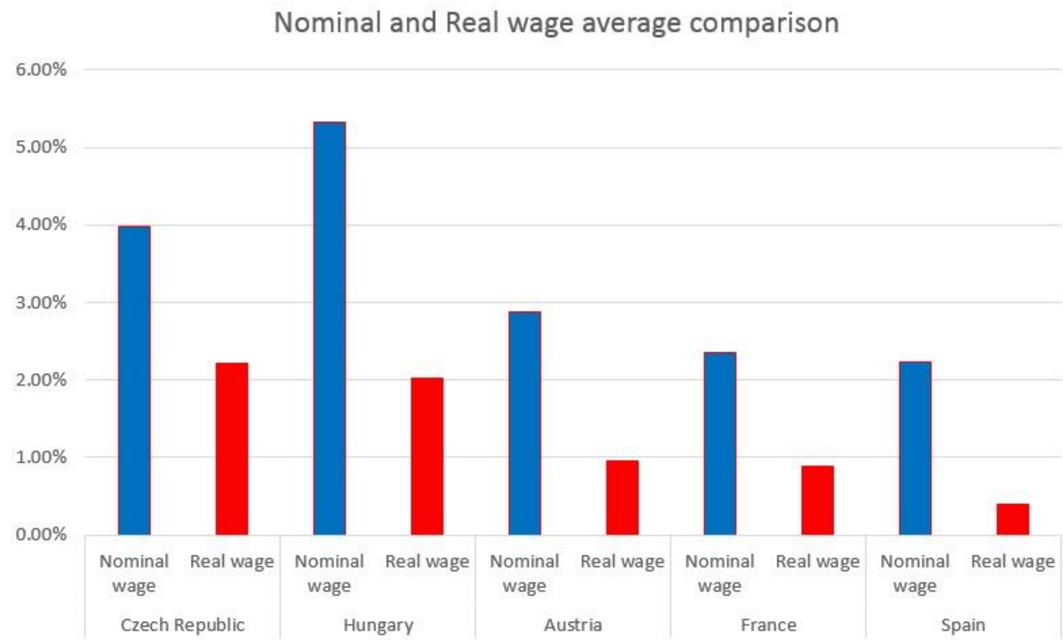


Figure 27. Comparison of nominal and real wage average (%), source: Author's interpretation of Eurostat data

Figure 27 shows that Non-Euro Area countries had higher average of nominal and real wage growth than Euro-area countries. Hungarian average of nominal wage growth rate was the highest, with average rate 5.32 %. Czech Republic experienced 3.97 % growth rate of nominal wage average. But if we compare the real wage growth rate of these two countries, Czech Republic had the highest rate, specifically 2. 22%, and Hungary with 2.02 %. In Euro-Area the chosen countries experienced smaller average rate of nominal wage in range of 2 – 3 %. The average of real wage rate was in range of 1%, but Spanish growth rate was under 0.5 %. This development might be consequence of convergence process of chosen Non-Euro Area countries.

### 5.1.10 Summary of descriptive analysis

This analysis helps us to better understand chosen data for better clarification of regression analysis. Out of this results we could see how the crisis in 2008 affected our chosen variables for chosen countries. We could observe that some variables for Non-Euro Area countries reacted with some lag compare to Euro-Area countries, it was mostly for unemployment groups. We were able to see and to confirm the risk of deflation, about which is spoken very often in Euro-Area nowadays. Also we could observe that real wages growth was in Euro-Are much slower than in Non Euro-Area countries. We were able to observe that our data indicates non-linear relationship between dependent and explanatory variables. This relationship will be tested in correlation analysis.

## 5.2 Model and hypotheses

Before we get to the model of this thesis, firstly we have to determine hypothesis of expected values for each explanatory variable on dependent variable. Previous research helped us to better understand chosen variables and now we can determine hypotheses.

Table 9. Hypotheses of regression model coefficients

| Variable | Hypothesis |
|---|---|
| *Business cycle* | *Negative* |
| *Nominal wage* | *Negative* |
| *Real wage* | *Negative* |
| *HICP* | *Negative* |

Source: Based on author's findings

In the table above you can observe the expected values of explanatory variables. As one of the objectives of this thesis is to estimate unemployment sensitivity, we expect that if the business cycle is in recession phase, the unemployment rate increases. Thus we expect negative value. In case of unemployment on the one side and nominal wage or real wage on other side, we get the regression model of Wage Phillips curve, which is showing inverse relationship between wages and unemployment, thus we expect negative values for both variables. Also for inflation, there is similar relationship, but in relation to Price Phillips curve. Anyway the expected value is also negative.

Following the methodology above, now we can process the model for multivariate regression analysis.

$$Y_{Y\_U} = \beta_0 - \beta_1 * \mathrm{Ct}_t - \beta_2 * \mathrm{Nom\_W}_t - \beta_3 * \mathrm{Real\_}W_t - \beta_4 * Pi + \varepsilon_t \qquad for\ (t = 48)$$
$$Y_{G\_U} = \beta_0 - \beta_1 * \mathrm{Ct}_t - \beta_2 * \mathrm{Nom\_W}_t - \beta_3 * \mathrm{Real\_}W_t - \beta_4 * Pi + \varepsilon_t$$
$$Y_{LT\_U} = \beta_0 - \beta_1 * \mathrm{Ct}_t - \beta_2 * \mathrm{Nom\_W}_t - \beta_3 * \mathrm{Real\_}W_t - \beta_4 * Pi + \varepsilon_t$$
$$Y_{T\_U} = \beta_0 - \beta_1 * \mathrm{Ct}_t - \beta_2 * \mathrm{Nom\_W}_t - \beta_3 * \mathrm{Real\_}W_t - \beta_4 * Pi + \varepsilon_t$$
$$Y_{M\_U} = \beta_0 - \beta_1 * \mathrm{Ct}_t - \beta_2 * \mathrm{Nom\_W}_t - \beta_3 * \mathrm{Real\_}W_t - \beta_4 * Pi + \varepsilon_t$$
$$Y_{F\_U} = \beta_0 - \beta_1 * \mathrm{Ct}_t - \beta_2 * \mathrm{Nom\_W}_t - \beta_3 * \mathrm{Real\_}W_t - \beta_4 * Pi + \varepsilon_t$$

As you can see above, the dependent variables are unemployment structures with following indications:

- Youth unemployment rate: Y_U
- Unemployment rate of graduates: G_U
- Long-term unemployment rate: LT_U
- Total unemployment rate: T_U
- Rate of male unemployment: M_U

- Rate of female unemployment: F_U

The explanatory variables in our model are variables with following indications:

- Business cycle as cyclical component: Ct
- Labour Cost Index as nominal value: Nom_W
- Real wages: Real_W
- Harmonised Indices of Consumer Prices: Pi

For purposes of sensitivity analysis will be applied the regression coefficients of business cycle to asses if the research question and the hypothesis of this thesis is correct. While we were processing this thesis, we have determined these minor hypotheses:

- *"The male unemployment is expected to be more sensitive than female unemployment when business cycle declines."*
- *"The long-term unemployment is expected to be more sensitive than total unemployment when business cycle declines."*

## 5.3 Correlation analysis

In this analysis we determine the strength and degree of association between two variables. Because we assume there might be non-linear relationship between dependent and explanatory variables. We assume negative coefficients of correlation matrix. In this analysis we are not interested in confirming or rejecting the hypotheses determined in previous chapter. We are looking for relationship between variables, if linear correlation, positive values or non-linear relationship, negative values. In our calculations we involved correlations without applying lag and correlation with one to four lag, because we are using quarterly data. Due to the large number of results, we will present just average correlations in table 10. Exact results can be found in Appendix A.

Table 10. Average correlation of lagged independent variables (0 – 4)

| | | | YU | GU | LTU | TU | MU | FU |
|---|---|---|---|---|---|---|---|---|
| EA countries | Austria | Ct | -0.3532 | -0.23134 | -0.28404 | -0.4154 | -0.44322 | -0.23776 |
| | | Nom_W | 0.0177 | -0.10182 | -0.1747 | -0.0326 | 0.09726 | -0.22762 |
| | | Real_W | 0.1635 | 0.00982 | 0.01302 | 0.13454 | 0.24336 | -0.07608 |
| | | Pí | -0.2705 | -0.263 | -0.3618 | -0.3267 | -0.3313 | -0.02682 |
| | France | Ct | -0.418 | -0.37382 | -0.27904 | -0.3474 | -0.2834 | -0.42942 |
| | | Nom_W | -0.5339 | -0.34984 | -0.39864 | -0.4941 | -0.53338 | -0.3733 |
| | | Real_W | -0.2133 | 0.15216 | 0.14122 | -0.0459 | -0.06488 | -0.00408 |
| | | Pí | -0.3705 | -0.45048 | -0.5237 | -0.461 | -0.476 | -0.38806 |
| | Spain | Ct | -0.3182 | -0.44314 | -0.431 | -0.3331 | -0.30246 | -0.3881 |
| | | Nom_W | -0.5886 | -0.65196 | -0.73702 | -0.571 | -0.5344 | -0.6252 |
| | | Real_W | -0.1956 | -0.25598 | -0.27802 | -0.1873 | -0.17218 | -0.2142 |
| | | Pí | -0.4264 | -0.40346 | -0.46422 | -0.4164 | -0.40006 | -0.43336 |
| Non-EA countries | Czech Republic | Ct | -0.7366 | -0.55164 | -0.49802 | -0.7152 | -0.71548 | -0.68048 |
| | | Nom_W | -0.4371 | -0.55446 | -0.22462 | -0.3252 | -0.32978 | -0.30494 |
| | | Real_W | -0.2905 | -0.37314 | 0.03046 | -0.1303 | -0.14956 | -0.10048 |
| | | Pí | -0.2008 | -0.32938 | -0.19906 | -0.2028 | -0.20932 | -0.1877 |
| | Hungary | Ct | -0.4015 | -0.43252 | -0.38196 | -0.3673 | -0.38314 | -0.33548 |
| | | Nom_W | -0.3521 | -0.45064 | -0.47216 | -0.3969 | -0.39634 | -0.38838 |
| | | Real_W | -0.6829 | -0.7332 | -0.76694 | -0.7353 | -0.73304 | -0.72654 |
| | | Pí | 0.3333 | 0.29868 | 0.31182 | 0.34948 | 0.34996 | 0.34926 |

Source: Author's calculations

The results for Austria implies, that between unemployment groups and business cycle is negative non-linear relationship. The strength of relationship is moderate than to be strong. Results for business cycle indicates that any fluctuation of business cycle will result in opposite way for unemployment. We can see that for inflation there is similar result with non-linear relationship, only in case of female unemployment the strength of this relationship is very weak. In case of real and nominal wage the results are mixed. We can see there are either negative or positive values. The values imply weak strength of correlation.

French correlation data are for business cycle, nominal wage and inflation very good. We can see that result range is around -0.3 % to -0.6 %. This proofs there is non-linear relationship with moderate strength of explanatory data on dependent variables. In case of real wage, results are in range of small negative to very small positive values close to zero, indicating that unemployment groups have weak correlation.

For Spain the correlation came out with non-linear relationship of explanatory variables on dependent variables. For inflation and business cycle the correlation imply moderate correlation between variables. For real wage the relationship is weak, but for nominal wage we can see that the strength of negative correlation is strong, with the highest value for long-term unemployment.

In case of Czech Republic, the correlation data for business cycle are very promising. We can see that there is strong non-linear correlation. Also nominal wage together with inflation reacts well and we can observe moderate non-linearity. The real wage has also negative correlation, but data have weaker correlation for nominal wage. Only exception is correlation of long-term unemployment on real wage, with linear correlation close to zero.

Hungarian real wage as only country in our analysis came out with strong negative correlation on dependent variables. The results for business cycle and nominal wage is similar to France. Also as only country its inflation has positive correlation of inflation data on dependent variables.

Every country reacts differently whether is in Euro-Area or not, also we have to take into account that we were analysing just average correlation, and the exact results might differ. In the following table we verify whether in the model are independent variables, which are highly correlated.

Table 11. Average correlation between independent of lagged (0 - 4) variables

| | | Nom_W | Real_W | Pi | Ct | |
|---|---|---|---|---|---|---|
| **EA countries** | **Austria** | 1 | 0.8216 | 0.1756 | 0.2405 | **Nom_W** |
| | | | 1 | -0.409 | -0.1171 | **Real_W** |
| | | | | 1 | 0.6007 | **Pi** |
| | | | | | 1 | **Ct** |
| | **France** | 1 | 0.2219 | 0.654 | 0.5988 | **Nom_W** |
| | | | 1 | -0.5474 | -0.0921 | **Real_W** |
| | | | | 1 | 0.584 | **Pi** |
| | | | | | 1 | **Ct** |
| | **Spain** | 1 | 0.5661 | 0.3138 | 0.5271 | **Nom_W** |
| | | | 1 | -0.4927 | 0.1615 | **Real_W** |
| | | | | 1 | 0.296 | **Pi** |
| | | | | | 1 | **Ct** |
| **Non-EA countries** | **Czech Republic** | 1 | 0.6776 | 0.468 | 0.6193 | **Nom_W** |
| | | | 1 | -0.3128 | 0.1581 | **Real_W** |
| | | | | 1 | 0.594 | **Pi** |
| | | | | | 1 | **Ct** |
| | **Hungary** | 1 | 0.4559 | 0.4052 | 0.5241 | **Nom_W** |
| | | | 1 | -0.574 | 0.4261 | **Real_W** |
| | | | | 1 | -0.0473 | **Pi** |
| | | | | | 1 | **Ct** |

Source: Author’s calculation

The correlation table shows only average correlations like in table 10. It provides only informative overview of applied data. If coefficient would have resulted with higher value than 0.8, it suggests that some independent variables are highly correlated. This result can indicate that in model is presence of multicollinearity, which decreases the reliability of final model. From Table 11 we can observe that Austrian nominal wage and real wage correlation coefficient 0.826 is bigger than 8. For other countries we can see that other highly correlated data are not present. For purposes of regression analysis will be used accurate correlation results in dependency whether we will apply lag or not.

According this analysis, now we have wider outline of data and we can continue with multivariate regression analysis.

## 5.4 Results of multivariate regression analysis

For model building, we applied the method of Ordinary Least Squares or the OLS method for all countries in period from 2004Q1 to 2015Q4, in total of 48 - 44 observations in dependency if we applied lag or not. The coefficient results tell us how explanatory variables respond on dependent variables. Mainly we would like to answer on our research question, how do different unemployment groups respond to the changes in business cycle and which group is the most sensitive? According the results of coefficient for business cycle, we would be able to confirm or reject the hypothesis, which will tell us if business cycle affects unemployment or not. If we confirm this hypothesis we would be able to do sensitive analysis by comparing coefficients of each chosen unemployment group and tell which group is the most sensitive one.

Like author stated in the beginning of this thesis, by adding other variables, we would be able to answer on more questions than just the unemployment sensitivity. This thesis offers to answer to other labour economic questions. How do wages respond on unemployment, are they flexible? Is the inverse relationship of unemployment to inflation true? Like was stated before we are interested, how do coefficients respond to each dependent variable.

The inflation coefficient should express relationship of inflation and unemployment which should be inversely related. Then increase of inflation should cause decrease of unemployment, in this case would not reject the hypothesis about expected negative value.

In case of real wage or nominal wage on unemployment the coefficient expresses, if wage adjust to a change of unemployment. We assumed in our hypotheses the negative value for both variables, which state that wages are elastic, because increase of unemployment rate will be balanced by decrease of wages.

In our analysis we have high number of outcomes, therefore we’ve decided to present in this thesis only some results for whole multivariate regression analysis, which were came out as the best. Other results will be summarized in the end of this chapter and attached in Appendix B.

In case of Czech Republic, we have selected for purposes of this thesis model of youth unemployment with two lags. This model came out with the highest sensitivity for youth unemployment. Results can be seen in Figure 28.

```
Model 18: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: Y_U

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const       14.1585      0.845882     16.74     6.24e-020 ***
  Ct_2        -1.82405     0.187337     -9.737    3.19e-012 ***
  Nom_W_2      0.818615    0.909829      0.8997   0.3735
  Real_W_2    -0.698079    0.804463     -0.8678   0.3906
  Pi_2         0.117583    0.824025      0.1427   0.8872

Mean dependent var   16.28696   S.D. dependent var   3.568168
Sum squared resid    138.7440   S.E. of regression   1.839565
R-squared            0.757835   Adjusted R-squared   0.734209
F(4, 41)             32.07654   P-value(F)           3.91e-12
Log-likelihood      -90.66293   Akaike criterion     191.3259
Schwarz criterion    200.4691   Hannan-Quinn         194.7510
rho                  0.714872   Durbin-Watson        0.571827
```

Figure 28. OLS results for Czech youth unemployment, source: authors calculation of Eurostat data

Before we get to the results, we have observed that only the business cycle responds on unemployment negatively without applying lag. The real wage responds on unemployment as we have expected after applying 2 lags. The adjustment of inflation wasn't effective by any change of lag in our model. The nominal wage seemed elastic with zero to one lag, but then by applying additional lags it didn't bring any adjustment.

We can observe on the results of OLS method that model is significant only for business cycle. Adjusted R-squared has explained 73.42 % of dependent variable, also result for p-value is low. We can observe that coefficient for business cycle is -1.82 and for real wage it is -0.7, which means we are not rejecting our hypothesis, both values have expected negative value. In case of nominal wage and inflation, we have to reject the hypothesis, because values are positive. Whereas we had to reject hypothesis for two of our coefficient, we have decided to perform correlation matrix to prove that in our model isn't multicollinearity. If coefficient would have resulted with higher value than 0.8, it means the independent variables are highly correlated. Neither coefficient did not result highly correlated with other independent variable. Correlation matrix suggested no presence of multicollinearity. To confirm this result, we have performed another test, the test of Variance Inflation Factors (VIF). Nominal wage, real wage and inflation had higher values of VIF than 10, which may indicate presence of multicollinearity. By omitting the real wage, it came out as the most appropriate solutions. New model didn't confirm presence of multicollinearity. We can observe that model significance improved together with Adjusted R-squared.

```
Model 8: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: Y_U

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const       14.1486       0.833132     16.98     2.01e-020 ***
  Ct_2        -1.82420      0.185136     -9.853    1.74e-012 ***
  Nom_W_2      0.942484     0.269270      3.500    0.0011    ***
  Real_W_2    -0.808750     0.211096     -3.831    0.0004    ***

Mean dependent var   16.28696   S.D. dependent var   3.568168
Sum squared resid    138.8129   S.E. of regression   1.817985
R-squared            0.757715   Adjusted R-squared   0.740409
F(3, 42)             43.78316   P-value(F)           5.43e-13
Log-likelihood      -90.67435   Akaike criterion     189.3487
Schwarz criterion    196.6633   Hannan-Quinn         192.0888
rho                  0.716751   Durbin-Watson        0.568203
```

Figure 29. Improved results for Czech youth unemployment, source: Author's calculation

We proved that the unemployment responds on business cycle as the primary objective of this thesis. In conformity with Knotek (2007) the business cycle coefficient expresses that if business cycle growth slowdowns it typically corresponds with increasing unemployment. Then we confirmed the hypothesis that there is Wage Phillips curve trade-off for real wage, meaning that high unemployment results in decrease of real wages. We rejected hypothesis for nominal wage, because its coefficient has positive value. It implies that nominal wage is not elastic enough to adjust to a changes in labour market. We assume that if unemployment decreases, nominal wage decreases as well and vice versa. This may be caused by legislative process; typical example are minimum wages or indexation of public sector wages. Also it could be caused by presence of centralized labour unions. The labour union is typical model of insider-outsider model described by Lindbeck and Snower (2001). Labour unions influence wages to remain high, which increase labour costs for companies due to they cannot hire more people thus it keeps unemployment at higher rate.

Hungarian model of youth unemployment with one lag came out with the highest sensitivity for youth unemployment and we've selected it for further interpretation. Results can be seen in Figure 30.

Model 2: OLS, using observations 2004:2-2015:4 (T = 47)
Dependent variable: Y_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 24.3914 | 1.88329 | 12.95 | 2.93e-016 | *** |
| Ct_1 | -0.570843 | 0.277150 | -2.060 | 0.0457 | ** |
| Nom_W_1 | 1.10912 | 0.861494 | 1.287 | 0.2050 | |
| Real_W_1 | -2.12484 | 0.662256 | -3.208 | 0.0026 | *** |
| Pi_1 | -1.15702 | 0.697961 | -1.658 | 0.1048 | |

| | | | |
|---|---|---|---|
| Mean dependent var | 22.04894 | S.D. dependent var | 4.254556 |
| Sum squared resid | 381.8769 | S.E. of regression | 3.015345 |
| R-squared | 0.541376 | Adjusted R-squared | 0.497697 |
| F(4, 42) | 12.39456 | P-value(F) | 9.61e-07 |
| Log-likelihood | -115.9215 | Akaike criterion | 241.8429 |
| Schwarz criterion | 251.0936 | Hannan-Quinn | 245.3240 |
| rho | 0.724486 | Durbin-Watson | 0.446384 |

Figure 30. OLS results for Hungarian youth unemployment, source: Author's calculation of Eurostat data

We have observed that business cycle, real wage and inflation responded on unemployment negatively without applying lag. But the nominal wage didn't respond as we expected. By gradual addition of lags, we've seen that business cycle became more sensitive only in first lag then the sensitivity started to decrease. The adjustment mechanism of nominal wage was with every additional lags, less flexible.

We can observe on the results of OLS method that model is significant only for the business cycle and the real wage. Adjusted R-squared has explained 49.78 % of dependent variable, also the p-value is very low. Inflation and nominal wage are not significant so we have decided to perform correlation matrix to prove that in model is not presence of multicollinearity. But neither coefficient did not result highly correlated with other independent variable. The VIF values showed slightly bigger than 10 for real wage and inflation and suggested that in model is present multicollinearity. We have decided to omit the inflation which showed as the most appropriate outcome as you can see in following figure.

Model 3: OLS, using observations 2004:2-2015:4 (T = 47)
Dependent variable: Y_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 25.2782 | 1.84205 | 13.72 | 2.60e-017 | *** |
| Ct_1 | −0.429394 | 0.268994 | −1.596 | 0.1177 | |
| Nom_W_1 | −0.201627 | 0.348897 | −0.5779 | 0.5663 | |
| Real_W_1 | −1.10095 | 0.243744 | −4.517 | 4.84e-05 | *** |

| | | | |
|---|---|---|---|
| Mean dependent var | 22.04894 | S.D. dependent var | 4.254556 |
| Sum squared resid | 406.8629 | S.E. of regression | 3.076025 |
| R-squared | 0.511368 | Adjusted R-squared | 0.477278 |
| F(3, 43) | 15.00027 | P-value(F) | 7.99e-07 |
| Log-likelihood | −117.4108 | Akaike criterion | 242.8217 |
| Schwarz criterion | 250.2223 | Hannan-Quinn | 245.6066 |
| rho | 0.731796 | Durbin-Watson | 0.405255 |

Figure 31. Improved results for Hungarian youth unemployment, source: Author's calculation

In improved model we removed multicollinearity and did not rejected hypothesis of expected value for business cycle, nominal wage and real wage. The youth unemployment responds to a business cycle change in opposite way, meaning that if business cycle drops the youth unemployment will increase, but the result is not statistically significant. Nominal wage seems flexible to a changes of youth unemployment, but this result is not significant as well. According to results, real wages adjust to a changes in unemployment flexibly and confirms the Wage Phillips curve. So if unemployment increases the real wage will decrease and vice versa.

Austrian model of male unemployment with two lags came out with the highest sensitivity for it. Results can be seen in Figure 32.

```
Model 9: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: M_U

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const        4.92958     0.275279     17.91     5.42e-021 ***
  Ct_2        -0.228921    0.0682777    -3.353    0.0017    ***
  Nom_W_2      1.86774     0.547543      3.411    0.0015    ***
  Real_W_2    -1.73112     0.547303     -3.163    0.0029    ***
  Pi_2        -1.80668     0.540685     -3.341    0.0018    ***

Mean dependent var   5.102174   S.D. dependent var   0.704742
Sum squared resid    11.29300   S.E. of regression   0.524823
R-squared            0.494715   Adjusted R-squared   0.445419
F(4, 41)             10.03559   P-value(F)           9.32e-06
Log-likelihood      -32.96864   Akaike criterion     75.93727
Schwarz criterion    85.08048   Hannan-Quinn         79.36237
rho                  0.406076   Durbin-Watson        1.177226
```

Figure 32. OLS result for Austrian male unemployment, source: Author’s calculations of Eurostat data

We have observed that business cycle, real wage and inflation responded on unemployment negatively since base period without applying lag. By gradual addition of lags, we’ve found out that unemployment responds on business most sensitively by applying second lag. The adjustment of nominal wage was very slow and inelastic throughout testing and any additional lags did not improve the result.

We can see that all variables are significant on dependent variable. Adjusted R-squared explains 44.54 % of dependent variable and p-value has low value. We rejected the hypothesis for nominal wage, because its value is 1.87. For business cycle, real wage and inflation we do not reject the hypothesis, because resulted values are negative. As in previous cases we applied correlation matrix and VIF to prove that in model isn’t multicollinearity. But both tests showed high correlations for inflation, nominal and real wage. Thus in model is present multicollinearity. But by omitting of these variables we did not improve the model, but it worsened. According to Dougherty (2011) multicollinearity doesn’t have to influence the outcome seriously, because it is often caused by time series, where two or more independent variables may have strong trend. This causes variables to correlate mutually and causes multicollinearity. Multicollinearity doesn’t indicate that model is imprecise. But we have to concede that these three variables indicate smaller reliability in our model.

Business cycle confirms our hypothesis that unemployment responds sensitively, when business cycle changes. When business cycle declines the male unemployment responds by an increase. We can observe that real wage is more elastic than nominal wage, which indicates to adjust very slowly and to be less elastic. The real wage confirms Wage Phillips curve’s inverse relationship with unemployment, so in case the male unemployment increases, the real wage will drop. As we mentioned the nominal wage is less elastic and if unemployment increases, the nominal wage increases as well. This may be caused by legislative process and high volume of centralized labour unions; the typical example is insider-outsider model described for Czech model. For inflation the coefficient confirms Price Phillips curve.

French model of female unemployment with two lags came out with the highest sensitivity for female unemployment. Results can be seen in Figure 33.

Model 24: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: F_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 9.26239 | 0.492409 | 18.81 | 8.94e-022 | *** |
| Ct_2 | -0.284469 | 0.128444 | -2.215 | 0.0324 | ** |
| Nom_W_2 | 0.991469 | 0.531653 | 1.865 | 0.0694 | * |
| Real_W_2 | -0.975832 | 0.443708 | -2.199 | 0.0336 | ** |
| Pi_2 | -1.04729 | 0.451447 | -2.320 | 0.0254 | ** |

| | | | |
|---|---|---|---|
| Mean dependent var | 9.100000 | S.D. dependent var | 0.839312 |
| Sum squared resid | 21.03480 | S.E. of regression | 0.716271 |
| R-squared | 0.336442 | Adjusted R-squared | 0.271704 |
| F(4, 41) | 5.197025 | P-value(F) | 0.001762 |
| Log-likelihood | -47.27451 | Akaike criterion | 104.5490 |
| Schwarz criterion | 113.6922 | Hannan-Quinn | 107.9741 |
| rho | 0.543786 | Durbin-Watson | 0.903895 |

Figure 33. OLS result for French female unemployment, source: Author's calculation of Eurostat data

We have observed that business cycle, real wage and inflation responded on unemployment negatively without applying lag. By gradual addition of lags, we've seen that business cycle becomes more sensitive till applying two lags then every additional lags decrease its sensitivity. The adjustment of nominal wage was inelastic throughout testing.

We can observe on the results of OLS method that model is significant for all variables. Adjusted R-squared explains 27.17 % of dependent variable, also the p-value is low. We rejected the hypothesis for nominal wage, because its value is 0.99 and didn't behave like we expected. For business cycle, real wage and inflation we do not reject the hypothesis, which resulted as negative. Correlation matrix didn't indicate multicollinearity, because correlation of independent variables didn't exceed 0.8 and data seemed reliable. But VIF values were higher than 10 for nominal wage and inflation, indicating presence of multicollinearity. Omitting of these variables did not improve the model, but it worsened. As we quoted Dougherty in case of Austria, the multicollinearity doesn't have to mean that model is imprecise, but we have to admit that these two variables indicate smaller reliability in the model.

Business cycle confirms our hypothesis that unemployment responds sensitively, when business cycle changes. Then female unemployment increases as a respond to a fall of business cycle. From the result of real wage, we can observe that it is more elastic than nominal wage, that seems to adjust very slowly and less flexible. The real wage confirms Wage Phillips curve's inverse relationship with unemployment, so in case the female unemployment increases, the real wage drops. As we mentioned the nominal wage is less flexible and if unemployment increases, the nominal wage increases too. This may be caused by legislative process and high volume of centralized labour unions, which is typical very for France. Price Phillips curve is confirmed by inflation result, so the inverse relationship of unemployment and inflation indicates to be correct in case of France.

Spanish model of long-term unemployment with applying one lag came out best with the highest sensitivity for long-term unemployment. Results used for further interpretation can be seen in Figure 34.

```
Model 15: OLS, using observations 2004:2-2015:4 (T = 47)
Dependent variable: LT_U

             coefficient   std. error   t-ratio    p-value
  --------------------------------------------------------
  const       12.5394       0.840752     14.91     2.20e-018 ***
  Ct_1        -0.173620     0.274321     -0.6329   0.5302
  Nom_W_1     -1.46407      0.584090     -2.507    0.0161    **
  Real_W_1    -0.465667     0.500914     -0.9296   0.3579
  Pi_1        -1.17413      0.537847     -2.183    0.0347    **

Mean dependent var    6.729170   S.D. dependent var   4.484637
Sum squared resid     296.6741   S.E. of regression   2.657756
R-squared             0.679323   Adjusted R-squared   0.648783
F(4, 42)              22.24328   P-value(F)           6.47e-10
Log-likelihood       -109.9885   Akaike criterion     229.9771
Schwarz criterion     239.2278   Hannan-Quinn         233.4582
rho                   0.819284   Durbin-Watson        0.363658
```

Figure 34. OLS result of Spanish long-term unemployment, source: Author's calculation of Eurostat data

We have observed that all independent variables responded on unemployment negatively since base period without applying lag. By gradual addition of lag, we've seen that business cycle becomes more sensitive only by one lag, then every additional lag decreased its sensitivity.

We can observe on the results of OLS method that nominal wage and inflation are significant in presence of long-term unemployment. The business cycle and real wage are not significant. Adjusted R-squared explains 64.87% of dependent variable, with low p-value. For all variables we confirm hypotheses, because coefficients have negative expected value. Some variables are not significant, so we have checked if independent variables are not highly correlated to each other. The correlation matrix and VIF indicate that in model is not present multicollinearity, so model seems reliable.

Business cycle confirms our hypothesis that unemployment responds sensitively, when business cycle changes, but the result isn't significant. Also real wage indicates that it adjusts flexibly to changes in unemployment, but like in case of business cycle, it is not significant. For nominal wage we confirmed the Wage Phillips curve, meaning that inverse relationship of unemployment and nominal wages indicates to be correct. As for wages we confirm the Price Phillips curve for inflation. Both variables should decrease if long-term unemployment starts to grow.

Some other OLS results together with correlation matrixes for presented models are attached in Appendix.

## 5.5 Sensitivity analysis

Now we examine the sensitivity analysis by comparing the coefficients of regression analysis for business cycle. These coefficients will show how do respond different unemployment structures to the changes of business cycle. For purposes of our analysis we took coefficients of those models, which came out with the best outcomes. Besides the main hypothesis, to determine if unemployment is sensitive to the business cycle we have determined hypotheses with expected values in chapter *Model and hypotheses*, where we expect that coefficients will have negative values. The negative values implying increased sensitivity on business cycle. In the following table you can observe the coefficients applied in this analysis.

Table 12. Sensitivity analysis

| **Coefficient/ Country** | **Non-Euro Area** | | **Euro-Area** | | |
|---|---|---|---|---|---|
| | *Czech Republic* | *Hungary* | *Austria* | *France* | *Spain* |
| *Youth unemployment* | -1.82420 | -0.429394 | -0.28446 | -0.568838 | -0.711956 |
| *Unemployment of graduates* | -0.14067 | -0.0813249 | -0.0969359 | -0.128076 | -0.45945 |
| *Long-term unemployment* | -0.288626 | -0.0540124 | -0.0670062 | -0.0277979 | -0.17362 |
| *Total unemployment* | -0.596942 | -0.119964 | -0.192850 | -0.0728607 | -0.508283 |
| *Male unemployment* | -0.576345 | -0.198657 | -0.228921 | 0.129788 | -0.541265 |
| *Female unemployment* | -0.668001 | -0.02782296 | -0.109177 | -0.284469 | -0.505042 |

Source: Author's calculations of Eurostat data

We can follow that all countries no matter if they are in Euro-Area or not, they do respond sensitively to changes in business cycle. The only exception in our analysis is male unemployment in France. We see that this coefficient is positive with value 0.129788. For this case we reject the hypothesis, because the negative expected value didn't show correct. On our research question, we have to answer that in France male unemployment indicates that they are not vulnerable to business cycle changes. But if we check the result for this model in appendix B, we can observe that this concrete business cycle coefficient is not significant.

To determine which unemployment group responds most sensitively, we have to take the lowest value for each country. Following this step, we can see that for all countries the youth unemployment showed to be the most vulnerable group when business cycle declines. So the hypothesis of this thesis indicates to be correct, therefore we do not reject it.

In chapter model and hypotheses, we determined two minor hypotheses, which are following:

- *"The male unemployment is expected to be more sensitive than female unemployment when business cycle declines."*
- *"The long-term unemployment is expected to be more sensitive than total unemployment when business cycle declines."*

We can observe that hypothesis about males is not rejected in case of Hungary, Austria and Spain. In Czech Republic are more sensitive females than males, and in case of France, males show to be unresponsive to changes of business cycles. The total unemployment showed to be more sensitive when business cycle declines than long-term unemployment that is less sensitive, thus we reject this hypothesis. It could indicate that long-term unemployment responds to a different economic variable or to condition in the labour market.

We must have reminded that each country has its particular conditions, and even though the results seem different, we can see some similarities. As we have already proved youth unemployment resulted with lowest value for all countries. And the long-term unemployment indicating to be less sensitive among all countries, with respect to rejected hypotheses.

## 5.6 Summary of results

In this section we look briefly at summary of our findings and how unemployment groups responded on explanatory variables in accordance with regression analysis and sensitive analysis.

Results for Czech Republic proved that all unemployment groups are responsive on business cycle changes. All results for business cycle were significant. In accordance with sensitive analysis, we confirmed main hypothesis of this thesis that youth unemployment is the most responsive group. All unemployment groups respond on business cycle changes most sensitively by applying at least one lag. Majority were the most sensitive when we applied two lags but in case of long-term and female unemployment, the highest sensitivity on business cycle is reached by using for testing with four lags. Nominal wage appeared to be for youth unemployment and graduates less elastic, causes to reject the hypothesis. Otherwise the majority confirmed the hypothesis for Wage Phillips curve. On contrary the real wage appeared to be mostly inelastic to adjust to shifts in unemployment. Only in case of youth unemployment and graduates the real wage seemed to be elastic. Inflation confirmed hypothesis just once. Other results rejected hypothesis for inverse relationship of inflation and unemployment for Price Phillips curve. That would mean that increase of unemployment will increase inflation. But this outcome is not correct so there is assumption that labour market is separated from inflation. In all models was confirmed presence of multicollinearity for both wages and inflation and by omitting some of these variables, model improved for male, female and youth unemployment. The other models didn't lead to improvement. Then these models, in which variables indicate multicollinearity are therefore less reliable and less significant.

Each unemployment group for Hungary responds sensitively when business cycle changes. Business cycle coefficients were significant only in case of graduates. Primary hypothesis of this thesis confirms that youth unemployment appears to be most vulnerable group when business cycle declines. To determine in what phase are unemployment groups most sensitive, mostly differ. Without applying any lag were most sensitive only total and male unemployment. For youth unemployment we applied one lag, for graduates and female unemployment two lags and for long-term unemployment four lags. Half of all dependent variables for nominal wage appeared to adjust very slowly and less flexible to shifts of unemployment and for second half we were able to confirm hypothesis, but these results are not significant. Outcome for real wage is significant and we confirmed hypothesis. Also for inflation we did confirm the hypothesis, but with no significant result. Models indicated multicollinearity for real wage and inflation and we were able to remove multicollinearity for graduates, male and female unemployment by omitting the inflation as problematic variable. For other models by omitting variables, the models worsened. Then these models which indicate multicollinearity are therefore less reliable and less significant.

We were able to determine that all Austrian unemployment groups are responsive on business cycle changes. According to sensitive analysis, the main hypothesis proved to be correct and confirmed that youth unemployment is the most responsive group. The result for business cycle was mostly significant with exception of females and graduates. Unemployment groups were most sensitive by applying two lags or four lags. The nominal and real wage always appeared with same result, but only for real wage the hypothesis was confirmed, both were mostly significant. Nominal wage appeared to be less elastic to adjust to shifts in unemployment. On contrary the real wage confirmed the Wage Phillips curve. The inflation also confirmed the Price Phillips curve, except for female unemployment. The nominal wage, real wage and inflation had higher correlation, which suggested presence of multicollinearity. By omitting some of these variables, the model improved only for total, female and youth unemployment. The other models didn’t lead to improvement. Then these models, in which variables indicate multicollinearity are therefore less reliable and less significant.

Results for France proved that all unemployment groups are responsive on changes in business cycle, except males indicating that they are not sensitive to shifts of business cycle at all. Result for females were as only one significant. It was confirmed that main hypothesis of this thesis proves that youth unemployment is the most sensitive group. All groups were most sensitive with application of two lags, exception was long-term unemployment with four lags. For nominal wage we rejected the hypothesis, but variable was significant only for youth unemployment, long-term unemployment and female unemployment. In case of youth unemployment, we didn’t reject the hypothesis. The hypothesis of real wage proved to be correct and its results are significant, except for graduates. Also the hypothesis for inflation wasn’t rejected and results were significant. The nominal wage and inflation indicated to have multicollinearity problem and were able to adjust and remove multicollinearity for models of youth, graduates and male unemployment. The rest models didn’t improve, but worsen by omitting these two variables. Then these models, in which variables indicate multicollinearity are therefore less reliable and less significant.

For Spain as only one country was all hypothesis confirmed. Firstly, we can again claim that youth unemployment really responds most sensitively, so the main hypothesis is confirmed. We have observed that coefficients were significant only for inflation, partially for nominal wage and only once for business cycle in presence of graduates. The models suggested there is no presence of multicollinearity and models were specified mostly without any applying lag, only for graduates and long-term unemployment were used one lag. For these models the sensitivity appeared to be highest.

For this summary were used models described in previous chapter together with other models attached in Appendix B.

# 6 Conclusion

The objective of this thesis was to estimate the sensitivity of unemployment in different groups to a business cycle in chosen countries. Conclusions of this thesis were assumed to help to answer the following research question:

- *How do the selected unemployment groups respond to changes in the business cycle and which group is the most sensitive?*

Following the research question, the hypothesis is that: *"The youth unemployment is expected to be the most sensitive to changes in the business cycle."*

With regard to be able to meet this question we needed to estimate the coefficients of multivariate regression analysis applied in this thesis as the main method. The other methodology applied in this thesis was methodology proposed by Hodrick and Prescott (1997) to dissect the cyclical component, the correlation analysis and the sensitivity analysis. The sensitivity analysis is a necessary part in order to be able to answer the main hypothesis.

With respect to all countries we were able to prove that unemployment groups responded to changes in the business cycle. According to our expectation the regression coefficients were negative for the business cycle. Only in one case of French male unemployment it had a positive coefficient. The results indicated that if the business cycle declines the unemployment rate will increase. To answer the main hypothesis, we conducted the sensitivity analysis by comparing all business cycle coefficients taken from multivariate regression analysis. In accordance with this step, we did not reject the hypothesis that youth unemployment responded most sensitively to changes in the business cycle. So we fulfilled both hypothesis and the research question of this diploma thesis.

During the study of labour market, we were given the opportunity to answer more questions than just unemployment sensitivity. We determined two secondary research questions:

- *How do wages respond on unemployment, are they flexible?*
- *Is the inverse relationship of unemployment to inflation true?*

In this thesis there were prevailing differences in response of nominal and real wage to unemployment. In most cases response of real wage to unemployment was notably bigger than reaction of nominal wage. The nominal wage was then indicating worse adjustment mechanism to changes in labour market and tended to be less flexible with downward direction. This indicates barriers in legislation process or strong centralization of labour unions. The real wage responded flexibly and confirmed the relationship of Wage Phillips curve. But some cases appeared here, in which nominal wage behaved more flexibly than real wage. For most of results we confirmed the Price Phillips curve for inflation, but in the case of Czech Republic the results weren't so as we expected and suggested that labour market was separated from inflation development. To be capable to answer our secondary questions, we have observed that wages are flexible only partially and suggesting differences in wage flexibility. The inflation reverse relationship seemed to be true for most of results.

The results were various from country to country, therefore we are not able to deduce whether the fact that the countries are in Euro-Area or not, has an effect on unemployment sensitivity and the other results.

Nevertheless, we should be aware of restraints which are connected with our chosen methods. For multivariate regression analysis we could apply different methodology to obtain other results. For nominal wage and inflation, which we used to obtain real wage, we could change the data on quarterly rate of change instead of annual rate of change. Moreover, we could use different data sample for nominal wage and inflation, such as chain linked volumes instead of fixed base indices. Furthermore, we can just use more observations instead of present forty-eight ones. By using different variables or just changing them we would be given different results.

We must also admit that if economy is in recovery phase even in expansion the young people will remain the most sensitive group despite the fact that its unemployment rate will decline. Due to that its rate will remain still at very high levels. The International Labour Organization or ILO together with OECD (2014) identified reasons which prove previous statement and claiming that poor skills and skills mismatch are major barriers to favourable labour market result. Recommendations that could reverse the negative development of youth unemployment should be ensured by government support. Governments should focus on reinforcement of apprenticeship, internship programmes and retraining courses. (ILO, 2014). These programmes help not just to young people, but to all workers to improve current skills or develop new one. García (2011) claimed that one of main reasons why the youth unemployment in Spain has reached such an enormous rate, was early school leaving which should be enhanced by reducing it through better control and support of the young people who may be at risk to leave education sooner. According to Eichhorst and coll. (2013) subsidies and grants are very effective tools to improve the youth unemployment. Subsidies and grants could be used as support of labour mobility or the temporary migration, because young people are the most flexible group. Then together with retraining courses or involving employer in vocational training, the subsidies can be applied as stimuli for an employer to hire young people.

The main focus how to improve wage flexibility should be on the side of governments, because the legislation process is the way how to regulate or deregulate the labour market and then it affects the wage flexibility. Main recommendation how to improve wage flexibility should be in direction of deregulations of labour market. One of the ways how to deregulate labour market could be regulations on temporary contracts, and support more fixed contracts and part time jobs to increase employment. On the other hand, Becker (2009) proposed to cut income taxes particularly corporate taxes together with other taxes on both human and physical capital. But this would lead to growth of debt ratio. He opposed that this would be compensated by increased private investment spending, which would result in increased demand for labour. This would eventually lead to significant GDP growth, which will have balanced the GDP/debt ratio. He also suggested that government should endorse reduction or elimination of the minimum wage. Another approach how to influence wage flexibility is to weaken or regulate the power of labour unions in tripartite.

Considering the conclusions of this thesis, further research should be focused on flexibility of labour market. We know that wages affect the unemployment negatively. But we have seen in this thesis that there were prevailing differences in response of nominal and real wage to unemployment. In accordance with our results the nominal wage indicates worse adjustment mechanism to changes in labour market and tended to be less flexible than the real wage. Thus in further research we could focus on nominal and real wages to identify the causes of its slow adjustment mechanism and assess the wage flexibility and its consequences on unemployment.

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# Appendix

# A Results of correlation analysis

Table 13. Correlation matrix of dependent and independent variables for Czech Republic

| | YU | GU | LTU | TU | MU | FU |
|---|---|---|---|---|---|---|
| Ct | -0.802 | -0.4956 | -0.3183 | -0.7598 | -0.7945 | -0.6902 |
| Nom_W | -0.6009 | -0.5804 | -0.1743 | -0.4786 | -0.5128 | -0.4187 |
| Real_W | -0.2873 | -0.2966 | 0.0219 | -0.1273 | -0.1565 | -0.086 |
| Pí | -0.3404 | -0.411 | -0.0845 | -0.3416 | -0.3733 | -0.2931 |
| Ct_1 | -0.852 | -0.5897 | -0.4201 | -0.8204 | -0.8411 | -0.759 |
| Nom_W_1 | -0.5146 | -0.585 | -0.2076 | -0.3847 | -0.3965 | -0.3509 |
| Real_W_1 | -0.2412 | -0.3241 | 0.0239 | -0.058 | -0.0795 | -0.0257 |
| Pi_1 | -0.3221 | -0.4166 | -0.141 | -0.3353 | -0.348 | -0.3075 |
| Ct_2 | -0.817 | -0.6471 | -0.5211 | -0.7967 | -0.7996 | -0.7514 |
| Nom_W_2 | -0.4419 | -0.5962 | -0.225 | -0.324 | -0.3163 | -0.3155 |
| Real_W_2 | -0.2592 | -0.3761 | 0.0475 | -0.0807 | -0.0872 | -0.0643 |
| Pi_2 | -0.2543 | -0.3858 | -0.2164 | -0.2657 | -0.2736 | -0.2484 |
| Ct_3 | -0.7012 | -0.5621 | -0.5975 | -0.6814 | -0.6672 | -0.6623 |
| Nom_W_3 | -0.3588 | -0.5313 | -0.2622 | -0.2674 | -0.2624 | -0.2573 |
| Real_W_3 | -0.3032 | -0.4017 | 0.0243 | -0.1649 | -0.1827 | -0.1343 |
| Pi_3 | -0.1246 | -0.2906 | -0.2611 | -0.1195 | -0.1181 | -0.1151 |
| Ct_4 | -0.5108 | -0.4637 | -0.6331 | -0.5176 | -0.475 | -0.5395 |
| Nom_W_4 | -0.2692 | -0.4794 | -0.254 | -0.1713 | -0.1609 | -0.1823 |
| Real_W_4 | -0.3617 | -0.4672 | 0.0347 | -0.2205 | -0.2419 | -0.1921 |
| Pi_4 | 0.0372 | -0.1429 | -0.2923 | 0.0483 | 0.0664 | 0.0256 |

Source: Author's calculation

Table 14. Correlation matrix of dependent and independent variables for Hungary

| | YU | GU | LTU | TU | MU | FU |
|---|---|---|---|---|---|---|
| Ct | -0.4654 | -0.4443 | -0.3251 | -0.4286 | -0.484 | -0.3367 |
| Nom_W | -0.4904 | -0.5268 | -0.4783 | -0.4799 | -0.4911 | -0.4483 |
| Real_W | -0.6671 | -0.7315 | -0.6712 | -0.712 | -0.7319 | -0.6738 |
| Pí | 0.1954 | 0.2199 | 0.1997 | 0.2506 | 0.2701 | 0.2287 |
| Ct_1 | -0.4873 | -0.4892 | -0.3558 | -0.4118 | -0.4426 | -0.3569 |
| Nom_W_1 | -0.4277 | -0.5213 | -0.5035 | -0.4498 | -0.458 | -0.4281 |
| Real_W_1 | -0.6798 | -0.7762 | -0.7512 | -0.7393 | -0.7587 | -0.7028 |
| Pi_1 | 0.2618 | 0.2764 | 0.2638 | 0.3007 | 0.3178 | 0.2797 |
| Ct_2 | -0.4505 | -0.5 | -0.3933 | -0.3842 | -0.3897 | -0.3673 |
| Nom_W_2 | -0.3474 | -0.4503 | -0.5072 | -0.4046 | -0.4007 | -0.3995 |
| Real_W_2 | -0.6845 | -0.7325 | -0.799 | -0.75 | -0.7481 | -0.7384 |
| Pi_2 | 0.3356 | 0.3008 | 0.3152 | 0.351 | 0.3555 | 0.3447 |
| Ct_3 | -0.3643 | -0.4269 | -0.4282 | -0.3407 | -0.3361 | -0.3395 |
| Nom_W_3 | -0.2716 | -0.4148 | -0.4718 | -0.347 | -0.3398 | -0.3542 |
| Real_W_3 | -0.6968 | -0.7353 | -0.8257 | -0.7522 | -0.7341 | -0.7676 |
| Pi_3 | 0.415 | 0.3469 | 0.3758 | 0.4133 | 0.4003 | 0.4297 |
| Ct_4 | -0.2402 | -0.3022 | -0.4074 | -0.2713 | -0.2633 | -0.277 |
| Nom_W_4 | -0.2235 | -0.34 | -0.4 | -0.303 | -0.2921 | -0.3118 |
| Real_W_4 | -0.6864 | -0.6905 | -0.7876 | -0.7232 | -0.6924 | -0.7501 |
| Pi_4 | 0.4589 | 0.3494 | 0.4046 | 0.4318 | 0.4061 | 0.4635 |

Source: Author's calculation

Table 15. Correlation matrix of dependent and independent variables for Austria

| | YU | GU | LTU | TU | MU | FU |
|---|---|---|---|---|---|---|
| **Ct** | -0.5087 | -0.189 | -0.1022 | -0.4859 | -0.5472 | -0.2386 |
| **Nom_W** | -0.1022 | -0.2187 | -0.2928 | -0.2203 | -0.0761 | -0.3639 |
| **Real_W** | 0.2837 | -0.0198 | -0.0672 | 0.1572 | 0.254 | -0.0415 |
| **Pí** | -0.6708 | -0.4039 | -0.434 | -0.6744 | -0.6447 | 0.497 |
| **Ct_1** | -0.5007 | -0.2588 | -0.2279 | -0.5629 | -0.5861 | -0.3288 |
| **Nom_W_1** | -0.0032 | -0.1652 | -0.3138 | -0.1189 | 0.0248 | -0.3221 |
| **Real_W_1** | 0.3019 | 0.0296 | -0.0388 | 0.2099 | 0.3247 | -0.0544 |
| **Pi_1** | -0.5237 | -0.3951 | -0.4916 | -0.5836 | -0.5772 | -0.4042 |
| **Ct_2** | -0.4437 | -0.2637 | -0.2979 | -0.4981 | -0.5261 | -0.2864 |
| **Nom_W_2** | 0.0374 | -0.1425 | -0.1189 | -0.004 | 0.1413 | -0.2465 |
| **Real_W_2** | 0.2123 | -0.0039 | 0.1166 | 0.1996 | 0.3325 | -0.076 |
| **Pi_2** | -0.3252 | -0.3088 | -0.4461 | -0.3945 | -0.4152 | -0.2569 |
| **Ct_3** | -0.2081 | -0.2394 | -0.382 | -0.3242 | -0.35 | -0.1959 |
| **Nom_W_3** | 0.0967 | -0.0845 | -0.1406 | 0.0492 | 0.2116 | -0.2039 |
| **Real_W_3** | 0.1133 | -0.0401 | -0.0017 | 0.0877 | 0.2404 | -0.1518 |
| **Pi_3** | -0.054 | -0.1512 | -0.2803 | -0.1124 | -0.1417 | -0.0559 |
| **Ct_4** | -0.1049 | -0.2058 | -0.4102 | -0.2057 | -0.2067 | -0.1391 |
| **Nom_W_4** | 0.0597 | 0.1018 | -0.0074 | 0.1309 | 0.1847 | -0.0017 |
| **Real_W_4** | -0.0935 | 0.0833 | 0.0562 | 0.0183 | 0.0652 | -0.0567 |
| **Pi_4** | 0.2214 | -0.056 | -0.157 | 0.1313 | 0.1223 | 0.0859 |

Source: Author's calculation

Table 16. Correlation matrix of dependent and independent variables for France

| | YU | GU | LTU | TU | MU | FU |
|---|---|---|---|---|---|---|
| **Ct** | -0.4426 | -0.2764 | -0.0951 | -0.3141 | -0.27 | -0.3598 |
| **Nom_W** | -0.5321 | -0.2651 | -0.277 | -0.4623 | -0.518 | -0.3117 |
| **Real_W** | 0.1746 | 0.4278 | 0.3326 | 0.2582 | 0.2062 | 0.3246 |
| **Pí** | -0.6444 | -0.5266 | -0.5538 | -0.6443 | -0.6501 | -0.5605 |
| **Ct_1** | -0.5133 | -0.3745 | -0.2273 | -0.3808 | -0.3258 | -0.4467 |
| **Nom_W_1** | -0.5729 | -0.3513 | -0.38 | -0.5297 | -0.5773 | -0.3986 |
| **Real_W_1** | -0.0282 | 0.3395 | 0.2465 | 0.0982 | 0.0722 | 0.1333 |
| **Pi_1** | -0.5354 | -0.5585 | -0.5736 | -0.5755 | -0.5961 | -0.4815 |
| **Ct_2** | -0.4903 | -0.4546 | -0.321 | -0.4003 | -0.3315 | -0.4904 |
| **Nom_W_2** | -0.5714 | -0.3684 | -0.4188 | -0.5144 | -0.5657 | -0.3691 |
| **Real_W_2** | -0.2429 | 0.2097 | 0.1644 | -0.0492 | -0.0734 | 0.0028 |
| **Pi_2** | -0.3918 | -0.5233 | -0.5443 | -0.4655 | -0.4832 | -0.3893 |
| **Ct_3** | -0.3843 | -0.4342 | -0.3685 | -0.3635 | -0.2881 | -0.4646 |
| **Nom_W_3** | -0.5286 | -0.4093 | -0.4494 | -0.4983 | -0.5341 | -0.3759 |
| **Real_W_3** | -0.4187 | -0.0018 | 0.0626 | -0.1874 | -0.1936 | -0.1428 |
| **Pi_3** | -0.213 | -0.4191 | -0.51 | -0.3755 | -0.3934 | -0.3075 |
| **Ct_4** | -0.2593 | -0.3294 | -0.3833 | -0.2785 | -0.2016 | -0.3856 |
| **Nom_W_4** | -0.4645 | -0.3551 | -0.468 | -0.4657 | -0.4718 | -0.4112 |
| **Real_W_4** | -0.5514 | -0.2144 | -0.1 | -0.3493 | -0.3358 | -0.3383 |
| **Pi_4** | -0.0681 | -0.2249 | -0.4368 | -0.2442 | -0.2572 | -0.2015 |

Source: Author's calculation

Table 17. Correlation matrix of dependent and independent variables for Spain

| | YU | GU | LTU | TU | MU | FU |
|---|---|---|---|---|---|---|
| **Ct** | -0.3538 | -0.4825 | -0.36 | -0.3897 | -0.373 | -0.4255 |
| **Nom_W** | -0.7011 | -0.7731 | -0.8102 | -0.6992 | -0.6687 | -0.7448 |
| **Real_W** | -0.189 | -0.2607 | -0.2779 | -0.1891 | -0.1774 | -0.2132 |
| **Pí** | -0.5284 | -0.4968 | -0.5223 | -0.5217 | -0.5077 | -0.5334 |
| **Ct_1** | -0.3666 | -0.4955 | -0.4246 | -0.3916 | -0.3679 | -0.437 |
| **Nom_W_1** | -0.6479 | -0.7151 | -0.782 | -0.6382 | -0.6046 | -0.6883 |
| **Real_W_1** | -0.19 | -0.2598 | -0.2847 | -0.1884 | -0.1747 | -0.2146 |
| **Pi_1** | -0.4837 | -0.4527 | -0.4983 | -0.473 | -0.4593 | -0.4844 |
| **Ct_2** | -0.3453 | -0.4747 | -0.4623 | -0.36 | -0.3291 | -0.4159 |
| **Nom_W_2** | -0.5909 | -0.6528 | -0.7439 | -0.5704 | -0.5331 | -0.6249 |
| **Real_W_2** | -0.196 | -0.2541 | -0.279 | -0.1868 | -0.1706 | -0.2157 |
| **Pi_2** | -0.4272 | -0.4041 | -0.4673 | -0.4136 | -0.3981 | -0.4289 |
| **Ct_3** | -0.2961 | -0.4212 | -0.4684 | -0.3016 | -0.2633 | -0.3675 |
| **Nom_W_3** | -0.5299 | -0.5904 | -0.6974 | -0.503 | -0.4637 | -0.5608 |
| **Real_W_3** | -0.1948 | -0.246 | -0.2652 | -0.1815 | -0.1652 | -0.208 |
| **Pi_3** | -0.3717 | -0.3548 | -0.4362 | -0.3596 | -0.3407 | -0.3814 |
| **Ct_4** | -0.2293 | -0.3418 | -0.4397 | -0.2225 | -0.179 | -0.2946 |
| **Nom_W_4** | -0.4731 | -0.5284 | -0.6516 | -0.4442 | -0.4019 | -0.5072 |
| **Real_W_4** | -0.2081 | -0.2593 | -0.2833 | -0.1908 | -0.173 | -0.2195 |
| **Pi_4** | -0.3212 | -0.3089 | -0.397 | -0.3141 | -0.2945 | -0.3387 |

Source: Author’s calculation

Table 18. Correlation matrix of independent variables for Czech Republic

| Correlation matrix, using the observations 2004:3 - 2015:4 | | | | |
|---|---|---|---|---|
| **Nom_W_2** | **Real_W_2** | **Pi_2** | **Ct_2** | |
| 1 | 0.6688 | 0.4892 | 0.613 | **Nom_W_2** |
| | 1 | -0.302 | 0.148 | **Real_W_2** |
| | | 1 | 0.598 | **Pi_2** |
| | | | 1 | **Ct_2** |

| Correlation matrix, using the observations 2005:1 - 2015:4 | | | | |
|---|---|---|---|---|
| **Nom_W_4** | **Real_W_4** | **Pi_4** | **Ct_4** | |
| 1 | 0.677 | 0.4904 | 0.633 | **Nom_W_4** |
| | 1 | -0.292 | 0.136 | **Real_W_4** |
| | | 1 | 0.666 | **Pi_4** |
| | | | 1 | **Ct_4** |

Source: Author’s calculation

Table 19. Correlation matrix of independent variables for Hungary

| **Correlation matrix, using the observations 2004:1 - 2015:4** | | | | | **Correlation matrix, using the observations 2004:2 - 2015:4** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Nom_W** | **Real_W** | **Pi** | **Ct** | | **Nom_W_1** | **Real_W_1** | **Pi_1** | **Ct_1** | |
| 1 | 0.437 | 0.3912 | 0.5131 | **Nom_W** | 1 | 0.4413 | 0.3995 | 0.5176 | **Nom_W_1** |
| | 1 | -0.6036 | 0.4455 | **Real_W** | | 1 | -0.593 | 0.4346 | **Real_W_1** |
| | | 1 | -0.0973 | **Pi** | | | 1 | -0.0726 | **Pi_1** |
| | | | 1 | **Ct** | | | | 1 | **Ct_1** |
| **Correlation matrix, using the observations 2004:3 - 2015:4** | | | | | **Correlation matrix, using the observations 2005:1 - 2015:4** | | | | |
| **Nom_W_2** | **Real_W_2** | **Pi_2** | **Ct_2** | | **Nom_W_4** | **Real_W_4** | **Pi_4** | **Ct_4** | |
| 1 | 0.4494 | 0.4094 | 0.5214 | **Nom_W_2** | 1 | 0.4919 | 0.4143 | 0.5399 | **Nom_W_4** |
| | 1 | -0.5771 | 0.4253 | **Real_W_2** | | -0.5304 | 0.4073 | 0.1477 | **Real_W_4** |
| | | 1 | -0.0493 | **Pi_2** | | | 1 | 0.0099 | **Pi_4** |
| | | | 1 | **Ct_2** | | | | 1 | **Ct_4** |

Source: Author's calculation

Table 20. Correlation matrix of independent variables for Austria

| **Correlation matrix, using the observations 2004:3 - 2015:4** | | | | |
|---|---|---|---|---|
| **Nom_W_2** | **Real_W_2** | **Pi_2** | **Ct_2** | |
| 1 | 0.8207 | 0.1716 | 0.2416 | **Nom_W_2** |
| | 1 | -0.414 | -0.117 | **Real_W_2** |
| | | 1 | 0.5989 | **Pi_2** |
| | | | 1 | **Ct_2** |

| **Correlation matrix, using the observations 2005:1 - 2015:4** | | | | |
|---|---|---|---|---|
| **Nom_W_4** | **Real_W_4** | **Pi_4** | **Ct_4** | |
| 1 | 0.8137 | 0.2308 | 0.2493 | **Nom_W_4** |
| | 1 | -0.371 | -0.12 | **Real_W_4** |
| | | 1 | 0.6207 | **Pi_4** |
| | | | 1 | **Ct_4** |

Source: Author's calculation

Table 21. Correlation matrix of independent variables for France

| Correlation matrix, using the observations 2004:3 - 2015:4 | | | | |
|---|---|---|---|---|
| **Nom_W_2** | **Real_W_2** | **Pi_2** | **Ct_2** | |
| 1 | 0.2187 | 0.6543 | 0.6 | **Nom_W_2** |
| | 1 | -0.5505 | -0.0926 | **Real_W_2** |
| | | 1 | 0.5828 | **Pi_2** |
| | | | 1 | **Ct_2** |

| Correlation matrix, using the observations 2005:1 - 2015:4 | | | | |
|---|---|---|---|---|
| **Nom_W_4** | **Real_W_4** | **Pi_4** | **Ct_4** | |
| 1 | 0.278 | 0.6352 | 0.6187 | **Nom_W_4** |
| | 1 | -0.5164 | -0.1002 | **Real_W_4** |
| | | 1 | 0.6355 | **Pi_4** |
| | | | 1 | **Ct_4** |

Source: Author's calculation

Table 22. Correlation matrix of independent variables for Spain

| Correlation matrix, using the observations 2004:1 - 2015:4 | | | | |
|---|---|---|---|---|
| **Nom_W** | **Real_W** | **Pi** | **Ct** | |
| 1 | 0.5336 | 0.3548 | 0.4235 | **Nom_W** |
| | 1 | -0.497 | 0.1852 | **Real_W** |
| | | 1 | 0.1469 | **Pi** |
| | | | 1 | **Ct** |

| Correlation matrix, using the observations 2004:2 - 2015:4 | | | | |
|---|---|---|---|---|
| **Nom_W_1** | **Real_W_1** | **Pi_1** | **Ct_1** | |
| 1 | 0.5475 | 0.3457 | 0.4689 | **Nom_W_1** |
| | 1 | -0.488 | 0.163 | **Real_W_1** |
| | | 1 | 0.2284 | **Pi_1** |
| | | | 1 | **Ct_1** |

Source: Author's calculation

# B Results of multivariate regression analysis

Model 8: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: Y_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 14.1486 | 0.833132 | 16.98 | 2.01e-020 | *** |
| Ct_2 | −1.82420 | 0.185136 | −9.853 | 1.74e-012 | *** |
| Nom_W_2 | 0.942484 | 0.269270 | 3.500 | 0.0011 | *** |
| Real_W_2 | −0.808750 | 0.211096 | −3.831 | 0.0004 | *** |

| | | | |
|---|---|---|---|
| Mean dependent var | 16.28696 | S.D. dependent var | 3.568168 |
| Sum squared resid | 138.8129 | S.E. of regression | 1.817985 |
| R-squared | 0.757715 | Adjusted R-squared | 0.740409 |
| F(3, 42) | 43.78316 | P-value(F) | 5.43e-13 |
| Log-likelihood | −90.67435 | Akaike criterion | 189.3487 |
| Schwarz criterion | 196.6633 | Hannan-Quinn | 192.0888 |
| rho | 0.716751 | Durbin-Watson | 0.568203 |

Figure 35. OLS result of female unemployment for Czech Republic, source: Author's calculation

Model 3: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: G_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 2.64926 | 0.160579 | 16.50 | 1.05e-019 | *** |
| Ct_2 | −0.140670 | 0.0355634 | −3.955 | 0.0003 | *** |
| Nom_W_2 | 0.524151 | 0.172719 | 3.035 | 0.0042 | *** |
| Real_W_2 | −0.558244 | 0.152716 | −3.655 | 0.0007 | *** |
| Pi_2 | −0.529343 | 0.156430 | −3.384 | 0.0016 | *** |

| | | | |
|---|---|---|---|
| Mean dependent var | 2.452174 | S.D. dependent var | 0.534889 |
| Sum squared resid | 5.000051 | S.E. of regression | 0.349217 |
| R-squared | 0.611640 | Adjusted R-squared | 0.573751 |
| F(4, 41) | 16.14303 | P-value(F) | 5.14e-08 |
| Log-likelihood | −14.22973 | Akaike criterion | 38.45946 |
| Schwarz criterion | 47.60267 | Hannan-Quinn | 41.88456 |
| rho | 0.074013 | Durbin-Watson | 1.849592 |

Figure 36. OLS result of Graduates unemployment for Czech Republic, source: Author's calculation

Model 14: OLS, using observations 2005:1-2015:4 (T = 44)
Dependent variable: LT_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 2.43320 | 0.214036 | 11.37 | 6.00e-014 | *** |
| Ct_4 | −0.288626 | 0.0479868 | −6.015 | 4.94e-07 | *** |
| Nom_W_4 | −0.788096 | 0.219208 | −3.595 | 0.0009 | *** |
| Real_W_4 | 0.786342 | 0.195401 | 4.024 | 0.0003 | *** |
| Pi_4 | 0.885939 | 0.206541 | 4.289 | 0.0001 | *** |

| | | | |
|---|---|---|---|
| Mean dependent var | 2.895489 | S.D. dependent var | 0.665412 |
| Sum squared resid | 7.269921 | S.E. of regression | 0.431750 |
| R-squared | 0.618162 | Adjusted R-squared | 0.578999 |
| F(4, 39) | 15.78438 | P-value(F) | 9.17e-08 |
| Log-likelihood | −22.82352 | Akaike criterion | 55.64704 |
| Schwarz criterion | 64.56799 | Hannan-Quinn | 58.95536 |
| rho | 0.715017 | Durbin-Watson | 0.531551 |

Figure 37. OLS result of long-term unemployment for Czech Republic, source: Author's calculation

```
Model 29: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: M_U

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const        4.54208     0.249517      18.20    1.53e-021 ***
  Ct_2        -0.576345    0.0573928    -10.04    9.90e-013 ***
  Real_W_2     0.118368    0.0517837      2.286   0.0274    **
  Pi_2         0.304939    0.0774125      3.939   0.0003    ***

Mean dependent var   5.463043   S.D. dependent var   1.087782
Sum squared resid    13.98674   S.E. of regression   0.577077
R-squared            0.737324   Adjusted R-squared   0.718562
F(3, 42)             39.29766   P-value(F)           2.93e-12
Log-likelihood      -37.88894   Akaike criterion     83.77788
Schwarz criterion    91.09245   Hannan-Quinn         86.51796
rho                  0.423471   Durbin-Watson        1.151409
```

Figure 38. OLS result of male unemployment for Czech Republic, source: Author’s calculation

```
Model 20: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: T_U

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const        5.63521     0.274190      20.55    3.33e-023 ***
  Ct_2        -0.596942    0.0607247    -9.830    2.42e-012 ***
  Nom_W_2     -0.513090    0.294918     -1.740    0.0894    *
  Real_W_2     0.578142    0.260764      2.217    0.0322    **
  Pi_2         0.781265    0.267105      2.925    0.0056    ***

Mean dependent var   6.497826   S.D. dependent var   1.159212
Sum squared resid    14.57802   S.E. of regression   0.596290
R-squared            0.758921   Adjusted R-squared   0.735401
F(4, 41)             32.26712   P-value(F)           3.58e-12
Log-likelihood      -38.84126   Akaike criterion     87.68252
Schwarz criterion    96.82573   Hannan-Quinn         91.10762
rho                  0.546310   Durbin-Watson        0.907709
```

Figure 39. OLS result of total unemployment for Czech Republic, source: Author’s calculation

```
Model 5: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: F_U

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const       10.1338      0.646275      15.68    3.68e-019 ***
  Ct_2        -0.0278296   0.0940729    -0.2958   0.7688
  Nom_W_2     -0.0672185   0.122501     -0.5487   0.5861
  Real_W_2    -0.499010    0.0862050    -5.789    8.00e-07  ***

Mean dependent var   8.819565   S.D. dependent var   1.547560
Sum squared resid    48.29938   S.E. of regression   1.072374
R-squared            0.551839   Adjusted R-squared   0.519828
F(3, 42)             17.23877   P-value(F)           1.91e-07
Log-likelihood      -66.39305   Akaike criterion     140.7861
Schwarz criterion    148.1007   Hannan-Quinn         143.5262
rho                  0.629780   Durbin-Watson        0.647567
```

Figure 40. OLS result of female unemployment for Hungary, source: Author’s calculation

Model 13: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: G_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 4.00307 | 0.332391 | 12.04 | 3.29e-015 | *** |
| Ct_2 | −0.0813249 | 0.0483834 | −1.681 | 0.1002 | |
| Nom_W_2 | −0.0349962 | 0.0630045 | −0.5555 | 0.5815 | |
| Real_W_2 | −0.236996 | 0.0443368 | −5.345 | 3.45e-06 | *** |

| | | | |
|---|---|---|---|
| Mean dependent var | 3.367391 | S.D. dependent var | 0.825175 |
| Sum squared resid | 12.77633 | S.E. of regression | 0.551542 |
| R-squared | 0.583033 | Adjusted R-squared | 0.553249 |
| F(3, 42) | 19.57578 | P-value(F) | 4.30e-08 |
| Log-likelihood | −35.80708 | Akaike criterion | 79.61417 |
| Schwarz criterion | 86.92873 | Hannan-Quinn | 82.35425 |
| rho | 0.479398 | Durbin-Watson | 0.982550 |

Figure 41. OLS result of graduates unemployment for Hungary, source: Author's calculation

Model 15: OLS, using observations 2005:1-2015:4 (T = 44)
Dependent variable: LT_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 4.53852 | 0.350839 | 12.94 | 1.09e-015 | *** |
| Ct_4 | −0.0540124 | 0.0508064 | −1.063 | 0.2943 | |
| Nom_W_4 | 0.0697806 | 0.161058 | 0.4333 | 0.6672 | |
| Real_W_4 | −0.349592 | 0.123646 | −2.827 | 0.0074 | *** |
| Pi_4 | −0.0464996 | 0.135810 | −0.3424 | 0.7339 | |

| | | | |
|---|---|---|---|
| Mean dependent var | 4.113875 | S.D. dependent var | 0.865331 |
| Sum squared resid | 11.87422 | S.E. of regression | 0.551785 |
| R-squared | 0.631216 | Adjusted R-squared | 0.593392 |
| F(4, 39) | 16.68824 | P-value(F) | 4.74e-08 |
| Log-likelihood | −33.61725 | Akaike criterion | 77.23449 |
| Schwarz criterion | 86.15544 | Hannan-Quinn | 80.54281 |
| rho | 0.641456 | Durbin-Watson | 0.651741 |

Figure 42. OLS result of long-term unemployment for Hungary, source: Author's calculation

Model 20: OLS, using observations 2004:1-2015:4 (T = 48)
Dependent variable: M_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 10.5736 | 0.856822 | 12.34 | 1.01e-015 | *** |
| Ct | −0.198657 | 0.126102 | −1.575 | 0.1225 | |
| Nom_W | 0.329192 | 0.390218 | 0.8436 | 0.4036 | |
| Real_W | −1.00905 | 0.299878 | −3.365 | 0.0016 | *** |
| Pi | −0.474258 | 0.313612 | −1.512 | 0.1378 | |

| | | | |
|---|---|---|---|
| Mean dependent var | 8.647917 | S.D. dependent var | 2.091827 |
| Sum squared resid | 81.21937 | S.E. of regression | 1.374344 |
| R-squared | 0.605079 | Adjusted R-squared | 0.568342 |
| F(4, 43) | 16.47064 | P-value(F) | 2.96e-08 |
| Log-likelihood | −80.73191 | Akaike criterion | 171.4638 |
| Schwarz criterion | 180.8198 | Hannan-Quinn | 174.9995 |
| rho | 0.564725 | Durbin-Watson | 0.826804 |

Figure 43. OLS result of male unemployment for Hungary, source: Author's calculation

Model 16: OLS, using observations 2004:1-2015:4 (T = 48)
Dependent variable: T_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 10.4872 | 0.794619 | 13.20 | 1.01e-016 | *** |
| Ct | -0.119964 | 0.116948 | -1.026 | 0.3107 | |
| Nom_W | 0.306539 | 0.361889 | 0.8471 | 0.4017 | |
| Real_W | -0.929273 | 0.278107 | -3.341 | 0.0017 | *** |
| Pi | -0.457991 | 0.290844 | -1.575 | 0.1227 | |

| | | | |
|---|---|---|---|
| Mean dependent var | 8.658333 | S.D. dependent var | 1.859059 |
| Sum squared resid | 69.85473 | S.E. of regression | 1.274570 |
| R-squared | 0.569957 | Adjusted R-squared | 0.529953 |
| F(4, 43) | 14.24751 | P-value(F) | 1.75e-07 |
| Log-likelihood | -77.11425 | Akaike criterion | 164.2285 |
| Schwarz criterion | 173.5845 | Hannan-Quinn | 167.7642 |
| rho | 0.631673 | Durbin-Watson | 0.685201 |

Figure 44. OLS result of total unemployment for Hungary, source: Author’s calculation

Model 16: OLS, using observations 2005:1-2015:4 (T = 44)
Dependent variable: F_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 4.79177 | 0.240144 | 19.95 | 1.00e-022 | *** |
| Ct_4 | -0.109177 | 0.0670918 | -1.627 | 0.1113 | |
| Pi_4 | 0.163077 | 0.111941 | 1.457 | 0.1528 | |

| | | | |
|---|---|---|---|
| Mean dependent var | 5.122727 | S.D. dependent var | 0.519330 |
| Sum squared resid | 10.81325 | S.E. of regression | 0.513554 |
| R-squared | 0.067604 | Adjusted R-squared | 0.022122 |
| F(2, 41) | 1.486376 | P-value(F) | 0.238125 |
| Log-likelihood | -31.55810 | Akaike criterion | 69.11621 |
| Schwarz criterion | 74.46878 | Hannan-Quinn | 71.10120 |
| rho | 0.651732 | Durbin-Watson | 0.662450 |

Figure 45. OLS result of female unemployment for Austria, source: Author’s calculation

Model 17: OLS, using observations 2005:1-2015:4 (T = 44)
Dependent variable: G_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 2.65191 | 0.315903 | 8.395 | 2.84e-010 | *** |
| Ct_4 | -0.0969359 | 0.0777467 | -1.247 | 0.2199 | |
| Nom_W_4 | 2.67155 | 0.690784 | 3.867 | 0.0004 | *** |
| Real_W_4 | -2.58339 | 0.684068 | -3.777 | 0.0005 | *** |
| Pi_4 | -2.51188 | 0.696467 | -3.607 | 0.0009 | *** |

| | | | |
|---|---|---|---|
| Mean dependent var | 2.911364 | S.D. dependent var | 0.674525 |
| Sum squared resid | 13.27804 | S.E. of regression | 0.583492 |
| R-squared | 0.321314 | Adjusted R-squared | 0.251705 |
| F(4, 39) | 4.615987 | P-value(F) | 0.003792 |
| Log-likelihood | -36.07557 | Akaike criterion | 82.15114 |
| Schwarz criterion | 91.07209 | Hannan-Quinn | 85.45946 |
| rho | 0.526327 | Durbin-Watson | 0.925372 |

Figure 46. OLS result of graduates unemployment for Austria, source: Author’s calculation

```
Model 6: OLS, using observations 2005:1-2015:4 (T = 44)
Dependent variable: LT_U

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const       1.22961      0.102470     12.00     1.15e-014 ***
  Ct_4       -0.0670062    0.0252189    -2.657    0.0114    **
  Nom_W_4     0.468452     0.224071      2.091    0.0431    **
  Real_W_4   -0.452695     0.221893     -2.040    0.0481    **
  Pi_4       -0.418150     0.225915     -1.851    0.0718    *

Mean dependent var   1.320455   S.D. dependent var   0.210845
Sum squared resid    1.397081   S.E. of regression   0.189269
R-squared            0.269153   Adjusted R-squared   0.194194
F(4, 39)             3.590680   P-value(F)           0.013816
Log-likelihood       13.46240   Akaike criterion    -16.92481
Schwarz criterion   -8.003860   Hannan-Quinn        -13.61649
rho                  0.740213   Durbin-Watson        0.535343
```

Figure 47. OLS result of long-term unemployment for Austria, source: Author's calculation

```
Model 24: OLS, using observations 2005:1-2015:4 (T = 44)
Dependent variable: T_U

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const       4.37299      0.273276     16.00     5.51e-019 ***
  Ct_4       -0.192850     0.0668227    -2.886    0.0063    ***
  Nom_W_4     0.346929     0.121015      2.867    0.0066    ***
  Real_W_4   -0.282566     0.111353     -2.538    0.0152    **

Mean dependent var   5.111364   S.D. dependent var   0.559990
Sum squared resid    10.71219   S.E. of regression   0.517498
R-squared            0.205582   Adjusted R-squared   0.146001
F(3, 40)             3.450442   P-value(F)           0.025354
Log-likelihood      -31.35153   Akaike criterion     70.70305
Schwarz criterion    77.83981   Hannan-Quinn         73.34971
rho                  0.675091   Durbin-Watson        0.598543
```

Figure 48. OLS result of total unemployment for Austria, source: Author's calculation

```
Model 52: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: Y_U

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const       9.68393      0.468683     20.66     1.27e-023 ***
  Ct_2       -0.284460     0.116134     -2.449    0.0186    **
  Nom_W_2     0.109204     0.0978226     1.116    0.2706
  Pi_2       -0.107691     0.183947     -0.5854   0.5614

Mean dependent var   9.778261   S.D. dependent var   0.981136
Sum squared resid    33.55521   S.E. of regression   0.893831
R-squared            0.225380   Adjusted R-squared   0.170050
F(3, 42)             4.073370   P-value(F)           0.012567
Log-likelihood      -58.01584   Akaike criterion     124.0317
Schwarz criterion    131.3462   Hannan-Quinn         126.7718
rho                  0.583469   Durbin-Watson        0.847843
```

Figure 49. OLS result of youth unemployment for Austria, source: Author's calculation

Model 12: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: G_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 6.07317 | 0.336286 | 18.06 | 2.06e-021 | *** |
| Ct_2 | −0.128076 | 0.101419 | −1.263 | 0.2136 | |
| Real_W_2 | −0.0395489 | 0.149558 | −0.2644 | 0.7927 | |
| Pi_2 | −0.303463 | 0.143180 | −2.119 | 0.0400 | ** |

| | | | |
|---|---|---|---|
| Mean dependent var | 5.552174 | S.D. dependent var | 0.662567 |
| Sum squared resid | 13.65193 | S.E. of regression | 0.570128 |
| R-squared | 0.308930 | Adjusted R-squared | 0.259568 |
| F(3, 42) | 6.258448 | P-value(F) | 0.001308 |
| Log-likelihood | −37.33168 | Akaike criterion | 82.66337 |
| Schwarz criterion | 89.97793 | Hannan-Quinn | 85.40345 |
| rho | 0.611482 | Durbin-Watson | 0.776093 |

Figure 50. OLS result of graduates unemployment for France, source: Author's calculation

Model 7: OLS, using observations 2005:1-2015:4 (T = 44)
Dependent variable: LT_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 4.33050 | 0.364097 | 11.89 | 1.51e-014 | *** |
| Ct_4 | −0.0277979 | 0.0940298 | −0.2956 | 0.7691 | |
| Nom_W_4 | 0.764253 | 0.369039 | 2.071 | 0.0450 | ** |
| Real_W_4 | −0.953269 | 0.308116 | −3.094 | 0.0036 | *** |
| Pi_4 | −1.05514 | 0.319119 | −3.306 | 0.0020 | *** |

| | | | |
|---|---|---|---|
| Mean dependent var | 3.611677 | S.D. dependent var | 0.611644 |
| Sum squared resid | 9.631900 | S.E. of regression | 0.496963 |
| R-squared | 0.401249 | Adjusted R-squared | 0.339839 |
| F(4, 39) | 6.533900 | P-value(F) | 0.000400 |
| Log-likelihood | −29.01289 | Akaike criterion | 68.02579 |
| Schwarz criterion | 76.94674 | Hannan-Quinn | 71.33411 |
| rho | 0.674576 | Durbin-Watson | 0.661062 |

Figure 51. OLS result of long-term unemployment for France, source: Author's calculation

Model 33: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: M_U

| | coefficient | std. error | t-ratio | p-value | |
|---|---|---|---|---|---|
| const | 11.5242 | 0.640061 | 18.00 | 2.31e-021 | *** |
| Ct_2 | 0.129788 | 0.193034 | 0.6724 | 0.5050 | |
| Real_W_2 | −0.979973 | 0.284658 | −3.443 | 0.0013 | *** |
| Pi_2 | −1.22091 | 0.272518 | −4.480 | 5.65e-05 | *** |

| | | | |
|---|---|---|---|
| Mean dependent var | 8.719565 | S.D. dependent var | 1.359186 |
| Sum squared resid | 49.45610 | S.E. of regression | 1.085139 |
| R-squared | 0.405092 | Adjusted R-squared | 0.362599 |
| F(3, 42) | 9.533063 | P-value(F) | 0.000063 |
| Log-likelihood | −66.93738 | Akaike criterion | 141.8748 |
| Schwarz criterion | 149.1893 | Hannan-Quinn | 144.6148 |
| rho | 0.505639 | Durbin-Watson | 0.953105 |

Figure 52. OLS result of male unemployment for France, source: Author's calculation

```
Model 20: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: T_U

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const      10.2853        0.608496    16.90      4.39e-020 ***
  Ct_2       -0.0728607     0.158725    -0.4590    0.6486
  Nom_W_2     0.806397      0.656992     1.227     0.2267
  Real_W_2   -1.23382       0.548313    -2.250     0.0299    **
  Pi_2       -1.40097       0.557877    -2.511     0.0161    **

Mean dependent var    8.891304   S.D. dependent var   1.068712
Sum squared resid     32.12190   S.E. of regression   0.885133
R-squared             0.375018   Adjusted R-squared   0.314044
F(4, 41)              6.150471   P-value(F)           0.000568
Log-likelihood       -57.01180   Akaike criterion     124.0236
Schwarz criterion     133.1668   Hannan-Quinn         127.4487
rho                   0.494854   Durbin-Watson        0.984616
```

Figure 53. OLS result of total unemployment for France, source: Author's calculation

```
Model 6: OLS, using observations 2004:3-2015:4 (T = 46)
Dependent variable: Y_U

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const       25.6304       1.14287     22.43      5.36e-025 ***
  Ct_2        -0.568838     0.298980    -1.903     0.0640    *
  Nom_W_2     -1.08850      0.497804    -2.187     0.0344    **
  Real_W_2    -0.560378     0.371322    -1.509     0.1387

Mean dependent var    22.56957   S.D. dependent var   2.087728
Sum squared resid     118.9879   S.E. of regression   1.683165
R-squared             0.393344   Adjusted R-squared   0.350012
F(3, 42)              9.077336   P-value(F)           0.000094
Log-likelihood       -87.12992   Akaike criterion     182.2598
Schwarz criterion     189.5744   Hannan-Quinn         184.9999
rho                   0.739065   Durbin-Watson        0.464284
```

Figure 54. OLS result of youth unemployment for France, source: Author's calculation

```
Model 7: OLS, using observations 2004:1-2015:4 (T = 48)
Dependent variable: F_U

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const       25.6873       1.06299     24.17      1.19e-026 ***
  Ct          -0.505042     0.344047    -1.468     0.1494
  Nom_W       -1.59940      0.782414    -2.044     0.0471    **
  Real_W      -0.595007     0.674207    -0.8825    0.3824
  Pi          -1.70770      0.720734    -2.369     0.0224    **

Mean dependent var    18.55000   S.D. dependent var   5.859635
Sum squared resid     550.5445   S.E. of regression   3.578178
R-squared             0.658844   Adjusted R-squared   0.627108
F(4, 43)              20.76048   P-value(F)           1.38e-09
Log-likelihood       -126.6620   Akaike criterion     263.3240
Schwarz criterion     272.6800   Hannan-Quinn         266.8597
rho                   0.849253   Durbin-Watson        0.300730
```

Figure 55. OLS result of female unemployment for Spain, source: Author's calculation

```
Model 16: OLS, using observations 2004:2-2015:4 (T = 47)
Dependent variable: G_U

             coefficient   std. error   t-ratio    p-value
  ----------------------------------------------------------
  const       14.5053      0.802707     18.07     2.02e-021 ***
  Ct_1        -0.459450    0.261907     -1.754    0.0867     *
  Nom_W_1     -0.950855    0.557659     -1.705    0.0956     *
  Real_W_1    -0.397162    0.478247     -0.8305   0.4110
  Pi_1        -0.909357    0.513509     -1.771    0.0838     *

Mean dependent var   10.42766   S.D. dependent var   3.800669
Sum squared resid    270.4318   S.E. of regression   2.537489
R-squared            0.593014   Adjusted R-squared   0.554253
F(4, 42)             15.29940   P-value(F)           8.51e-08
Log-likelihood      -107.8121   Akaike criterion     225.6242
Schwarz criterion    234.8750   Hannan-Quinn         229.1053
rho                  0.865528   Durbin-Watson        0.266243
```

Figure 56. OLS result of graduates unemployment for Spain, source: Author's calculation

```
Model 6: OLS, using observations 2004:1-2015:4 (T = 48)
Dependent variable: M_U

             coefficient   std. error   t-ratio    p-value
  ----------------------------------------------------------
  const       24.3224      1.55794      15.61     2.51e-019 ***
  Ct          -0.541265    0.504242     -1.073    0.2891
  Nom_W       -1.60852     1.14672      -1.403    0.1679
  Real_W      -0.867587    0.988132     -0.8780   0.3848
  Pi          -2.28434     1.05632      -2.163    0.0362    **

Mean dependent var   15.93542   S.D. dependent var   7.468472
Sum squared resid    1182.594   S.E. of regression   5.244254
R-squared            0.548898   Adjusted R-squared   0.506935
F(4, 43)             13.08055   P-value(F)           4.72e-07
Log-likelihood      -145.0114   Akaike criterion     300.0228
Schwarz criterion    309.3788   Hannan-Quinn         303.5585
rho                  0.888369   Durbin-Watson        0.204729
```

Figure 57. OLS result of male unemployment for Spain, source: Author's calculation

```
Model 4: OLS, using observations 2004:1-2015:4 (T = 48)
Dependent variable: T_U

             coefficient   std. error   t-ratio    p-value
  ----------------------------------------------------------
  const       24.9797      1.34531      18.57     3.73e-022 ***
  Ct          -0.508283    0.435424     -1.167    0.2495
  Nom_W       -1.62015     0.990221     -1.636    0.1091
  Real_W      -0.749994    0.853274     -0.8790   0.3843
  Pi          -2.05655     0.912158     -2.255    0.0293    **

Mean dependent var   17.05625   S.D. dependent var   6.787470
Sum squared resid    881.8259   S.E. of regression   4.528529
R-squared            0.592742   Adjusted R-squared   0.554858
F(4, 43)             15.64607   P-value(F)           5.63e-08
Log-likelihood      -137.9681   Akaike criterion     285.9362
Schwarz criterion    295.2922   Hannan-Quinn         289.4718
rho                  0.877167   Durbin-Watson        0.234464
```

Figure 58. OLS result of total unemployment for Spain, source: Author's calculation

```
Model 1: OLS, using observations 2004:1-2015:4 (T = 48)
Dependent variable: Y_U

             coefficient   std. error   t-ratio    p-value
  ---------------------------------------------------------
  const       54.0431      2.89791      18.65     3.16e-022 ***
  Ct          -0.711956    0.937937     -0.7591   0.4520
  Nom_W       -3.59041     2.13301      -1.683    0.0996    *
  Real_W      -1.69233     1.83802      -0.9207   0.3623
  Pi          -4.56553     1.96486      -2.324    0.0249    **

Mean dependent var   36.45625   S.D. dependent var   14.62757
Sum squared resid    4091.707   S.E. of regression   9.754792
R-squared            0.593124   Adjusted R-squared   0.555275
F(4, 43)             15.67083   P-value(F)           5.52e-08
Log-likelihood      -174.8014   Akaike criterion     359.6029
Schwarz criterion    368.9589   Hannan-Quinn         363.1385
rho                  0.873769   Durbin-Watson        0.235732
```

Figure 59. OLS result of youth unemployment for Spain, source: Author’s calculation