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## Labour Market Transitions, Shocks and Institutions during the Great Recession: A Cross-Country Analysis

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# Labour Market Transitions, Shocks and Institutions during the Great Recession: A Cross-Country Analysis

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## **Abstract**

This paper analyses the impact of the Great Recession on labour market dynamics in industrialized countries. Using unique measures of labour market flows constructed from worker-level micro data, we examine to what extent macro shocks were transmitted to national labour markets. Following Blanchard and Wolfers (2000), we focus on the role of the interaction of shocks and institutions for labour market flows – in addition to the unemployment rate – in order to explain cross-country differences in labour market reactions to the Great Recession. Our results show that interactions between shocks and institutions have explanatory power when considering observable macroeconomic shocks; interactions with trade union variables are of particular relevance in this context.

**JEL codes:** *J6, E24*

**Keywords:** *worker flows, labour market dynamics, institutions, Great Recession*

# 1 Introduction

The recent Great Recession was associated with job losses and displacements for a large number of persons, and a strong and persistent increase in unemployment in many European countries. The average unemployment rate in the Eurozone rose from an average of 7.0% in 2008 to 10.9% in 2013 (Eurostat, 2014). This average figure, however, masks large divergences in labour market reactions across the EU and associated countries (European Central Bank, 2012; OECD, 2013). In some countries, such as Austria, Germany and Poland, the unemployment rate hardly increased during the crisis; in others, such as Spain and Greece, it rose strongly, reaching up to 25%. As for worker flows which determine the level of unemployment, substantial heterogeneity can be observed across countries as well (Bachmann, Bechara, Kramer, and Rzepka, 2015). For certain countries, job losses were predominant during the Great Recession, while for others job creation came to a halt. These differences in labour market reactions are not only likely to be strongly influenced by the magnitude of economic shocks but also by the institutional framework prevailing in national labour markets.

In this paper, we therefore investigate the role institutions play for the transmission of macroeconomic shocks to national labour markets, looking at both the unemployment rate and worker flows. In particular, we apply Blanchard and Wolfers' (2000) framework to explain cross-country differences in unemployment and labour market dynamics between 1999 and 2013, a period covering the Great Recession, for a large number of European countries as well as the US. We enhance the empirical model by allowing for changes in institutional variables which accounts for the variation of institutions within countries as motivated by Nickell (1997). Specifically, we investigate the impact of shocks and the interaction of shocks and labour market institutions in this context. We separately identify (i) the role of the exposure to the macroeconomic shocks directly and (ii) how shocks of a given size were transmitted to the national labour markets through the institutional framework, captured by the interaction of shocks and institutions.<sup>1</sup> The latter measures the channeling property of the corresponding institution and, thus, the indirect effect of institutions on our outcomes of interest - the unemployment rate and worker flows.

By analysing worker flows which determine the unemployment rate, we aim to widen the knowledge about the role of shocks and institutions for national labour market performance. Thereby, we complement the large and rapidly growing literature on worker flows, focusing on the mechanisms underlying the cyclical behaviour of the unemployment rate. These studies investigate the relative importance of the inflows into and the outflows from unemployment. While earlier studies for the US found inflows from employment into unemployment to be the decisive factor for the cyclicity of unemployment (e.g. Darby, Haltiwanger, and Plant, 1986) and later studies found a more important role for outflows from unemployment to employment (Hall, 2005; Shimer, 2012), more recent articles have established a relatively balanced role for inflows into and outflows out of unemployment (e.g., Elsby, Michaels, and Solon, 2009; Yashiv, 2008; Fujita and Ramey, 2009). Providing cross-country evidence, Elsby, Hobijn, and Sahin (2013) examine a sample of 14 OECD countries. They find that outflows play a much more important role for unemployment variation than inflows in Anglo-Saxon countries, whereas for Continental European and Nordic countries, their relative importance is roughly equal. A second strand of the literature connected to our paper examines the role of institutions for labour market dynamics, an overview of which is provided in Boeri and Van Ours (2013).

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<sup>1</sup>Note that our analysis does not identify causal effects in a strict sense, however.

The variation in labour market performance across countries has been analysed in a large body of theoretical and empirical literature (Nickell, 1997; Blanchard and Wolfers, 2000; Bassanini and Duval, 2006). Labour market institutions shape national labour markets adversely by limiting wage flexibility and eliminating low-wage employment relationships, but also are able to internalise harmful employment consequences of excessive wage claims. Thus, some institutions create rigidities which in theory lead to deviations from labour market equilibria by distorting price- and wage-setting mechanism (Richard, Nickell, and Jackman, 1991; Layard, Nickell, and Jackman, 2005; Blanchard, 1999), whereas others increase coordination in the labour market which may result in desirable outcomes. Empirical research in the late 1990s and early 2000s being motivated by the diverging development of US and European unemployment over the period 1960 to 1990 has identified two partially conflicting roles of institutions in shaping unemployment. On the one hand Nickell and his co-authors in Nickell (1997) and Nickell, Nunziata, and Ochel (2005) argue that changes in institutions making European labour markets more rigid were responsible for the sharp rise in unemployment in these countries which implies a direct effect from institutions on labour markets. On the other hand Blanchard and Wolfers (2000) and Bertola, Blau, and Kahn (2001) assign an indirect effect to institutions. Their rationale is that once the unemployment rate was brought up above the equilibrium level by macroeconomic shocks (especially shocks to oil prices), adjustment processes back to the equilibrium level were hindered by strong institutional rigidities in Europe. Thus, economies with more adverse institutions suffer from a lower speed of labour market adjustment and hence higher unemployment persistence after a macroeconomic shock.

More recently, Eichhorst, Feil, and Marx (2010), Orlandi (2012), de Serres and Murtin (2013) and Gal and Theising (2015) have investigated the importance of institutions for the evolution of the unemployment rate in a large number of industrialized countries including the early years of the Great Recession. While the former study attributes a key role to the internal flexibility of labour markets, but cannot find support for the significance of classical labour market institutions, the other studies confirm institutions as crucial determinants for labour market outcomes.

Our contribution to the literature is therefore to assess the institutional determinants in labour market adjustments for more updated years and to look explicitly at labour market transitions. First, we review the role of shocks and institution by replicating previous findings for the unemployment development across countries with new data. These data cover the time period of the recent Great Recession, a period of strong increases in unemployment which, at least in some countries, were highly persistent. Second, we analyse institutional influence on labour market flows. These contributions allow for a more precise investigation of labour market reactions to the Great Recession, as worker flows are generally more sensitive, and move more quickly, to macroeconomic shocks than is the case for employment and unemployment. Furthermore, an analysis of worker flows provides insights into the mechanisms underlying the behaviour of employment and unemployment. This is particularly relevant in the context of the Great Recession, where labor market dynamics evolved very heterogeneously across countries.

The remainder of the paper is structured as follows. The next section describes the data used to construct unemployment rate and worker flows and provides descriptive evidence on labour market dynamics for the 21 countries in our sample. Section three illustrates the data bases employed to obtain measures for shocks and institutions and discusses their evolution over time and their potential impacts on labour market dynamics. The next section explains the empirical identification strategy.

The fifth section presents the results, the last section summarizes the main findings and concludes the discussion.

## 2 Unemployment and Labour Market Flows: Data and Descriptive Analysis

In order to compute labour market transition rates of European countries, we use the European Labour Force Survey (EU-LFS). The micro data set consists of a large number of representative national household surveys. The EU-LFS covers all EU Member States without Croatia (EU 27) as well as Norway, Iceland and Switzerland. The Labour Force Surveys are conducted by the national statistical agencies applying harmonized concepts and definitions, which enables us to conduct cross-country comparisons. Based on the information of a person's current and previous labour market status, we compute the stock of employed, unemployed and non-participating individuals, as well as transition rates between labour market states by year and country. In the data, an individual's current labour market status is defined according to the ILO standard. However, the labour market status in the previous year is based on self-perception of the interviewed person. Hence, these two definitions might not overlap perfectly, but using an alternative measure for the current status would cause additional year and country combinations to drop out of the data set due to low response rates (see ISG and RWI, 2010 for further details).

Information for the US comes from the Labor Force Statistics released by the Bureau of Labor Market Statistics (BLS, <http://www.bls.gov/webapps/legacy/cpsflowstab.htm>), which are extracted from the Current Population Survey (CPS). Yearly labour market transition rates are obtained directly from monthly flows and yearly stocks. This data structure counts multiple working status changes of one individual per year. In contrast in the EU-LFS, one observes at most one labour market transition per person.<sup>2</sup>

In our analysis, we focus on the time period 1999 to 2013 corresponding to the largest number of available country-year combinations for which information on labour market transitions is available in the EU-LFS. On the individual level, we focus on dependent-status employees, and omit individuals living in institutional households (e.g. retirement homes or military barracks), children under the age of 15 and adults aged 65 and over. We delete Bulgaria, Ireland, Iceland, and Switzerland from the sample since they show low response rates up to the year 2007. We also exclude the Netherlands from the analysis because information on the previous year's employment status is largely missing until 2008. Lastly, a few data points are randomly not available in the time-series for certain countries due to the same reason. If this is the case, we impute the missing information by averaging transition rates close to the respective years.<sup>3</sup> The final data set contains information on the unemployment rate and transition rates at the country-year level for 20 European countries<sup>4</sup> and the US.

A graphical representation of unemployment and worker flows between employment and unemploy-

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<sup>2</sup>This raises the issue of time-aggregation bias, which will be dealt with in future versions of this paper.

<sup>3</sup>Specifically, since we average the observations within 3 year windows we use the available years in these windows for imputation.

<sup>4</sup>The countries are Austria, Belgium, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Hungary, Italy, Luxembourg, Norway, Poland, Portugal, Sweden, Slovenia, Slovak Republic and the United Kingdom.

ment over the time period 1999 to 2013 reveals stark cross-country differences, especially during the Great Recession. As for the unemployment rate, one observes an increase for most countries during the recession (Figure 1), which is in accordance with Okun's Law. These increases differ between countries, ranging from around one percentage point in the Czech Republic to 14 percentage points in Spain. In countries where the unemployment rate rose considerably, it remained persistently high until 2013. An exceptional case is Estonia. After the rate peaks in 2010, it decreases quickly, going back almost to its initial level. By contrast, some countries experienced hardly any change or even a decrease in unemployment during the observation period. For example, a stable unemployment rate can be observed in Austria, Belgium, Finland, Norway and Poland; in Germany the unemployment rate even decreased during most of the recession years.

A similar picture emerges for the transition rates from employment to unemployment and unemployment to employment. Changes in the worker flow from employment to unemployment are especially pronounced in 2008, when the Great Recession began, which is in line with expectations: At the start of the recession, the large adverse shock raised job destruction, increasing transition rates from employment to unemployment (Figure 2). It becomes apparent that countries which were strongly hit by the recession, such as the US, Spain, Greece, Portugal and Estonia, experienced a substantial rise in transition rates from employment to unemployment of up to 7 percentage points. Again Estonia's rate recovers quite fast. The same holds true for the US. In most countries, the corresponding rate remained more subdued between 1999 and 2013, but still increased. Interestingly, in Germany the transition rate from employment to unemployment decreased slightly during the Great Recession.<sup>5</sup>

The evolution of worker flows from unemployment to employment displays pronounced trends in a number of countries, together with some business-cycle turbulence (Figure 3). In Portugal, the US and Spain, for example, one can observe a falling trend. The opposite is visible for Austria, Norway and Poland. As for cyclical fluctuations, one would expect that the transition rate from unemployment to employment decreases at the start of the Great Recession, since the adverse economic shock is likely to reduce job creation and hence hirings. This is indeed the case for most of the countries in our sample, but some countries, such as Austria and Poland, experience an increase in this transition rate.

The worker flows between employment and unemployment are major factors for the evolution of the unemployment rate (Shimer, 2012). An increase in the transition rate from employment to unemployment accompanied by a decrease in the transition rate from unemployment to employment increases the unemployment rate. That is the underlying picture one would expect during recessions. For most countries in our sample the variation in both rates during the Great Recession are of comparable size. Nevertheless, there are exceptions. In Estonia for example, the change in the transition rate from employment to unemployment is much more pronounced than the corresponding change in the worker flow from unemployment to employment, whereas for Spain we see the opposite picture. Both countries were hit strongly by the recession. This difference in the patterns of worker flows might be caused by the countries' prevailing institutional framework.

The descriptive evidence, thus, displays that the unemployment and the worker flow rates between employment and unemployment behaved idiosyncratically to a certain degree in the countries under investigation, especially during the Great Recession. Furthermore, it suggests that the trajectory of the

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<sup>5</sup>See e.g. Burda and Hunt (2011) for an analysis of the German experience during the Great Recession.

unemployment rate is influenced by the two transition rates to a differing extent and the persistence of the macroeconomic shock varies across labor markets. Against this background, our aim is to analyse to what extent the cross-country differences in institutions led to differing transmissions of the adverse macroeconomic shock during the Great Recession on the unemployment rate and labour market dynamics.

### 3 Shocks, institutions and their interactions: Descriptive analysis and theoretical considerations

Macroeconomic shocks are measured in various forms in the economic literature. Depending on the research question, either a direct indicator of aggregate economic activity such as GDP, or more specific measures such as total factor productivity growth or interest rates, are used. Related analyses which also focus on the effects of economic shocks on unemployment apply indicators individually or within a set of measures (Blanchard and Wolfers, 2000; Nickell, Nunziata, and Ochel, 2005; Bassanini and Duval, 2006). In order to proceed as parsimoniously as possible, in our analyses we focus on the most aggregate measure of the business cycle available, the annual GDP growth rate. Nevertheless, in robustness checks we also include total factor productivity (TFP) and the interest rate as explanatory shock variables.

We use a GDP time-series provided by the OECD to construct annual economic growth rates.<sup>6</sup> Figure 4 displays that all countries in the sample experienced relatively stable growth in the time period 1999-2007, and a reduction in GDP growth in 2007/2008. The latter was relatively mild in some countries such as Austria, Belgium and Germany, and rather strong in other countries such as Estonia, Finland and Slovenia. Furthermore, in the following years, while some countries recovered relatively quickly (e.g. Estonia and Sweden), other countries faced a protracted recession (e.g. Greece and Spain).

Overall, the description indicates that the national economies of our sample were affected to a different degree during the Great Recession and afterwards. For this paper, however, the main interest is how national labour market institutions channeled macroeconomic shocks to labour markets. Therefore, we turn to a description of labour market institutions next.

We capture the institutional setting of the labour market in each country by eight different variables as in Blanchard and Wolfers (2000). The variables cover the unemployment insurance system, employment protection legislation (EPL), the collective bargaining system, active labour market policies and the tax burden of employees for each country. Table 1 depicts descriptive statistics of our indicator and gives an impression of their size, variation and availability. The correlation between the various institutions used in this paper is strong (Table 2) implying for instance that strict EPL is connected with high union coverage and high tax wedges.

In the following, we briefly illustrate how these indicators might affect labour market dynamics directly and indirectly, i.e. as transmission channel of economic shocks to national labour markets. Note, that we focus on the empirical identification of indirect impacts of institution. However, in order

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<sup>6</sup>See the data appendix for a detailed description of the shocks and institutions variables, as well as the respective data sources.

to understand the plausible mechanisms we start by portraying direct impacts and give an overview of the empirical findings.

Among the variables characterizing the unemployment insurance system, we choose the benefit replacement rate and the benefit duration. While the replacement rate captures the level of unemployment benefits relative to previous earnings, benefit duration measures how long individuals are entitled to unemployment benefits. The likelihood of taking up a job decreases as unemployment benefits increase since they reduce an unemployed individual's effort to search for work. Moreover, by lowering costs of unemployment, they may shift the wage distribution to the right which can lead to increased separation rates. Simultaneously, they probably induce a raise the quality of employee and employer matches by providing jobseekers with more time to find a well-suited job, which ultimately lowers the probability of job separations (Acemoglu and Shimer, 2000). Taken together, theory predicts a negative influence of a unemployment insurance system on employment inflows and ambiguous impact on outflows. As a result, the overall effect on unemployment is unclear. However, empirical evidence suggests that unemployment benefits have a significant adverse effect on unemployment (among others Nunziata, 2002; Nickell, Nunziata, and Ochel, 2005).

We study the impact of EPL governing regular employment which applies to workers with permanent contracts on labour market dynamics, as this is generally the most prevalent employment type. The strictness of employment protection measures the costs that arise for firms in case of the dismissal of an employee. The stricter EPL, the more costly it is for employers to lay off workers, which reduces worker outflows from employment. At the same time, because employers are forward looking, outflows from unemployment to employment are reduced. Therefore, we would expect that EPL lowers labour turnover with ambiguous effects on unemployment (Mortensen and Pissarides, 1999). The empirical evidence confirms both lower labour market flows and the uncertainty with respect of the impact the unemployment rate (Scarpetta, 1996; Nunziata, 2002).

Trade unions have a considerable influence on the labour market. The general perception is that they have power to push wages above the marketing-clearing level leading to unemployment. In the context of this article, it is particularly important that strong unions – e.g. measured by union coverage or density – may foster the inclusiveness of labour markets since they pursue the objective to protect employed, the insiders, from unemployment. Outsiders, i.e. not employed, thus experience more difficulties to enter it. In theory, the effect of the structure of collective wage bargaining is ambiguous. Specifically, the relationship between unemployment and the degree of centralization is not monotonic, but empirical evidence suggests that it is rather hump-shaped (Calmfors, Driffill, Honkapohja, and Giavazzi, 1988). Also, trade union of a given size act very heterogeneously across countries. Hence, the cumulative impact of trade unions on labour market dynamics is not clear-cut. For the German case it has been argued that the coordination between employer associations, trade unions and works councils has been crucial for the country's good labour market performance during the last decade (Dustmann, Fitzenberger, Schönberg, and Spitz-Oener, 2014).

Countries engage in active labour market policy (ALMP) to reduce unemployment by improving the job matching process and by enhancing opportunities for unemployed to accumulate work experience and skills. The intended effect is to make unemployed persons more employable. In theory, this increases the transitions from unemployment to employment and reduces the unemployment rate. However, in practice, the direction of the connection depends on the specific program design (Card, Kluge, and Weber, 2010, 2015).



The tax system is likely to have an effect on unemployment and labour market dynamics, too. The incentivising effects of taxes can be partially captured by the labour tax wedge, which measures by how much the tax system reduces the difference between the labour costs to the employers and the corresponding net take-home pay of the employee. It is expected to affect unemployment and worker flows via the reservation wage (Blanchard and Wolfers, 2000). A higher labour tax wedge increases the reservation wage, reducing the efforts of an unemployed individual to take up a job and increasing job destruction, which has an adverse effect on worker flows from unemployment to employment and raises transitions from employment to unemployment. In total this would lead unambiguously to an increase in the unemployment rate. The latter relationship is supported in many empirical studies (Belot and Van Ours, 2004; Nickell, 1997).

In order to show the patterns of institutions, both with respect to cross-country differences and its evolution over time, we depict our indicator for EPL applying to regular workers and union density over the time period 1999 to 2013 by country in Figure 5 and Figure 6. Both indicators vary little in our time window. For a few countries, e.g. Greece and Portugal, the EPL measure, however, falls after the Great Recession. Union density features in most countries a negative time-trend. The levels differ substantially across countries.

The graphical evidence suggests that institutions alone are unlikely to be able to directly explain the evolution of the unemployment rate or of labour market dynamics during the investigation period, since they no systematic relationship between both sets of variables across all countries and over time can be detected. We argue, however, that institutions act predominately indirectly via economic shocks on labour market as motivated by Blanchard and Wolfers, 2000 and Bassanini and Duval, 2006 by amplifying effects of economic turbulence or lessen them.

These interactions often become effective through the wage channel. Within a search and matching model, many labour market institutions increase wage rigidities, thereby reducing the sensitivity of wages to economic conditions, which leads to a stronger reaction of worker flows and unemployment (see among others Blanchard, 1999). Therefore, higher wage rigidities may lead to higher dismissals in the presence of economic shocks, which is equivalent to higher worker flows from employment to unemployment and to a higher unemployment rate. Institutions that compound wage rigidities are high unemployment benefits and taxes. Thus, we expect for their interaction with shocks an negative relationship with unemployment and employment to unemployment flows, but a positive correlation with unemployment to employment flows. In contrast, well-designed ALMP can reduce wage rigidities by increasing the influence of unemployed and individual's out of the labour market. Therefore, we expect reverse signs for this relations. Concerning the strength of trade unions, the effect is ambiguous. Even though strong unions - e.g. measured by union coverage or density - lead to more rigid wages, the total effect of unions depend on the structure of collective wage bargaining (Traxler and Kittel, 2000). Wage rigidities might be reduced by a more coordinated wage-setting process, because unions are induced to internalise detrimental effects. Furthermore, stronger unions may lead to more inclusive labour markets, and to a more employment-friendly reaction of an economy to a large negative shock such as the Great Recession (Soskice, 1990).

In the next section, we explain the methodology used to investigate these issues.

## 4 Methodology

The aim of our empirical analysis is to examine the medium-term developments in a number of European countries and the US over the time period 1999 to 2013. In order to do so, we apply the empirical methodology of Blanchard and Wolfers (2000) and employ it to investigate the importance of the interaction of shocks and institutions for the unemployment rate and various worker flow rates. We also follow Blanchard and Wolfers (2000) in estimating two models: While the first model assumes that shocks are unobservable but common across countries, and hence uses time dummies as approximations to exogenous shocks, the second model allows for observable and country-specific shocks. The first model has the advantage of comprising a very general shock measure which accounts for the correlation of prevailing economic states between countries, whereas the second model can take into account differences in economic development between countries, e.g. with respect to the depth of the Great Recession.

The unobserved shocks model is based on Blanchard and Wolfers' (2000) benchmark estimation and reads as follows:

$$tr_{it} = c_i + d_t + \sum_j b_j (d_t * X_{it}^j) + \epsilon_{it} \quad (1)$$

where  $tr_{it}$  is the dependent variable which is either the unemployment rate or a worker flow rate in country  $i$  at time  $t$ ,  $c_i$  are country dummies and  $d_t$  represent time dummies. These time dummies stand for common unobserved shocks at the country level. Their coefficients measure the direct effects of shocks on national labour markets. Furthermore,  $X_{it}^j$  is the value of institution  $j$  in country  $i$  at time  $t$ . The estimation allows us to quantify the interaction between shocks and institutions by the coefficient  $b_j$ . Specifically, this coefficient captures the transmission function of the corresponding institution and, thus, the indirect effect of institutions via shocks on the outcome variable. This interaction therefore accounts for the fact that similar shocks can induce very heterogeneous effects in countries with different institutions as well as that the same institutions may have different implications depending on the state of economy.

In the second model the common observed shocks are replaced by an explicit country-specific shock measure, the annual growth rate of GDP. It has the following form:

$$tr_{it} = c_i + \theta Y_{it} + \sum_j b_j * (\theta Y_{it} * X_{it}^j) + \epsilon_{it} \quad (2)$$

where the notation is the same as before, only that  $Y_{it}$  is the shock in terms of GDP growth. The annual GDP growth rate enters equation (2) in levels. Due to the presence of country dummies in the regression, the corresponding coefficient can be interpreted as deviation from country averages from the value in the first period (1999-2001).

Our models meet the hypothesis of the underlying theory. That is, given the same shocks, countries with different institutions experience distinct evolutions in transition rates and unemployment. For example, one would expect that in a country with low labour market flexibility, i.e. induced by high unemployment benefits, an adverse shock has a stronger effect on transitions from employment to unemployment. The rate will increase more than in a country with high labour market flexibility, vice versa for the transition from unemployment to employment. Concerning the unemployment rate, thus, one would expect the lower labour market flexibility, the higher the unemployment rate and

the higher persistency of the imbalance as rigid labour market institution can lead slower adjustment processes.

The shocks and institution interactions are a function of the level of the institutions and not their change. The eight labour market institution measures which we describe in the third section in detail are constructed as deviations from the cross-country mean as in Blanchard and Wolfers (2000). Since each institution interacts separately with the same shock measures both models are estimated non-linearly. This approach does not allow us to interpret the effects of a shock or of an institution on the dependent variable separately. The shock measures enter the equations not only via interaction term, but also separately in levels. Thus, the coefficient on the shock measure depends on the interaction. The same holds true for the interaction coefficient since institutions are not build in independently. Furthermore, the estimation equations include country dummies, which capture time-invariant level differences in the dependent variables. Such time-invariant level differences could be due to various factors, such as culture or risk preferences, which could be correlated with institutions, and have therefore be (indirectly) controlled for through country dummies.<sup>7</sup>

We estimate both models with the full country sample consisting of 20 European countries and the US. We split the observation period from 1999 to 2013 into five three-year sub-periods. These periods are 1999 to 2001, 2002 to 2004, 2005 to 2007, 2008 to 2010 and 2011 to 2013. For each sub-period, we compute the average of the yearly transition rates. Therefore, both the dependent and the explanatory variables enter our estimation as three-year averages. This has two specific advantages compared to the use of annual data. First, as argued by Blanchard and Wolfers (2000), the slow movement of institutions only justifies a model in which all variables are summarized over a longer period of time. Second, this helps with the problem of autocorrelation, which would lead to biased and inconsistent coefficients, and reduces the degree of first order autocorrelation in the error term. Finally, business-cycle effects are smoothed, allowing us to abstract from short-run labour market reactions.

Regarding the fit of our two models, notice that the second model including country-specific shocks might be considering that the Great Recession has hit countries very differently a better description of reality than the specification assuming common shocks. It is reasonable to assume that national labour markets have reacted with divergent speed to shocks. An aspect which is controlled for. Nevertheless, at the same time, the presence of country specific shocks raises the threats to identification for this empirical framework which is by its nature set out with substantial threats. It roots in the endogeneity of the macroeconomic shock since countries economic situations are interdependent. Because we do not have suitable instruments for macroeconomic policies, we must assume that the corresponding estimates may be biased downward in absolute value.

The main concerns for identification which apply to both of our models are endogeneity of labour market institutions, multicollinearity of our institutional set, autocorrelation and heteroscedasticity. First, endogeneity arises from reverse causality between labour market dynamics and institutions. Put in other words, it might be that the evolution in transitions into employment and into unemployment in countries over time has led to certain political actions. Hence, past developments in transition rates may have had an impact on institutions, and, therefore, transition rates and institutions are interdependent. The same reasoning holds for the unemployment rate.

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<sup>7</sup>We refrain from adding country specific time trends, because this would change the interpretation to explaining movements around a time trend.

In our benchmark specification we estimate equations (1) and (2) using time-varying institutional measures. Thus, we exploit variation in national labour market institutions over time. However, it raises doubts on the unbiased nature of the coefficients. In order to deal with this potential source of endogeneity we follow three strategies. The institutional variables only vary once between the three-year periods. They take the value of the first observation in each time window. Also, we check the robustness of the estimates by including lagged institutional variables and fixing all measures at values of the year 1999. The latter, therefore, neglects changes in labour market institutions after 1999. Comparing the estimates from the fixed and varying specification enables us to interpret the direction of the potential bias. Furthermore, we test whether replacing institution variables with their respective 3-year-lagged value changes our estimates.

Second, multicollinearity between institutional measures and within one institution variable over time is problematic for identification. The set of labour market institutions are homogenous in terms of the overall policy direction. Therefore, the variables are likely to depend on each other. Also, institutions change very slowly over time. This implies that a value of one institution at period  $t$  in a country is correlated with the same institution in the period before and after. Typically, the consequences of multicollinearity are that the estimates of the coefficients become sensitive to minor changes and standard error for the coefficients can get widely inflated. Thus, we center the institutional variables by subtracting the sample mean. The centered variables show very low degrees of collinearity. Moreover, based on results from a principal component analyses we run both models on 5 subsets of institutions to check the stability of our estimates.

Lastly, heteroscedasticity and autocorrelation are of concern in our regression specification. The application of 3-year-intervals of all variables reduces the issue to a certain degree. One must also keep in mind that all institution measures have been constructed ex-post by researchers who were aware of the developments in each countries labour markets. It is hard to argue that the knowledge of the economic situation did not enter these measures.

## 5 Results

Our empirical analysis starts with the original outcome variable from Blanchard and Wolfers (2000), the unemployment rate. We therefore estimate the equations for unobserved shocks which are common across countries (Equation 1) and for observed country-specific shocks (Equation 2) for the time period 1999 to 2013 with the unemployment rate as dependent variable.

In the model including unobserved shocks, the coefficients measuring the effect of institutions on unemployment via their interaction with shocks are not significant at conventional levels of significance (Table 3). However, the signs stay the same over all institutional subsets we employ with the exception of employment protection and tax wedge. Union coverage and coordination are adversely related with the unemployment rate. Both, being in line with neoclassical considerations. The replacement rate and union density influence unemployment negatively which is at odds with the theory. R-squared ranges between 0.71 to 0.74 which is rather low and increases naturally with the number of regressors. Furthermore in order to test the performance of the model, we assess whether fitted values of these regressions are a good approximation of the observed unemployment rate, and find that this is not the case (exemplified Figure 7, right panel). One can therefore conclude that the model assuming that unobserved shocks are a good description of the reality in the recent past does not perform well

in explaining the unemployment patterns for the time period 1999 to 2013.

The model with observed country-specific shocks behaves better. This becomes apparent first by a higher R-squared taking up values within the interval from 0.95 to 0.96 being displayed in Table 4 and second by the Figure 7 (left panel) and Figure 8. The latter shows the predicted and actual unemployment rate trajectories by country taking up values in the interval of using the full institution set. Furthermore, all institution coefficients have similar sizes in both models, but the standard errors in the unobserved models are substantially higher implying imprecision of the regression. This result stands in stark contrast to the results in Blanchard and Wolfers (2000). They find that the empirical model with unobserved shocks is a better description of the heterogeneity of the national unemployment patterns for the time period 1965 to 1994. We suspect that the oil shocks which occurred predominantly in the period of analysis of Blanchard and Wolfers (2000) must have been more homogeneous across countries than during the more recent past. Table 8 supports our notion since the standard deviation of national GDP growth rates in recession increases with time. This can be explained by the financial shock which initiated the latest recessions and spread over countries very asymmetrically leading to different reactions of the real economy. For example Ireland and Spain displaying a very large construction sector collapsed quickly in the Great Recession. Since the analysis of labour market flows using unobserved shocks also yields no significant results (available from the authors upon request) this argument is backed and we henceforth discuss only the results of the observed shocks model.

The estimates of the observed shocks model suggest that the shock variable, annual GDP growth, is significantly negatively related to the unemployment rate indicating that a decrease in GDP growth is associated with a higher unemployment rate (Table 4). Concerning the interaction of this shock variable with institutions, the most important variables are those related to trade unions. In particular, the coefficients on union density and bargaining coordination are significant in all specification. The signs of the interaction coefficients are unexpected, but in concur with the unobserved shocks results: union density weakens the unemployment effects of a given shock, whereas increased coordination amplifies them. The most intuitive explanation for the former result is that trade unions pursue the objective to protect employed from unemployment which leads to inclusive labour markets where insiders, i.e. the employed, gain and outsiders, i.e. not employed, face thus difficulties to enter the labour market at all. This behavior compromises a moderation in employment growth during economic growth periods and reduction of employment outflows in recessions. We will investigate these hypotheses further below. The indirect adverse effect of the level of coordination of wage might be driven by the fact that trade unions require more time to bargain efficient wage levels than workers that have power to bargain individually with their employer. However, this might come at the cost in the short run since the latter employees might have to face wage cuts in order to keep their jobs. The interaction coefficient on ALMP in the last specification implies that the effects of a shock on unemployment is more persistent in countries in which government invests highly in such programs than in countries where this is not the case. This finding is probably caused by endogeneity, i.e. countries experiencing a shock to GDP resulting mechanically in an increase in unemployment, react to this by spending more money on ALMP. The replacement rate is no longer consistently over all specifications negatively connected to the unemployment rate. Its coefficient is either marginally negative or positive. The indirect relationship between employment protection and unemployment is throughout all institution subsets insignificant, albeit negative indicating a higher EPL is associated

with lower levels of unemployment. With regard to the flows we will discuss this result later. Union coverage is similar to the unobserved common shocks model adversely related to unemployment. Moreover, the full model shows that the influence of benefit length and tax wedge are negligible.

The regression results for transitions from employment to unemployment using the country-specific shocks model are displayed in Table 5. Intuitively, all coefficients should go in the same direction compared to the coefficients to the previous exercise. Indeed, GDP growth has a direct negative impact on these flows. Also, the core interactions coefficients on institutions that explain transitions employment are similar to those in the unemployment regression, respectively. Hence, variables sketching the power of trade unions seem to be able to explain the heterogeneity in patterns of outflows from employment across countries. Specifically, union density exhibits a negative and coordination a positive indirect influence via the shocks on this transition. Therefore, in countries where unions are strong (measured by union density) and wage bargaining is decentralized, outflows from employment to unemployment react less pronounced to an exogenous shock. Furthermore, the coefficient on EPL has a negative sign in some specifications implying reduced turnover which is in line with the theoretical considerations and empirical findings discussed Section 3. The other estimates support some of the bottom line findings of the unemployment regression which strengthens the results: The replacement rate's and benefit length's indirect influence is negligible. Furthermore, ALMP is positively associated with the respective flow. Nevertheless, the union coverage interaction coefficient now is insignificant and very small. Additionally, the tax wedge is negatively related to flows from employment to unemployment. In the full model even significantly. Overall the regression model with observed shocks performs quite well in predicting past employment to unemployment flows which is displayed in Figure 9 for most countries.

The regression for the worker flows from unemployment to employment does not yield any significant coefficients (Table 6). To our surprise not even the shock variable is significant. Our model assuming shocks and the interaction between shocks and institutions to shape unemployment outflow patterns seems to fail. Thus, institution indirect effect is not important in this context. In other words, the transmission of shocks through institutions did not affect worker flows from unemployment to employment to a substantial extent. This is confirmed by the relatively bad fit of the econometric model when comparing the model prediction for unemployment to employment flows with the actual trajectories of these flows by country (Figure 10). One reason for this finding is that the composition of unemployed individuals with respect to quality depends strongly on the state of economy. At the beginning of recessions the pool of unemployed includes more educated and experienced persons since firm's have to let go workers they wouldn't fire under normal circumstances.

Overall, our analysis implies that trade union related variables have strong explanatory power compared to other labour market institutions for the prevailing patterns of unemployment and of worker flows from employment to unemployment before and during the Great Recession. Specifically, we find a negative indirect effect of union density and decentralization of wage bargaining via shocks on both outcomes. This result stands in contrast to the previous findings of Blanchard and Wolfers (2000) where they show that strong unions and centralization of wage bargaining are associated positively with unemployment in a course of a shock. Interestingly, however, the results are partially in line with Bassanini and Duval (2006) who study the period from 1982 to 2003. One reason could be that unions lately were able to influence the labour market in a different way than in earlier periods. Trade unions might have stabilized employment positively by moderating employment growth before

recent recessions. This could be the outcome of trade union’s aim to protect employed workers thereby increasing the inclusiveness of the labour market. Tentative evidence for this line of argument is displayed in Table 7. In the period just before the Great Recession union density is weakly negatively and coordination positively correlated with employment growth. After the recession the correlation reverses for union density. This pattern indicates that trade unions tend to hinder employment growth in booms and employment destruction in recessions. Furthermore, our models deviate from Blanchard and Wolfers (2000) because we allow for variation in institutions within a country which accounts for institutional reforms.

In order to support our conclusions with respect to the determining role of trade unions via the interaction with shock in shaping unemployment and worker transitions from employment to unemployment patterns we run a battery of robustness tests. In the following we briefly describe their results including worker flows from unemployment to employment, as well.

First, fixing the institution measures to the year 1999, we find qualitatively similar results with a few exceptions (Table 9 ). Only coefficients on trade union related variables are significant. However, not for all specifications. The direction stays for both outcomes the same, except for coordination in the unemployment regression which is now negative and insignificant. This institution specification does not allow for changes in the respective variables which over the time period 1999 to 2013 have been quite substantial in certain countries. To name one, Germany has implemented many reforms in the early years of the 20th century. They affected, in particular, the level of collective bargaining (Dustmann, Fitzenberger, Schönberg, and Spitz-Oener, 2014). Such alterations are not included and this might be the reason why not all previous results materialize. Next, we apply a test which also assesses the endogeneity problem of institutions, too, by using lagged institutional instead of contemporary measures (Table 10). Thus, variation in institutions is still present. The estimates are generally robust to this variation in the specification except coordination loses its significance.

Moreover, we exclude countries that have performed considerably bad in terms of economic stability and of labour market dynamics during the Great Recession, i.e. Spain and Portugal, and the reverse picture, namely Germany as a country that was not hit strongly. Our estimates support our previous findings for the unemployment rate and labour market transitions widely (Table 11, Table 12 and Table 13). We also exclude the US to check whether its substantial size difference in both flows, employment to unemployment and unemployment to employment (Table 14), drives the benchmark results. The estimates for employment outflows remain quite the same. However, the unemployment to employment transitions is predicted better by the model without US. First GDP is significantly influencing the rate and trade unions seem to hinder employment inflows which leads to inclusion of employed workers and exclusion of not employed from the labour market.

Replacing the shocks measure GDP growth rates with the output gap does not induce any major changes in the estimates for the unemployment rate and the flows from employment to unemployment (Table 15). However, this specification improves the fit of the unemployment outflows regression remarkably. The shock is directly positively correlated with the outcome. Furthermore, again our notion that trade unions promote the inclusiveness of labour markets is supported since union density affects the flow negatively implying disadvantages for outsiders.

Next, we add the share of temporary workers to the model assuming the same relationship as the other institution. That is, it impacts labour market dynamics indirectly via shocks. Temporary

workers are more less costly for firms to fire than regular workers. Thus, we expect that countries with a high rate of temporary workers show a higher adverse reactions in unemployment and in worker outflow from employment. This is indeed the case as depicted in Table 16 and Table 17. The former includes share contemporaneously, the latter though is added in lagged terms . The estimates are robust to these variations. All estimates on the share of temporary workers support the reasoning since they are positive significant.

As a robustness test for the analysis of worker flows out of employment, we additionally consider transitions to non-participation. This is of great interest because given the size of the adverse shock during the Great Recession, it is possible that a considerable number of workers left the labour market relatively quickly when they lost their job. Such worker flows would not enter the regression results presented above because they only consider persons who became unemployed after job loss. Hence, we extend our analysis to aggregate employment outflows (both to unemployment and to nonparticipation). The corresponding results presented in Table 18 are relatively similar to the results for transitions from employment to unemployment, with somewhat less significance for EPL. Therefore, taking into account the participation margin does not substantially alter our results and supports the empirical finding that trade union play an important role in explaining labour market dynamics across countries in the most recent past.

## 6 Conclusion

In this paper, we examine the reasons for cross-country differences in labour market reactions to the Great Recession for a large number of European countries as well as the US. In doing so, we follow the methodology of Blanchard and Wolfers (2000) by investigating the impact of shocks, of institutions, and the interaction of shocks and institutions in this context. In our analysis, we focus on both the unemployment rate and worker flows between different labour market states within national labour markets, which we compute from micro data at the worker level.

Using a specification which assumes a common shock across countries does not lead to significant results for the interaction of shocks and institutions in explaining worker flows from employment to unemployment and vice-versa. This is in all likelihood due to the involved assumption that there is one common (unobservable) shock across all countries, which is unlikely to hold for the Great Recession.

Our second specification, which includes country-specific shocks, suggests that shocks affected national labour markets indeed asymmetrically. In particular, we find that labour market institutions played a role in the transmission of macroeconomic shocks to national labour market with respect to the unemployment rate and worker flows from employment to unemployment. The most important variables in this context are related to trade unions, namely union density and coordination; employment protection legislation also has some role to play in this context. The results for trade unions could be due to trade unions leading to more inclusive labour market models and moderating employment growth during economic expansions. This hypothesis will be investigated further in future versions of this paper.

Finally, our results show that the interaction of shocks and institutions is not relevant for worker flows from unemployment to employment. This suggests that labour market institutions cannot be blamed for the persistence of unemployment observed in some European countries after the crisis.



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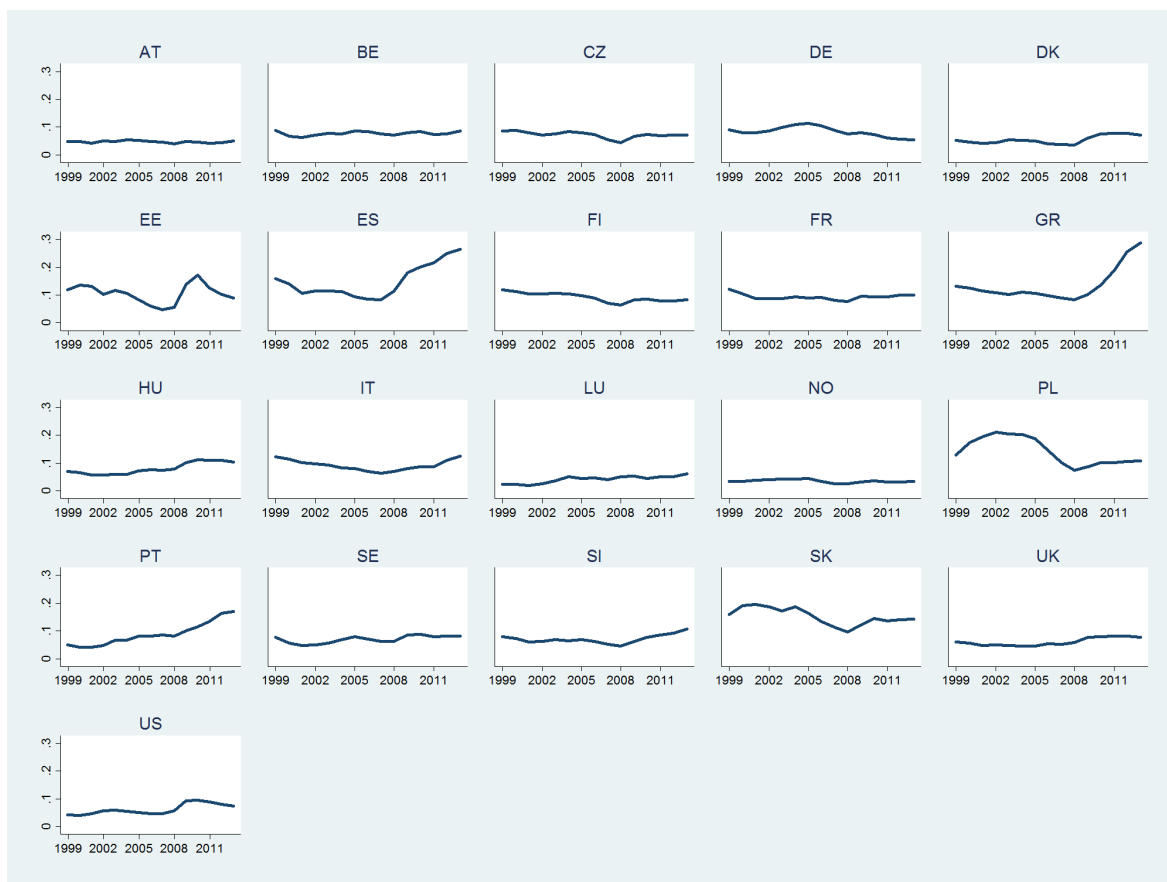
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## Appendix A – Figures and Tables

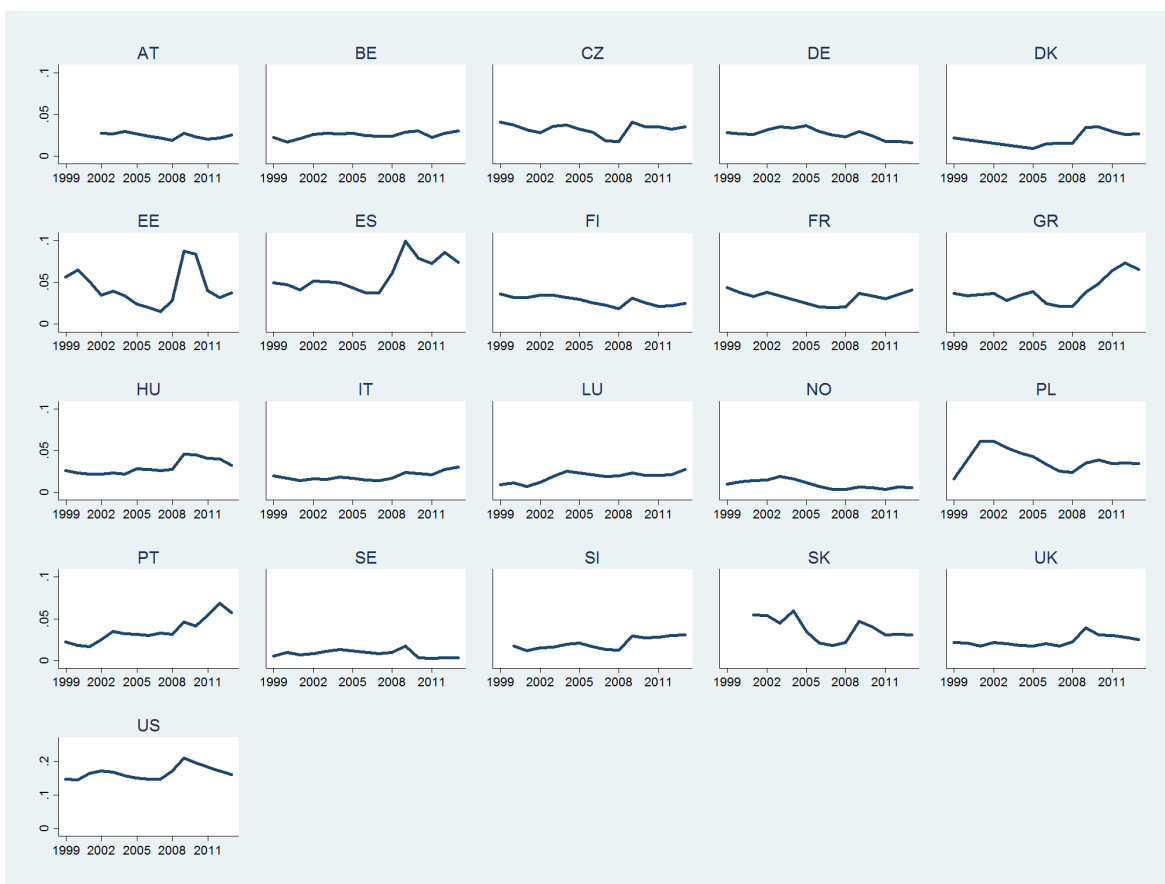
Figure 1: Unemployment rate by country, 1999 – 2013



*Notes:* Country codes: AT: Austria, BE: Belgium, CZ: Czech Republic, DE: Germany, DK: Denmark, EE: Estonia, ES: Spain, FI: Finland, FR: France, GR: Greece, HU: Hungary, IT: Italy, LU: Luxembourg, NO: Norway, PL: Poland, PT: Portugal, SE: Sweden, SI: Slovenia, SK: Slovak Republic, UK: United Kingdom, US: United States of America.

*Source:* EU-LFS, CPS, own calculation.

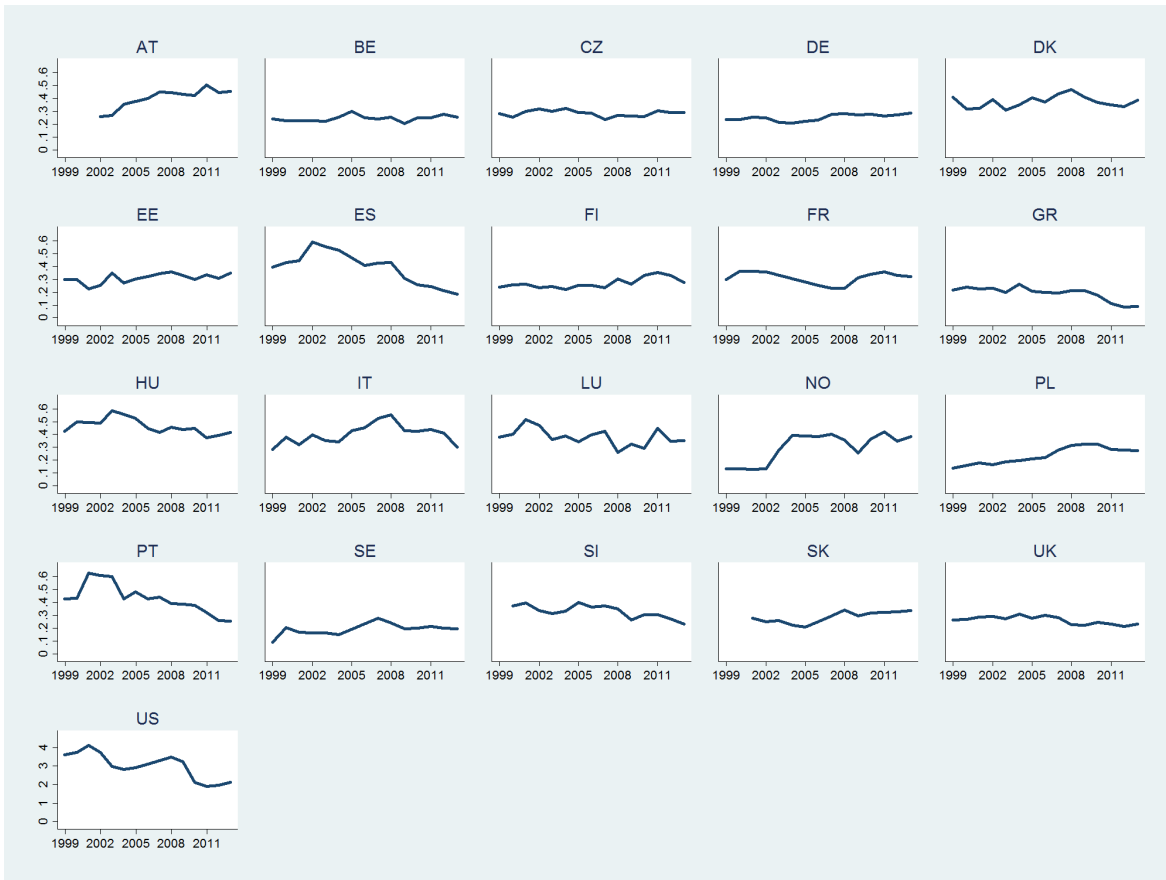
Figure 2: Annual transition rate from employment to unemployment by country, 1999 – 2013



Notes: See Figure 1 for the country codes.

Source: EU-LFS, CPS, own calculation.

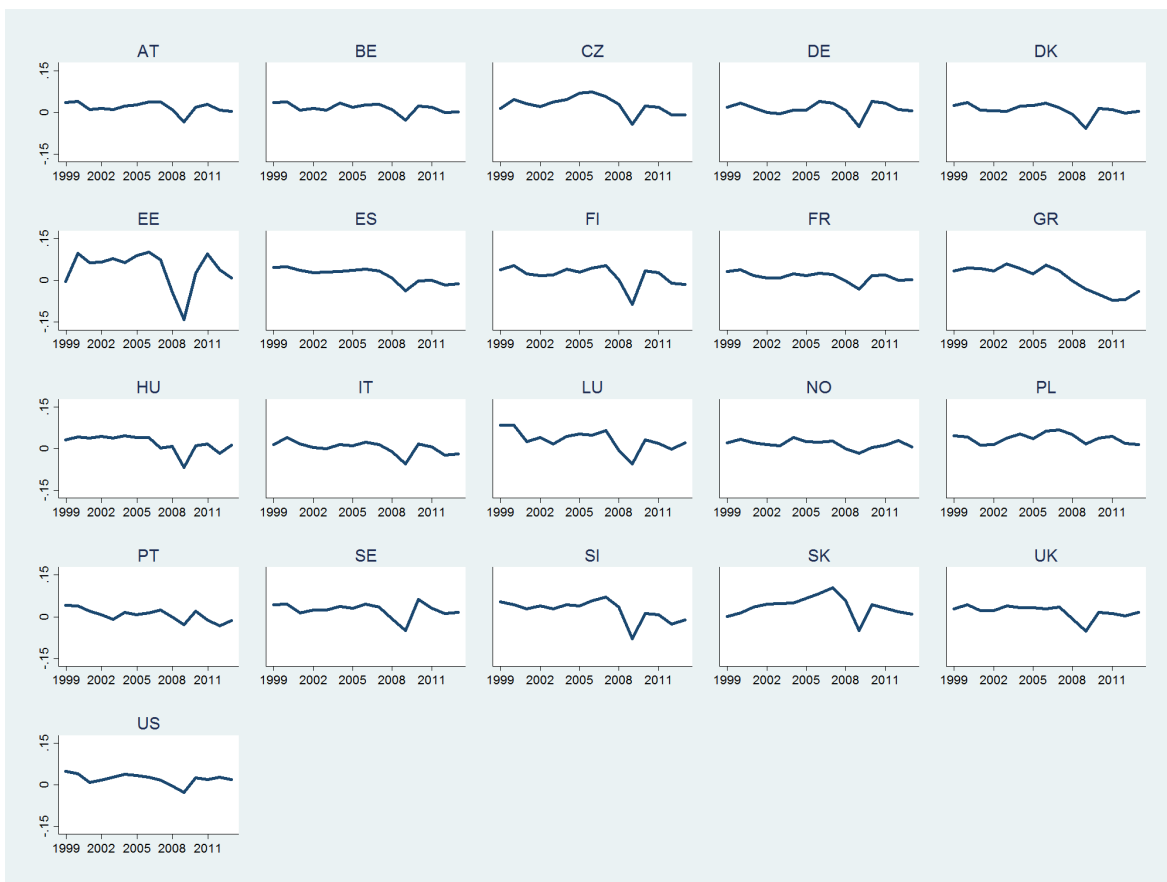
Figure 3: Annual transition rate from unemployment to employment by country, 1999 – 2013



Notes: See Figure 1 for the country codes.

Source: EU-LFS, CPS, own calculation.

Figure 4: Annual GDP growth by country, 1999 – 2013



Notes: See Figure 1 for the country codes.

Source: Economic Outlook No. 95, own calculation.

Table 1: Descriptive statistics of labour market institutions

<b>Institution Measure</b>	<b>Obs.</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
Replacement Rate	265	37.062	15.222	17.409	72.308
Benefit Length	76	16.006	10.317	5	48
Employment Protection	288	2.327	0.784	0.257	4.583
Union Coverage	146	59.643	28.194	13	100
Union Density	244	33.358	20.69	7.05	81.59
Coordination	273	2.832	1.281	1	5
ALMP	257	0.661	0.429	0.05	2.21
Tax Wedge	294	31.863	8.137	9.880	44.55

Source: OECD Economic Outlook 95, ICTWSS, own calculations.

Table 2: Pairwise correlations across labour market institutions, total variation

	Replacement Rate	Benefit Length	Employment Protection	Union Coverage	Union Density	Coordination	ALMP
Benefit Length	0.730***	1					
Employment Protection	0.143**	0.157	1				
Union Coverage	0.657***	0.402***	0.558***	1			
Union Density	0.495***	0.484***	0.00322	0.569***	1		
Coordination	0.647***	0.428***	0.208***	0.841***	0.656***	1	
ALMP	0.656***	0.676***	0.174***	0.679***	0.592***	0.556***	1
Tax Wedge	0.280***	0.164	0.193***	0.479***	0.198***	0.336***	0.412***

Source: OECD Economic Outlook 95, ICTWSS, own calculations. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .



Figure 5: Employment protection legislation by country, 1999 – 2013



Notes: See Figure 1 for the country codes.

Source: OECD Indicators of Employment Protection (2013).

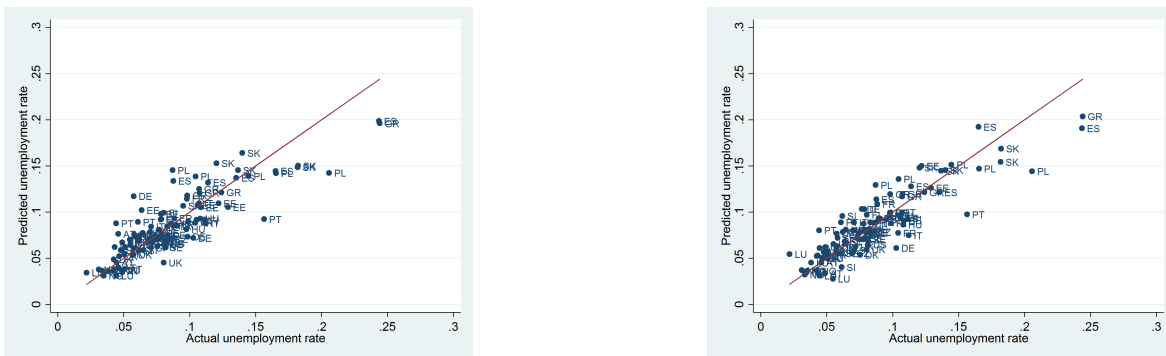
Figure 6: Union density rate by country, 1999 – 2013



Notes: See Figure 1 for the country codes.

Source: ICTWSS.

Figure 7: Unemployment rate: Model prediction vs. actual values (left panel: unobserved shocks model, right panel: observed shocks model)



Notes: See Figure 1 for the country codes.

Source: EU-LFS, CPS, own calculation.

Figure 8: Unemployment rate: Observed shocks model prediction vs. actual evolution by country, 3-year averages



Notes: See Figure 1 for the country codes.

Source: EU-LFS, own calculation.

Figure 9: Transitions from E to U: Observed shocks model prediction vs. actual evolution by country, 3-year averages



Notes: See Figure 1 for the country codes.

Source: EU-LFS, own calculation.

Figure 10: Transitions from U to E: Observed shocks model: Model prediction vs. actual evolution by country, 3-year averages



Notes: See Figure 1 for the country codes.

Source: EU-LFS, own calculation.

Table 3: Unemployment Rate: Unobserved shocks model

	Specification				
	I	II	III	IV	V
Replacement Rate	-0.048 (-1.29)	-0.056 (-1.18)	-0.087 (-0.87)	-0.048 (-1.29)	-0.150 (-0.71)
Benefit Length					0.017 (0.25)
Employment Protection	0.015 (0.03)	-0.394 (-0.60)	-1.153 (-0.78)	0.034 (0.07)	-1.454 (-0.68)
Union Coverage	0.025 (1.27)	0.050 (1.52)	0.043 (0.78)	0.021 (1.04)	0.058 (0.68)
Union Density		-0.034 (-1.27)	-0.126 (-1.19)		-0.186 (-0.89)
Coordination			2.033 (1.15)		2.651 (0.91)
ALMP					1.758 (0.50)
Tax Wedge				0.025 (0.63)	-0.037 (-0.29)
Observations	105	105	105	105	105
R-squared	0.710	0.716	0.739	0.711	0.741

*Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.*

*Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .*

*The institutional estimates refer to the institutional coefficient separated out from the interaction of the time dummy and the corresponding institution.*

Table 4: Unemployment Rate: Observed shocks model

	Specification				
	I	II	III	IV	V
GDP Growth	-0.461*** (-3.54)	-0.487*** (-3.91)	-0.455*** (-3.83)	-0.462*** (-3.54)	-0.475*** (-4.02)
Replacement Rate	-0.008 (-0.33)	0.009 (0.40)	0.004 (0.19)	-0.006 (-0.26)	-0.023 (-0.66)
Benefit Length					-0.010 (-0.38)
Employment Protection	-0.083 (-0.21)	-0.405 (-1.10)	-0.519 (-1.37)	-0.087 (-0.22)	-0.438 (-1.21)
Union Coverage	0.007 (0.59)	0.024* (1.83)	0.002 (0.17)	0.005 (0.40)	-0.004 (-0.26)
Union Density		-0.049** (-2.42)	-0.057** (-2.60)		-0.069*** (-2.98)
Coordination			0.789** (2.32)		1.007** (2.63)
ALMP					1.898* (1.94)
Tax Wedge				0.019 (0.70)	-0.044 (-1.47)
Observations	105	105	105	105	105
R-squared	0.947	0.952	0.957	0.947	0.960

*Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.*

*Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .*

*The institutional estimates refer to the institutional coefficient separated out from the interaction of GDP growth and the corresponding institution.*

Table 5: Transitions from E to U: Observed shocks model

	Specification				
	I	II	III	IV	V
GDP Growth	-0.244*** (-5.48)	-0.252*** (-6.27)	-0.245*** (-6.22)	-0.244*** (-5.44)	-0.254*** (-6.53)
Replacement Rate	-0.000 (-0.02)	0.013 (0.98)	0.011 (0.85)	-0.001 (-0.04)	-0.016 (-0.76)
Benefit Length					0.008 (0.48)
Employment Protection	-0.211 (-0.85)	-0.494** (-2.17)	-0.546** (-2.36)	-0.210 (-0.84)	-0.489** (-2.22)
Union Coverage	-0.006 (-0.88)	0.010 (1.33)	0.000 (0.01)	-0.006 (-0.80)	-0.003 (-0.35)
Union Density		-0.044*** (-3.62)	-0.047*** (-3.75)		-0.055*** (-4.29)
Coordination			0.342** (2.05)		0.529*** (2.83)
ALMP					1.158** (2.04)
Tax Wedge				-0.003 (-0.19)	-0.043** (-2.38)
Observations	102	102	102	102	102
R-squared	0.978	0.982	0.983	0.978	0.985

*Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.*

*Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .*

*The institutional estimates refer to the institutional coefficient separated out from the interaction of GDP growth and the corresponding institution.*



Table 6: Transitions from U to E: Observed shocks model

	Specification				
	I	II	III	IV	V
GDP Growth	0.567 (0.70)	0.634 (0.79)	0.619 (0.76)	0.559 (0.69)	0.615 (0.74)
Replacement Rate	-0.136 (-0.51)	-0.090 (-0.47)	-0.094 (-0.47)	-0.146 (-0.51)	-0.099 (-0.41)
Benefit Length					-0.098 (-0.48)
Employment Protection	-2.476 (-0.67)	-2.852 (-0.77)	-2.952 (-0.74)	-2.495 (-0.66)	-2.992 (-0.72)
Union Coverage	0.043 (0.52)	0.072 (0.68)	0.066 (0.62)	0.051 (0.55)	0.050 (0.52)
Union Density		-0.095 (-0.67)	-0.099 (-0.66)		-0.138 (-0.69)
Coordination			0.275 (0.20)		1.181 (0.53)
ALMP					3.763 (0.56)
Tax Wedge				-0.080 (-0.44)	-0.148 (-0.59)
Observations	104	104	104	104	104
R-squared	0.967	0.967	0.968	0.967	0.968

*Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.*

*Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .*

*The institutional estimates refer to the institutional coefficient separated out from the interaction of GDP growth and the corresponding institution.*

Table 7: Correlation of union related variables with employment growth for two time periods

	Employment Growth	
	2005-2007	2008-2009
Union Density	-0.2346	0.0669
Coordination	0.0774	0.1078

*Source: EU-LFS, CPS, ICTWSS.*

## Appendix B – Additional Figures and Tables

Table 8: Heterogeneity of main economic recessions

Recessions	SD in GDP growth
1973-1975	0.962
1980-1982	1.115
2001-2003	1.593
2008-2009	2.242

*Source: OECD Economic Outlook 95, own calculations.*

*SD (standard deviation) of the country average of yearly growth rates in the respective recession periods.*

Figure 11: Unemployment rate: Unobserved shocks model prediction vs. actual evolution by country, 3-year averages



Notes: See Figure 1 for the country codes.

Source: EU-LFS, own calculation.

Table 9: Robustness check: Fixed institutions

	Outcome															
	U					E to U					U to E					
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V	
GDP Growth	-0.430*** (-3.21)	-0.460*** (-3.58)	-0.440*** (-3.44)	-0.433*** (-3.23)	-0.460*** (-3.51)	-0.239*** (-5.12)	-0.250*** (-5.82)	-0.250*** (-5.77)	-0.239*** (-5.09)	-0.264*** (-6.03)	0.824 (0.98)	0.932 (1.11)	0.913 (1.08)	0.800 (0.95)	0.800 (0.95)	0.959 (1.10)
Replacement Rate	-0.015 (-0.55)	0.002 (0.10)	0.004 (0.17)	-0.015 (-0.54)	-0.026 (-0.64)	-0.004 (-0.23)	0.009 (0.65)	0.009 (0.64)	-0.004 (-0.23)	-0.025 (-1.08)	-0.037 (-0.35)	-0.005 (-0.06)	-0.004 (-0.05)	-0.040 (-0.36)	-0.040 (-0.36)	-0.038 (-0.28)
Benefit Length					0.020 (0.66)					0.019 (1.11)					0.007 (0.08)	
Employment Protection	0.254 (0.55)	-0.056 (-0.14)	-0.059 (-0.14)	0.234 (0.51)	-0.012 (-0.03)	-0.050 (-0.19)	-0.289 (-1.22)	-0.288 (-1.21)	-0.051 (-0.19)	-0.207 (-0.91)	-1.564 (-0.82)	-1.880 (-1.00)	-1.920 (-0.97)	-1.549 (-0.79)	-1.549 (-0.79)	-0.95 (-0.95)
Union Coverage	0.013 (0.96)	0.026* (1.82)	0.052** (1.99)	0.012 (0.88)	0.047* (1.82)	-0.003 (-0.41)	0.008 (1.11)	0.007 (0.57)	-0.003 (-0.41)	0.002 (0.15)	0.016 (0.36)	0.037 (0.73)	0.050 (0.61)	0.020 (0.41)	0.020 (0.41)	0.039 (0.50)
Union Density		-0.049** (-2.34)	-0.027 (-1.13)		-0.031 (-1.23)	-0.041*** (-3.36)	-0.042*** (-2.81)			-0.051*** (-3.24)		-0.083 (-0.94)	-0.073 (-0.78)		-0.096 (-0.89)	
Coordination			-0.829 (-1.38)		-0.761 (-1.28)		0.049 (0.16)			0.150 (0.50)			-0.378 (-0.22)		-0.031 (-0.02)	
ALMP					0.854 (0.78)					1.089* (1.71)					1.513 (0.42)	
Tax Wedge				0.023 (0.73)	0.001 (0.02)				0.001 (0.03)	-0.029 (-1.43)				-0.082 (-0.59)	-0.109 (-0.76)	
Observations	105	105	105	105	105	102	102	102	102	102	104	104	104	104	104	104
R-squared	0.948	0.953	0.954	0.948	0.955	0.977	0.981	0.981	0.977	0.982	0.966	0.967	0.967	0.967	0.967	0.968

Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.

Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .

The institutional estimates refer to the institutional coefficient separated out from the interaction of the time dummy and the corresponding institution.

Table 10: Robustness check: One period lagged institutions

	Outcome															
	U					E to U					U to E					
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V	
GDP Growth	-0.425*** (-3.24)	-0.466*** (-3.72)	-0.465*** (-3.70)	-0.426*** (-3.24)	-0.492*** (-3.83)	-0.237*** (-5.23)	-0.253*** (-6.33)	-0.253*** (-6.29)	-0.237*** (-5.20)	-0.263*** (-6.44)	0.730 (0.89)	0.843 (1.03)	0.842 (1.02)	0.842 (1.02)	0.726 (0.88)	0.907 (1.07)
Replacement Rate	-0.014 (-0.52)	0.001 (0.06)	0.006 (0.26)	-0.012 (-0.46)	-0.021 (-0.59)	-0.003 (-0.19)	0.008 (0.66)	0.009 (0.69)	-0.003 (-0.19)	-0.017 (-0.79)	-0.084 (-0.55)	-0.051 (-0.47)	-0.049 (-0.44)	-0.089 (-0.56)	-0.097 (-0.60)	-0.036 (0.35)
Benefit Length			0.013 (0.49)							0.019 (1.18)						
Employment Protection	0.244 (0.52)	-0.155 (-0.39)	-0.136 (-0.34)	0.219 (0.47)	-0.117 (-0.31)	-0.074 (-0.28)	-0.405* (-1.80)	-0.402* (-1.77)	-0.073 (-0.27)	-0.361 (-1.64)	-2.001 (-0.83)	-2.314 (-0.99)	-2.306 (-0.98)	-2.306 (-0.98)	-1.951 (-0.81)	-2.068 (-0.99)
Union Coverage	0.009 (0.72)	0.028** (2.00)	0.031** (2.04)	0.008 (0.61)	0.028* (1.93)	-0.006 (-0.75)	0.012* (1.67)	0.013 (1.61)	-0.006 (-0.73)	0.012 (1.57)	0.030 (0.55)	0.056 (0.84)	0.058 (0.81)	0.058 (0.81)	0.034 (0.58)	0.057 (0.83)
Union Density		-0.050** (-2.54)	-0.047** (-2.39)		-0.053** (-2.57)		-0.045*** (-4.03)	-0.045*** (-3.88)		-0.049*** (-4.05)			-0.077 (-0.86)	-0.076 (-0.84)		-0.085 (-0.90)
Coordination			-0.193 (-0.68)		-0.135 (-0.49)			-0.031 (-0.19)		0.014 (0.09)			-0.106 (-0.10)			0.019 (0.02)
ALMP					0.984 (1.16)					0.628 (1.25)						1.204 (0.38)
Tax Wedge				0.025 (0.78)	-0.001 (-0.04)				-0.001 (-0.03)	-0.020 (-1.12)				-0.062 (-0.46)		-0.085 (-0.66)
Observations	105	105	105	105	105	102	102	102	102	102	104	104	104	104	104	104
R-squared	0.947	0.953	0.954	0.948	0.955	0.977	0.983	0.983	0.977	0.983	0.967	0.967	0.967	0.967	0.967	0.968

Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.

Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .

The institutional estimates refer to the institutional coefficient separated out from the interaction of the time dummy and the corresponding institution.

Table 11: Robustness check: Omitted country Spain

	Outcome														
	U					E to U					U to E				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
GDP Growth	-0.332*** (-2.68)	-0.371*** (-3.00)	-0.343*** (-2.88)	-0.333*** (-2.68)	-0.374*** (-3.07)	-0.196*** (-4.42)	-0.214*** (-5.04)	-0.208*** (-4.96)	-0.195*** (-4.39)	-0.222*** (-5.21)	0.277 (0.32)	0.387 (0.45)	0.383 (0.44)	0.269 (0.31)	0.420 (0.46)
Replacement Rate	-0.026 (-0.74)	-0.006 (-0.19)	-0.009 (-0.30)	-0.024 (-0.68)	-0.029 (-0.67)	-0.010 (-0.51)	0.007 (0.43)	0.006 (0.36)	-0.010 (-0.52)	-0.018 (-0.73)	-0.318 (-0.29)	-0.178 (-0.35)	-0.180 (-0.34)	-0.343 (-0.28)	-0.148 (-0.33)
Benefit Length					-0.014 (-0.42)					0.008 (0.42)					-0.144 (-0.36)
Employment Protection	0.017 (0.03)	-0.314 (-0.68)	-0.456 (-0.94)	0.012 (0.02)	-0.434 (-0.97)	-0.180 (-0.61)	-0.471* (-1.74)	-0.532* (-1.91)	-0.179 (-0.61)	-0.513* (-1.97)	-4.719 (-0.33)	-4.251 (-0.46)	-4.308 (-0.45)	-4.819 (-0.32)	-4.190 (-0.47)
Union Coverage	0.006 (0.42)	0.022 (1.37)	-0.001 (-0.04)	0.004 (0.24)	-0.004 (-0.24)	-0.011 (-1.20)	0.007 (0.72)	-0.003 (-0.30)	-0.010 (-1.11)	-0.004 (-0.40)	0.076 (0.29)	0.100 (0.43)	0.098 (0.41)	0.096 (0.29)	0.075 (0.41)
Union Density		-0.043* (-1.71)	-0.054* (-1.90)		-0.072** (-2.35)		-0.041*** (-2.75)	-0.045*** (-2.89)		-0.057*** (-3.47)		-0.116 (-0.41)	-0.118 (-0.41)		-0.181 (-0.46)
Coordination			0.883* (1.89)		1.092** (2.16)			0.352* (1.72)		0.549** (2.41)			0.109 (0.05)		1.415 (0.36)
ALMP					1.954 (1.59)					1.135 (1.65)					5.014 (0.41)
Tax Wedge				0.024 (0.68)	-0.045 (-1.20)				-0.005 (-0.23)	-0.045** (-2.08)					-0.200 (-0.42)
Observations	100	100	100	100	100	97	97	97	97	97	99	99	99	99	99
R-squared	0.952	0.954	0.958	0.952	0.960	0.979	0.982	0.983	0.979	0.984	0.967	0.968	0.968	0.968	0.968

Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.

Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .

The institutional estimates refer to the institutional coefficient separated out from the interaction of the time dummy and the corresponding institution.

Table 12: Robustness check: Omitted country Portugal

	Outcome														
	U					E to U					U to E				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
GDP Growth	-0.414*** (-3.29)	-0.431*** (-3.52)	-0.405*** (-3.69)	-0.418*** (-3.33)	-0.436*** (-4.05)	-0.228*** (-5.47)	-0.234*** (-6.07)	-0.227*** (-6.38)	-0.228*** (-5.44)	-0.240*** (-7.02)	0.512 (0.63)	0.547 (0.67)	0.512 (0.62)	0.503 (0.61)	0.544 (0.65)
Replacement Rate	-0.035 (-1.09)	-0.015 (-0.54)	-0.033 (-1.12)	-0.032 (-1.04)	-0.067* (-1.70)	-0.020 (-1.14)	-0.005 (-0.31)	-0.013 (-0.85)	-0.020 (-1.12)	-0.046** (-2.18)	-0.240 (-0.53)	-0.196 (-0.53)	-0.227 (-0.51)	-0.247 (-0.52)	-0.245 (-0.53)
Benefit Length					-0.008 (-0.33)					0.010 (0.71)				-0.100 (-0.43)	
Employment Protection	-1.035* (-1.91)	-1.155** (-2.22)	-1.644*** (-2.84)	-1.069* (-1.99)	-1.481*** (-2.93)	-0.937*** (-2.96)	-1.059*** (-3.60)	-1.292*** (-4.26)	-0.942*** (-2.95)	-1.187*** (-4.42)	-6.069 (-0.64)	-5.928 (-0.68)	-6.777 (-0.63)	-6.099 (-0.62)	-6.387 (-0.66)
Union Coverage	0.008 (0.68)	0.023 (1.65)	-0.011 (-0.72)	0.005 (0.39)	-0.018 (-1.23)	-0.006 (-0.88)	0.008 (1.10)	-0.009 (-1.02)	-0.007 (-0.91)	-0.012 (-1.55)	0.049 (0.50)	0.071 (0.58)	0.038 (0.37)	0.055 (0.50)	0.014 (0.17)
Union Density		-0.044** (-2.02)	-0.049** (-2.29)		-0.063*** (-2.87)		-0.040*** (-3.24)	-0.042*** (-3.55)		-0.050*** (-4.38)		-0.069 (-0.50)	-0.076 (-0.49)		-0.120 (-0.59)
Coordination			1.181*** (2.76)		1.384*** (3.11)			0.564*** (3.13)		0.751*** (3.95)			1.238 (0.47)	2.211 (0.57)	
ALMP					2.377** (2.37)					1.446*** (2.75)				5.294 (0.57)	
Tax Wedge				0.032 (1.10)					0.005 (0.28)					-0.050 (-0.29)	
Observations	100	100	100	100	100	97	97	97	97	97	99	99	99	99	99
R-squared	0.749	0.767	0.815	0.754	0.835	0.961	0.967	0.973	0.961	0.977	0.952	0.953	0.952	0.954	0.954

Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.

Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .

The institutional estimates refer to the institutional coefficient separated out from the interaction of the time dummy and the corresponding institution.

Table 13: Robustness check: Omitted country Germany

	Outcome															
	U					E to U					U to E					
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V	
GDP Growth	-0.478*** (-3.64)	-0.497*** (-3.97)	-0.449*** (-3.78)	-0.479*** (-3.63)	-0.456*** (-3.89)	-0.250*** (-5.55)	-0.255*** (-6.32)	-0.244*** (-6.18)	-0.250*** (-5.51)	-0.250*** (-6.46)	0.633 (0.77)	0.680 (0.82)	0.658 (0.79)	0.629 (0.76)	0.629 (0.76)	0.594 (0.69)
Replacement Rate	-0.005 (-0.20)	0.014 (0.63)	0.010 (0.46)	-0.003 (-0.11)	-0.011 (-0.31)	0.002 (0.13)	0.017 (1.26)	0.016 (1.15)	0.002 (0.11)	-0.009 (-0.42)	-0.125 (-0.54)	-0.083 (-0.48)	-0.088 (-0.47)	-0.134 (-0.55)	-0.088 (-0.35)	-0.088 (-0.35)
Benefit Length					-0.022 (-0.77)					0.001 (0.08)					-0.114 (-0.47)	
Employment Protection	-0.064 (-0.17)	-0.385 (-1.06)	-0.508 (-1.33)	-0.067 (-0.17)	-0.430 (-1.16)	-0.198 (-0.81)	-0.483** (-2.14)	-0.540** (-2.34)	-0.198 (-0.80)	-0.483** (-2.19)	-2.236 (-0.72)	-2.661 (-0.80)	-2.774 (-0.77)	-2.238 (-0.72)	-2.238 (-0.72)	-3.074 (-0.68)
Union Coverage	0.006 (0.52)	0.023* (1.80)	0.001 (0.07)	0.004 (0.32)	-0.007 (-0.52)	-0.007 (-0.92)	0.009 (1.28)	-0.001 (-0.08)	-0.006 (-0.85)	-0.005 (-0.58)	0.039 (0.55)	0.067 (0.70)	0.062 (0.63)	0.047 (0.58)	0.048 (0.49)	0.048 (0.49)
Union Density		-0.049** (-2.45)	-0.060** (-2.60)		-0.078*** (-2.98)		-0.045*** (-3.63)	-0.049*** (-3.76)		-0.059*** (-4.30)		-0.088 (-0.68)	-0.093 (-0.66)		-0.149 (-0.64)	-0.149 (-0.64)
Coordination			0.836** (2.32)		1.135** (2.64)		0.358** (2.08)			0.575*** (2.91)		0.260 (0.20)			1.292 (0.50)	1.292 (0.50)
ALMP					2.296** (2.14)					1.337*** (2.27)					4.175 (0.54)	4.175 (0.54)
Tax Wedge				0.020 (0.74)	-0.047 (-1.50)				-0.002 (-0.15)	-0.044** (-2.39)				-0.072 (-0.46)	-0.153 (-0.56)	-0.153 (-0.56)
Observations	100	100	100	100	100	97	97	97	97	97	99	99	99	99	99	99
R-squared	0.947	0.952	0.958	0.947	0.962	0.978	0.983	0.984	0.978	0.986	0.967	0.967	0.967	0.967	0.967	0.968

Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.

Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .

The institutional estimates refer to the institutional coefficient separated out from the interaction of the time dummy and the corresponding institution.



Table 14: Robustness check: Omitted country US

	Outcome														
	U					E to U					U to E				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
GDP Growth	-0.459*** (-3.43)	-0.475*** (-3.71)	-0.441*** (-3.62)	-0.465*** (-3.46)	-0.460*** (-3.75)	-0.227*** (-5.29)	-0.230*** (-5.94)	-0.223*** (-5.90)	-0.227*** (-5.26)	-0.232*** (-6.16)	0.528* (1.70)	0.568* (1.93)	0.552* (1.86)	0.514 (1.65)	0.535* (1.79)
Replacement Rate	-0.006 (-0.25)	0.011 (0.48)	0.007 (0.28)	-0.004 (-0.17)	-0.022 (-0.61)	0.001 (0.04)	0.015 (1.06)	0.013 (0.92)	0.001 (0.06)	-0.018 (-0.84)	-0.047 (-0.71)	-0.008 (-0.17)	-0.010 (-0.21)	-0.053 (-0.75)	-0.051 (-0.60)
Benefit Length					-0.008 (-0.29)					0.012 (0.74)					0.001 (0.01)
Employment Protection	0.060 (0.13)	-0.334 (-0.76)	-0.447 (-0.99)	0.072 (0.16)	-0.399 (-0.91)	0.122 (0.42)	-0.232 (-0.87)	-0.281 (-1.04)	0.123 (0.42)	-0.245 (-0.95)	0.089 (0.10)	-0.732 (-0.82)	-0.787 (-0.84)	0.061 (0.07)	0.061 (0.07)
Union Coverage	0.007 (0.62)	0.024* (1.78)	0.002 (0.16)	0.005 (0.42)	-0.004 (-0.25)	-0.004 (-0.60)	0.011 (1.48)	0.001 (0.11)	-0.005 (-0.62)	-0.002 (-0.25)	0.036 (1.18)	0.069* (1.67)	0.062 (1.49)	0.042 (1.22)	0.059 (1.39)
Union Density		-0.049** (-2.30)	-0.058** (-2.45)		-0.071*** (-2.77)		-0.045*** (-3.46)	-0.049*** (-3.60)		-0.057*** (-4.05)		-0.103* (-1.67)	-0.108 (-1.62)		-0.134 (-1.63)
Coordination			0.812** (2.24)		1.030** (2.48)		0.375** (2.12)			0.542*** (2.73)		0.310 (0.56)			0.889 (1.09)
ALMP					1.915* (1.85)					1.225** (2.06)					1.782 (0.82)
Tax Wedge				0.022 (0.78)	-0.044 (-1.37)				0.003 (0.17)	-0.041** (-2.12)					-0.123 (-1.31)
Observations	100	100	100	100	100	97	97	97	97	97	99	99	99	99	99
R-squared	0.947	0.952	0.957	0.947	0.960	0.955	0.964	0.966	0.955	0.969	0.975	0.978	0.978	0.976	0.979

Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.

Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .

The institutional estimates refer to the institutional coefficient separated out from the interaction of the time dummy and the corresponding institution.

Table 15: Robustness check: Output gap

	Outcome														
	U					E to U					U to E				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
Output Gap	0.676*** (7.42)	0.654*** (7.46)	0.590*** (6.56)	0.675*** (7.36)	0.578*** (6.35)	0.265*** (7.52)	0.254*** (7.44)	0.247*** (6.85)	0.266*** (7.57)	0.240*** (6.55)	-2.080*** (-3.34)	-1.945*** (-3.23)	-2.118*** (-3.34)	-2.127*** (-3.53)	-2.070*** (-3.28)
Replacement Rate	-0.006 (-0.52)	0.002 (0.14)	0.010 (0.82)	-0.005 (-0.39)	-0.022 (-1.04)	0.012 (1.21)	0.019* (1.85)	0.022* (1.91)	0.006 (0.48)	0.003 (0.13)	0.045* (1.94)	0.065** (2.39)	0.053* (1.98)	0.014 (0.55)	0.019 (0.47)
Benefit Length					0.015 (0.76)					0.007 (0.35)					0.043 (1.09)
Employment Protection	0.029 (0.19)	-0.137 (-0.84)	-0.102 (-0.58)	0.031 (0.20)	-0.032 (-0.18)	0.016 (0.10)	-0.138 (-0.87)	-0.129 (-0.78)	-0.001 (-0.00)	-0.101 (-0.58)	-1.254*** (-2.81)	-1.706*** (-2.80)	-1.603*** (-3.02)	-1.298*** (-3.02)	-1.709*** (-3.03)
Union Coverage	0.004 (0.73)	0.014** (2.03)	0.004 (0.42)	0.004 (0.53)	0.003 (0.32)	-0.009 (-1.58)	-0.000 (-0.05)	-0.004 (-0.43)	-0.005 (-0.73)	-0.003 (-0.28)	-0.020 (-1.41)	-0.001 (-0.08)	0.008 (0.46)	-0.001 (-0.07)	0.022 (1.25)
Union Density		-0.026** (-2.53)	-0.034*** (-2.77)		-0.048*** (-3.10)		-0.025** (-2.42)	-0.027** (-2.40)		-0.034** (-2.49)		-0.056* (-1.96)	-0.047* (-1.81)		-0.042 (-1.44)
Coordination			0.327* (1.95)		0.450** (2.15)			0.092 (0.65)		0.242 (1.33)			-0.249 (-0.92)		-0.003 (-0.01)
ALMP					1.167* (1.72)					0.512 (0.77)					-1.193 (-0.95)
Tax Wedge				0.003 (0.15)	-0.030 (-1.26)				-0.021 (-1.19)	-0.040* (-1.71)				-0.094** (-2.08)	-0.101* (-1.79)
Observations	100	100	100	100	100	97	97	97	97	97	99	99	99	99	99
R-squared	0.967	0.971	0.972	0.967	0.974	0.983	0.984	0.984	0.983	0.985	0.975	0.977	0.978	0.977	0.980

Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.

Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .

The institutional estimates refer to the institutional coefficient separated out from the interaction of the time dummy and the corresponding institution.

Table 16: Robustness check: Share of temporary workers

	Outcome														
	U					E to U					U to E				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
GDP Growth	-0.446*** (-3.74)	-0.464*** (-3.94)	-0.439*** (-3.88)	-0.445*** (-3.72)	-0.447*** (-3.90)	-0.235*** (-5.97)	-0.243*** (-6.50)	-0.237*** (-6.45)	-0.233*** (-5.95)	-0.240*** (-6.56)	0.532 (0.66)	0.590 (0.73)	0.583 (0.71)	0.513 (0.64)	0.557 (0.67)
Replacement Rate	-0.011 (-0.45)	0.001 (0.03)	-0.003 (-0.12)	-0.011 (-0.45)	-0.018 (-0.52)	-0.003 (-0.23)	0.007 (0.56)	0.006 (0.47)	-0.005 (-0.36)	-0.013 (-0.64)	-0.150 (-0.50)	-0.109 (-0.48)	-0.110 (-0.47)	-0.168 (-0.49)	-0.102 (-0.37)
Benefit Length					-0.010 (-0.38)					0.008 (0.53)					-0.107 (-0.46)
Employment Protection	-0.128 (-0.35)	-0.329 (-0.90)	-0.437 (-1.17)	-0.128 (-0.34)	-0.419 (-1.13)	-0.251 (-1.11)	-0.452** (-2.06)	-0.497** (-2.24)	-0.250 (-1.10)	-0.485** (-2.22)	-2.722 (-0.64)	-2.942 (-0.71)	-2.993 (-0.70)	-2.800 (-0.62)	-3.232 (-0.65)
Union Coverage	-0.021 (-1.49)	-0.004 (-0.30)	-0.022 (-1.25)	-0.021 (-1.47)	-0.024 (-1.35)	-0.027*** (-2.93)	-0.010 (-1.07)	-0.017 (-1.65)	-0.026*** (-2.85)	-0.018* (-1.82)	-0.000 (-0.00)	0.037 (0.41)	0.034 (0.36)	0.006 (0.08)	0.024 (0.26)
Union Density		-0.032* (-1.70)	-0.040** (-2.00)		-0.052*** (-2.36)		-0.033*** (-2.89)	-0.036*** (-3.07)		-0.043*** (-3.46)		-0.075 (-0.56)	-0.078 (-0.55)		-0.120 (-0.60)
Coordination			0.714** (2.20)		0.963** (2.50)			0.282* (1.78)		0.477** (2.62)			0.141 (0.10)		1.136 (0.47)
ALMP					1.208 (1.21)					0.598 (1.03)					2.927 (0.43)
Tax Wedge				-0.002 (-0.06)										-0.128 (-0.50)	-0.165 (-0.55)
Share of Temp. Workers	0.145*** (2.71)	0.117** (2.45)	0.110** (2.32)	0.145*** (2.66)	0.100** (2.08)	0.105*** (3.64)	0.079*** (3.13)	0.075*** (2.99)	0.112*** (3.71)	0.076*** (2.89)	0.238 (0.57)	0.162 (0.53)	0.161 (0.52)	0.284 (0.57)	0.154 (0.46)
Observations	105	105	105	105	105	102	102	102	102	102	104	104	104	104	104
R-squared	0.956	0.958	0.962	0.956	0.964	0.983	0.985	0.985	0.983	0.987	0.968	0.968	0.968	0.968	0.969

Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.

Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .

The institutional estimates refer to the institutional coefficient separated out from the interaction of the time dummy and the corresponding institution.

Table 17: Robustness check: One period lagged average of share of temporary workers

	Outcome														
	U					E to U					U to E				
	I	II	III	IV	V	I	II	III	IV	V	I	II	III	IV	V
GDP Growth	-0.440*** (-3.90)	-0.455*** (-4.05)	-0.434*** (-3.99)	-0.439*** (-3.86)	-0.437*** (-3.96)	-0.234*** (-6.03)	-0.242*** (-6.55)	-0.237*** (-6.49)	-0.232*** (-6.01)	-0.239*** (-6.60)	0.523 (0.65)	0.578 (0.72)	0.576 (0.71)	0.503 (0.63)	0.548 (0.66)
Replacement Rate	-0.012 (-0.53)	-0.003 (-0.11)	-0.005 (-0.23)	-0.013 (-0.55)	-0.019 (-0.55)	-0.004 (-0.26)	0.007 (0.51)	0.006 (0.45)	-0.006 (-0.41)	-0.014 (-0.69)	-0.154 (-0.49)	-0.114 (-0.48)	-0.114 (-0.47)	-0.174 (-0.49)	-0.105 (-0.38)
Benefit Length					-0.006 (-0.24)					0.011 (0.69)					-0.103 (-0.44)
Employment Protection	-0.163 (-0.46)	-0.328 (-0.92)	-0.425 (-1.17)	-0.162 (-0.45)	-0.421 (-1.15)	-0.268 (-1.19)	-0.461** (-2.12)	-0.501** (-2.27)	-0.268 (-1.19)	-0.489** (-2.25)	-2.812 (-0.63)	-3.002 (-0.70)	-3.019 (-0.69)	-2.910 (-0.61)	-3.284 (-0.64)
Union Coverage	-0.026* (-1.89)	-0.013 (-0.85)	-0.028 (-1.58)	-0.026* (-1.85)	-0.029 (-1.64)	-0.027*** (-3.02)	-0.011 (-1.19)	-0.016 (-1.66)	-0.026*** (-2.94)	-0.017* (-1.81)	-0.005 (-0.06)	0.031 (0.35)	0.030 (0.32)	0.002 (0.02)	0.023 (0.24)
Union Density		-0.027 (-1.50)	-0.034* (-1.83)		-0.045*** (-2.13)		-0.032*** (-2.86)	-0.035*** (-3.03)		-0.041*** (-3.37)		-0.072 (-0.54)	-0.073 (-0.53)		-0.115 (-0.58)
Coordination			0.641** (2.10)		0.883** (2.41)			0.251 (1.60)		0.437** (2.43)			0.046 (0.03)	1.044 (0.44)	
ALMP					0.887 (0.91)					0.537 (0.92)				2.693 (0.40)	
Tax Wedge				-0.008 (-0.31)	-0.048 (-1.57)					-0.021 (-1.32)			-0.138 (-0.51)	-0.166 (-0.55)	
Share of Temp. Workers	0.182*** (3.07)	0.157*** (2.90)	0.147*** (2.77)	0.184*** (3.03)	0.140** (2.55)	0.112*** (3.78)	0.086*** (3.30)	0.081*** (3.11)	0.119*** (3.85)	0.081*** (3.00)	0.275 (0.58)	0.198 (0.56)	0.198 (0.55)	0.329 (0.57)	0.186 (0.48)
Observations	105	105	105	105	105	102	102	102	102	102	104	104	104	104	104
R-squared	0.961	0.962	0.965	0.961	0.966	0.983	0.985	0.986	0.984	0.987	0.968	0.968	0.968	0.968	0.969

Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.

Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .

The institutional estimates refer to the institutional coefficient separated out from the interaction of the time dummy and the corresponding institution.

Table 18: Transitions from E to U and N: Observed shocks model

	Specification				
	I	II	III	IV	V
GDP Growth	-0.246*** (-4.62)	-0.254*** (-5.04)	-0.245*** (-4.96)	-0.246*** (-4.59)	-0.251*** (-5.08)
Replacement Rate	-0.002 (-0.08)	0.011 (0.65)	0.009 (0.52)	-0.002 (-0.13)	-0.021 (-0.78)
Benefit Length					0.019 (0.94)
Employment Protection	0.059 (0.19)	-0.212 (-0.75)	-0.264 (-0.92)	0.061 (0.20)	-0.234 (-0.84)
Union Coverage	-0.003 (-0.35)	0.012 (1.28)	0.000 (0.03)	-0.002 (-0.22)	-0.001 (-0.07)
Union Density		-0.041*** (-2.75)	-0.045*** (-2.87)		-0.051*** (-3.19)
Coordination			0.412* (1.91)		0.607** (2.44)
ALMP					0.760 (1.05)
Tax Wedge				-0.010 (-0.49)	-0.052** (-2.16)
Observations	102	102	102	102	102
R-squared	0.995	0.996	0.996	0.995	0.996

Source: EU-LFS, OECD Economic Outlook 95, ICTWSS, own calculations.

Nonlinear least-squares estimation. T-statistics in parentheses. \* / \*\* / \*\*\* refers to  $\alpha = 0.1/0.05/0.01$ .

The institutional estimates refer to the institutional coefficient separated out from the interaction of GDP growth and the corresponding institution.

## Appendix C – Data description and imputation methods

The GDP growth rate is calculated by annual GDP values in volume measured in market prices extracted from the OECD Economic Outlook No. 25.

The benefit replacement rate and the benefit duration are obtained from the OECD Benefit and Wages Statistics (2014). The former is a summary measure which is defined as the average of the net unemployment benefit replacement rate for two earnings levels, three family situations and 60 months of unemployment. It is available for between 2001 and 2013 for all countries of the sample. We impute values for 1999 from the measure in 2001. Our variable for benefit length captures for how many months 40-year old unemployed individuals are entitled to receive unemployment benefits. The source provides measures only for the years 2002, 2005, 2007 and 2010. Since we are interested in the years 1999, 2002, 2005, 2008 and 2010, we use the values most closely to the corresponding year as a proxy for the measure in the three-year window.

Employment protection legislation (EPL) in a country is measured by an index and stems from OECD Indicators of Employment Protection (2013). There are several indicators available. We select version I, which measures the strictness of regulation of individual dismissal of employees on regular or indefinite contracts. This index ranges from 0 to 5. For most countries it is available at a yearly frequency in the time period between 1999 and 2011. However, it includes missing data for Estonia, Luxembourg and Slovenia before 2008. We conduct a complete imputation for the previous years using the value of 2008 for these countries.

The dispersion of wage bargaining is characterized by three measures. We take all of them from the ICTWSS (Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts). The first is the coordination of wage setting and represents an indicator ranging from one to five where five is the highest form of collective bargaining that is equal to centralized wage bargaining. It is complete for our country-year combinations. The second measure is union coverage. It is calculated as the ratio of employees covered by collective bargaining agreements to the proportion of all wage and salary earners in employment with the right to bargaining, adjusted for the possibility that some sectors or occupations are excluded from the right to bargain. Since it is missing within countries at most for one year at once, we impute the previous year's value. The last institutional variable to capture the dispersion of wage bargaining is union density, defined as the proportion of trade union members as a percentage of all employees. Here, mainly the same missing structure exists as for the union coverage variable. Thus, we apply the same imputation method as before. Nevertheless, for Estonia, France, Poland and Greece up to three years are lacking in the data set. Thus, we use for 1999 the information of 2002.

The measure for active labour market policies (ALMP) comes from OECD Employment and Labour Market Statistics (2013). It refers to expenditures on programs that are aimed at helping unemployed individuals to get back into work. The time series is complete for all countries between 1999 and 2011.

The OECD reports a tax wedge indicator. We use the information given in 2015. The measure displays the difference between real labour costs and take home pay for a single-earner couple at 100 per cent of average earnings with two children. Since its values are missing for all countries in 1999, we use the data of 2000 instead.