CHARLES UNIVERSITY IN PRAGUE

FACULTY OF SOCIAL SCIENCES

Institute of Economic Studies

BACHELOR THESIS

The impact of tax-benefit system on the labour market

Author: **Pavel Žofák**

Supervisor: **Mgr. Barbara Pertold-Gebická Ph.D.**

Year of defence: **2014**

Declaration of Authorship

I hereby proclaim that I wrote my bachelor thesis on my own under the leadership of my supervisor, that the references include all resources and literature I have used and that this thesis has not been used to obtain any other university diploma.

I grant a permission to reproduce and to distribute copies of this thesis document in whole or in part.

Prague, May 16, 2014

Signature

Acknowledgment

I would like to express my gratitude to Mgr. Barbara Pertold-Gebicka, Ph.D. for leading my thesis and for many useful suggestions and remarks.

My thanks also belongs to Petr Kašpar who took care of the final design of this thesis.

Bibliography reference

Žofák, Pavel, *The impact of tax-benefit system on the labour market* Prague, 2014. 33 p. Bachelor thesis (Bc.) Charles University, Faculty of Social Sciences, Institute of Economic Studies. Supervisor: Mgr. Barbara Pertold-Gebická Ph.D.

Extent of the thesis

58,984 characters (with spaces)

Abstract

This thesis assesses the impact of taxes and unemployment benefits on the unemployment rates. The aim of the thesis is to find determinants of tax-benefit system which influence the unemployment rate and how much they do so. This issue is studied both theoretically and empirically. The empirical part is built on the panel dataset of 28 OECD countries which covers the period between 2005 and 2012. The main influence on unemployment is ascribed to the labour taxes which drives the wedge between the labour costs and the net income of the worker. On the other hand, the consumption tax seems to be neutral in determining the unemployment rates and the impact of benefit levels crucially depends on the way they are taxed and on the eligibility criteria. Whole tax-benefit system impacts rather the long-term unemployment rates than the overall unemployment.

JEL Classificiation	E24, H20, J08, J30
Keywords	labour market, tax-benefit system, benefits, taxes, unemployment

Author's email	p.zofak@centrum.cz
Supervisor's email	gebicka@fsv.cuni.cz

Abstrakt

Tato práce hodnotí vliv daní a dávek v nezaměstnanosti na míru nezaměstnanosti. Cílem práce je najít determinanty systému daní a dávek, které mají vliv na nezaměstnanost a jak velký tento vliv je. Problematika je studována teoreticky i empiricky, kde empirická část analyzuje dataset 28 států od roku 2005 do roku 2012. Hlavní vliv na nezaměstnanost je připisován zdanění práce, které zvětšuje rozdíl mezi náklady zaměstnavatele a čistou mzdou pracovníka. Na druhé straně zdanění spotřeby nemá vliv na nezaměstnanost. Vliv dávek v nezaměstnanosti závisí na jejich zdanění a podmínkách, které musí jejich příjemci splňovat. Celkově systém daní a dávek v nezaměstnanosti ovlivňuje více míru dlouhodobé nezaměstnanosti než tu celkovou nezaměstnanost.

JEL klasifikace	E24, H20, J08, J30
Klíčová slova	trh práce, systém daní a dávek, dávky, daně, nezaměstnanost
Email autora	p.zofak@centrum.cz
Email vedoucího práce	gebicka@fsv.cuni.cz

Bachelor thesis proposal

Author	Pavel Žofák
Supervisor	Mgr. Barbara Pertold-Gebická Ph.D.
Topic	The impact of tax-benefit system on the labour market

Characteristics

Low rate of unemployment is one of the main targets of fiscal policy. One of the tools to influence equilibrium unemployment and to stimulate new job creation is a tax-benefit system. Taxes and benefits have both direct and indirect impact on the unemployment rate. Across the Europe there are several different tax-benefit systems, more or less successful in reaching their goals. The aim of my theses is to analyse different tax-benefit systems and their impact on the demand and supply sides of the labour market. Various tax-benefits for unemployed might discourage some individuals to enter the labour market. On the other hand lower tax burden generally results in lower unemployment. The first part of my thesis will present and compare different tax-benefit systems found in the European Union. In the second part I will try to find empirical evidence, to support the theoretical background and results from the first part, using the data provided by OECD. I will ask the question: what are the the key parameters of the tax system which influence the equilibrium in the labour market.

Preliminary structure

1. Introduction
2. Theoretical background
3. Different tax-benefit systems across Europe
4. Data and methodology of the empirical part
5. Empirical analysis of the data
6. Conclusion

Reference

[1] Carone, G., and Salomäki, A. Reforms in tax-benefit systems in order to increase employment incentives in the EU (2001)

[2] Pissarides, C. The impact of employment tax cuts on unemployment and wages: The role of unemployment benefits and tax, *Centre for Economic Performance London School of Economics and Political Science* (1997)

[3] Joumard, I. Tax Systems in European Union Countries, *OECD Economics Department Working Papers 301, OECD Publishing* (2001)

Author

Supervisor

Contents

Acronyms

CIT Corporate income tax

GDP Gross Domestic Product

FE Fixed effect model

NRR Net replacement rate

OECD Organisation for Economic Co-operation and Development

OLS Ordinary least squares

rCw Real consumption wage

RE Random effect model

rLc Real labour costs

SSC Social security contributions

UB Unemployment benefits

UK United kingdom

USA United states of America

1 Introduction

The high rates of unemployment are prevailing in the OECD countries in the past years in both before and after the global financial crisis. This is one of the biggest social issue of the developed word as the unemployed persons are dependent on the state aid or drop into poverty. The unemployment is a consequence of inefficient labour market which is significantly contributed by labour market rigidities (Layard, Nickell, Jackman, 1991). This is quite wide concept covering for employment protection, power of unions, minimum wage, fixed-term contracts, employee's rights as well as unemployment benefits, tax system, and several others. The focus of this work is the tax-benefit system which can be easily adjusted for better labour market performance by policy makers. The tax-benefit system may motivate or discourage employees to enter the labour market and find the job as well as increase or decrease the labour costs and influence the behavior of employers and job creation. Therefore, I see this as one of the tools to lower the unemployment rates and improve the labour market performance. Particularly, I look at the different tax rates as the consumption tax, social security contributions, and income tax, and the unemployment benefits together with its duration and asses their role in explaining the high unemployment rates present in many OECD countries.

The paper is divided into 5 main parts. After the introduction, in the second part, the theoretical framework of different policy tools is described and their impact on the labour market and consequently on the unemployment is studied. Several influential papers as Scarpetta (1996), Nickell (1997) or Pissarides (1998) are presented and discussed. In this section I also state few hypothesis which are then studied in the empirical part. Next, the model which is based on the experiences and conclusions from the related literature is presented. The model is quite simple, however, it is sufficient to obtain relevant results of the impact of studied variables. The section 3 continues with presenting the dataset which is used latter on and gradually describes individual variables and some interesting evidence in particular countries. The data are then studied in the empirical analysis in section 4 where I follow the model derived earlier and estimate the parameters of this model. I also

offer an interpretation of my findings and answer the hypothesis made earlier.

The main findings and results of the empirical part of this thesis are summarized in the conlusion.

2 Policy Tools

In this chapter the features of tax-benefit system are studied together with its theoretical implication to the labour market performance and unemployment rate.
I summarize the theoretical findings on the effect of the benefit payments, different taxes, and tax progressivity. The aim is to offer an intuitive way how to evaluate the impact of these policy tools on unemployment rates through simple schemes.

2.1 Net replacement rate and unemployment benefits

In recent years, there has been a number of reforms on the tax side comparing to a few reforms on the benefit side. The unemployment benefits (UB) serve as a security to people unable to find a job or to those who lost it. Such a social policy is common in developed countries and helps people to overcome the temporary loss of income and effectively search for a new job by providing a direct payments. On the other hand, these positive effects can be partially offset by discouraging people to become employed (Layard, Nickell, Jackman, 1991).

The net replacement rate (NRR) is simply a ratio of the income if unemployed to the income if employed. The lower the ratio, the higher the incentives for unemployed people to effectively search for job as the financial bonus from becoming employed is higher. The other way round, higher replacement rates lower the costs of leisure and being unemployed becomes more attractive. In this paper, the impact of tax-benefit system on unemployment rates is assessed. The motivation to study tax side together with the benefit side is the strong connection between them. Particularly, the unemployment is mainly influenced by the net replacement ratio which is defined as follows:

$$NRR = \frac{B_g(1 - t_B)}{w_g(1 - t_w - t_{ssc})} \tag{1}$$

where the B_g is gross unemployment benefit, w_g represents gross wage and t_B, t_w, t_{ssc} stand for tax rates on benefits, wages, and for social security contribution, respectively.

This is a simple scheme which can produce relevant outcome in assessing the impact of benefits and taxes. It is straight-forward that higher B_g, t_w and t_{ssc}

increase the NRR and increase in w_g or $t_b$decrease it. On the other hand, the provided benefit levels are usually decreasing in time and unemployed are entitled to receive them only for a limited time period which lowers the NRR in time. The duration of unemployment benefits, which varies from country to country, is proven to have greater effect on unemployment than the amount of benefits themselves (see Buti, Franco, Pench, 1998 or Scarpetta, 1996). Katz and Meyer (1990) studied the impact of duration of unemployment benefits on the duration of unemployment in the US concluding that the budget cut in terms of reducing the duration of unemployment benefits lowered the unemployment duration almost twice as much as the equivalent budget cut in terms of levels of UB.

The final effect of UB crucially depends on the way they are taxed. More precisely whether it is the net replacement rate which is fixed or the level of UB (Pissarides, 1998). This coincides with the intuition from the formula of NRR above. If the level of UB is fixed and wages are rising, the NRR is decreasing and the surplus from becoming employed is higher. The same happens if the tax rates on wages or social security contributions(SSC) are decreased or t_B increased. Therefore, the NRR can be easily lowered, and according to my hypothesis that the lower NRR leads to decrease in unemployment[1], it can also lower the unemployment rate. Pissarides (1998) studied the UB and taxes in four models (competitive labour markets, union wage bargaining, search equilibrium, efficiency wages) and proved the above mentioned. If the level of net UB is indexed to the net wage (i.e. NRR is fixed), any change in labour taxes is almost fully absorbed by the labour supply with no impact on the employment. In another words, the labour supply is less elastic. Once we keep the level of UB fixed, the change in tax rates can have a significant impact on employment. Pissarides (1998) estimates this effect as 1% decrease in equilibrium unemployment caused by 10% decrease in taxes levied on employers if the unemployment benefits are fixed in real terms.

[1]The hypothesis is studied in empirical part

2.1.1 Unemployment trap and poverty trap

High replacement rates and subsequent disincentives to enter the labour market are mainly present at the low end of the wage scale where the difference between the UB and possible wage is too small to pay off the effort in work (Carone and Sälomaki, 2001). This phenomena is known as an unemployment trap and has three possible consequences. First, the search intensity is decreased as the unemployed can count with satisfactory disposable income from UB, second, it gives more power to Unions, and third, the duration of unemployment spell is extended accordingly to duration of UB (Carone and Sälomaki, 2001). The latter could be a serious problem as the long-term unemployed loose their skills and habits and become even more difficult to employ.

Another well-known phenomena linked to low end of wage scale is a poverty trap. Unlike the unemployment trap, which discourages the unemployed, the poverty trap is linked to employed who are discouraged from increasing the work effort or to undergo training and improve their skills. Because of high marginal tax rates and possible withdrawal of social benefits provided to low income earners, the increase in disposable income connected to the increase in work effort or training could be very low and the move from dependency on benefits to fully independent status is not profitable enough (OECD, 2011).

The suggested policies to overcome the unemployment trap or poverty trap are negative income tax and employment subsidies. These policies are designed to lower the marginal effective tax rate for low income workers and thereby increase the incentive to either enter the labour force or increase the supply of worked hours. Even though the negative income tax is not a perfect redistributive tool and it is associated with a relevant efficiency loss, the disadvantages of UB are still higher. For further evidence on negative income tax see Snower (1995).

2.1.2 Important role of eligibility criteria for unemployment benefits

Till now, I discussed the possible impact of UB on the unemployment through the expected behavior of unemployed agents. However, the unemployed who are entitled to receive UB have to meet the eligibility criteria which can affect their behavior

and thus partially or fully offset the negative impact (OECD, 2000). The most usual criteria include active job search, accepting appropriate job if possible, regular interviews with the officials, and requirements for retraining or further education. The purpose is to force unemployed to behave as if they did not receive any UB while protecting them from falling into poverty. This is a key element of the system of UB which we have to take into account. Suppose two different countries, in the first the UB levels are high with replacement rates about 80% and duration of 24 months with strict eligibility criteria and the second, with low replacement ratio, let's say about 60%, and duration of UB entitlement up to 18 months but with mild eligibility criteria. The agent in the latter one is expected to seek for new job with higher intensity (20% difference of NRR) increasing his effort with last months he is entitled for the UB. If the inevitable increase in seeking intensity take place after 12 months of being unemployed, the probability of finding appropriate job is reduced by long lasting work inactivity. On the other hand, the unemployed from the first country are forced to actively seek for job, despite the 80% replacement rate, because of the strict criteria. Once the unemployed does not meet the eligibility criteria, his replacement rate falls down sharply which makes a pressure on the receivers to follow the criteria. Therefore, if we are able to set strict eligibility criteria, we can maintain high benefit levels without increasing the disincentives to seek for a job (Carone and Sälomaki, 2001).

To succeed we need to have a strong definition of the criteria and powerful and effective administration. This could also avoid high costs, and consequently the negative impact on budget deficit, of UB programs (Carone and Salomäki, 2001). Even though it is hard to compare the countries according to strictness of their eligibility criteria, and therefore to evaluate the impact, Grubb (1999) concluded that they may have considerably influence the unemployment rates.

2.2 Direct and indirect taxes

2.2.1 Tax wedge

The tax structure is very complex and trying to asses its impact we need to refer to some general concept. Commonly used concept is the tax wedge which is a ratio between the real labour cost (rLc), paid by the employer and the real consumption wage (rCw) received by the worker. Carone and Sälomaki (2001) derive the tax wedge as follows:

$$rCw = \frac{W(1 - SSCEE)(1 - t_i)}{p(1 + t_c)} \tag{2}$$

$$rLc = \frac{W(1 + SSCER)}{p} \tag{3}$$

where the W is a nominal gross wage, $SSCEE$ is the social security contribution rate born by the employee, $SSCER$ is the social security contribution rate born by the employer, t_i and t_c are tax rates on the personal income and consumption tax rates, respectively. The p is the GDP deflator at factor costs. If we divide the rLc by rCw, we get the tax wedge which is following:

$$\delta = \frac{(1 + SSCER)(1 + t_c)}{(1 - SSCEE)(1 - t_i)}. \tag{4}$$

As the tax wedge is a gap between the real labour cost of producers and purchasing power of the workers it measures the distortive effect of taxes on labour market. This gap influences the agents behavior and creates an efficiency loss (Carone and Sälomaki, 2001). Nickell (1999), Nickell and Layard (1999) and Daveri and Tabellini (2000) use tax wedge as the main indicator of tax system. Therefore, they assume the tax structure does not matter once we include the tax wedge. In the empirical part the model including tax wedge is compared with the model covering for tax rates on consumption, income, and also the payroll tax.

2.2.2 Labour taxes

It is not a surprise that the impact of labour taxes on unemployment rates was studied the most. Its direct impact on the real labour cost and subsequent effect

on the labour market equilibrium was a subject to both, theoretical and empirical papers. The crucial question is whether the increase in tax wedge is borne by the employers or employees[2]. It is well known that in competitive markets any taxes on labour are shifted on the labour supply which is inelastic (Disney, 2000). This leads to reduction in wages with no impact on the employment. In the imperfect competition market it is not so obvious and depends on the elasticity of labour supply which differs across the income levels, marriage status, and number of children as well as on the institutional framework. The theoretical conclusion is that the increase in tax wedge affects both sides of the labour market with a negative impact on unemployment rates. However, the empirical evidence is not very strong. For example, Scarpetta (1996) estimates only a minor impact on the long-term unemployment while the tax rate has no impact on overall unemployment. On the other hand, Daveri and Tabellini (2000), who grouped countries according to the rate of the unionization, the extent of coverage of collective bargaining, and an indicator of the degree of bargaining centralization, found a strong evidence of the negative impact of labour taxes on unemployment rate (i.e. higher tax wedge leads to higher unemployment rate) in the group of countries from continental Europe. These are characterized by strong unions and relatively decentralized bargaining. A half but still significant impact is estimated for Anglo-Saxon countries with highly decentralized wage setting and only in the Nordic countries characterized by strong unions and highly centralized bargaining the impact is not significant. This supports the arguments of Nickell (1997) and Scarpetta (1996) who stress the importance of labour market institutions, particularly, the union density and wage bargaining institutions. Therefore, the final impact of labour tax on the labour market is through the increase in labour costs which could differ in accordance to other institutions. It is caused by the impossibility to shift the taxes on the labour supply because of the law (for example minimum wage) or the wage resistance and powerful unions.

Social security contributions represent a special example of labour taxes. The difference are the benefits, health care and social security, which the worker buys by paying the SSCs. If the agent values these benefits enough, any increase in SSC

[2]See Disney (2000) for an overview who bears the taxes

will be partially shifted on the agent and result in a smaller increase of wage. It also encourages the workers to step out from the shadow economy and join the formal one (Carone and Salomäki, 2001).

2.2.3 Consumption tax and other non-labor taxes

Consumption taxes are often recommended as less distortive because they do not raise the labour costs, which is the main problem of taxes on labour. Therefore, an equivalent switch, in terms of tax revenue, from labour taxes to consumption taxes could lower the unemployment rates. This is equivalent with prediction of Daveri and Tabellini (2000). The same consumption tax is faced by employed and unemployed and does not raise the wedge between income from work and from UB. Consequently, there is no pressure on higher wages. This is not true if the wages are indexed to consumer price. Suppose that consumer prices fall and wages are deflated accordingly. This would drive the wedge between the income if employed and unemployed, and therefore it may influence the unemployment rate (Daveri and Tabellini, 2000). In their empirical study, they found the consumption tax to be insignificant in explaining the unemployment rate in all three "regions"[3]. According to Nickell (1997), it is not the level of labour costs which is important but the level of tax wedge (4). He argues that high labour costs mainly influence the unemployment rates of low skilled workers who do not save much and spend all their income on the consumption. It means they are much more sensitive to what they can consume for their wage instead of the level of net wage. And the consumption which they can afford is affected by the consumption tax. This results in an upward pressure on wages and the effort to shift the tax on labour demand.

There are other non-labour taxes which may have an impact on labour market through different channels. As long as taxes distort economic decisions and produce ineffective allocation of resources, they reduce the labour demand. OECD taxation and employment study (2011) highlights the Corporate income tax (CIT) as the one with the most of an impact. The problem in assessing its final effect is that

[3]The regions are continental Europe, Anglo-Saxon countries and Nordic countries. See Daveri and Tabellini (2000) for details.

the CIT can be borne by labour, capital, or consumer and in most of the cases by combination of them. The consequences of taxes borne by labour and consumers were already discussed above, however, CIT adds the need to study the impact of tax borne by capital. There are three ways how the increase in cost of capital may affect the labour market. It lowers the level of output, because of higher production costs, and reduces the labour demand. On the other hand, the relatively more expensive capital would be substituted by labour and the primary reduction could be partly offset. Because the capital is not perfectly substitutional for labour, the drop in the demand would not be fully compensated. And finally the labour productivity falls as the ratio capital per employee is decreasing which reduces the wages and lower the labour supply (OECD, 2011). The impact of CIT on unemployment is indirect and crucially depends on the fact who bears the taxes and how much it raises the cost of capital.

Among others, I would like to stress the environmental tax which is a popular one in recent years. Such a tax can reduce the unemployment by shifting the tax burden on unemployed which reduces the NRR and increase the labour supply and simultaneously improves the environment (Bovenberg, 2003). Once the labour taxes are replaced by the green tax the burden from labour taxes levied on employed is spread on the employed as well as unemployed. Koskela and Schöb (1999) discuss the importance of unemployment benefit indexation for the final employment effect of the green tax.

2.3 Progressive taxation

Evaluating progressive or regressive taxation we face more than just the unemployment issue. We should consider the fairness of such a tax tool with respect to high-income earners and the impact on the effort in education as well as in work. This is not the aim of this paper, however, it needs to be stressed as the policy makers are responsible to their voters and have to take it into account.

The tax progression was studied in perfect competition markets, where the agents are price (wage) takers as well as in uncompetitive markets, where agents posse some bargaining power. The results are significantly different. In the competitive markets

the tax progression reduces the labour supply, which is linked to the effort already mentioned, and rises wages (Bovenberg and van der Ploeg, 1994). This simply leads to lower employment which is politically unwanted. On the other hand, in the imperfect labour market competition it was shown that the progressive taxation leads to wage moderation and thus reduces the labour costs and consequently unemployment (Holmund, Kolm, 1995; P.B. Sørensen, 1999).

The main impact of tax progression is through the higher marginal tax rate. For example, unions face the trade off between higher employment and higher wages in the union wage bargaining model. Once the marginal tax is increasing with the income, the costs of lower wages are more than offset by higher employment. Other models, such as, search equilibrium model and efficiency wage model produce similar results (see Pissarides, 1998 or P.B. Sørensen, 1999). However, simple increase in tax progressivity in order to alleviate the union bargaining power and to reduce unemployment would not be a "free lunch" because of labour supply distortions, which are caused simultaneously with the increase. Therefore, we can find optimal tax progressivity, which is increasing with high unemployment and total tax level, that is the most efficient (Boeters, 2011). Both, Boeters (2011) and Sørensen (1999) concluded that the tax progressivity in most of the countries is higher than the optimal. Summing all these findings together we can undoubtedly say that the tax progression plays a significant role in determining the unemployment rate. On the other hand, it would be inefficient to increase tax progression in most of the OECD countries.

3 Empirical strategy, Data and Descriptive Statistics

Till now, the impact of taxes and benefits on unemployment have been studied only theoretically. As already stated above, almost every tax or benefit somehow affects the unemployment rates or at least the incentives of agents to enter the labour force. I also stressed the importance of the tax structure, eligibility criteria in case of benefits and other institutions. Taking into account all these facts and the complexity of tax-benefit structure as well as the labour market rigidities, the question appears what are the key determinants of unemployment and how much they really impact the unemployment rates. Unemployment rate is chosen as a relevant outcome of labour performance. The reason is that unemployment is one of the main issues for politicians. Some papers assessing the impact of taxes focus on the employment rates instead (see for example Nickell, 2004) but here the majority of papers is followed and the unemployment rate is preferred as it reflects the imperfection of labour market which does not clear. To find influential parameters, what really matters, and how much they impact the unemployment, a simple econometric model is developed in this section. The chapter follows with description of the data used for the empirical analysis, presenting some features and differences among the OECD countries.

3.1 Empirical strategy and the model

The aim is to quantify the impact of different taxes on unemployment rate in the recent years. Here, in this section, I develop and justify a simple model which is then used in the empirical part. The works of Scarpetta (1996), Nickell (1997), Nickell (1999), Daveri and Tabellini (2000), and few others are followed. They all build their empirical analysis on similar models accounting for the tax wedge, replacement rates, and few indexes to account for labour market institutions. In chapter 2, the probable impact of NRR, benefit duration, tax wedge and several others taxes is described. These are the main impacts to be quantified and which needs to be included in the model. As already mentioned Daveri and Tabellini (2000)

found a significant differences in impacts of taxes on countries grouped according to the unions and wage bargaining behavior. That's why the union density and wage bargaining coordination index are included in the model as well. To find an appropriate model few variables describing the labour demand needs to be added. To account for the different position of countries in the business cycle and their actual economic performance, which may affect the size and dynamics of unemployment (Scarpetta, 1996), the output gap variable is included. Next, it seems relevant to include the index for the strictness of employment protection as it affects the decisions of the firms to hire or fire workers (Scarpetta, 1996). The dependent variable is the unemployment rate so the main model to be estimated is following:

$$u_{it} = \beta_0 + \beta_1 atw_{it} + \beta_3 nrr_{it} + \beta_4 bd_{it} + \beta_5 ud_{it} + \beta_6 coord_{it} +$$

$$+ \beta_7 gap_{it} + \beta_8 ep_{it} + v_{it} \tag{5}$$

where $\beta_n,\ n = 0, ..., 8$ are the parameters to be estimated, i is the individual dimension and t is the time dimension. Variable u stands for the unemployment rate, atw is the average tax wedge, nnr is net replacement rate, bd represents the benefit duration measure, ud stands for the union density, $coord$ for the wage bargaining coordination, gap for the output gap, and ep for the strictness of employment protection. The v_{it} is the disturbance term.

Model described by the equation number 5 assess the impact of average tax wedge, however, one of the aims of this work is to find out what matters. Whether the atw is sufficient in evaluating the tax-system or we need to distinguish the type of taxes. Another hypothesis to be tested is the zero impact of consumption tax. To be able to do so, the model needs to be slightly modified.

$$u = \beta_0 + \beta_1 t.em_{it} + \beta_3 sscer_{it} + \beta_4 c.t_{it} + \beta_5 nrr_{it} + \beta_6 bd_{it} +$$

$$+ \beta_7 ud_{it} + \beta_8 coord_{it} + \beta_9 gap_{it} + \beta_{10} ep_{it} + v_{it} \tag{6}$$

where $\beta_n,\ n = 0, ..., 10$ are the parameters to be estimated $t.em$ is the tax rate levied on the employees, $sscer$ stands for the social security contribution rate paid

by the employer and the $c.t$ refers to taxes of consumption and services. The other variables and indices are already described below the equation (5). The latter equation allows me to find out separate impact of different taxes and check for their significance in explaining the unemployment rate. Furthermore the long-term unemployment rate is used as the dependent variable to see how taxes contribute to the persistent levels of unemployment.

3.2 The data and descriptive statistics

Once the model to be estimated is derived, the relevant data are necessary. In this section the sources of the data, their magnitudes, and averages are described and the question what they really refer to is answered. Some interesting evidence is pointed out and a simple overview of the OECD countries on the basis of collected data is given. Most of the data were downloaded from the OECD iLibrary[4]. I rely on the methodology of the OECD and do not transform them much. The problem is that the taxes and benefits differ across the earning levels and family types. Additionally, the consumption tax rate differs over the different goods and services, therefore the final tax rate depends on the consumption basket. These are particular issues faced in this subsection. The final dataset which is studied consists of 28 OECD countries over the period from 2005 to 2012. As for some countries few variables are not provided for whole period, the final dataset is unbalanced. The countries are: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, the United Kingdom, and the USA.

3.2.1 Tax rates

Two approaches how to examine the impact of taxes are studied. The first is described by the average tax wedge as already discussed in chapter 2. The data were provided by the OECD and represent the difference between the total labour costs

[4]http://www.oecd-ilibrary.org/statistics;jsessionid=5dwwdu133bm41.x-oecd-live-02

faced by the employer and net income of the worker. The atw is the difference expressed in the percentage points. Particularly, it corresponds to the wedge of the single person with no child with the average income. The lower rates of the average tax wedge, around the 30% or below, are present in the countries outside the continental Europe. Mainly in the Anglo-Saxon countries, such as, Canada (rounded average of 8 years period is 31%), the USA (30%), Australia (27%), Ireland (24%), and New Zealand with the lowest atw of all the studied countries (18.7%). The exception among the European countries is Switzerland, where the atw counts only for 22% of the income of a single person with the average income. On the second end of the scale we can find the countries from continental Europe. Namely it is France (50%), Germany (51%), Hungary (51%), and the highest atw is in Belgium where the tax wedge takes out almost 56% of the income. Daveri and Tabellini (2000) predict the major negative impact of tax wedge on unemployment within the countries from continental Europe. Surprisingly, the highest average tax wedges are present in the same countries. This fact just increase the negative effects. The mean of atw across all the countries and years is 38.44%.

The second model is built on three types of tax rates to allow to compare the impacts of different taxes. First, it is a tax levied on the employees (t.em) which is taken out from the workers gross wage. The final rate of the t.em is a sum of the income tax rate and the SSCEE. There is a little difference as the SSCEE payer is entitled to receive some security payments during unemployment spell and the effect on the agents behavior was already described. However, I assume this effect to be really minor, and therefore the SSCEE and income tax are summed up to represent the tax levied on the employee. The data were provided by the OECD in their iLibrary and represent the rates levied on the single person with no child earning an average income. The 8 year within the country averages do not deviate much from the sample mean of 27.6% (11.4% for SSCEE and 16.2% for income tax), however, few of the countries are worth mentioning. Ireland levied the lowest average tax rate on employees (16%) during the period of 2005-2012, however, there is a significant increase of almost 4% between the year 2008 and 2010. Switzerland (18%), New Zealand (18.7%) and Estonia (19%) are another countries with the

t.em rate below 20%. The highest rates are consistent with the atw as Germany and Belgium experience 41% and 42% rates, respectively. Next, I would like to point out Denmark which reduced the SSCEE by 8%, however, the drop was accompanied by increase of 6 percentage points in the income tax. The motivation behind this switch can be the differences in progressivity of income tax and SSCEE in Denmark as the SSCEE is a flat rate, while the income tax is progressive. The outliers in social security contributions imposed on employees are Australia and New Zealand as there are no such payments any.

Once the tax levied on employees were discussed it is time to move to tax levied on the employers. In the model this is represented by the SSCER and the data are consistent with those from previous paragraph. They are provided by the OECD and corresponds to a single person with average earning level with no child. These rates are assumed to have the biggest negative impact among all of the rates studied and they differ a lot among countries. The sample mean is 19.9% with standard deviation equals to 11.5. New Zealand keeps the policy of zero social security payments, while Australia (6%) is replaced by Denmark with no social security contributions paid by the employers. Greatly highest SSCER imposes France with the 8 year average of almost 44%, moreover, the rate is slightly growing reaching the rates above 44 in 2010 for the first time. Then there is the Czech Republic (34.5%) Estonia (34%) and other European countries with rates over 30%.

The last type of tax analyzed in this work is a consumption tax (c.t). Here the problems of a different rates on different types of goods or services and also the heterogeneity of the consumption baskets across the countries as well as within the countries are faced. Therefore, the relevant data for this work, which are available, are the revenue statistics from the taxes imposed on goods and services. To be able to compare different countries in multiple years, the revenue is expressed as percentage of GDP. The consumption tax do not fluctuate much around its unweighted sample average of 11 percentage points of GDP. The only countries experiencing significantly lower consumption tax are the USA (4.4% of revenue to GDP ratio), Japan (5.2%) and Switzerland (6.3%). On the contrary, Danish and Hungarian revenues from the taxes levied on the goods and services exceeds 15% of their GDP.

3.2.2 Net replacement rate and benefit duration

Another group of variables consists of the net replacement rate data and benefit duration. Net replacement rates were provided by the OECD in their statistics of benefits and wages. It refers to the ratio of income if unemployed to the income if employed expressed in percentage points. Again, the data refer to NRR for the single person with no child earning the 100% of country average income. The included benefits in the income if unemployed are unemployment benefits together with family benefits. The person does not qualify for the social assistance or cash housing assistance and the income taxes payable on benefits are determined from the annualized benefit values, where the monthly values were multiplied by 12 even if the benefit duration is shorter. The sample mean is around 54.3% with standard deviation equals to 17.1. It is difficult to find any pattern in the data but the English speaking countries seems to have lower NRR than others. For example, in the UK (13,3%) the NRR is significantly lowest among all studied countries. The UK is followed by Australia (24%), New Zealand (27%), and Greece (27%), where the replacement rate grows from the 22% in 2006 to 32% in 2011 to drop to 26% in 2012. Here it is important to stress that the increase in NRR was supported by the decreasing average wage. The respond of politicians facing the Greece issues can be seen in the drop between 2011 and 2012. The highest replacement rates are present in Luxembourg (84.6%) and Portugal (80.3%). Another state worth noting is Austria (55%) which is the only one with the constant NRR over the 8 years[5].

The hypothesis that the impact of benefit duration is bigger than the impact of NRR was already formulated. As a measure of benefit duration (bd) the maximum number of months the unemployment benefits can be provided for is used. The data provided by OECD benefits and wages statistics are not available for Australia and New Zealand. Next, the data are available only for years 2005, 2007 and 2010. Therefore, I linearly interpolated these data for years 2006, 2008 and 2009. The exception is Estonia and Slovenia where the bd is collected only for years from 2007 to 2010. Because of the limited data I will employ the variable bd in another separate regression to avoid loosing information in data from years 2011 and 2012.

[5]The different effect of fixed NRR or fixed benefit levels is studied in section 2

In Belgium, the unemployment benefits are provided for unlimited period so I follow the methodology of Nickell (1997) who suggests to replace unlimited period by 4 years. The duration of 48 months is also the second highest, particularly in Denmark till 2007. The lowest duration of unemployment benefits is in the Czech Republic where it used to be 6 months in 2005 and 2007 while in the 2009 it was reduced to only 5 months. In Slovakia and the United Kingdom the bd equals to 6 months during the whole 6 years.

3.2.3 Other labour institutions and the output gap

To account for the country differences in the labour institutions few other variables are included. First, it is the union density which reflects the net union membership as proportion of wage or salary earners in employment. The data were also provided by OECD in their iLibrary statistics. The union density differs across the countries a lot as the mean is app 30% and the standard deviation equals to almost 18. We can find the highest union membership density in countries from North Europe such as Sweden (70%), Finland (70%) followed by Denmark (69%) and Norway(54%). Conversely, the lowest union densities which do not exceed even the 8% are in France and Estonia.

The only one variable which is not provided by the OECD is the coordination of wage-setting index (coord), where the index constructed by Jelle Visser in his Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts is used. The index ranges from 1 to 5 according to the centralization and the level where the main wage bargaining takes place. The countries with highly centralized wage bargaining are evaluated with 5 and vice versa[6]. Belgium is the only one country with the coord equals to 5 for the whole studied period whereas the countries assigned with 1 are Canada, New Zealand, Poland, the UK, and the USA.

The variable describing the employment protection is an index constructed by OECD and provided in the iLibrary statistics. The index is describing the strict-

[6]For complete descrption of this index see the codebook of the database accesable via http://www.uva-aias.net/uploaded_files/regular/ICTWSScodebook40.pdf

ness of regular contracts, which evaluate 21 items covering for different aspects of employment protection. Each item is evaluated from 0 to 6, where 6 stands for the strictest protection. These sub evaluation are then averaged so the ep ranges from 0 to 6 as well. The Portugal (4.2) experiences the strictest employment protection. On the other end of the scale is USA (0.26). The rest of countries do not deviate that much from the sample mean of 2.1 points.

The statistics of output gap were provided by the OECD Economic outlook and measures the deviations of actual GDP as a per cent of potential GDP which was computed using the methodology described in Johansson et. al. (2013). The sample mean is 0.38% with the standard deviation of 3.65. Most of the countries experienced positive values before the 2009 and than a significant drop which keeps the numbers below zero till 2012.

3.2.4 Unemployment rate

This is a key variable of this work and the standard well known unemployment rate which expresses the ratio of unemployed to the total labour force is used. This data were also provided by the OECD iLibrary statistics. The unemployment rates stayed relatively stable for most of the countries, however, the increase connected with the financial crisis in 2009 is obvious. The sample mean is 7.66% and the standard deviation 3.74. For example, Estonia experienced increase of more than 10 percentage points in the unemployment between 2008 and 2010 but decreasing trend from 2011 is present. This is not the case of Greece and Spain where the unemployment rate is substantially increasing from the year 2008 and reaching 24,5% in Greece and 25.2% in Spain. The lowest average unemployment rate over the 8 studied years is in Norway (3.4%) followed by Switzerland (4.1%).

The second measure of unemployment to be employed in the analysis is the long-term unemployment. The data provided by OECD iLibrary statistics on long-term unemployment refer to the number of people who are registered as unemployed for 12 months or more as a percentage of total unemployment. I took this data and computed the ratio of long-term unemployed to the total labour force, which I am using in the analysis. In the original data we can learn that lots of the countries

are facing quite high percentage of the long term unemployed around 50% of the total unemployment. The highest rates are in Slovakia where on average 64% of unemployed people are job less for a year or more. On the other hand, several countries are very successful in keeping this rate really low, for example, New Zealand (8%), Norway (9.5%) or Canada (10%).

Some basic features of variables are summarized in this table.

Variable	Observation	Mean	Std. Dev.	Min	Max
atw	224	38.44	9.10	15.87	56.08
t.em	224	27.64	7.5	13.87	42.83
SSCER	224	19.89	11.47	0	44.03
t.c.	221	10.95	2.74	4.256	17.52
nrr	224	54.33	17.16	13	85
bd	152	16.76	10.82	5	48
ud	185	29.98	17.94	7.5	76.52
coord	220	2.78	1.26	1	5
ep	215	2.13	0.78	0.26	4.42
gap	224	0.38	3.65	-12.61	13.72
u	224	7.66	3.74	2.56	25.18
long-term u	222	2.89	2.43	0.16	14.52

4 Empirical analysis

The data described above are finally analyzed in this section and the evidence of the impact of taxes and benefits on the unemployment rate in the recent years is provided. The aim is to find an appropriate estimation procedure of the models derived above and justify this selection. Then, the outputs of models described by equations 5 and 6 are compared and their consistency with the theory conclusions is discussed. Also the hypothesis stated previously in this paper are examined. The results are discussed in two subsections as in the first it is the unemployment rate which serves as the dependent variable while in the second the long-term unemployment is used. A special regression for assessing the impact of benefit duration can be found in another subsection as it reduces the data set.

4.1 Estimation method

Because the collected panel data are unbalanced the estimation procedure is restricted to the pooled OLS estimation, fixed-effect model (FE) or random-effect model (RE). As already mentioned the unemployment rate is highly influenced by the labour market institutions in the specific country and these institutions are difficult to measure and even if I account for the union density, employment protection and bargaining coordination the data do not vary much in time. It means I am facing the issue of fixed effect which is related to specific country (Daveri and Tabellini, 2000). Thus, the FE is preferred as it allows for different intercepts to each country and hence accounts for the institutions not included in the regression. This selection was verified by the test developed by Hausman (1978) which compares the estimates of fixed effect model and random effect model. The null hypothesis that the difference in the coefficients is not systematic was rejected at the 0.0001% significance level. Hence the random effect estimator is not consistent and we prefer the FE.

Once the estimation method is chosen, few assumptions need to be discussed. As declared by Wooldridge (2002) the FE is unbiased if two assumptions hold. First, I assume the strict exogeneity of explanatory variables. This is a strong assumption which is crucial for the analysis and possible consequences and further

discussion follows when interpreting the results. The second assumption is that none of the variables is constant over all of the years and countries which is fully satisfied. Further assumptions as homoskedasticity and no serial correlation were tested by Wooldridge's (2002) test for serial correlation and modified Wald statistic for groupwise heteroskedasticity in fixed effect model presented by Green (2000). Both, heteroskedasticity and serial correlation, were detected. As long as these violations of efficiency assumptions bias the standard errors, the robust standard errors are used to take care of it and avoid misinterpretation.

4.2 Results of regressions with unemployment as the dependent variable

First, the regressions where the unemployment rate is used as the dependent variable are presented. As already discussed, the robust standard errors are used to deal with the heteroskedasticity and serial correlation. The robustness of the analysis causes most of the variables to be insignificant at the common levels of significance. I start with the regression described by equation number 5 with the average tax wedge representing the whole tax structure. The results are summarized in the table below.

The objects of interest in this particular regression are atw and nrr. Let me begin with the variable atw. As already mentioned, due to the robust standard errors, the average tax wedge is significant only at the 12% level of significance, however, the sign of the effect is positive as expected. The coefficient estimated from the data set consisting of 28 countries is 0.3. It means an increase of 1% in the average tax wedge would cause an increase of 0.3% in unemployment rate. This is comparable with the results for Anglo-Saxon group in Daveri and Tabellini (2000) which equals to 0.27. This is quite big effect as the differences in atw across the countries are in tens of percentage points.

The nrr is also insignificant at the common significance levels but what is more important is the fact the sign of the estimate is the opposite one than expected. From the regression summarized in table above we can learn that higher net replacement

Table 1: Dependent variable: u

Variable	**Coefficient**	**(Std. Err.)**
atw	0.300	(0.186)
nrr	-0.056	(0.036)
ud	0.295*	(0.120)
ep	-2.253*	(0.923)
coord	-0.221	(0.283)
gap	-0.504**	(0.047)
Intercept	-4.369	(8.775)
N	178	
adj-R^2	0.858	
$F_{(5,27)}$	23.917	

Significance levels : † : 10% ∗ : 5% ∗∗ : 1%

rates leads to reduction in unemployment. This is not consistent with the theoretical conclusion derived in section 2. The possible explanation could be the endogeneity of the net replacement rate as the countries with low unemployment rate can deserve to pay out more to the individuals. However, this was tested by using an instrument variable in form of lagged values of unemployment with no effect on the negative sign of nrr in explaining the unemployment rate. Another explanation goes back to the article about the increasing importance of eligibility criteria which would be the key element of the impact of benefit system on unemployment. Anyway the nrr is insignificant in explaining the unemployment.

The variables ep, ud and gap which stand for the employment protection, union density and the output gap, respectively, are all significant at the 5% significance level where the variable gap reports the p-value below 0.001. This fact along with the high R-squared value of 0.858 shows that the model derived in section 3.1 is appropriate. The only variable which is insignificant and simultaneously not the subject of my study is the coord. This is due to chosen estimation method. The FE is built on time-demeaned data where the time average of the individual is

subtracted from the data and because the variable coord is constant for most of the countries it is taken out together with the country specific effect.

Next, the equation 6 derived in section three is followed and the atw is replaced by variables measuring the consumption tax and taxes imposed on employees and employers. The results of the regression are again summarized in the table below.

Table 2: Dependent variable: u

Variable	**Coefficient**	**(Std. Err.)**
t.c	-0.395	(0.397)
SSCER	0.716	(0.478)
t.em	0.034	(0.131)
nrr	-0.011	(0.054)
ud	0.335*	(0.129)
ep	-2.512*	(0.943)
Coord	-0.220	(0.271)
gap	-0.498**	(0.045)
Intercept	-6.526	(14.459)
N	177	
adj-R^2	0.862	
$F_{(7,27)}$	21.241	

Significance levels : † : 10% ∗ : 5% ∗∗ : 1%

Again, the heteroscedasticity and serial correlation robust standard errors leave us with taxes and nrr insignificant even at the 10% level of significance. In spite of this fact, the difference in magnitude as well as in the significance between the SSCER representing the taxes levied on employers and taxes levied on employees is obvious. My estimates predicts the 0.7 percentage point increase of unemployment rate for a one percentage point increase in the SSCER while the same increase in t.em (i.e. increase in income tax or SSCEE) yields only 0.03 of percentage point increase in unemployment rate. Therefore, the suggested policy to lower the unemployment rates based on this regression is to shift the taxes levied on employers to employees.

This could be simply done by increasing SSCEE and decreasing SSCER because of their similar nature. Especially France and the Czech republic, which experience the highest SSCER, should lower the rate of social security contributions paid by employers as it is the tax rate which contributes most to high unemployment rates.

In section 2 the hypothesis that the consumption tax represented by the variable c.t have no impact on the unemployment rates is stated. The regression summarized in the table above supports this hypothesis as the coefficient is not statistically different from zero. However, the p-value is still lower for consumption taxes than for the taxes levied on employees. Even though it is insignificant the predicted coefficient is negative. My explanation is that the reduction in taxes levied on employers is usually accompanied by the increase in consumption taxes. As long as this switch is followed by decrease in unemployment rates, because of the reduction of influential labour tax, the drop in unemployment could be ascribed to the increase in consumption tax.

The nrr is much more insignificant, if the regression follows equation number 6 derived earlier. The effect of nrr on unemployment rate seems to be minor and the conclusion that it is possible to maintain high benefit levels and keep low unemployment rates is relevant.

The rest of the regression is consistent with the previous one where the ud, ep and gap variables are statistically significant and the coord is not. Also the coefficients are very similar with the negative sign for all except the union density which has the positive sign.

4.3 Results of regressions with the long-term unemployment as the dependent variable.

I continue with regressions analyzing the impact on long-term unemployment. The same was studied by Nickell (1997) and Heitger (2002) with two different results. The later study found larger impact of taxes on long-term unemployment, while Nickell (1997) on the short-term. My hypothesis is that the impact should be larger or at least more significant in explaining the long-term unemployment as the influ-

ence of short-term fluctuations and frictional unemployment is diminished. Broadly speaking, market rigidities including the tax-benefit system are contributing rather to the long-term unemployment than the short-term. First, the regression including the average tax wedge is estimated and the results can be found below.

Table 3: Dependent variable: long-term u

Variable	**Coefficient**	**(Std. Err.)**
atw	0.492**	(0.155)
nrr	-0.056*	(0.024)
ud	0.212†	(0.109)
ep	-1.123	(0.939)
Coord	-0.096	(0.144)
gap	-0.227**	(0.034)
Intercept	-16.591*	(7.264)
N	176	
adj-R^2	0.858	
$F_{(5,27)}$	14.177	

Significance levels : † : 10% * : 5% ** : 1%

Due to the presence of heteroskedasticity and serial correlation in the explanatory variables, the robust standard errors accounting for these violations of assumptions were used again. In spite of that the variables of the interest are statistically different from zero at the 5% significance level unlike in the previous regressions which supports my hypothesis. The result on tax wedge is consistent with Heitger (2002) and the estimated impact on long-term unemployment is higher by approximately two thirds than the impact on overall unemployment rate. It is also very significant as the reported p-value is lower than 0.005. The findings predict a half percent increase in the long-term unemployment for every 1% increase in the average tax wedge.

Also the net replacement rate is significant and the estimated impact on the long-term unemployment is negative again. Despite the fact I have already refused

the problem of reverse causality on the basis of instrumental variable which does not help in explaining the negative sign, we still have to take it into account. On the other hand, the importance of eligibility criteria was already stressed and also Nickell (1997) mentions the idea that high benefit levels might reduce the long-term unemployment as unemployed who wants to receive these benefits are pushed to find the job shortly.

The variables accounting for the employment protection and union density are less significant in case of the long-term unemployment which seems to be mainly determined by the output gap, average tax wedge and also the nrr. The adjusted R^2 is still very high and the model seems to explain the variation in long-term unemployment sufficiently.

As in case of overall unemployment I continue by estimating the model described by equation 6 in section 3 and using the long-term unemployment as the dependent variable. The main results of the regression are described in the table below.

Table 4: Dependent variable: long-term u

Variable	**Coefficient**	**(Std. Err.)**
t.c	-0.048	(0.184)
SSCER	0.570†	(0.302)
t.em	0.249†	(0.135)
nrr	-0.028	(0.037)
ud	0.244*	(0.100)
ep	-1.272	(0.924)
Coord	-0.149	(0.162)
gap	-0.228**	(0.041)
Intercept	-17.213†	(9.471)
N	175	
adj-R^2	0.850	
F $_{(7,27)}$	10.075	

Significance levels : $\dagger$: 10% $*$: 5% $**$: 1%

The results are bit different when comparing to the regression with overall unemployment. The main difference is in the tax rate levied on the employees. When the dependent variable is long-term unemployment it turns out to be statistically different from zero at the 10% significance level with the estimated coefficient of 0.249. The SSCER is significant at the same level as t.em and the predicted impact is approximately twice higher so the above suggested policy to decrease the SSCER rate and increase the SSCEE rate by the same amount holds. Furthermore, the consumption tax is highly insignificant in explaining variation in the long-term unemployment. This supports the hypothesis of no effect of consumption tax as this kind of tax rate affects the unemployed the same as the employed.

The puzzling variable nrr is again very insignificant, if we include the tax rates separately instead of the average tax wedge. For the rest of the model the estimates are very similar to the previous. Employment protection seems to influence rather the short term unemployment, while the union density does not show much difference in influencing the overall or long-term unemployment.

4.4 The evidence on the impact of benefit duration

In this short subsection the evidence on the impact of benefit duration on the unemployment is investigated. I study this in the separate regression as the data are restricted to less countries and cover only the years between 2005 and 2010. The particular model to be estimated here is the one describe by equation 5 with additional variable for the duration expressed in years. The fixed effect estimation with robust standard errors is used as the heteroscedasticity and serial correlation is present again. The results where I am focusing only on the coefficient and significance of the bd can be found in the table below.

The estimate of the impact of benefit duration is statistically insignificant so we cannot say the impact of unemployment benefit duration on unemployment rate is statistically different from zero. Disregarding the insignificance the estimated coefficient is positive. This can partly offset the negative[7] impact of net replacement

[7]The impact is negative in the sense of decreasing the unemployment when increasing the nrr (i.e. the impact is positive for the society.

Table 5: Dependent variable: u

Variable	**Coefficient**	**(Std. Err.)**
atw	0.442**	(0.129)
nrr	-0.040	(0.039)
bd	0.069	(0.076)
ud	0.344**	(0.118)
ep	-2.413†	(1.241)
Coord	-0.264	(0.346)
gap	-0.467**	(0.050)
Intercept	-12.988	(9.704)
N	141	
adj-R^2	0.843	
$F_{(6,25)}$	21.087	

Significance levels : † : 10% ∗ : 5% ∗∗ : 1%

rate and also shows the bigger importance of benefit duration than the nrr. Anyway both are insignificant and the eligibility criteria seems to be the determinant of the impact of benefit system on unemployment.

4.5 Summary of the empirical findings

I find it useful to summarize and point out some of the empirical findings before the conclusion as I ran five regressions and the results differ significantly over these. The tax-benefit system influences rather the long-term unemployment where there is a sufficient statistical evidence that the average tax wedge contribute to the higher rates. Also the analysis of the individual tax rates proves that what matters in explaining the long-term unemployment are labour taxes imposed on employers and employees where the larger impact is ascribed to the taxes levied on employers. Conversely, I was not able to find sufficient evidence in the dataset that the taxes levied on goods and services can affect the overall unemployment nor the long-term.

The most powerful tool when assessing the influence of tax system on the unemployment seems to be the average tax wedge despite the fact it is not so significant in explaining the overall unemployment as in explaining the long-term unemployment.

The net replacement rate which is chosen to represent the benefit system showed to be a tricky one as the empirical results are not consistent with the theoretical findings. The NRR is found insignificant in all of the regressions but one. I found statistical evidence of the net replacement rate on the long-term unemployment in the model described by equation number 5 but the impact was opposite than expected. My explanation for this is the importance of eligibility criteria. As already mentioned the problem of endogeneity was tested by employing the instrumental variable and although it did not help to explain the negative sign we should have in mind that the estimates might be influenced by some kind of endogeneity. The benefit duration seems to be insignificant as well and the estimated effect has a positive sign.

5 Conclusion

In this thesis I examine the impact of taxes and benefits on the unemployment. As the tax-benefit system is quiet complex structure it was necessary to catch the key determinants of tax and benefit structures. To be able to objectively evaluate the impact of taxes and benefits I need to take care of other policy and economic variables. Therefore, the model accounting for the employment protection, union density and output gap as the measure of economic cycle is derived.

While summarizing the theoretical findings of the previous researches few hypothesis were stated. First, the consumption tax was found to have no impact on the unemployment rates and the evidence is even stronger when explaining the long-term unemployment. Second, the high rates of net replacement rates were expected to raise the unemployment. This hypothesis was refused as the NRR seems to be insignificant in explaining the overall unemployment and even the effect is the opposite one than expected. This needs to be verified and further investigated in future works where it is necessary to collect larger and more complex dataset to be able to conclude the net replacement rate could have the negative effect on unemployment rate. The main problem is missing measure of the strictness of eligibility criteria and its interaction with the level of NRR which seems to be more important in recent years. At least we can conclude that it is possible to keep high NRR without upward pressure on the unemployment rates. The third hypothesis expected the benefit duration to influence the unemployment more then the levels of benefits. I was not really able to support this hypothesis with a sufficient evidence as the benefits seems to be insignificant in explaining the unemployment rate as well as the NRR. On the other hand, the estimated effect of benefit duration was positive, in opposite to the net replacement rate.

When estimating the effects of taxes I found most useful to account for the tax wedge as it is the most significant measure of tax system in explaining the unemployment and especially long-term unemployment. When compering the theoretical findings with the empirical we can learn that the theoretical fits much more the regressions where the long-term unemployment is explained.

The main contribution of my work is in summarizing the theoretical impacts via economical intuition and simple schemes. The impacts are also studied on the newest relevant data where it is shown that even a simple econometric methods can prove that mainly the labour taxes contributed to high levels of unemployment in the last decade.

Bibliography

[1] Boeters, S. Optimal tax progressivity in unionised labour markets. *Economic Modelling*, 5 (2011), 2282–2295.

[2] Bovenberg, L. Tax policy and labour market performance. *CESifo Working Paper Series*, 1035 (2003).

[3] Bovenberg, L., and van der Ploeg, R. Effects of the tax and benefit system on wage formation and unemployment, 1994.

[4] Buti, M., Franco, D., and Pench, L. R. Reconciling the welfare state with sound public finances and high unemployment. *The Welfare State in Europe*, 4 (1998), 7–42.

[5] Carone, G., and Salomäki, A. Reforms in tax-benefit systems in order to increase emplyoment incentives in the eu. *European Economy - Economic Papers*, 160 (2001).

[6] Daveri, F., and Tabellini, G. Unemployment, growth and taxation in industrial countries. *Economic Policy 15*, No 30 (2000), 47–104.

[7] Disney, R. The impact of tax and welfare policies on employment and unemployment in oecd countries. *IMF Working paper*, 164 (2000).

[8] Greene, W. H. *Econometric analysis*, 4th ed. ed. Prentice Hall, Upper Saddle River, N.J., c2000.

[9] Grubb, D. Eligibility criteria for unemployment benefits. *OECD Economic Studies*, No. 31/II (2000).

[10] Heitger, B. The impact of taxation on unemployment in oecd countries. *Cato Journal*, 2 (2002).

[11] Holmund, B., and Kolm, A.-S. Progressive taxation, wage setting and unemployment. *Uppsala - Working Paper Series*, No 15 (1995).

[12] Johansson, A. Long-term growth scenarios. *OECD Economics Department Working Papers*, 1000 (2013).

[13] Katz, L. F., and Meyer, B. D. The impact of the potential duration of unemployment benefits on the duration of unemployment. *Journal of Public Economics 41*, 1 (1990), 45–72.

[14] Koskela, E., and Schöb, R. Alleviating unemployment. *European Economic Review*, 43 (1999), 1723–1746.

[15] Layard, R., and Nickell, S. Labor market institutions and economic performance. *Handbook of Labor Economics*, 3c (1999), 3029–3084.

[16] Layard, R., Nickell, S., and Jackman, R. *Unemployment*. Oxford University Press, New York, 1991.

[17] Nickell, S. Unemployment and labor market rigidities. *Journal of Economic Perspectives*, 11 (1997), 55–74.

[18] Nickell, S. Finnish unemployment. *Finnish Economic Papers*, 2 (1999).

[19] Nickell, S. Employment and taxes. *CEP Discussion Paper*, No 634 (2004).

[20] OECD. OECD Benefits and Wages: Statistics [online]. http://www.oecd.org/els/benefitsandwagesstatistics.htm.

[21] OECD. Oecd employment outlook june, 2000.

[22] OECD. Taxation and employment, 2011.

[23] OECD. OECD iLibrary statistics [online], 2014. http://www.oecd-ilibrary.org/content/data/data-00285-en.

[24] Pissarides, C. A. The impact of employment tax cuts on unemployment and wages. *European Economic Review*, 42 (2000), 155–183.

[25] Scarpetta, S. Assessing the role of labour market policies and institutionals settings on unemployment. *OECD Economic Studies*, No. 26 (1996), 43–97.

[26] Snower, D. J. Unemployment benefits versus conditional negative income taxes. *IMF Working Paper*, 65 (1995).

[27] Sørensen, P. B. Optimal tax progressivity in imperfect labour markets. *Labour Economics 6*, 3 (1999), 435–452.

[28] Wooldridge, J. M. *Econometric analysis of cross section and panel data*, 2nd ed. ed. MIT Press, Cambridge, Mass., c2010.