Unemployment in the 21st Century: The Interaction between Macroeconomic Shocks and Institutions

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Abstract

This paper analyses the driving factors of youth- and adult unemployment in the OECD-countries during the 21st century. Focus is on both macroeconomic shock variables, such as the GDP-gap, the real interest rate and total factor productivity-growth, and institutional variables, such as union density, active labour market policies, the tax wedge, the replacement rate and the share of temporary employment contracts. The interactions between shocks and institutions are also evaluated. This is done empirically in with a panel data regression analysis on 25 OECD-countries annually during 1999-2017. The result of the paper is that the replacement rate, the tax wedge and the real interest rate seem to increase the unemployment rates. Spending on active labour market policies, the share of temporary employment contracts and the GDP-gap are found to reduce the unemployment rates. Adding interactions to the model does not improve the fit very much. A variable on the size of the public sector is added to the analysis but found insignificant in explaining unemployment.

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1. Introduction

The unemployment rates of the developed countries have during the 21st century experienced many fluctuations. During the global financial crises that started in 2008, the unemployment rates increased in the OECD-countries but have since then recovered. Another dimension of the financial crises was that the unemployment of young people was also affected increasingly, and in some European countries, such as Spain, Greece and Portugal for example, the share of unemployed young people increased dramatically. Many potential key factors are driving the aggregate unemployment rate. The rate of unemployed people is affected both by different types of macroeconomic shocks as well as different institutional and policy settings. To determine the factors that affect and drives unemployment during the 21st century is the main purpose of this paper. These factors include shocks and institutional variables, as well as the interaction between shocks and institutions. Another purpose is to divide the unemployed population into two groups, the young and the adult population and to see if these two groups are affected differently when it comes to the development of the unemployment rate over time.

To be able to trace out the determinants of the unemployment rate, both for the young and the adult population is important in many perspectives. The reason behind this is for policymakers to have as good information as possible when formulating policy decisions so the unemployment rate can be reduced to the lowest possible level. A low unemployment rate is positive for many reasons. On the aggregate level, a high unemployment rate leads to suboptimal production hence lowers total GDP (Birch-Sørensen and Whitta-Jacobsen, 2010). A high unemployment rate also reduces the total taxable income in the country, which leads to governments earning less money from taxes. Being unemployed can also have negative consequences on the individual level. The most direct consequence is the income loss from being out of work. The consequences from losing income can be socially undesirable, and lead to health problems and being outside of a social context. This effect was evident after the financial crisis of 2008-09, and even stronger for young people, concluded by Bell and Blanchflower (2011, p.16-18). Being out of work for a long time can also affect the probability of acquiring a new job negatively. The reason for this is mainly due to the loss of skills while being out of work (Pissarides, 1992).

The evolution of unemployment can be seen in figure 1. It shows the average unemployment rate in OECD over the entire time period. For the first years of the 21st century, the unemployment rates were quite stable. The years before the crisis of 2008-09, the unemployment rates went down. During and after the crisis, the rates went up for about five

years before it started to recover towards the unemployment rates that were present at the beginning of the 21st century. The adult- and youth unemployment rates seem to move similarly for most of the years. It is, however, clear that during the years following the financial crisis, youth unemployment went up more than the adult unemployment rate.

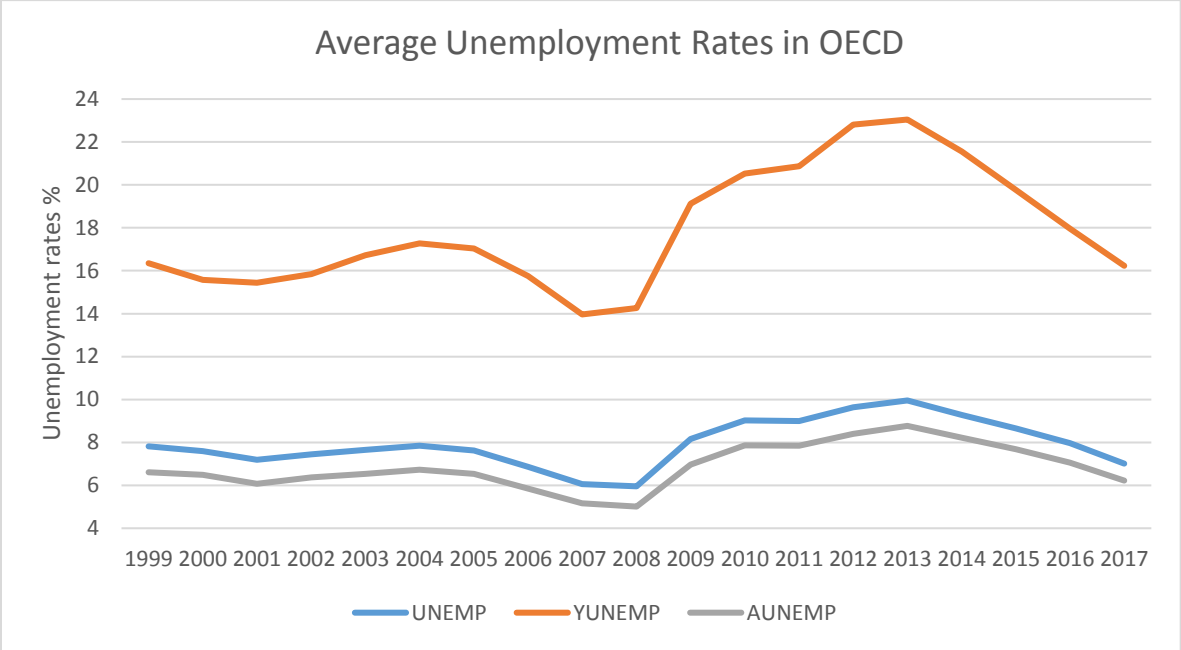

Figure 1. The average total-, youth-, and adult unemployment rates in OECD in the 21th century. (UNEMP= Total unemployment rate, YUNEMP= youth unemployment rate, AUNEMP= Adult unemployment rate).

That the adult and youth unemployment rate was affected differently, can also be seen in figure 2. Figure 2 shows the difference between the youth unemployment rate and the adult unemployment rate. It is clear that the difference increased the years after the crisis. However, around 2013, the gap started to decrease and has been decreasing up until now. The gap lies around ten percentage points.

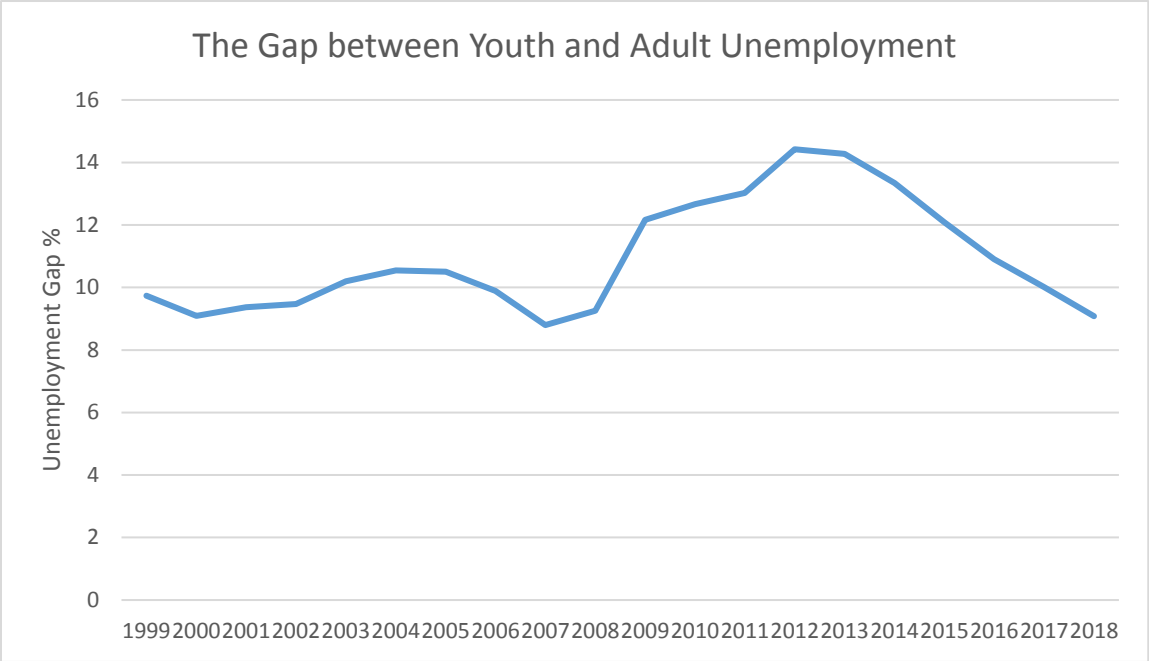

Figure 2. The Unemployment Gap between youths and adults.

This paper follows the work of several different authors that have been performing research on the topic of unemployment. These authors include, for example, Blanchard and Wolfers (2000) who investigate the interaction between shocks and institutional factors in determining the total unemployment rate of OECD-countries. Nickell et al. (2005) and Bassanini and Duval (2006) further develop the ideas from Blanchard and Wolfers and try to put further light on the issue of unemployment by adding more variables in the analysis and trying different specifications in the statistical analysis. Other articles covering the determinants of unemployment and youth unemployment for different countries and different periods are, for example, the ones from Scarpetta (1996), Choudry et al. (2013), Banjeri et al. (2015) and Tomić (2018).

A panel data regression analysis on 25 OECD-countries during the time-period 1999-2017 is conducted to evaluate the purpose of this paper. Possible explanatory factors to unemployment are shock variables such as the GDP-Gap, the real interest rate and total factor productivity-growth. Other explanatory factors are institutional factors, which include the replacement rate, spending on active labour market policies (ALMP), the share of temporary employment contracts, the tax wedge, union density, and public spending as a share of GDP. Interactions between institutional factors and shocks are also tested. The main result is that unemployment is affected by both shocks and institutional factors. Adding interactions to the model does not improve the explanation of unemployment very much, even though there seem to be some interactions that significantly affect unemployment.

This paper will be organized as follows. In the next section, the existing research on the topic of unemployment will be put together and summarized. After that, follows a section on the specification of the model connected to fundamental theories of unemployment. Thereafter follows a discussion on the data and method that will be used in the empirical analysis of this paper. The results of the empirical analysis are thereafter presented. A discussion of the results follows. Lastly, the results of the paper will be concluded in the finishing section.

2. Literature review

The literature on unemployment is quite extensive. Many studies use a panel regression analysis approach, with the measure of unemployment as the dependent variable, and regressing the explanatory variables they which to test on these. Most research have been conducted on OECD-countries, or European countries. In this section, some of the articles on the topic of unemployment will be summarized.

Olivier Blanchard and Justin Wolfers (2000) argues that unemployment in developed countries is explained by shocks, institutional settings, as well as the interaction between shocks and institutional factors. The authors' idea is that adverse shocks can explain a general effect on unemployment, but not the degree of heterogeneity that exists among developed countries. That is why the interactions between shocks and institutions are interesting in the explanation of the development of aggregate unemployment. This idea is evaluated empirically with a panel data regression analysis. The sample consists of 20 OECD-countries from 1960 through 1995. Three shock variables are used, namely TFP-growth, real interest rate shocks, and labour demand shocks. Eight institutional variables are used, the replacement rate, unemployment benefits, ALMPs, employment protection legislation (EPL), the tax wedge, union coverage, union density, and the degree of coordination in collective bargaining. First, the authors regress a time-invariant measure of the institutions interacted with time-dummies, to capture how institutions interact with unobservable shocks. After that, they add observable shocks to the regression and interact these with institutions. The result of their investigation is that both shocks and institutions can explain the development of unemployment significantly. The model with unobservable shocks performs a better fit than the model with observable shocks.

In the article "Employment Patterns in OECD Countries: Reassessing the Role of Policies and Institutions" (2006), Andrea Bassanini and Romain Duval investigate the role of institutions and policies for explaining the unemployment rate. To this investigation, the authors also add interactions among the institutional variables and interactions between macroeconomic shocks and time-invariant institutions. As Blanchard and Wolfers (2000) also do, Bassanini and Duval distinguish between unobservable and observable shocks. Lastly, they also add a dynamic version of the model to see if the persistence of unemployment shocks is affected by their interaction with institution and policy measures. The analysis is done with a panel data approach, with a big focus on robustness of the econometric analysis. The result of this paper is that the amount and the duration of unemployment benefits, the tax wedge and anti-competitive product market regulation are found to increase the unemployment rate. Higher

spending on ALMPs is found to decrease unemployment. The authors also find that shocks to the total factor productivity, the real interest rate, the terms of trade, and to the labour demand significantly affect the unemployment rate. They also conclude that the effect on unemployment of shocks is affected by institutions and the interaction there in between.

Another paper that looks at interactions between shocks and institutions is the one written by Nickell et al. (2005). The authors perform a yearly analysis of the development of unemployment for 20 OECD-countries during the time-period 1960-2002. This is done with a panel data regression, including institutional variables, shock variables, interactions between institutional variables and in the last specification interactions between shocks and institutions. The interactions between shocks and institutions are evaluated by interacting time dummies with the institutional variables, measuring the unobservable shock effect on these institutions. The conclusion is that labour market institutions explain the development of unemployment. However, in contrast to Blanchard and Wolfers (2000) and Bassanini and Duval (2006), Nickell et al. (2005) find that adding interactions between shocks and institutions add no or very little explanation to the development of unemployment.

Iva Tomić (2018) analyses the driving factors behind youth unemployment in the 28 countries that are connected to the European Union during the years of 2002-2014. This is analysed with panel data regression of different specifications. The author's focus is on the factors affecting youth unemployment, but regressions on the adult unemployment rate is also computed to be able to compare the estimates between the age groups. To reduce heterogeneity among countries, Tomić divides the sample into two groups of low and high unemployment. This article concludes that GDP-growth, the public debt as a share of GDP, and the share of construction in gross value added have a significant effect on the unemployment rates. Another conclusion from the article is that the effects of the significant variables are bigger for the youth unemployment rates than for the adult unemployment rate.

Banjeri et al. (2015) also examine the determinants of youth unemployment in 22 European countries, with most of these countries being the ones that have the Euro as their currency. The time-period of interest is 1980-2012, and the method used is panel data regression analysis. The authors first regress youth and total unemployment on the GDP-gap to test Okun's law. After that, they add institutional factors to the regressions. The result from the first regression is that youth unemployment is more sensitive to the business cycle than total unemployment and that the size of this effect varies among countries. The result when adding institutions to the regression is that the tax wedge, unemployment benefits, the minimum wage and a higher share

of temporary work contracts significantly increase the unemployment rate and that ALMPs significantly reduce the unemployment rate.

Stefano Scarpetta (1996) analyses unemployment from two perspectives. The author first tries to determine the relationship between different institutional factors and equilibrium unemployment. Equilibrium unemployment is in this paper, the unemployment rate that is consistent with stable wage inflation. Thereafter Scarpetta investigates how these institutional factors affect the persistence of unemployment. The analysis is done with two types of panel data regression analysis. One is a static regression for testing the relation of unemployment and institutions, not taking lagged unemployment into account. The other model is a dynamic version for testing the relation between institutional factors persistence of unemployment. The regression is dynamic in the sense that lagged unemployment is added as an explanatory variable. These regressions are performed on the total unemployment rate, the youth unemployment rate, the long-term unemployment rate, and the non-employment rate. The sample used for the analysis consists of 15-17 countries depending on the specification, over the period of 1983-1993 for the static regression, and 1973-1993 for the dynamic regression. High levels of unemployment benefits and strict EPL are found to increase the rate and persistence of equilibrium unemployment, and ALMP is found to decrease the rate of unemployment.

Choudry et al. (2013) investigate the effects of institutional factors on total and youth unemployment. This investigation is done with panel data regressions on 27 high income-countries during the period 1980-2009. The main contribution of this paper is adding an index on labour market regulation (LMR) and testing the effect of this index on the unemployment rates. The index is based on six measures of LMR, namely the minimum wage, hiring and firing regulations, centralized collective bargaining, mandated cost of hiring and the mandated cost of worker dismissal and conscription. The regressions are done on this index and several control variables. The result of the analysis is that the LMR-index affects both youth and total unemployment negatively, which means that a higher level of labour market regulation decreases the unemployment rates. The effect of the index is found to be bigger for the young population than for the total population.

The effect of ALMPs on unemployment has been investigated throughout the years, with the conclusions being a bit unclear. Jochen Kluve (2006) performs a meta-analysis on the topic. The main conclusion is that the type of policy and the targeted group matters for the effectiveness. Traditional training programs, private sector incentives and services, and

sanctions seem to be the most effective types of policies, in contrast to public sector programs, which seems to be less effective. ALMPs targeted at the adult population are more effective than those targeted at young people according to the author's findings. Caliendo and Schmidl (2016) investigate the effect of ALMPs on youth unemployment. In line with Kluve (2006), these authors also conclude that the effect of different types of ALMPs varies. The main findings are that job search assistance seems effective, the effect of minimum wages and training programs are mixed, and that public sector programs seem to have a negative effect. Martin (2014) has reviewed the macroeconomic empirical investigations on ALMPs. The main conclusion is that ALMPs, in general, seem to reduce unemployment, but that that effectiveness of the policies varies among countries.

The empirical relation between unemployment and the business cycle is called Okun's Law. This relation has been proven by research and is a well-known empirical relation, for example, by Banjeri et al. (2015) and Tomić (2018). Research also seems to conclude that youth unemployment is affected by business cycles to a bigger extent than adult unemployment. This result is put forward by, for example (OECD, 2008, p.33-35) and Caporale and Gil-Alana (2014). Most papers prove this by regressing unemployment rates on either GDP-growth or the GDP-gap, but the conclusions are the same.

Blanchard and Summers (1986) propose the theory of hysteresis. Hysteresis means that unemployment is persistent when hit by shocks. They argue that this effect is due to the divergence of insiders and outsiders on the wage bargaining process (see Lindbeck and Snower, 2002). Other researchers have confirmed this view, and it is reasonable to believe that unemployment is dependent on its previous values (Birch-Sørensen and Whitta-Jacobsen, 2010, p.286). Persistence is also likely to be present in the case of youth unemployment. This is tested in the article by Caporale and Gil-Alana (2014), who concludes that youth unemployment is persistent.

Most papers that analyses the causes of aggregate unemployment uses panel data regression analysis. The majority of papers do this with a static version, not taking unemployment persistence into account. This could be a weakness since it is established that unemployment is likely to be persistent (Blanchard and Summers, 1986), (Caporale and Gil-Alana, 2014). Two papers that take the persistence into account are the ones by Scarpetta (1996) and Nickell et al. (2005). Both do this by adding lagged unemployment as an explanatory variable. As mentioned in both papers, this leads to potentially biased estimators, since the lagged unemployment is correlated with the other explanatory variables when using country-specific effects (Nickell,

1981). Nickell et al. (2005) acknowledges the potential bias but proceeds with the analysis without correcting for it. Scarpetta solves the problem by using country dummies (Scarpetta, 1996, p.73). Another way of solving the problem is to use the generalized method of moments-estimator of the dynamic model (Arellano and Bond, 1991).

For the papers that look at the interaction between shocks and institutions, they mostly use a time-invariant measure of the institutional variables. In Blanchard and Wolfers (2000), Nickell et al. (2005) and Bassanini and Duval (2006) the measure of the time-invariant institution is constructed by taking the country average of the institutional variable and then taking its deviation from the sample average. One argument for the use of time-invariant measure instead of a time-variant one is that the institutional variables do not change radically from year to year. Bassanini and Duval (2006) argue in the same way, by saying that the variation among countries is bigger than the variation among time. When Blanchard and Wolfers (2000) adds time variation among institutions, the model results in a lower R-squared than when institutions are time-invariant.

The contribution to the existing literature from this paper will be the following. First, data from the latest years will be added to the analysis. Tomić (2018) analyses youth unemployment until 2014, but mostly with other variables than in this paper. Other articles with the same variables (Banjeri et al. 2015) and Choudry et al. (2013) have 2012 and 2009 as their latest year. This paper, therefore, adds the years 2012-2017, where unemployment rates recovered after the crisis. The time frame will include the years before, during, and after the financial crisis, which makes it an interesting period to analyse. Secondly, the perspective of the interaction between shock and institutional variables to youth unemployment and adult unemployment will be added. The interaction perspective has not yet been analysed with a measure of the shock that the financial crisis of 2008 imposed. Lastly, the variable of government spending as a share of GDP will be added to the analysis to investigate how changes in the size of the public sector of a country affect unemployment. This variable has to my knowledge not yet been analysed before. Tomić (2018) argues that this could affect unemployment rates, but do not test it in her analysis.

3. Specification

The variables that will be in the regression analysis will be specified in a theoretical setting in this section. After a short introduction to labour supply and demand, the unemployment rates will be introduced. These are the dependent variable in the regression. After that, the different shock and institutional variables will be specified. The section will be finished with the final specification of the econometric model.

3.1 A short introduction to labour demand/supply theory

In theory, the number of people who want to work and the number of people firms want to hire is determined by the real wage. The total number of people who want to work make up the labour supply, and the total amount of people whom firms want to hire make up the labour demand. There is a level of the real wage where the labour supply and the labour demand are equal. This level is the equilibrium level, and since there are as many people supplying labour as there are people demanded by firms, no individual is unemployed. Unemployment arises when the supply of labour exceeds the demand for labour, caused by a real wage higher than the equilibrium wage. If wages could adjust to the equilibrium level immediately, there would be no unemployment. However, since the wages adjust slowly in practice, unemployment will occur. The reasons that the wages adjust slowly are due to different institutional and policy measures. This slow wage adjustment is referred to as wage rigidity. The wage rigidity is often divided into two parts. Short-run wage rigidity implies that nominal wages can adjust to the equilibrium level, only that it takes some time for markets to adjust the wages. Long-run wage rigidity implies that even in the long run, wages cannot adjust to the equilibrium level, giving rise to an inefficient labour market. This is the theoretical explanation of why unemployment is likely to be persistent when hit by shocks. Since the wage does not adjust to the equilibrium level, there will be an excess of labour supply. This excess of labour supply gives rise to what is called structural unemployment. For this to be reduced, institutions and policies that affect the wage rigidity must be changed (Birch-Sørensen and Whitta-Jacobsen, 2010, p.291-295).

3.2. The dependent variables: The Unemployment rates

The labour force in a country at some point in time consists of all people who are willing to work. There are two types of individuals in the labour force, the people with a job and the people without a job. The people with a job is the employed, and the people without a job are the unemployed. Dividing the number of unemployed people with the total labour force gives the unemployment rate (Birch-Sørensen and Whitta-Jacobsen, 2010, p.279-280).

The labour force can be divided into groups of different characteristics, such as age. One can, therefore, define the youth unemployment rate as the number of unemployed young people divided by the total labour force of young people. A typical age boundary of the young population is 15-24 years. In the same sense, one can also define the adult unemployment rate to be the unemployment rate of people between 25-64 years old.

The different unemployment rates will be the dependent variable in the regression analysis.

3.3 The explanatory variables: Shock Variables

3.3.1 The GDP-Gap

The empirical relationship between unemployment and GDP-growth is called Okun's law. The relationship is negative, meaning that an increase in GDP-growth will lead to an absolute change in the unemployment rate. Okun's law implies that unemployment is related negatively to the business cycle (Birch-Sørensen and Whitta-Jacobsen, 2010, p.283).

3.3.2 The Real Interest Rate

The real interest rate is the long run nominal interest rate when inflation is subtracted. In an economy whit a standard Cobb-Douglas production function, the price of capital is the real interest rate. The real interest rate affects the accumulation of capital. At a given wage rate, shifts in the real interest rate will affect how much firms can invest in labour, and thereby, the number of people firms can afford to hire. The price of labour in this setting is the real wage rate. When the price of capital changes, the price of labour also changes, leading to a changed wage rate. When the market adjusts to the new wage, the share of unemployed people will change depending on the direction of change in the interest rate. In theory, an increase in the real interest rate should lead to an increase in unemployment and vice versa (Blanchard and Katz, 1997).

3.3.3 Total Factor Productivity

Besides capital and labour, the production in Cobb-Douglas production function is affected by technology or total factor productivity. When factor productivity increases, the effectiveness of capital increases, meaning the same amount of workers produce more output. Productivity is connected to unemployment through the channel of real wages. In equilibrium, productivity and real wages grow at the same rate. When technological changes appear, the growth of factor productivity is affected. Hence, productivity grows faster than real wages. Since it takes time for workers to change their expectations of the wage, the unemployment rate is affected in the

short-run. During the time it takes for wages to adjust to the same growth rate as productivity, the share of unemployed people will be affected (Ball and Moffitt, 2001). The expected direction of impact from an increase in the TFP-growth is a decrease in the unemployment rate and vice versa.

3.4 The Explanatory Variables: Institutional variables

3.4.1 The Tax Wedge

One part of the wage formation is the tax wedge. The wedge between labour costs to employers and workers consumption wages affects the wage level in different ways. In a labour market that is perfectly competitive, the tax would be entirely put on the individual worker leaving unemployment unchanged and a lower net wage for the individual. In practice, the labour market is not perfectly competitive, and wages are set above the equilibrium wage level. One reason for this is that workers negotiate the net wage, wanting as low tax rate as possible on their income (Bassanini and Duval, 2006, p.60, 70). Therefore, an increase in the tax wedge is expected to increase the unemployment rate.

3.4.2 Active Labour Market Policies

Active labour market policies are used to increase the experience and skills of unemployed individuals, making them eligible for more jobs. Being eligible for more jobs are expected to increase the search intensity of the unemployed people and also make the matching process on the labour market more effective (Calmfors et al. 2001, p.77-78). It can also reduce the cost of hiring new people for employers. Therefore, the influence of outsiders on the labour market can be increased (Lindbeck and Snower, 2001). Spending on ALMP is expected to reduce the unemployment rate.

3.4.3 Union Density

One agent that plays a role in the wage setting process is trade unions. Workers organize in trade unions to set the wage together with representatives from the firms. Therefore, the labour market cannot work competitively, but in a monopolistic setting. Since workers are interested in as high wages as possible, trade unions often set a wage that is higher than the equilibrium real wage. Since the wage is higher than the equilibrium wage, workers will supply more labour than is demanded by firms, and unemployment will therefore occur. In a fully competitive market, the wage would now be pressured downwards. However, since the labour market is not sufficiently competitive, the trade union will make sure the wage rate that the set are held with the consequence of unemployment (Birch-Sørensen and Whitta-Jacobsen, 2010, p.295).

3.4.4 The Share of Temporary Employment Contracts

The theory of insiders and outsiders on the labour market have been used to discuss the potential sources of unemployment. It divides the labour force into two categories: insiders and outsiders. Insiders are the employed people that are covered by labour turnover costs. Outsiders are, on the other hand the people, unemployed or employed that are not covered by these turnover costs. The labour turnover costs are associated with firing employees and hiring and training costs for newly employed people. One consequence of these labour turnover costs is an increasing market power of the insiders. This market power can be used by the insiders to push up wages, and thereby giving outsiders a smaller opportunity of becoming an insider (Lindbeck and Snower, 2002).

One factor that affects this divergence is EPL. A high degree of EPL should increase the labour turnover costs, giving a stronger position for insiders. This can affect unemployment in two different ways. First, it becomes more expensive to hire new people, which should increase unemployment. However, since it also means that it becomes more expensive to fire people who already have a job, fewer people lose their jobs and become unemployed, which should reduce aggregate unemployment. Therefore, the effect of strict EPL on unemployment is, in theory, hard to predict. One measurement of EPL is the share of temporarily employed people on the labour market. The people who are temporarily employed are associated with low or no labour turnover costs, which means that they are outsiders. A higher share of temporarily employed people in the labour market could affect unemployment in two ways. It reduces the cost of hiring new people, which should lead to lower aggregate unemployment. It also reduces the cost of firing people with a temporary contract, which leads to a bigger probability of losing a job. This effect could be different for different age groups, since young people are more likely to be outsiders than adults.

3.4.5 The Replacement Rate

The replacement rate, i.e., the share of the previous income an unemployed worker receives in unemployment benefits is expected to affect the unemployment rate through different channels. One effect of a high replacement rate is that individuals' reservation wages are increased. An increase in the reservation wage should reduce the search intensity for the unemployed people, and also the willingness to accept a job offer. This can increase the wage claims of the currently employed individuals through increased bargaining power in unions, and thereby increase the real wage (Holmlund, 1998). Both of these effects of an increased replacement rate are expected to increase the share of unemployed people.

3.4.6 Public Spending

For countries where the share of government out of total GDP is high, the public sector is big relative to the private sector and therefore has relatively more individuals employed in the public sector than the private sector. Public sector jobs are associated with high labour turnover costs, due to legal protection from being fired (Luechinger et al. 2008). There is also a requirement for experience and specific education for public sector jobs. This could lead to a divergence between insiders and outsiders on the labour market, where the insiders put an upwards pressure on the real wage and thus increase the unemployment rate. Therefore, one could expect countries that have a big public sector relative to the private sector to have a higher share of unemployed individuals. One could also expect this effect to be bigger for the young population than for the adult population since young people have less education and experience on average.

3.5 Explanatory Variables: Interactions between Shocks and Institutions

When countries are hit by shocks that affect unemployment, the real wage rate is affected, and unemployment occurs. No country has a labour market that is perfectly competitive, implying wage rigidity and that it will take time for wages to adjust to the equilibrium level. How fast the wages adjust depends on the institutional settings in the country. The slow wage adjustment is one explanation of why countries have a considerable variation in unemployment rates, even when similar adverse shocks hit the countries (Blanchard and Wolfers, 2000). Depending on the type of shock and institutional variable, these interactions will have different effects on the unemployment rates.

3.6 Econometric specification

The econometric specification will be the following. For a random effects model, the panel data regression will look like this:

(1) $y_{it} = \beta_0 + x'_{it} * \beta + \alpha_i + u_{it}$ where $u_{it} \sim IID(0, \sigma_u^2)$.

For a fixed effects model, all individuals will have an intercept that is different from the other countries. The regression will look like this:

(2) $y_{it} = \alpha_i + x'_{it} * \beta + u_{it}$ where $u_{it} \sim IID(0, \sigma_u^2)$.

Where *i* is the group variable and *t* is the time variable. (Verbeek, 2017, p.386-391).

For choosing between the two models, one can perform a Hausman test. In the Hausman test, both a fixed effect and a random effect regression is performed. The null hypothesis is that there is no difference in coefficients, and the alternative hypothesis is that there is a difference in coefficients. If the null hypothesis is rejected, the way to proceed is to use the fixed effects model (Verbeek, 2017, p.394-395).

Besides different specifications to test the robustness of the estimates, this paper will use two main specifications.

The first one is the static panel data regression, which will be specified as equation (2). y_{it} is the unemployment rate, and x'_{it} is the set of explanatory variables used in the analysis. β is the marginal effect of these explanatory variables.

The second specification will include interactions between shocks and institutions. In this specification, shocks will be observable and interacted with the institutional variables. This interaction will take the form of a multiplicative term. Institutions will in this specification be the deviation of the country average from the entire sample average. For every country and institutional variable, an average over the whole time-period will be computed. After that, the country average will be subtracted from the average of the entire sample. In that way, institutions are time-invariant. The regression will look like this:

$$(3)\ y_{it} = \beta_0 + \sum_j \bar{x}_i^j * \beta_j + \left(\sum_j \gamma_l * Z_{it}^l\right) * [1 + \sum_j (\bar{x}_i^j - \bar{x}^j)] + \alpha_i + u_{it}$$

$\sum_j \bar{x}_i^j * \beta_j$ is the time-invariant measure of the institutional variables. γ_l is the coefficient on the shock, and Z_{it}^l is the observed shock *l* for country *i* in time-period *t*. $\bar{x}_i^j$ is the country *i* average of institution *j*, over the entire time periods. $\bar{x}^j$ is the entire sample average for institution *j*. Multiplying the two parenthesis in (3) gives the interaction term. Since the institutional variable is time-invariant, fixed effects will lead to collinearity of the institutional variables. This collinearity imposes the use of random effects, making equation (3) to be a version of equation (1). The multiplicative term makes this specification is non-linear.

4. Data

In the analysis of this paper, data from 25 countries from the OECD is used. The countries are developed countries, and most of them are European countries. Even though there exists heterogeneity among countries in Europe when it comes to labour market behaviour, the countries are similar enough in the sense of being developed and industrial countries to draw credible conclusions. An example of the heterogeneity among countries in unemployment rates can be seen in figure 3. The unemployment rate in the sample varies from slightly below 5% for Switzerland, to above 25% for Greece.

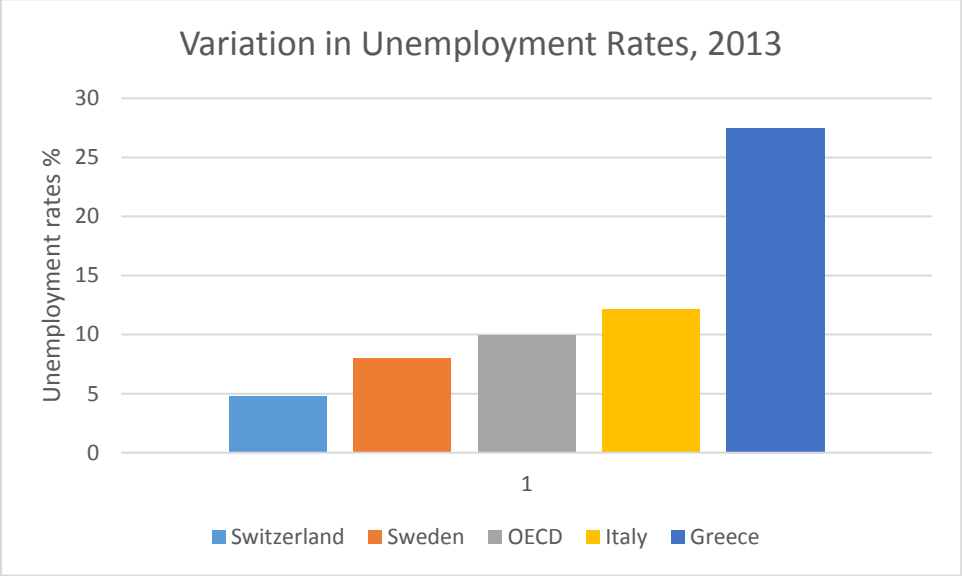

Figure 3. Variation in Unemployment rates, 2013.

The time period of interest in this paper is 1999-2017. The data is gathered on an annual basis for these 19 years. The time-period is an interesting period in the sense that the global financial crisis of 08/09 occurred in the middle of the sample which can be seen as a big shock to the business cycle, and therefore affecting unemployment- and youth unemployment rates which increased in many countries during the recession. Ten years after the crisis, countries have had many years to recover from the recession. The variation among time can be seen in figure 4.

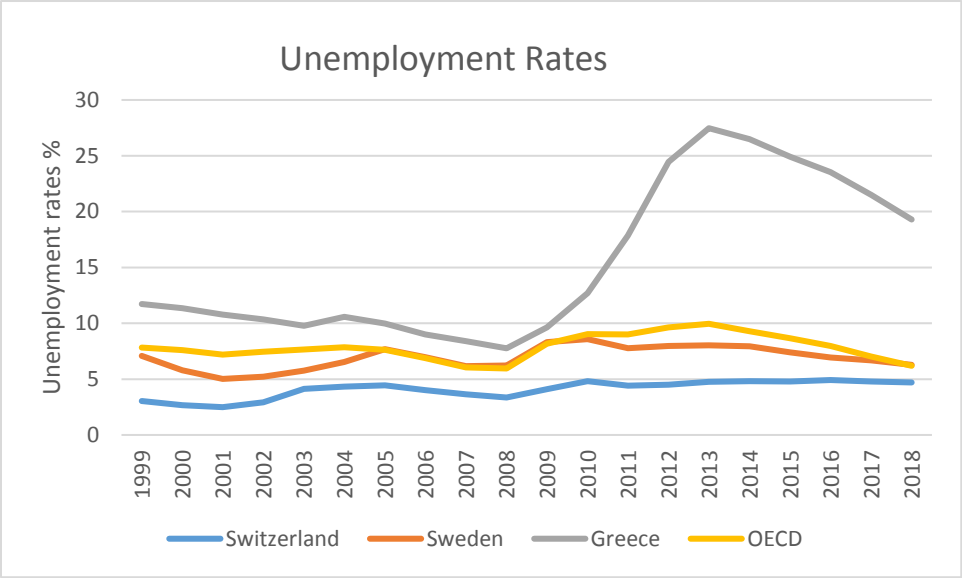

Figure 4. Variation in Unemployment Rates over Time.

Descriptive statistics can be found in the appendix. In table A1:3 in the appendix, the mean and the standard deviation of the total unemployment rates for all countries in the sample are shown. The average unemployment rate for all countries throughout all years is equal to 7.96%. The tables A1:1 and A1:2 depict the same summary statistics for youth unemployment and adult unemployment. As can be seen in the tables, youth unemployment is higher than the adult unemployment, with a mean of 17.63% compared with 6.94% for the adult population. The standard deviation is also higher for the youth population than for the adult population, implying a bigger variation among countries and over time for the youth population. Table A2:1-2 shows the descriptive statistics for the explanatory variables used in the analysis.

4.1 The dependent variables

The dependent variables are the different types of unemployment rates, total-, youth- and adult unemployment. The definition of the unemployment rate is as previously mentioned the share of people in the workforce who are currently without a job and is currently seeking for a new job.

Total unemployment: This is the percentage of people unemployed in the whole working age population.

Youth unemployment: Youth Unemployment is the share of people between 15-24 years old who are unemployed.

Adult unemployment: This is the share of unemployed people between 25-64 years old.

4.2 Explanatory variables

Active labour market policies (ALMP): ALMP is a measurement of how much the government in a country spends on these policies as a share of GDP.

Temporary employment contracts: This variable is the share of the employment contracts on the labour market that is of a temporary character. This measure can be seen as a measurement of employment protection legislation. An index on employment protection legislation exists in the OECD database, but only have data until 2013. Therefore, the share of temporary employment contracts is used as a measure of EPL, since this is one of the variables that is used in the EPL-index.

The replacement rate: The measure is an average replacement rate for different durations of the unemployment spell, for one specific family situation. The durations are 1 year, 3 years and 5 years, and the family situation is a single person with a previous income of 67%.

The tax wedge: The tax wedge is the average tax wedge in the country. This is the wedge between labour costs to employers and workers consumption wages affects the wage level in different ways.

Union density: The variable union density is the percentage of workers who are connected to a union out of total employees in the labour market.

The public sector: The variable on the public sector is the share of government spending out of total GDP.

GDP-gap: The GDP-gap is the deviations of the real GDP from the trend GDP computed with an HP-filter. This measure is computed by OECD (2018).

The real interest rate: The real interest rate is the 10-year nominal interest rate with inflation subtracted. [1]

Total factor productivity (TFP): This is the Solow residual, calculated as growth in GDP minus the growth in the capital stock and the labour force. TFP-growth is a measure of the yearly technological change. [2]

Total factor productivity and the share of government spending are withdrawn from the Penn world table (Feenstra et al. 2015). All other variables are gathered from OECD (2019).

[1] The Real Interest Rate = 10-year nominal interest rate - inflation
[2] TFP-Growth= GDP-growth – (1/3)*Capital-growth – (2/3)*Labour-force-growth

4.3 Data problems/limitations

Some potential problems could arise with the use of this data.

Missing values is one potential problem with the data set used. If the values are missing systematically, this could lead to an unbalanced panel and biased estimators (Verbeek, 2017, p.433-434). The most important variables in this paper are the unemployment rates. There were few missing values for these rates, and the ones missing could be collected from Eurostat (Eurostat, 2019), resulting in no missing data on the unemployment rates. For most of the explanatory variables, there are some, but only a few missing values, and they appear to be missing randomly. This should, therefore, not be a problem leading to misleading estimators. Iceland, Latvia and Lithuania were left out of the analysis because of many missing values. Some variables have more missing values than others, for example, ALMP and the Union density. Both ALMP and Union density only have data until 2016. The values for 2017 is proxied by the 2016 values to be able to make full use of the other variables that have data for the entire time period. This approximation should not affect the results.

Another potential problem could be omitted variable bias, namely leaving out variables that are important in explaining the unemployment rate. Omitted variable bias could lead to explanatory variables becoming correlated to the error term, making the variables endogenous. Endogeneity can lead to biased estimators and false inference (Verbeek, 2017, p.146-147). This could be a problem in the analysis of this paper. However, including too many variables that are similar to each other could, on the other hand, result in multicollinearity in the regressions. Potential variables that are left out of this paper but that has been found significant in other papers are the degree of centralization of collective bargaining, a variable on product market regulation, labour demand shocks, the share of homeowners and union coverage. The reasons for leaving out these variables are either because of poor access to data, or potential multicollinearity.

5. Method

The method used is panel data regression analysis[3], with the country-level data with yearly frequency. The first version of the regression is a static regression where the youth and adult unemployment rates will be regressed on all variables except the public spending variable. After that, ALMP will be dropped, and public spending will be added in the next version. Results will be compared between the age groups.

Thereafter, interactions between shocks and institutions will be analysed. This section will be done in a similar manner as Blanchard and Wolfers (2000) but adding the divergence between youth and adult unemployment to the analysis. The focus will be on the interaction between observable shocks and institutions. As specified in equation (3) institutions will, in this setting, be time-invariant, leaving the focus on shocks and the divergence in institutions among countries. For simplicity, 2 institutional variables will be left out. Interactions between the shock variables: the GDP-gap, TFP-growth and the real interest rate, and the institutional variables: the tax wedge, the replacement rate and the share of temporary employment contracts are tested.

For checking the robustness of the estimates in the different regressions, sensitivity analysis will be performed. The sensitivity analysis is done in several ways. For example, including different specifications of the regressions, dropping variables and testing with alternative data. Another way to check the robustness is to divide the sample into smaller subsamples, to reduce the heterogeneity among the sample.

Several tests will be performed to determine the specification of the regression. The Hausman test will be performed to choose between the random and the fixed effects model.

A test for the presence of heterogeneity among countries will also be conducted. If all explanatory variables are exogenous, autocorrelation in the error terms will not lead to inconsistent estimators, but the standard errors will be inefficient. To avoid inefficient standard errors and thereby also to make a false inference, one can adjust the standard errors to correct for heteroscedasticity.

5.1 Estimation problems

Some potential problems could arise with the use of this method. These problems could result in endogeneity and lead to biased and inconsistent estimators

[3] All regressions, tests and calculations are done in Stata/IC 15.1

One potential problem that could arise is simultaneity bias. This bias is the problem of reverse causality, where two variables cause each other. One example of that in this paper could be the relationship between ALMPs and unemployment. It could be the case that higher spending on ALMPs is associated with reduced unemployment, but it could also be the case that an increase in unemployment could lead to an increase in spending on ALMPs. The way to correct for simultaneity bias is to use instrumental variables. Due to the lack of good instruments, the ordinary variables with be used, with this problem being kept in mind.

Another potential problem could be that if the variables in the regression are not stationary, the result of the regression could be spurious. There exist some unit-root tests and cointegration tests for panel data to test for the issue of stationarity, but these tests have received the critique of being unreliable (Verbeek, 2017, p.423-424). These unit-root tests have the null hypothesis of all panels containing a unit root and the alternative hypothesis of panels being stationary. For the test to reject the null hypothesis, all panels must be stationary. To know which ones that are stationary or not if the test is not rejected require much work. One way to solve the problem of unit root-variables is to take the first difference of these variables and then regress on those variables. The problem of a unit root should not be a big one the regressions in this paper. Most of the data are ratios between 0 and 1 and do not have a trending pattern. Therefore, stationarity will be assumed, and regressions will be performed on the original variables. The problem will, however, be kept in mind when analysing the results.

5.2 Methodological limitations

The selection of method in the statistical analysis of this paper was a choice between a static and a dynamic panel model. Literature has shown that unemployment seems to be persistent, and this persistence is captured in a dynamic model. However, the static model was selected for two reasons. The first reason is that the focus of this paper is not on the persistence mechanism of unemployment. The focus is on the actual causes of unemployment, and the difference between the young and the adult population. The second reason is that most papers that analyses the development of the unemployment rate uses a static model. The use of a static model makes it easier to compare the results of this paper to the existing literature. Even though the main focus will be on the static model, a dynamic model will be conducted as a part of the sensitivity analysis.

6. Results

6.1 Hausman Tests and Test for Heterogeneity

The results from the Hausman tests are shown in the appendix. In table A3:1 in the appendix, the result from Hausman tests for the main regressions are presented. As can be seen, the p-value is lower than 0.05 for all regressions. Therefore, the null hypothesis of no difference in coefficients is rejected, suggesting the use of fixed effects in the regressions. The same conclusion is drawn when looking at the Hausman tests for the regressions that include the public spending variable. The results can be seen in table A3:2, where all p-values indicate that the null hypothesis should be rejected. Due to the results of the Hausman tests, fixed effects will be used in all regressions performed in the analysis, with the exception of the regression including interactions, since this in this regression, random effects have to be used to get around the problem of collinearity.

Table A3:3 shows the result for the test of the presence of heterogeneity among countries in the first two regressions. The result clearly shows the presence of heterogeneity. Therefore, heterogeneity is likely to be present in all regressions. Robust standard errors will, therefore, be used in all regressions in this paper.

6.2 Static model

The result from the main regression is presented in table 1. For every age group, the GDP-gap is significant, affecting the aggregate unemployment rate negatively. It can also be seen that youth unemployment is affected by the business cycle to a greater extent than adult unemployment is. The real interest rate is significant for both age groups, although only at the 10%-level for the young population. The coefficient is positive, suggesting that an increase in the real interest rate increases the aggregate unemployment rate. Total factor productivity is also significantly positive at the 1%-level for the adult unemployment rate, and at the 5%-level for the youth unemployment rate. The replacement rate and the tax wedge seem to increase unemployment. ALMP and the share of temporary employment contracts seem to reduce unemployment. The relationship between union density and unemployment seem to be insignificant.

Table 1. The Main Regression

VARIABLES	(1) UNEMP	(2) YUNEMP	(3) AUNEMP
GDP	-0.653***	-1.335***	-0.609***
	(0.055)	(0.131)	(0.054)
Real Interest Rate	0.156*	0.354*	0.161**
	(0.086)	(0.184)	(0.077)
TFP-Growth	0.117***	0.177**	0.118***
	(0.029)	(0.065)	(0.028)
Union Density	0.031	-0.156	0.021
	(0.061)	(0.136)	(0.047)
RepR	0.048*	0.127***	0.033
	(0.023)	(0.044)	(0.022)
ALMP	-1.538	-6.784***	-1.191
	(1.122)	(1.884)	(1.049)
Tax Wedge	0.152	0.206	0.178**
	(0.089)	(0.206)	(0.074)
TempEmp	-0.213*	-0.446*	-0.189*
	(0.115)	(0.254)	(0.097)
Constant	1.064	15.402	-0.443
	(4.333)	(9.702)	(3.453)
Observations	429	429	429
R-squared	**0.721**	**0.701**	**0.729**
Number of Countries	25	25	25

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

6.3 Adding Public Spending

The result when adding the share of government spending out of total GDP is presented in table 2. The effect of the variable seems to differ between the age groups, being positive for the youth unemployment rate and being negative for the adult unemployment rate. However, the effect is significant for neither of the rates. In this setting, the real interest is no longer significant.

Table 2. Adding Public Spending to the Main Regression

VARIABLES	(1) UNEMP	(2) YUNEMP	(3) AUNEMP
GDP	-0.625***	-1.219***	-0.588***
	(0.061)	(0.153)	(0.060)
Real Interest Rate	0.115	0.270	0.123
	(0.088)	(0.178)	(0.082)
TFP-Growth	0.106***	0.177**	0.105***
	(0.031)	(0.071)	(0.029)
Union Density	0.021	-0.126	0.014
	(0.053)	(0.125)	(0.040)
RepR	0.047**	0.102**	0.033
	(0.022)	(0.048)	(0.021)
Tax Wedge	0.133	0.159	0.149**
	(0.083)	(0.206)	(0.068)
TempEmp	-0.243*	-0.510*	-0.219*
	(0.124)	(0.295)	(0.108)
Public Spending	1.587	19.851	-1.784
	(6.965)	(13.061)	(5.840)
Constant	1.451	11.634	0.995
	(4.390)	(10.117)	(3.494)
Observations	448	448	448
R-squared	0.697	0.655	0.706
Number of Countries	26	26	26

6.4 Interactions between shocks and institutions

Interactions between different shock and institutional variables will be added to the regressions in this section. The result of the regression, when including interactions, can be seen in Table 3. Significant coefficients are found for the GDP-gap interacted with the replacement rate, the tax wedge and the share of temporary employment contracts. The interaction between the real interest rate and the share of temporary employment contracts is also found to be significant for both young people and adults.

Table 3. Observable shocks interacted with institutions

VARIABLES	(1) UNEMP	(2) YUNEMP	(3) AUNEMP
GDPGAP	-0.566***	-1.206***	-0.523***
	(0.047)	(0.122)	(0.042)
Real Interest Rate	0.214***	0.308**	0.201***
	(0.069)	(0.151)	(0.064)
TFP-Growth	0.117***	0.125**	0.116***
	(0.027)	(0.054)	(0.027)
RepR	-0.068**	-0.214***	-0.058**
	(0.028)	(0.065)	(0.025)
TempEmp	-0.119	-0.344**	-0.106
	(0.095)	(0.162)	(0.090)
Tax Wedge	-0.083**	-0.253*	-0.073**
	(0.042)	(0.138)	(0.033)
GDPGAP#RepR	0.005**	0.007	0.006***
	(0.002)	(0.007)	(0.002)
GDPGAP#TempEmp	0.018***	0.053***	0.019***
	(0.006)	(0.012)	(0.006)
GDPGAP#TaxWedge	-0.029***	-0.047**	-0.026***
	(0.008)	(0.018)	(0.007)
RealInterestRate#RepR	-0.004	-0.009	-0.004
	(0.003)	(0.007)	(0.003)
RealInterestRate#TempEmp	-0.041***	-0.056*	-0.038***
	(0.013)	(0.031)	(0.013)
RealInterestRate#TaxWedge	-0.003	0.005	-0.005
	(0.011)	(0.020)	(0.010)
TFPGrowth#RepR	-0.002	-0.001	-0.002
	(0.002)	(0.004)	(0.002)
TFPGrowth#TempEmp	-0.000	-0.005	0.000
	(0.005)	(0.009)	(0.005)
TFPGrowth#TaxWedge	0.004	0.013*	0.003
	(0.003)	(0.008)	(0.003)
Constant	6.707***	15.759***	5.723***
	(0.445)	(1.056)	(0.396)
R-squared	**0.733**	**0.712**	**0.745**
Observations	490	490	490
Number of Countries	25	25	25

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.

6.5 Sensitivity Analysis and Robustness Checks

In this section, different robustness checks are performed to test the validity of the regression results. Checking for the robustness is done in several ways. These include different specifications of the regressions, dropping variables. Division of the sample into smaller subsamples are also done.

6.5.1 Fixed Time Effects

In table A4 in the appendix, fixed time effects are added to the specification. There are some differences to the main specification. The real interest rate is now only significant for the adult unemployment rate, and at a lower significance rate. TFP-growth is still significant, but only at a lower significance level. Otherwise, the differences are small. The replacement rate is now significant for the adult unemployment. The significance level of ALMP on youth unemployment and the tax wedge on adult unemployment has gone down to the 10%-level, whereas it has increased to the 5%-level for the share of temporary employment contracts.

Adding fixed time effects to the specification with public spending does not affect the result; the variable is still insignificant in explaining the unemployment rates. This can be seen in Table A5.

When adding fixed time effects to the regression including interactions, the biggest difference is that the interaction between the GDP-gap and the replacement rate is no longer significant. Otherwise, the results are similar to the ones in table 3. The result can be seen in table A6.

6.5.2 Dropping Variables

As was mentioned in the data section, some variables in the analysis could be associated with multicollinearity. The problem of multicollinearity could lead to insignificant results even though a relationship exists. In the main regression, dropping variables do not change the results from table 1 that much. When dropping the GDP-gap, the explanatory power of the model reduces significantly. The TFP-growth becomes negative but insignificant when dropping the GDP-gap. The two variables could be correlated, but if one variable were to be left out, it should be the TFP-growth due to the higher explanatory power of the GDP-gap.

The tax wedge could be correlated with the public spending variable. Dropping the tax wedge in the regression of table 2 makes the public spending variable significant positive for the youth

unemployment rate. But since being insignificant in all other specifications, no firm conclusions are drawn from this result.[4]

6.5.3 Dividing the Sample

One way to reduce the heterogeneity among countries and time is to divide the sample. The sample was divided into two groups by their country averages, one low and one high average unemployment group. The time was divided in 2008, where one group has the years of 1999-2008 and one group with the years 2009-2017. This division does not result in a big change in the results. The biggest difference is that when dividing the sample into two periods, is that ALMP is only significant for the years 2009-2017, for the youth unemployment.

A regression where the years of the financial crisis of 2008-09 and one year before and after are left out is also performed. The result of this specification is similar to the main specification. The one big difference is that in this specification, TFP-growth is not significant. Not very surprising since the crisis resulted in a big shock to the TFP-growth, together with big increases in the unemployment rates.

6.5.4 Adding Lagged Unemployment

To avoid biased estimators, adding lagged unemployment is done by using the GMM-method by Arellano and Bond (1991). The result is shown in table A7 in the appendix. Table A7 shows that unemployment is likely to be persistent. Two lags of unemployment are significant for both adult- and youth unemployment. This gives support to the hysteresis model presented by Blanchard and Summers (1986), and to the result of Caporale and Gil-Alana (2014). The effect of the GDP-gap is still significant, but the effect seems to be smaller than when not taking lagged unemployment into account. Otherwise, the results are quite similar to the result of the main regression in table 1.

When adding lagged unemployment to the regression with public spending, the coefficient on the public spending variable becomes significantly positive for both age groups. This can be seen in table A8.

[4] Tables from the regressions in this section are left out. They are available upon request.

7. Discussion

In this section, the results will be discussed.

It is not surprising that the coefficient on the GDP-gap is significant and negative in all specifications. As have been proven before, unemployment is dependent of the business cycle. It is also clear that the youth unemployment rate is more sensitive to the business cycle than the adult unemployment rate which gives further support to the conclusion of Tomić (2018), Banjeri et al. (2015) and Caporale and Gil-Alana (2014).

Shocks to the real interest rate seem to be associated with an increase in the unemployment rates. The coefficient is positive and significant in most specifications, although not significant when holding time effects fixed. Therefore, shocks to the real interest rate are likely to increase unemployment, but the result in this paper is not as robust as the GDP-gap. The result is consistent with previous research, giving support to the findings of Blanchard and Wolfers (2000) and Bassanini and Duval (2006).

The coefficient on the TFP-Growth is in all specifications positive. The positive sign comes as a surprise since both previous literature and theory tends to say the opposite. For example, Blanchard and Wolfers (2000) and Bassanini and Duval (2006) concludes that the growth in factor productivity reduces unemployment. One reason for this could be that the growth in productivity is correlated with the business cycle and that the inclusion of the GDP-gap changes the effect of the TFP-growth. Even though the variable is significant in most of the settings, no firm conclusion of this is drawn. There is still reason to believe that the growth in total factor productivity reduces unemployment, even though the analysis in this paper seems to show the opposite.

The replacement rate seems to increase unemployment in all specifications. For the youth unemployment rate, the coefficient is significantly positive in all settings. For the adult unemployment rate, it is only significant when holding time effects fixed. It is likely that a higher replacement rate increases the unemployment rate. This is in line with previous research, such as Bassanini and Duval (2006). It is a little bit surprising that the effect seems to be stronger for the youth unemployment rate since young people have lower reservation wages and have also on average had a lower income than adults, benefitting less from a high replacement rate.

The effect of union density on unemployment seems in the analysis in this paper to be mixed. The coefficient on youth unemployment is negative and positive on adult unemployment, indicating that union density affects the age groups differently. However, since the effect is

insignificant, this result should be interpreted carefully. If union density is high, workers have more power in the wage setting process, which in theory should drive up the real wage. This is expected to affect the young population more since they compete for low-paid jobs more than the adult population. This point is put forward by Scarpetta (1996), who argues that young people should be affected more since they are more likely to be outsiders on the labour market. However, Scarpetta argues that the relationship is weak. It is likely that union density has an increasing effect on unemployment for both age groups but given the result of this paper and the argumentation of Scarpetta (1996), the relationship is likely to be weak. Bassanini and Duval (2006) also get insignificant values of union density in their paper. They argue that one reason for this is that union density may poorly capture the bargaining power of workers.

The tax wedge seems to have an increasing effect on the unemployment rates in the setting of this paper. However, it seems to be significant for the adult unemployment rate only. The positive effect gives support to previous research, for example, Banjeri et al. (2015) and Bassanini and Duval (2006). It seems likely that a high tax wedge leads to higher unemployment rates, even for the young population. Since an increase in the tax wedge leads to an increase in the real wage, young people should also be affected.

Spending on ALMP seems to have a negative effect on unemployment. The effect is only significant on the youth unemployment rate in the main specification. In absolute value, the effect is bigger for the youth unemployment rate than for the adult unemployment rate. This suggests that higher spending on ALMP benefits the young population more. The significance level is reduced when imposing fixed time effects. When dividing the sample into two periods, ALMP is only significant for the years 2009-2017. Although losing significance level when checking the robustness, the effect is still negative. It is, therefore, likely for ALMP to have a negative effect on unemployment. This is consistent with previous research, for example, Choudry et al. (2013), Banjeri et al. (2015) and Scarpetta (1996). As Kluve (2006) and Calliendo and Schmidl (2016) argue, the effect is likely to be negative, but the effect varies with the type of policy, and among countries Martin (2014).

A high level of EPL has been found to increase unemployment in some papers (Scarpetta, 1996), and to be having an unclear effect in some papers (Bassanini and Duval, 2006). The share of temporary employment contracts is one measure that is included in the EPL-index. The one paper to have analysed the effect of the share of temporary employment contracts found a positive effect on unemployment (Banjeri et al. 2005). That is in contrast to the result of this paper, which shows that the share of temporary contracts seems to reduce both youth- and adult

unemployment. However, as can be seen in table 1, the coefficient is only significant in the 10%-level. The result stands when checking the robustness, making it more likely to be the case that in the setting of this paper, the share of temporary employment contracts reduce unemployment.

The relationship between the share of government spending and unemployment is unclear. When added to the analysis, the effect is insignificant with high variation. When adding lagged unemployment to the regression with public spending, the coefficient becomes significantly positive (See table A8.). However, the result on the public spending variable is not very robust, and no firm conclusions are drawn from the significant result of table A8. A better measurement of this variable could potentially prove to more robust in explaining unemployment. For example, the share of workers in the public sector could prove a better explanation than the share of government spending. Reliable data on the share of workers in the public sector could not be found. OECD has one measurement on the share of government employment, which could be one measure of this variable. However, the data did not exist in the time period of interest in this paper.

When looking at the interactions in table 3, some interactions seem to play a role in explaining the development of unemployment. The interactions between the GDP-gap and the institutional variables seem to be the most important interactions. When comparing the numbers between the two age groups, there are only minor differences. The interaction between the GDP-Gap and the replacement rate is found to be significant for the adult unemployment rate, but not for the youth unemployment rate. Otherwise, it seems to be similar results. Similar to Blanchard and Wolfers (2000), the model performs well in explaining the development of unemployment. However, the difference to the static model is quite small.

Comparing the result to the one in the static version of table 1, it does not seem to be the case that adding interactions improve the explaining power of the model. This gives credit to the conclusion of the paper by Nickell et al. (2005), who argues that interactions between shocks and institutions give no or only complementary understanding of the evolution of the unemployment rate. It is also a similar conclusion to the one from Bassanini and Duvall (2006), who argues that a static model with the GDP-gap and some institutional variables explain unemployment almost as good as when adding interactions between shocks and institutions. The result for the single variables should not be compared to the ones in table 1 since this is a non-linear setting and time-invariant measurements of the variables.

8. Concluding Remarks

It is clear that macroeconomic shocks hit the unemployment rates. The financial crisis of 2008-09 was an example of a big shock that hit all countries in the OECD, resulting in increased unemployment rates. One explanation to why the different magnitude of the effect on countries' unemployment rates, and the recovery after that, is different institutional labour market settings.

By imposing a static panel data regression framework on 25 OECD-countries during the period of 1999-2017, this paper has reached the conclusion that macroeconomic shocks, institutional variables and the interaction between shocks and institutions play a role in explaining the outcome on the labour market. The most influential shock variable in this analysis is the GDP-gap, meaning a close relationship between the business cycle and unemployment. Shocks to the real interest rate are in this paper found to have an increasing effect on the unemployment rates.

The replacement rate and the tax wedge seemed to be associated with an increase in the unemployment rate. Spending on ALMP and the share of temporary employment contracts was found to be associated with a decrease in the unemployment rates. The effect of union density and the size of the public sector measured as the share of government spending out of total GDP was found insignificant and unclear.

Some interactions between shocks and institutions are found to be significant, where the interactions with the GDP-gap are found to play the most crucial role in explaining unemployment. However, adding interactions to the model does not improve the explanation to a big extent. With that being said, labour market institutions play a role in affecting the labour market outcome when macroeconomic shocks hit an economy.

The implication for policymakers who wants to reduce unemployment is to reduce the magnitude of business cycles and try to stay as close to the trend as possible. Another implication is that policymakers should be aware that shocks to the real interest rate probably affect unemployment positively. This should be kept in mind when setting the nominal interest rate. Policymakers should also know that labour market institutions can affect the development of the unemployment rates when a macroeconomic shock hits an economy. The result of the analysis recommends the following. If the target is to reduce adult unemployment, a lower tax wedge and a lower replacement ratio seem to be most effective. If the target is to lower the youth unemployment rate, policymakers should spend more money on ALMPs and reduce the replacement rate. Increasing the number of temporary employment contracts is another way to potentially reduce unemployment. It should be kept in mind that this is the conclusions from

the analysis of this paper, with this specific set of countries, this specific period, and this specific econometric specification. The conclusions need not be of a general character.

For further research, it would be interesting to find new institutional variables or new measurements of already existing variables that can affect unemployment. One such variable could be another measurement of the public sector variable that was tested this paper. It would also be interesting to look at the interactions between shocks and institutions in explaining the persistence mechanism of unemployment. This is done shortly by Bassanini and Duvall (2006), but it would be interesting to see a more thorough analysis with the inclusion of data on the financial crisis of 2008-09. Many papers that analyses the influencing factors of unemployment do this on OECD-countries due to data quality. When data quality for other regions and other types of countries become better, it would be of big interest to analyse if these countries are affected by the same factors as OECD-countries. Another suggestion for further research is to look individually at countries that were affected very negatively by the crisis, such as Spain and Greece. The panel data approach provides a general explanation for all countries in the sample and not the specific explanation to the single countries mentioned.

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Appendix 1. Descriptive Statistics

Table A1:1. Adult Unemployment Rates.

AUNEMP	Mean	Std.Dev.	Freq.
Austria	4.29	0.63	20
Belgium	6.52	0.77	20
Czech Republic	5.62	1.54	20
Denmark	4.81	1.10	20
Estonia	8.61	3.30	20
Finland	6.91	0.88	20
France	7.76	1.03	20
Germany	6.89	2.33	20
Greece	13.79	6.96	20
Hungary	6.49	2.06	20
Ireland	7.00	3.80	20
Italy	7.90	1.81	20
Japan	4.05	0.69	20
Luxembourg	3.79	1.18	20
Netherlands	3.84	1.25	20
Norway	2.78	0.61	20
Poland	9.93	4.44	20
Portugal	8.24	3.56	20
SlovakRepub..	11.91	2.88	20
Slovenia	6.21	1.63	20
Spain	14.28	5.52	20
Sweden	5.32	0.67	20
Switzerland	3.61	0.79	20
UnitedKingdom	4.32	0.99	20
United States	4.84	1.66	20
Total	6.94	4.07	532

Table A1:2. Youth Unemployment Rates.

YUNEMP	Mean	Std.Dev.	Freq.
Austria	8.89	1.98	20
Belgium	20.18	2.26	20
Czech Republic	15.35	4.09	20
Denmark	10.24	2.48	20
Estonia	17.59	5.81	20
Finland	18.91	1.52	20
France	21.6	2.3	20
Germany	9.45	2.4	20
Greece	35.7	11.96	20
Hungary	17.97	6.03	20
Ireland	17.08	8.87	20
Italy	29.84	6.74	20
Japan	7.79	1.9	20
Luxembourg	13.96	4.61	20
Netherlands	8.16	1.85	20
Norway	9.71	1.41	20
Poland	27.66	9.77	20
Portugal	21.14	9.48	20
SlovakRepub..	29.14	6.96	20
Slovenia	15.5	3.45	20
Spain	33.69	13.06	20
Sweden	18.95	4.42	20
Switzerland	7.6	1.24	20
UnitedKingdom	14.66	3.6	20
United States	12.48	2.99	20
Total	17.65	9.76	532

Table A1:3 Total Unemployment Rates.

UNEMP	Mean	Std. Dev.	Freq.
Austria	4.85	0.77	20
Belgium	7.73	0.75	20
Czech Republic	6.43	1.88	20
Denmark	5.55	1.25	20
Estonia	9.38	3.51	20
Finland	8.37	0.93	20
France	9.06	1.01	20
Germany	7.09	2.32	20
Greece	15.38	6.94	20
Hungary	7.39	2.24	20
Ireland	8.43	4.25	20
Italy	9.48	2.01	20
Japan	4.22	0.82	20
Luxembourg	4.57	1.38	20
Netherlands	4.52	1.32	20
Norway	3.67	0.63	20
Poland	11.65	5.14	20
Portugal	8.94	3.72	20
Slovak Repub..	13.8	3.7	20
Slovenia	6.99	1.56	20
Spain	15.98	5.8	20
Sweden	6.91	1.04	20
Switzerland	4.08	0.79	20
United Kingdom	5.76	1.3	20
United States	5.91	1.79	20
Total	7.96	4.4	532

Table A2:1. Descriptive Statistics: Institutions

Institutional Variables	Obs	Mean	Std. Dev.	Min	Max
ALMP	513	0.450	0.342	0.020	1.870
Temporary Employment	516	11.810	6.279	1.680	33.950
Tax Wedge	532	40.334	7.542	21.860	57.100
Union Density	519	30.817	21.714	4.500	98.700
Replacement Rate	508	47.440	18.229	0.000	88.750
Public Spending	532	0.189	0.052	0.072	0.315

Table A2:2 Descriptive Statistics: Shocks

Shock Variables	Obs	Mean	Std. Dev.	Min	Max
GDP	493	-0.747	3.442	-15.680	11.960
Real Interest Rate	518	1.220	2.779	-15.400	21.000
TFP-Growth	532	0.834	3.205	-11.480	28.402

Appendix 2. Tests and Robustness Checks

Table A3:1. Hausman Test for the Static Model

Hausman	UNEMP	YUNEMP	AUNEMP
Test Stat	19.66	24.03	17.82
P-value	0.0064	0.0011	0.0128

Table A3:2. Hausman Test for the Static Model with Public Spending Added.

Hausman	UNEMP	YUNEMP	AUNEMP
Test Stat	38.37	37.21	38.05
P-value	0.000	0.000	0.000

Table A3:3. Wald Test for Group wise Heterogeneity.

	Reg. 1	Reg. 2
Chi2	417.40	411.54
P-value	0.000	0.000

Table A4. Fixed time effects.

VARIABLES	(1) UNEMP	(2) YUNEMP	(3) AUNEMP
GDP	-0.783***	-1.460***	-0.715***
	(0.064)	(0.155)	(0.056)
Real Interest Rate	0.113	0.317	0.146*
	(0.092)	(0.188)	(0.082)
TFP-Growth	0.110**	0.181*	0.107**
	(0.048)	(0.092)	(0.044)
Union Density	0.038	-0.062	0.058
	(0.093)	(0.189)	(0.076)
RepR	0.058**	0.160***	0.042**
	(0.021)	(0.045)	(0.019)
ALMP	-0.346	-4.512*	0.043
	(1.291)	(2.253)	(1.204)
Tax Wedge	0.101	0.115	0.128*
	(0.085)	(0.214)	(0.069)
TempEmp	-0.257**	-0.558**	-0.236**
	(0.107)	(0.237)	(0.090)
	(5.883)	(12.879)	(4.719)
Observations	429	429	429
R-squared	0.788	0.772	0.799
Number of Countries	25	25	25

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A5. Adding Public Spending. Fixed Time Effects.

VARIABLES	(1) UNEMP	(2) YUNEMP	(3) AUNEMP
GDP	-0.767***	-1.403***	-0.710***
	(0.053)	(0.147)	(0.048)
Real Interest Rate	0.077	0.238	0.104
	(0.081)	(0.151)	(0.077)
TFP-Growth	0.103**	0.182*	0.095**
	(0.047)	(0.094)	(0.044)
Union Density	0.043	0.029	0.057
	(0.070)	(0.155)	(0.058)
RepR	0.058***	0.147***	0.044**
	(0.019)	(0.041)	(0.017)
Tax Wedge	0.078	0.038	0.099
	(0.080)	(0.219)	(0.066)
TempEmp	-0.286**	-0.657**	-0.266***
	(0.110)	(0.267)	(0.093)
Public Spending	-2.425	-8.519	-5.803
	(13.734)	(32.001)	(12.224)
Constant	3.208	14.278	1.703
	(4.794)	(11.545)	(3.869)
Observations	448	448	448
R-squared	0.768	0.740	0.778
Number of Countries	26	26	26

Table A6. Fixed Time Effects and Observables Shocks Interacted with Institutions

VARIABLES	(1) UNEMP	(2) YUNEMP	(3) AUNEMP
GDPGAP	-0.779***	-1.445***	-0.707***
	(0.075)	(0.137)	(0.069)
Real Interest Rate	0.054	0.175	0.098
	(0.115)	(0.235)	(0.103)
TFP-Growth	0.135***	0.221***	0.126***
	(0.033)	(0.063)	(0.032)
RepR	-0.064**	-0.214***	-0.056**
	(0.028)	(0.069)	(0.026)
TempEmp	-0.136	-0.375**	-0.117
	(0.085)	(0.152)	(0.081)
Tax Wedge	-0.082**	-0.245*	-0.072**
	(0.041)	(0.141)	(0.033)
GDPGAP#RepR	0.002	0.004	0.003*
	(0.002)	(0.007)	(0.002)
GDPGAP#TempEmp	0.016***	0.049***	0.016***
	(0.005)	(0.010)	(0.005)
GDPGAP#TaxWedge	-0.024***	-0.039**	-0.022***
	(0.007)	(0.017)	(0.006)
RealInterestRate#RepR	-0.007*	-0.008	-0.005
	(0.004)	(0.010)	(0.004)
RealInterestRate#TempEmp	-0.031***	-0.038	-0.030***
	(0.012)	(0.028)	(0.011)
RealInterestRate#TaxWedge	-0.004	0.002	-0.007
	(0.011)	(0.019)	(0.010)
TFPGrowth#RepR	-0.003	-0.003	-0.002
	(0.002)	(0.004)	(0.002)
TFPGrowth#TempEmp	-0.002	-0.009	-0.002
	(0.005)	(0.012)	(0.005)
TFPGrowth#TaxWedge	0.003	0.007	0.003
Constant	7.200***	15.105***	5.944***
	(0.680)	(1.341)	(0.639)
Observations	490	490	490
Number of Countries	25	25	25

Table A7. Dynamic Version of the Main Regression. 2 lags.

VARIABLES	(1) UNEMP	(2) YUNEMP	(3) AUNEMP
L.UNEMP	0.969***		
	(0.074)		
L2.UNEMP	-0.350***		
	(0.037)		
GDP	-0.234***	-0.565***	-0.219***
	(0.044)	(0.083)	(0.043)
Real Interest Rate	0.169***	0.367***	0.157***
	(0.048)	(0.073)	(0.045)
TFP-Growth	0.003	-0.055	0.015
	(0.020)	(0.055)	(0.017)
TempEmp	-0.165***	-0.373***	-0.131***
	(0.050)	(0.138)	(0.044)
Tax Wedge	-0.063	-0.334***	-0.064
	(0.066)	(0.127)	(0.053)
RepR	0.025***	0.047**	0.017*
	(0.009)	(0.023)	(0.009)
Union Density	0.025	0.051	0.028
	(0.022)	(0.035)	(0.021)
ALMP	-2.319***	-5.973***	-1.951**
	(0.855)	(1.625)	(0.758)
L.YUNEMP		0.819***	
		(0.079)	
L2.YUNEMP		-0.249***	
		(0.065)	
L.AUNEMP			0.976***
			(0.074)
L2.AUNEMP			-0.355***
			(0.036)
Constant	6.258**	23.773***	5.615***
	(2.730)	(5.852)	(2.160)
Observations	420	420	420
Number of Countries	25	25	25

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A8. Dynamic Version with Public Spending Added. 2 lags.

VARIABLES	(1) UNEMP	(2) YUNEMP	(3) AUNEMP
L.UNEMP	0.970***		
	(0.078)		
L2.UNEMP	-0.305***		
	(0.043)		
GDP	-0.159***	-0.363***	-0.154***
	(0.031)	(0.059)	(0.031)
Real Interest Rate	0.122***	0.280***	0.119***
	(0.047)	(0.078)	(0.042)
TFP-Growth	-0.015	-0.087	0.000
	(0.024)	(0.055)	(0.020)
TempEmp	-0.200***	-0.458***	-0.149***
	(0.046)	(0.102)	(0.045)
RepR	0.009	0.013	0.003
	(0.011)	(0.027)	(0.012)
Union Density	0.016	-0.016	0.019
	(0.021)	(0.034)	(0.018)
Public Spending	22.254***	60.377***	19.077***
	(4.285)	(9.156)	(3.813)
L.YUNEMP		0.820***	
		(0.081)	
L2.YUNEMP		-0.198***	
		(0.061)	
L.AUNEMP			0.980***
			(0.079)
L2.AUNEMP			-0.319***
			(0.041)
Constant	1.050	0.314	-0.490
	(2.786)	(2.867)	(0.942)
Observations	437	437	437
Number of Countries	26	26	26

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1