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Evidence for the OECD, 1985-2013

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Abstract

This paper provides econometric evidence on the impact of labour market regulations on ('structural') unemployment rates. Based on a data set for 23 OECD countries over the time period 1985-2013, the panel regression results suggest that standard institutional labour market indicators - such as employment protection legislation, trade union density, tax wedge, minimum wages - largely underperform in explaining (medium-term) unemployment, while cyclical macroeconomic factors - in particular capital accumulation, but also the long-term real interest rate - are essential determinants. These results underscore that the existing macroeconometric evidence in favour of the view that labour market rigidities are at the heart of increased 'structural' unemployment in advanced economies is modest at best. Some labour market variables do have an impact on unemployment, but it is in general smaller than the impact of relevant macroeconomic variables. To understand the development of unemployment in OECD countries, researchers and policy-makers therefore should focus on capital accumulation.

Keywords: unemployment, labour market institutions, NAIRU, capital accumulation

JEL classification: C54, E24, E62

CONTENTS

TABLES AND FIGURES

1 Introduction

As a consequence of the economic crisis of 2008/2009, unemployment rates in most advanced countries increased markedly (e.g. OECD, 2013). Unemployment in the euro area rose from 7.6% in 2008 to 12.0% in 2013, falling to 9.1% in 2017 - with large differences in labour market performance across euro area countries (e.g. ECB, 2015; Andor, 2016; Gräbner et al, 2017). Although unemployment rates in advanced economies have eventually fallen after a severe crisis-related surge (to varying degrees and at different speeds across countries), unemployment in several developed countries today still stands above pre-crisis levels. Are labour market rigidities leading to persistently high unemployment, especially in large parts of Europe? This question features prominently both in the academic literature as well as in policy debates (e.g. Arpaia et al, 2014; Heimberger et al, 2017; Constancio, 2018). The proposition that increased unemployment is to be reduced by measures that aim at deregulating the respective country's labour market (i.e. by easing employment protection legislation, decentralising collective bargaining, cutting minimum wages etc.) has influenced policy-making in the aftermath of the crisis: within Europe, especially the Southern European countries have introduced major deregulation measures over recent years, leading to intense debates about their macroeconomic effects (e.g. Eggertsson et al, 2014; Campos et al, 2018; Duval and Furceri, 2018).

On a theoretical level, the crucial question posed by economists in the context of persistently high unemployment rates is how the 'non-accelerating inflation rate of unemployment' - or, in short, NAIRU - has developed in the respective countries before and after the crisis. The NAIRU is at the core of modern macroeconomics, building on the proposition that there exists some (unobserved) rate of unemployment at which inflation does not accelerate (e.g. Stockhammer, 2008; Blanchard, 2018; Constancio, 2018). The NAIRU has also been identified with the idea of a 'natural rate of unemployment' (Ball and Mankiw, 2002), which would prevail if all cyclical and seasonal fluctuations were cancelled out, so that 'natural unemployment' represents structural unemployment existing independently of all temporary and seasonal fluctuations (Friedman, 1968). However, while the theoretical foundations of the NAIRU as a main theory for explaining unemployment remain contested, Stockhammer (2008) has emphasised that the NAIRU model can be made consistent with several theoretical traditionsm, including Post-Keynesian and marxist theory. On an empirical level, a large literature has provided diverse estimations regarding the econometric determinants of ('structural') unemployment rates from the 1990s

onwards (e.g. OECD, 1994; International Monetary Fund, 2003; Blanchard, 2006, for an extensive literature review, see section 2).[1] Much of this literature has estimated reduced-form NAIRU models by regressing a variable capturing ('structural') unemployment on the change in the inflation rate (introduced to capture a possible trade-off in the Phillips curve relationship between unemployment and inflation), a set of institutional labour market indicators and macroeconomic control variables (e.g. Nickell, 1997; Stockhammer and Klär, 2011; Heimberger et al, 2017). In this paper, we go beyond the existing literature in various respects by including a comprehensive set of macroeconomic and institutional control variables, by accounting for a longer time frame - we also include data for some years after the financial crisis of 2007/2008, which most of the papers have not been able to do -, by including a larger OECD country group than most previous studies, and by providing several additional robustness checks. The empirical evidence presented in this paper contributes to revisiting the evidence on the determinants of unemployment based on recent data and econometric methods, which should be valuable for policy-makers and for a broader audience of researchers working on unemployment in OECD countries.

The remainder of this paper is structured as follows. In Section 2, we review the empirical literature that analyzes the determinants of unemployment in advanced economies; furthermore, we summarise the theoretical foundations of the relevant empirical applications. Section 3 discusses the data used in this paper to measure unemployment, labour market institutions and relevant macroeconomic control variables. In Section 4, we develop the econometric strategy for assessing the determinants of unemployment rates; furthermore, we present the econometric baseline results. Section 5 provides a thorough set of robustness checks for the baseline findings. Section 6 concludes our argument.

[1] In the remainder of the paper, we write 'structural' unemployment in apostrophes since structural unemployment is unobservable and, hence, has to be estimated based on economic models, where relevant model estimates remain subject to criticism and contestation (e.g. Galbraith, 1997; Heimberger and Kapeller, 2017; Blanchard, 2018).

2 Literature review: The determinants of unemployment rates in OECD countries

From the late 1970s to the 1990s, many OECD countries had experienced a marked increase in unemployment rates (e.g. Blanchard, 2006). The academic literature has extensively studied the explanatory factors for rising unemployment. Table 1 provides an overview of the relevant empirical papers on the determinants of unemployment. A substantial strand of the literature has emphasised that labour market rigidities caused by protective labour market institutions are to be considered the major factor behind increasing unemployment rates across OECD countries (OECD, 1994; Scarpetta, 1996; Siebert, 1997; Elmeskov et al, 1998; Blanchard and Wolfers, 2000; International Monetary Fund, 2003; Belot and van Ours, 2004; Nickell et al, 2005; Bernal-Verdugo et al, 2012). The view that protective labour market institutions are the main factor driving higher unemployment led to corresponding calls for 'structural labour market reforms', i.e. calls to decentralise wage bargaining, reduce employment protection legislation, cut minimum wages etc., which was supported by "a wide range of analysts and international organisations - including the EC [European Commission], the Organisation for Economic Co-operation and Development (OECD), and the International Monetary Fund (IMF) , [which] have argued that the causes of high unemployment can be found in labour market institutions." (International Monetary Fund, 2003, p. 129) Crucially, however, the more recent literature has pointed out that the identified empirical correlations between labour market institutions and increasing unemployment were not robust to using appropriate estimation strategies, including alternative hypotheses for explaining unemployment, and variations in selected country groups and time period (Baker et al, 2005; Howell et al, 2007; Baccaro and Rei, 2007; Arestis et al, 2007; Stockhammer and Klär, 2011; Vergeer and Kleinknecht, 2012; Avdagic and Salardi, 2013; Stockhammer et al, 2014; Heimberger et al, 2017; Constancio, 2018). Hence, the existing empirical evidence for the view that institutions are at the heart of unemployment problems in OECD countries from the 1970s to the 1990s can be described to be modest at best.

The econometric literature on the determinants of unemployment has focused on explaining movements in unemployment rates across OECD countries by using labour market institutions (short: LMIs) – e.g. employment protection legislation, tax wedge, minimum wages, trade union density – as explanatory variables. However, after a number of studies had not found a meaningful relationship between the OECD's measures of labour market deregulation and

shifts in 'structural' unemployment (e.g. Baker et al, 2005; Heckman, 2007; Stockhammer and Klär, 2011), researchers shifted to including additional explanatory variables in the regressions, which represent alternative explanations for movements in unemployment rates. In particular, Blanchard and Wolfers (2000) control for macroeconomic shock variables (the long-term interest rate, deviations from the trend in total factor productivity growth and shifts in labour demand); they underscore the relationship between these macroeconomic shocks and labour market institutions – similar to later papers, which have also emphasised the importance of interaction terms (e.g. International Monetary Fund, 2003; Bassanini and Duval, 2006).

Other papers, such as Arestis et al (2007) and Stockhammer and Klär (2011), among others, argue along Keynesian lines that the most crucial variable for explaining unemployment is not the structure of labour market institutions but the formation of the capital stock, assigning a crucial role to investment; hence, these studies include capital accumulation, capturing changes in the capital stock, as the main variable of interest in their panel data regressions on the determinants of unemployment. Others, such as Bassanini and Duval (2006), prominently include a shock variable regarding terms of trade shocks in their empirical analysis, as they argue that a change in the terms of trade affects domestic unemployment, with the expectation of a positive impact on domestic employment as imports become less attractive (and vice versa).[2]

In the empirical analysis of this paper, we will contribute to the existing literature in the following respects. First, we overcome a shortcoming of most of the empirical studies on the determinants of unemployment in the OECD, which either neglect the role of capital accumulation and long-term interest rates as alternative explanatory hypotheses or only include few institutional labour market variables. We do so by compiling a comprehensive data set on macroeconomic and labour market variables, which we will introduce in more detail in section 3. Second, we use data over a longer time period (1985–2013) than most studies and also provide robustness checks regarding variations in the years considered. Furthermore, we consider a larger OECD country group than other studies (see Table 1). Third, we provide regression results regarding the determinants of unemployment on annual unemployment data, 5-year averages of unemployment data, and the OECD's NAIRU estimates as a commonly used proxy of 'structural unemployment' (Rusticelli, 2014). By doing so, we provide versatile empirical

[2]Orlandi (2012) and Heimberger et al (2017) also argue in favor of including a proxy for boom-bust patterns in the housing market as a cyclical explanatory variable for shifts in unemployment. However, in this paper we will not use this variable, since the harmonised data are not available for our whole country group of 23 OECD countries.

evidence that should allow for valid statistical inferences. Fourth, we provide a comprehensive set of additional robustness checks, as we analyze the importance of interaction terms, lag specifications and variations in the country group.

Table 1: Literature review: Econometric studies on the determinants of ('structural') unemployment

	Data	**Dependent variable**	**LMI variables**	**Other controls**
Scarpetta (1996)	17 OECD countries (1983-1993)	UNEMP	ALMP, EPL, UBR, UDens, TW	real interest rate, TOTS
Nickell (1997)	20 OECD countries (1983-1994)	UNEMP	UBR, BD, UDens, EPL, CBC, TW, ALMP	—
Elmeskov et al (1998)	19 OECD countries (1983-1995)	UNEMP	UBR, UDens, EPL, CBC, TW, ALMP, MW	—
Blanchard and Wolfers (2000)	20 OECD countries (1960-1996)	UNEMP	UBR, BD, UDens, COORD, TW, ALMP, MW	LTI, TFPS, TOTS, LDS
Alexiou and Pitelis (2003)	13 OECD countries (1961–1998)	UNEMP	—	several macroeconomic controls
International Monetary Fund (2003)	20 OECD countries (1960-1998)	UNEMP	UBR, EPL, UDens, COORD, TW	LTI, TFPS, TOTS, CBI
Belot and van Ours (2004)	17 OECD countries (1960–1999)	UNEMP	UBR, EPL, UDens, CWB	—
Baker et al (2005)	20 OECD countries (1960-1999)	UNEMP	UBR, BD, UDens, EPL, COORD, ALMP	—
Nickell et al (2005)	20 OECD countries (1961-1995)	UNEMP	UBR, BD, UDens, EPL, COORD, TW	LTI, TFPS, LDS, TOTS, money supply
Bassanini and Duval (2006)	21 OECD countries (1982-2003)	UNEMP	UBR, BD, EPL, UDens, COORD, ALMP, PMR	LTI, TFPS, TOTS, LDS
Palacio-Vera et al (2006)	USA 1964:2-2003:1	NAIRU (OECD)	—	ACCU, TOTS
Arestis et al (2007)	9 OECD countries (quarterly data, max. 1979-2002)	UNEMP	UBR, strike activity	ACCU

Baccaro and Rei (2007)	18 OECD countries (1960-1998)	UNEMP	UBR, BD, UDens, EPL, COORD, TW	LTI, TFPS, TOTS, LDS
Bertola et al (2007)	20 OECD countries (1960-1996)	Employment rate	UBR, BD, UDens, EPL, COORD, ALMP	LTI, TFPS, LDS
Gianella et al (2008)	19 OECD countries (1978-2002)	NAIRU (OECD)	TW, PMR, UBR, UDens	LTI
Stockhammer and Klär (2011)	20 OECD countries (1983–2003; 1960–1999)	UNEMP	UBR, BD, UDens, EPL, TW, COORD, CBC, PMR	TOTS, ACCU, TFPS, LTI, LDS
Bernal-Verdugo et al (2012)	97 countries (1985–2008)	UNEMP	MW, EPL, CWB, COH	Several macroeconomic controls
Orlandi (2012)	13 EU countries (1985–2009)	NAWRU (EC)	UBR, TW, UDens, ALMP	TFP growth, LTI, HBOOM
Vergeer and Kleinknecht (2012)	20 OECD countries (1961-1995)	UNEMP	UBR, BD, UD, EPL, COORD, TW	LTI, TFPS, LDS, TOTS, money supply
Avdagic and Salardi (2013)	32 EU and OECD countries (1980–2009)	UNEMP	UBR, EPL, TW, COORD, UDens	TOTS, LTI, CBI
European Commission (2013)	15 EU Countries (1985–2008)	NAWRU (EC)	TW, PLM, ALMP, SMI, MEI	TFP growth, HBOOM
Flaig and Rottmann (2013)	19 OECD countries (1960–2000)	UNEMP	EPL, UDens, UBR, CWB, TW	—
Sturn (2013)	20 OECD countries (1985–2008)	UNEMP	EPL, MW, UDens, UBR	LTI, ACCU, output gap
Stockhammer et al (2014)	12 OECD countries (2007–2011)	UNEMP	EPL, ALMP, MW, UDens, UBR	LTI, HBOOM, ACCU
Heimberger et al (2017)	14 OECD countries (1985-2012)	NAWRU (EC)	EPL, ALMP, MW, UDens, UBR, TW	LTI, HBOOM, ACCU, TOTS, TFP growth
Constancio (2018)	10 OECD countries (2007-2016)	NAWRU (EC)	UBR, TW, UDens, ALMP	TFP growth, LTI, HBOOM

[2] *Notes:* ACCU, capital accumulation; ALMP, active labour market policy; BD, benefit duration; CBC, collective bargaining coverage; CBI, Central Bank Independence index; COORD, wage bargaining coordination; CWB, centralisation of wage bargaining; EPL, employment protection legislation; HBOOM, proxy for boom-bust patterns in housing; LMI, labour market institution; LDS, labour demand shock; LTI, long-term real interest rate; MEI, Matching efficiency indicator; MW, minimum wage; PLM, passive labour market policies; PMR, product market regulation; SMI, skill mismatch indicator; TFPS, deviation of total factor productivity from its trend; TOTS, terms of trade shock; TW, tax wedge; UDens, trade union density; UBR, unemplomet benefit replacement rate

3 Data on unemployment, labour market institutions and macroeconomic variables

The data set used for the panel-econometric work on the determinants of unemployment in this study includes 23 OECD countries over the time period 1985-2013: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, USA. Table 2 describes the details on which variables we included in our data set. Our data on structural labour market indicators (LMI) consists of six standard labour market variables, all of which were obtained from the OECD's data base: employment protection legislation (EPL), expenditures on active labour market policies (ALMP),[3] trade union density (UDens), unemployment benefit replacement rate (UBR and UBR2),[4] tax wedge (TW) and minimum wage (MW). Additionally, we consider several variables related to alternative explanations of ('structural') unemployment, summarised in $C_{i,t}$. First, we use an indicator covering changes in the capital stock (Stockhammer and Klär, 2011). The variable is called capital accumulation (ACCU), defined as the ratio of real gross fixed capital formation to the real net capital stock. Second, we include the annual growth rate in total factor productivity (TFP). It should be stressed that we are aware of the limitations and problems of total factor productivity estimates, which are endogenous to economic activity (Felipe and McCombie, 2004; Magacho and McCombie, 2017). However, we still decided to include a TFP growth variable since a) most of the mainstream literature also does so and b) we want to stick relatively closely to these specifications in order to test whether mainstream hypotheses can be rejected. Third, we use a variable for terms of trade shocks (TOTS). Fourth, we consider the long-term interest rate (LTI). Notably, the panel data used in this paper are unbalanced.

Which signs should we expect the explanatory variables summarised in Table 2 to have according to theoretical considerations? The mainstream literature on the determinants of un-

[3] Notably, we use the ratio of ALMP expenditures (in % of GDP, as provided in the OECD database), but divide this measure by the unemployment rate. We do so to account for the fact that ALMP expenditures increase and decrease in tandem with movements in unemployment.

[4] For the period 20002013, we use OECD data on unemployment benefit net replacement rates (UBR2). However, as those data are only available from 2000 onwards, we have to use gross replacements rates for the period 1985-2011 (UBR). The OECDs gross replacement rate data are only available for every second year; therefore, we used interpolation to obtain data for the missing years. Two separate time series of gross replacement rates were chained. The first series ranges from 1961 to 2005 and is based on Average Production Worker wages (APW); the second time series ranges from 2005 to 2011 and is based on Average Worker wages (AW). To chain these time series, we took the following approach: we calculated the growth rates in AW, and then extended the APW time series from 2005 to 2011 by using the growth rates from the AW time series.

employment has emphasised the dominant role of labour market institutions when it comes to explaining shifts in unemployment. In this sense, authors such as Nickell (1998), International Monetary Fund (2003), Bassanini and Duval (2006) and others expect the variables UBR, UDens, MW and TW to all have a positive sign, i.e. to be positively correlated with unemployment. The reasoning provided is generally that protective labour market institutions bias the bargaining position in wage negotiations in favour of the employees and workers, and also reduce the willingness and capacity of the unemployed to accept wage cuts – all of this, according to the mainstream literature, leads to wage rigidities that inhibit the functioning of the labour markets and push up unemployment. Notably, the effects of the protective labour market institutions unemployment benefits, trade union density, minimum wages and tax wedge on unemployment rates are controversial, since several studies make the theoretical case that certain labour market rigidities can help stabilise the expectations of employees and workers, thereby promote labour productivity, technology and aggregate demand, which supports a stable economic development (e.g. Kleinknecht, 1998; Vergeer and Kleinknecht, 2014; Storm and Capaldo, 2018). In this study, however, we use the mainstream theoretical predictions as the baseline, since these have been most prominent in the relevant empirical literature discussed in section 2.

In contrast, ALMP is expected to have a negative sign, because expenditures on active labour market policies are expected to increase matching efficiency and, hence, reduce labour market rigidity (e.g. Arpaia et al, 2014). The expected empirical effects of EPL, however, are theoretically ambiguous. On one hand, it could be expected that employment protection will reduce job creation, as employers are reluctant to hire employees: they might fear that employees cannot be laid off easily. On the other hand, more rigid employment protection increases job retention, because employers lay off fewer employees, especially during recessions. Additionally, stronger EPL might encourage investments in employee training, which raises innovation on the firm-level and pushes productivity (e.g. Zhou et al, 2011). Hence, the effects of EPL are ex ante unclear (e.g. Avdagic and Salardi, 2013). Nevertheless, the mainstream literature usually expects that EPL has a positive impact on unemployment (e.g. Skedinger, 2010).

As an additional hypothesis for explaining unemployment, we include ACCU: here, a decrease in investment is expected to cause an increase in unemployment and vice versa (Stockhammer and Klär, 2011). From the supply-side, it has also been argued that limited substitutability between labour and capital can lead to a long-run impact of ACCU on "structural" unemploy-

ment (e.g. Sturn, 2013). Furthermore, an increase in real long-term interest rates is expected to push up unemployment, as the cost of capital increases, which slows down investment and increases unemployment (Gianella et al, 2008). TFP is expected to have a negative sign, as a decline in TFP growth pushes unemployment upwards (e.g. Blanchard and Wolfers, 2000). Finally, TOTS is used as a measure of for changes in the terms of trade; here, a deterioration in the terms of trade means that imports become relatively more expensive. As a consequence, rising relative import prices increases upward-pressure on wages, and a negative change in the terms of trade is expected to increase unemployment (Bassanini and Duval, 2006).

Table 2: Variables and data sources

	Data description	**Data source**
UNEMP	Unemployment rate	OECD EO (May 2018)
Δ INFL	Change in the growth rate of the harmonised consumer price index	OECD EO (May 2018)
Labour market institutions ($LMI_{i,t}$)		
EPL	Strictness of employment protection, individual and collective dismissals (regular contracts)	OECD LMI (June 2018)
ALMP	Public expenditure and participant stocks on LMP (in % of nominal GDP), divided by unemployment rate	OECD LMI (June 2018)
UDens	Trade union density	OECD LMI (June 2018)
UBR	Gross unemployment benefit replacement rate	OECD LMI (June 2018); oc
UBR2	Net unemployment benefit replacement rate	OECD LMI (June 2018)
TW	Average tax wedge (Single person at 100% of average earnings, no child)	OECD LMI (June 2018)
MW	Real minimum wages (In 2015 constant prices at 2015 USD PPPs)	OECD LMI (June 2018)
Additional control variables ($C_{i,t}$)		
ACCU	Capital accumulation: real gross fixed capital formation / real net capital stock	AMECO (May 2018); oc
LTI	Real long-term interest rate	OECD EO (June 2018); oc
TFP	Total factor productivity (yearly growth rate)	AMECO (May 2018); oc
TOTS	yearly growth rate in terms of trade index	OECD LMI (June 2018); oc
Additional data on 'structural' unemployment		
NAIRU	Non-accelerating inflation rate of unemployment	OECD EO (May 2018)

Note: oc... abbreviation for 'own calculations'. OECD EO... OECD Economic Outlook. OECD LMI... OECD labour Market Indicators Database.

4 Econometric approach

The baseline regression equation that we use to analyze the determinants of ('structural') unemployment rates in OECD economies is:

$$UNEMP_{\mathrm{i,t}} = \beta_1 \Delta INFL_{\mathrm{i,t}} + \beta_2 LMI_{\mathrm{i,t}} + \beta_3 C_{\mathrm{i,t}} + \gamma_1 FE_{\mathrm{i}} + \gamma_2 FE_{\mathrm{t}} + \epsilon_{\mathrm{i,t}}$$

where $UNEMP_{\mathrm{i,t}}$ is the dependent variable, capturing ('structural') unemployment in country i at time t. In some specifications, we will use annual data, in others five-year averages (in section 4.1, we will explain why we also use five-year averages). Furthermore, we will experiment with an alternative NAIRU measure to proxy 'structural' unemployment, as will be explained in more detail below. $\Delta INFL$ is the change in the inflation rate, which was introduced as an additional control variable to capture a possible trade-off in the Phillips curve relationship between unemployment and inflation, which is a feature of the reduced form NAIRU models used in the empirical literature (e.g. Nickell, 1997; Stockhammer and Klär, 2011; Heimberger et al, 2017). $LMI_{\mathrm{t,\ i}}$ is a set of structural labour market indicators, which were already introduced in section data, and can be seen in more detail from Table 2; $C_{\mathrm{i,\ t}}$ is a set of additional control variables, which are summarised in Table 2. FE_{i} are country-fixed effects, which we introduce to account for unmeasurable, time-invariant country-specific characteristics that may influence the unemployment rate. FE_{t} are period-fixed-effects, which capture time-varying shocks affecting all countries. And $\epsilon_{\mathrm{i,t}}$ is the stochastic residual. Note that our baseline specification, consistent with large parts of the literature discussed in section 2, represents an econometric reduced form NAIRU model (e.g. Nickell, 1997; Stockhammer, 2008; Stockhammer and Klär, 2011).

4.1 Unit root and cointegration tests and choice of estimation strategy

To identify the most suitable estimation approach, we tested for non-stationarity by running Augmented Dickey Fuller Tests on the country time series for unemployment, labour market variables and additional controls (ACCU, LTI, TFP and TOTS). For the time period 1985–2011, the null hypothesis that all country series contain a unit root can be rejected for all variables but UNEMP and TW. Furthermore, we tested for cointegration by using the Maddala-Wu test (Maddala and Wu, 1999), where the null hypothesis is the presence of a unit root in the residuals, which implies no cointegration of the variables included. Since the Maddala-Wu test statistics

allow for rejecting the null hypothesis of no cointegration at the 1% level, we find evidence that our equation explains unemployment in the long run, implying that standard OLS and Fixed Effects estimators are consistent and, hence, that estimating our proposed model in levels is appropriate.[5]

To come up with robust results on the determinants of unemployment, our empirical strategy accounts for four different aspects. First, since the unit root and cointegration tests have suggested that running the regressions in levels is appropriate, our preferred estimation technique is to use ordinary least squares, where we include both country and period fixed effects.[6] We use clustered (heteroskedasticity-robust) standard errors to avoid overconfidence in standard errors. Second, the OLS regressions in levels are not only performed on annual data but also on 5-year averages. The rationale for using 5-year-averages is mainly to eliminate (some of the) cyclical effects and allow for more reliable causal interpretations (Baccaro and Rei, 2007).[7] The obvious drawback of averaging the data is a loss of information as contained in the data, which makes it more difficult to account for short-term effects between the independent variables and the unemployment rate. Third, we also use the first difference estimator as an additional tool for examining the robustness of relationships between institutional variables, additional control variables and the unemployment rate. Fourth, we analyze a long-term baseline model based on data for the time period 1985–2011. However, we also provide an alternative baseline specification by focusing on a more recent period (2000-2013). Aside from data considerations - the 2000-2013 sample allows for the inclusion of more countries and two additional labour market variables -, this second specification is motivated by the specific temporal settings, which makes it possible to focus on the run-up to and aftermath of the financial crisis.

Some additional important remarks have to be made concerning model specification and estimating the above equation by using OLS: when we use annual data over the long time period 1985–2011, we will also include a lag of the dependent variable ($UNEMP_{\text{i,t-1}}$) to account for the persistence of unemployment and potential hysteresis effects. With this dynamic specification, we follow papers like International Monetary Fund (2003) and Nunziata (2005). Note that

[5] Note that the Maddala-Wu test cannot be conducted with unbalanced panel data; hence, we had to first balance the data; and by doing so, we lost some observations. Detailed results for the unit root and cointegration tests are available upon request.

[6] Many of the relevant papers in the existing econometric literature (see Table 1) also perform OLS estimations in levels (e.g. Nickell et al, 2005; Baccaro and Rei, 2007; Stockhammer and Klär, 2011; Flaig and Rottmann, 2013; Heimberger et al, 2017)).

[7] In accordance with Baccaro and Rei (2007), we also find that by using first differences of 5-year-average-data, we are able to remove the positive autocorrelation in the residuals that characterises the baseline regression results based on annual data.

we include the lagged unemployment rate only with yearly data but not with the five-year-averages. The reason is that Nickell (1981) raises concerns that the estimation results might be biased as we include both a lagged dependent variable (the lag of UNEMP) and country-fixed effects. However, the order of the bias is 1 / T; and this number is quite small when we use the whole annual dataset (1/27). Judson and Owen (1999) test the performance of the fixed effect estimator by using Monte Carlo simulation. Their results suggest that when T=30, the fixed effect estimator performs as well or even better than many estimation alternatives. As our time dimension in the long annual panel is very close to T=30, we can include a lagged dependent variable because the concern raised by Nickell (1981) does not feature prominently. We do not include a lagged dependent variable when we use five-year averages. There are also no strong theoretical reasons for including a lag with 5-year data, while it is sensible to assume that exogenous shocks are not absorbed in one year, and, hence, one should use a dynamic specification with yearly data (Baccaro and Rei, 2007). Finally, as another robustness check we also run OLS estimations in first differences, which wipes out the country-fixed effects. In sum, our choice of model specifications in combination with the structure of the data series ensures that the Nickell bias is not a problem for our analysis.

4.2 The determinants of unemployment: Baseline results

The econometric baseline results for 23 OECD countries over the time period 1985-2011 are shown in Table 3 for five different models. In the first column, we regress the unemployment rate on four instititutional labour market indicators (EPL, ALMP, UDens, UBR); in addition, we control for total factor productivity growth and TOTS. It can be argued that this specification leaves ample scope for the labour market institutional variables to explain the variation in the dependent variable (UNEMP). Note that the regression coefficients represent the impact of a 1 unit increase in the respective explanatory variable on the unemployment rate (in percentage points). For example, an increase in the unemployment benefit replacement rate (UBR) by 10 percentage points increases the unemployment rate by about 0.09 percentage points. Standard errors of the fixed effects models shown in Table 4 are clustered (heteroskedasticity-robust) standard errors. In Model 1 of Table 3, all coefficients of the institutional variables – but EPL – are signed as expected in the mainstream literature on the determinants of structural unemployment. In this specification, both ALMP and EPL are negatively associated with the unemployment rate, while UBR (UDens) has a positive coefficient and is statistically significant

using a 95% (90%) confidence interval. The adjusted R^2 indicates that the explanatory variables (together with the fixed effect estimates, which are not reported in the table) are able to explain about 74.2% of the variation in the unemployment rate. These results from column 1 in Table 3 suggest that unemployment rates cannot be exclusively explained by labour market institutions and productivity growth. Therefore, model (2) introduces capital accumulation and the long-term interest rate; by doing so, we test alternative hypotheses for the determinants of unemployment. The introduction of those two additional variables leads to an increase in the adjusted R^2, which changes to 78.8%. The coefficient of LTI is positively signed and highly significant, suggesting that an increase in the real long-term interest rates pushes up unemployment. As expected in the relevant literature (e.g. Arestis et al, 2007; Stockhammer and Klär, 2011), capital accumulation is negatively associated with unemployment and strongly significant; the coefficient implies that an increase in the ratio of real gross fixed capital formation to the real net capital stock by 1 percentage point lowers the unemployment rate by 0.4 percentage points. The size of the coefficients of the institutional variables in column (2) changes to varying degrees, while the estimated direction remains the same for all LMI variables except for EPL, which switches sign. However, UDens is the only labour market variable that remains statistically significant. Model (3) is the same as model (2), but instead of annual data we now use five-year averages. Remember that by taking 5-year averages, we are arguably able to eliminate most of the cyclical effects and allow for more reliable causal interpretations. We are able to confirm the main results: ACCU and LTI remain correctly signed and (highly) significant; however, we do not find a single statistically significant LMI variable after building 5-year-averages.

In model (4), we assess the robustness of the relationships between the variables in the model by employing the First Difference estimator. It can be seen that most of the main results from model (2) are confirmed. The coefficient of LTI is smaller and less significant. ALMP and UBR show a statistically significant parameter, respectively. ACCU is again signed as expected and highly significant. In model (5), we follow the strategy preferred by Baccaro and Rei (2007), i.e. deploying the First Difference estimator after calculating 5-year averages for all time series – allowing us to confirm previous results regarding the impact of ACCU and LTI on the unemployment rate: as in model (3), not a single institutional labour market variable is statistically significant. The major finding so far is that capital accumulation and the long-term interest rate are important determinants of the unemployment rate.

Table 3: Baseline results 1985-2011

	Dependent variable:				
	UNEMP				
	(1) FE	(2) FE	(3) FE	(4) FD	(5) FD
Δ INFL	-0.139^{***}	-0.042	0.434	-0.047	0.226
	(0.037)	(0.039)	(0.302)	(0.038)	(0.198)
UNEMP_{t-1}	0.912^{***}	0.761^{***}		0.328^{***}	
	(0.033)	(0.053)		(0.051)	
ACCU		-0.383^{**}	-1.680^{***}	-1.167^{***}	-1.698^{***}
		(0.148)	(0.324)	(0.129)	(0.329)
LTI		0.177^{***}	0.428^{***}	0.105^{*}	0.193^{*}
		(0.046)	(0.157)	(0.063)	(0.110)
EPL	-0.407	0.810	2.831	-0.597	0.870
	(0.509)	(0.594)	(2.066)	(0.743)	(1.456)
ALMP	-0.015	-0.004	-0.009	-0.049^{***}	-0.023
	(0.012)	(0.013)	(0.031)	(0.014)	(0.033)
UDens	0.061^{*}	0.052^{**}	-0.022	0.067	-0.020
	(0.034)	(0.026)	(0.083)	(0.050)	(0.061)
UBR	0.042^{**}	0.023	0.0004	0.030^{**}	0.013
	(0.020)	(0.016)	(0.043)	(0.012)	(0.026)
TFP	-0.036	-0.059	-0.602^{**}	0.012	-0.149
	(0.058)	(0.044)	(0.259)	(0.013)	(0.188)
TOTS	-0.024	-0.010	0.042	0.002	-0.051
	(0.018)	(0.015)	(0.098)	(0.005)	(0.049)
Observations	310	304	75	281	54
R^2	0.789	0.829	0.674	0.677	0.649
Adjusted R^2	0.742	0.788	0.381	0.666	0.587
Data	annual	annual	5-year-avg	annual	5-year-avg
Number of countries	23	23	21	23	21
Country FE	yes	yes	yes	no	no
Period FE	yes	yes	yes	no	no
Note:					*p<0.1; **p<0.05; ***p<0.01

The table reports clustered (heteroskedasticity-robust) standard errors. FE: Fixed effects estimated by OLS; FD: First Difference estimator.
UNEMP, unemployment rate; $\Delta INFL$, change in inflation rate; ACCU, capital accumulation; LTI, long-term interest rate; EPL, employment protection legislation; ALMP, active labour market policies; UDens, trade union density; UBR, gross unemployment benefit replacement rate; TFP, total factor productivity growth; TOTS, terms of trade shock.

5 Robustness checks on the determinants of unemployment rates in OECD countries

In this section, we proceed with several robustness checks. First, we introduce variations in the time period by providing evidence on the 2000-2013 period. By doing so, we are able to include additional variables on labour market institutions. Second, we use different measures of 'structural' unemployment, i.e. we vary the dependent variable in the regressions. Third, we introduce lag specifications, since it might be argued that some of the explanatory variables impact on unemployment with a lag. Fourth, we consider interaction terms, as some papers in the literature emphasise the interaction effects of labour market institutions and their impact on unemployment. Fifth, we vary the country group to check whether the baseline results are robust.

5.1 Varying the time period: Evidence for 2000–2013

As a first robustness check, we improve the coverage of labour market variables, which are not available over the longer time period 1985–2011; by doing so, we are also able to analyze whether the choice of the time period matters. Table 4 illustrates the baseline results for the time period 2000-2013, where all model specifications are the same as in Table 3. However, we are now able to introduce two more LMI variables, namely minimum wages (MW) and tax wedge (TW). Furthermore, the unemployment benefit net replacement rate (UBR2) replaces the unemployment benefit gross replacement rate (UBR). Looking at model (1) of Table 4, we find that the labour market variables, productivity growth and the terms of trade variable – together with the fixed effect estimates, which are not reported in the table – are able to explain about 74.2% of the variation in unemployment. Once we introduce ACCU and LTI in model (2), the adjusted R^2, however, increases to 80.2%, which again suggests that these additional variables ought not be omitted. ACCU is signed as expected – i.e. an increase in capital accumulation pushes unemployment downwards – and significant, while an increase in LTI is associated with an increase in unemployment. In column (2), not a single labour market variable is statistically significant, and in model (3), MW and TW are statistically significant, but do not have the sign expected in the mainstream literature. In models (4) and (5), we again find that ACCU – and, in model (4), LTI – is a significant determinant of unemployment, while labour market variables largely underperform as explanatory variables. Summing up, running regressions on the shorter time period of 2000-2013 - for which data availability for labour market variables has improved - supports our baseline findings from the longer time period 1985-2011: most variables that capture labour market institutions are either statistically insignificant – or their statistical significance is sensitive to the model specification being used. Cyclical factors, however - in particular capital accumulation - have been shown to play a prominent role in explaining unemployment, and this finding is robust to various model specifications.

Table 4: Results 2000–2013

	Dependent variable:				
	UNEMP				
	(1)	(2)	(3)	(4)	(5)
Δ INFL	−0.137**	0.011	1.829**	0.040	0.867
	(0.063)	(0.077)	(0.486)	(0.035)	(0.583)
$UNEMP_{t-1}$	0.922***	0.653***		0.246***	
	(0.052)	(0.066)		(0.041)	
ACCU		−0.825***	−2.428**	−1.447***	−1.992*
		(0.274)	(0.697)	(0.308)	(0.891)
LTI		0.201**	0.330	0.226***	0.417
		(0.078)	(0.172)	(0.061)	(0.341)
MW	0.0002*	0.0002	−0.001**	0.0002*	−0.0005
	(0.0001)	(0.0001)	(0.0004)	(0.0001)	(0.0003)
EPL	−1.385	0.281	5.549	0.045	−3.072
	(1.452)	(1.136)	(3.824)	(0.694)	(6.803)
ALMP	−0.027	−0.005	−0.065**	−0.038*	−0.043
	(0.023)	(0.027)	(0.022)	(0.022)	(0.061)
UDens	0.297	0.162	0.130	−0.034	0.731
	(0.265)	(0.202)	(0.326)	(0.089)	(0.400)
UBR2	0.056	0.006	0.179**	0.010	0.031
	(0.051)	(0.058)	(0.046)	(0.032)	(0.126)
TW	0.015	−0.124	−0.849**	−0.088	−0.621
	(0.064)	(0.093)	(0.326)	(0.056)	(0.455)
TFP	−0.019	−0.034	0.200	0.016	−0.921
	(0.065)	(0.043)	(0.320)	(0.020)	(0.680)
TOTS	−0.040**	−0.022	−1.299***	0.013	−0.270*
	(0.018)	(0.016)	(0.159)	(0.012)	(0.137)
Observations	117	116	29	103	18
R^2	0.813	0.861	0.966	0.771	0.887
Adjusted R^2	0.742	0.802	0.812	0.743	0.725
Data	annual	annual	5-year-avg	annual	5-year-avg
Number of countries	13	13	11	13	11
Country FE	yes	yes	yes	no	no
Period FE	yes	yes	yes	no	no
Note:					*p<0.1; **p<0.05; ***p<0.01

The table reports clustered (heteroskedasticity-robust) standard errors. FE: Fixed effects estimated by OLS; FD: First Difference estimator.
UNEMP, unemployment rate; $\Delta INFL$, change in inflation rate; ACCU, capital accumulation; LTI, long-term interest rate; EPL, employment protection legislation; ALMP, active labour market policies; MW... Minimum Wage; UDens, trade union density; UBR2, net unemployment benefit replacement rate; TFP, total factor productivity growth; TOTS, terms of trade shock. TW... Tax Wedge.

5.2 Variation in the dependent variable: The determinants of the OECD's NAIRU estimates

A possible objection to the results presented above is that it is not surprising to find that capital accumulation is negatively correlated with (medium-run) unemployment, since the latter consists of both a structural component – which depends on the institutional characteristics of a given economy, especially labour market regulations, and represents the 'true' employment capacities underlying any given economy (e.g. Laubach, 2001) – and a cyclical component, which responds to the ups and downs of the business cycle (e.g. Planas and Rossi, 2015). Although we have also shown results on the determinants of unemployment by taking 5-year averages – where, arguably, business cycle effects have been largely cancelled out –, it might still be argued

that researchers should specifically look at the determinants of 'structural' unemployment, i.e. unemployment independent of cyclical and seasonal influences. Obviously, 'structural' unemployment is unobservable; it can only be proxied based on estimates derived from economic modelling (e.g. Gordon, 1997; Ball and Mankiw, 2002; Blanchard, 2018). The most prominent approach is to estimate the non-accelerating inflation rate of unemployment (NAIRU) and to use these estimates as a proxy for 'structural' unemployment. The central NAIRU proposition states that any economy can be characterised by a clearly defined but unobservable rate of unemployment, at which inflation remains constant. While the theoretical foundations of the NAIRU as a main theory for explaining unemployment remain contested – as the NAIRU model can be made consistent with several theoretical traditions (Stockhammer, 2008) –, the dominant empirical practice is to estimate the unobservable NAIRU by means of statistical filtering models that allow for separating the 'structural' component from the cyclical component of unemployment (Laubach, 2001; Durbin and Koopman, 2012).[8] Here, we use the prominent NAIRU estimates as provided by the OECD – which are available for most of the OECD countries in our country sample – as an alternative unemployment variable, which has been used to proxy 'structural' unemployment and, as such, directly or indirectly informs economic policy-making as a measure for labour market slack (Galbraith, 1997; Gianella et al, 2008; Guichard and Rusticelli, 2011; Rusticelli, 2014).[9]

Table 5 depicts the determinants of the OECD's NAIRU estimates. The explanatory variables are the same as in the specifications in Table 3 – with the exception that we drop the $\Delta INFL$ term, which is supposed to capture a possible trade-off in the Phillips curve relationship between unemployment and inflation, since this trade-off was already implicitly accounted for in the underlying estimation of the NAIRU variable (Guichard and Rusticelli, 2011; Rusticelli, 2014). In model (1), the labour market variables plus TFP growth and the terms of

[8] More specifically, these NAIRU models are based on a Kalman Filter applied to an econometric model cast into a state-space framework (Kalman, 1960; Durbin and Koopman, 2012), which consists of a set of assumptions about the unobservables in the model that are of statistical nature (in particular autoregressive processes and lag structures) and a theoretical component based on a Phillips curve framework (e.g. Rusticelli, 2014; Planas and Rossi, 2015). These multivariate statistical filtering models have been criticised on the ground that they produce pro-cyclical estimates that might misinform policy-makers about the 'structural' unemployment rate in a particular country and, as a consequence, lead to suboptimal policy decisions (e.g. Heimberger and Kapeller, 2017; Hristov et al, 2017; Jump and Stockhammer, 2018).

[9] For euro area countries, estimates of the NAIRU are of special importance, since they are used as an input to calculate cyclically-adjusted budget balances, which are the basis of medium-term fiscal objectives under the EU fiscal surveillance framework (Orlandi, 2012; Klaer, 2013; Lendvai et al, 2015). See Heimberger et al (2017) and Heimberger and Kapeller (2017) for an econometric analysis of the determinants of the relevant NAIRU estimates of the European Commission, which are not available for the non-European OECD countries covered in this paper. The econometric evidence suggests that the Commission's NAIRU estimates are not a good proxy for 'structural unemployment'. On this point, see also Constancio (2018).

trade variable (TOTS) underperform in explaining the OECD's NAIRU estimates. Only EPL is statistically significant (but negatively signed). In models (2) and (3), we introduce ACCU and LTI. When we use 5-year averages in model (3), none of the OECD's institutional labour market variables shows statistical significance; however, we again find that capital accumulation is signed as expected and significant. The basic picture also does not change when we use the first difference estimator (based on annual data in model (4) and based on 5-year-averages in model (5)): we confirm that capital accumulation is an important determinant of unemployment, while institutional labour market variables largely underperform as explanatory variables. As a sidenote, these findings provide further evidence that widely-used NAIRU estimates are a rather poor proxy of 'structural' unemployment (Heimberger et al, 2017; Hristov et al, 2017) and should be used with great care as a measure of labour market slack. Indeed, econometric NAIRU estimates based on statistical filtering methods are at least partly driven by cyclical factors, so that a pure 'structural' interpretation may severely misinform policy-makers and lead to suboptimal macroeconomic policies (Heimberger and Kapeller, 2017).

5.3 Lag specifications, interaction terms and variations in the country group

As a third step in the robustness analysis, we investigate how the introduction of lags affects the regression results – since it might be argued that, in particular, labour market institutions will affect 'structural' unemployment with a lag. We use the specifications in Table 3 as a reference point, as they include all major variables that proved to be empirically relevant in the empirical explorations. Table 6 depicts lag specification results for the time period 1985–2011, where columns (1)-(3) refer to results based on annual data and columns (4)-(6) depict the results when using five-year averages. In columns (1) and (4), we include lags for all the labour market variables to allow for the argument that institutional changes tend to affect the unemployment rate with a lag, which could also have an impact on the performance of other explanatory variables. This hypothesis, however, does not hold, as coefficients and standard errors of the variables ACCU, and LTI remain largely unaffected after we introduce LMI lags (although the LTI coefficient loses statistical significance in model (4)); at the same time, the institutional labour market variables either have a sign that is not in line with their standard theoretical prediction, lack statistical significance, or their impact is quite sensitive to the model specification. We proceed by introducing lags for capital accumulation and the long-term interest rate

Table 5: Results 1985-2011. Dependent variable: NAIRU (OECD)

	Dependent variable:				
	NAIRU (OECD)				
	(1) FE	(2) FE	(3) FE	(4) FD	(5) FD
$NAIRU_{t-1}$	0.901^{***}	0.851^{***}		0.556^{***}	
	(0.031)	(0.040)		(0.143)	
ACCU		-0.094^{**}	-0.843^{***}	-0.162^{***}	-0.516^{***}
		(0.042)	(0.230)	(0.045)	(0.139)
LTI		0.016	−0.067	0.018^{***}	0.050
		(0.012)	(0.093)	(0.005)	(0.043)
EPL	-0.500^{**}	−0.205	−0.761	−0.282	0.026
	(0.201)	(0.196)	(1.160)	(0.215)	(1.574)
ALMP	−0.003	−0.003	−0.018	-0.004^{*}	-0.018^{**}
	(0.003)	(0.003)	(0.011)	(0.002)	(0.007)
UDens	0.016	0.024^{**}	−0.030	0.001	0.029
	(0.018)	(0.011)	(0.043)	(0.010)	(0.035)
UBR	0.009	0.004	−0.011	0.001	0.016
	(0.005)	(0.004)	(0.008)	(0.002)	(0.012)
TFP	−0.025	-0.037^{*}	−0.222	0.001	−0.076
	(0.021)	(0.020)	(0.201)	(0.007)	(0.120)
TOTS	−0.007	−0.005	0.040	−0.00002	0.005
	(0.004)	(0.003)	(0.026)	(0.002)	(0.016)
Observations	313	307	73	284	52
R^2	0.881	0.914	0.719	0.606	0.525
Adjusted R^2	0.856	0.894	0.467	0.595	0.450
Data	annual	annual	5-year-avg	annual	5-year-avg
Number of countries	23	23	21	23	21
Country FE	yes	yes	yes	no	no
Period FE	yes	yes	yes	no	no
Note:					*p<0.1; **p<0.05; ***p<0.01

The table reports clustered (heteroskedasticity-robust) standard errors. FE: Fixed effects estimated by OLS; FD: First Difference estimator.
UNEMP, unemployment rate; $\Delta INFL$, change in inflation rate; ACCU, capital accumulation; LTI, long-term interest rate; EPL, employment protection legislation; ALMP, active labour market policies; UDens, trade union density; UBR, gross unemployment benefit replacement rate; TFP, total factor productivity growth; TOTS, terms of trade shock.

in columns (2) and (5) to check whether these alternative determinants impact on the unemployment rate with a lag. By doing so, we are able to confirm the role of capital accumulation (ACCU) in explaining unemployment. In columns (3) and (6) we include all possible lag terms: both for the labour market institutional variables, and for the cyclical variables ACCU and LTI; furthermore, we also account for lags of TOTS and TFP. The main results from the reference model in the baseline results table 3 still hold: while the importance of ACCU is underscored, the econometric evidence for the role of labour market variables can at best be described as mixed; in fact, expenditures on active labour market variables is the only LMI variable, which is statistically significant in two of the six models included in Table 6.

Table 6: Lag specifications: 1985–2011

	Dependent variable:					
	UNEMP					
	(1)	(2)	(3)	(4)	(5)	(6)
$UNEMP_{t-1}$	0.767^{***}	0.765^{***}	0.799^{***}			
	(0.040)	(0.031)	(0.032)			
Δ INFL	−0.026	0.065	−0.026	0.739^{*}	0.612^{**}	0.295
	(0.037)	(0.115)	(0.091)	(0.376)	(0.255)	(0.358)
ACCU	-0.575^{***}	-1.099^{***}	-1.152^{***}	-2.428^{***}	-2.348^{***}	-2.439^{***}
	(0.123)	(0.203)	(0.241)	(0.254)	(0.426)	(0.266)
$ACCU_{t-1}$		0.610^{***}	0.794^{***}		−0.248	0.034
		(0.188)	(0.214)		(0.227)	(0.232)
LTI	0.134^{***}	0.235^{**}	0.157^{*}	0.074	0.196	−0.055
	(0.038)	(0.098)	(0.084)	(0.162)	(0.117)	(0.212)
LTI_{t-1}		−0.129	−0.034		−0.253	0.500^{**}
		(0.142)	(0.104)		(0.193)	(0.232)
EPL	0.326	−0.100	0.204	1.442	0.360	1.055
	(0.814)	(0.316)	(0.815)	(2.581)	(1.435)	(3.055)
EPL_{t-1}	−0.416		−0.470	−1.804		−1.905
	(0.841)		(0.847)	(1.530)		(1.572)
ALMP	-0.050^{***}	−0.0001	-0.042^{***}	−0.021	−0.008	−0.033
	(0.015)	(0.012)	(0.013)	(0.048)	(0.033)	(0.040)
$ALMP_{t-1}$	0.066^{**}		0.055^{**}	0.064^{*}		0.066
	(0.027)		(0.024)	(0.035)		(0.039)
UDens	0.095^{*}	0.035	0.029	0.027	0.004	0.009
	(0.051)	(0.024)	(0.042)	(0.094)	(0.065)	(0.098)
$UDens_{t-1}$	−0.037		0.015	0.067		0.072
	(0.030)		(0.028)	(0.065)		(0.066)
UBR	0.0003	0.028^{**}	−0.012	−0.050	0.029	−0.018
	(0.028)	(0.011)	(0.029)	(0.063)	(0.039)	(0.053)
UBR_{t-1}	0.026		0.036	−0.001		0.018
	(0.021)		(0.025)	(0.055)		(0.060)
TFP	−0.011	0.053	0.079	-0.907^{***}	-0.730^{**}	-0.827^{**}
	(0.041)	(0.055)	(0.054)	(0.255)	(0.279)	(0.319)
TFP_{t-1}	−0.052		−0.009	0.698^{**}		0.517
	(0.057)		(0.062)	(0.316)		(0.335)
TOTS	0.035^{***}	0.037^{***}	0.024^{***}	0.088^{**}	0.096^{***}	0.093^{***}
	(0.011)	(0.008)	(0.008)	(0.032)	(0.026)	(0.030)
$TOTS_{t-1}$	−0.005		−0.0005	0.122		0.168^{***}
	(0.010)		(0.012)	(0.089)		(0.055)
Observations	291	301	290	58	71	57
R^2	0.878	0.862	0.892	0.857	0.776	0.876
Adjusted R^2	0.844	0.829	0.861	0.546	0.524	0.536
Data	annual	annual	annual	5-year-avg	5-year-avg	5-year-avg
Number of countries	22	22	22	19	21	19
Country FE	yes	yes	yes	yes	yes	yes
Period FE	yes	yes	yes	yes	yes	yes
Note:						*p<0.1; **p<0.05; ***p<0.01

The table reports clustered (heteroskedasticity-robust) standard errors.
UNEMP, unemployment rate; $\Delta INFL$, change in inflation rate; ACCU, capital accumulation; LTI, long-term interest rate; EPL, employment protection legislation; ALMP, active labour market policies; UDens, trade union density; UBR, gross unemployment benefit replacement rate; TFP, total factor productivity growth; TOTS, terms of trade shock.

The fourth area of robustness analysis concerns interaction effects. The existing literature is characterised by a number of studies, which point out that institutional labour market variables should be expected to have an impact on unemployment through their interactions (e.g. Blanchard and Wolfers, 2000; International Monetary Fund, 2003; Bassanini and Duval, 2006). However, Stockhammer and Klär (2011) have pointed out that "[t]he theoretical foundation

for these interactions is [...] unspecific. For example, the IMF (2003) argues that the effects of different LMI are reinforcing, without specifying ex ante which LMI should interact. This poses a problem for an attempt to statistically evaluate the effects of interactions: since there are numerous potential interactions, the inclined researcher is bound to find some that prove statistically significant." (Stockhammer and Klär, 2011, p. 449). Nevertheless, we ran several estimations to analyze whether interaction terms matter. The results can be summarised as follows: it does not matter whether we include interactions between institutional labour market variables only, interactions among the LMI variables and the additional macroeconomic controls ACCU and LTI only, or all interactions at once, as we always find that there is no evidence that interaction terms matter systematically, while ACCU and LTI remain correctly signed and statistically significant. In brief, the econometric analysis does not support the hypothesis that interaction terms are of central importance for explaining unemployment rates in OECD countries, while the basic result that cyclical factors need to be accounted for when it comes to explaining unemployment rates in OECD countries has been confirmed.[10]

Finally, we also checked whether outlier countries drive our overall econometric baseline results as reported in Table 3: we introduced variations in the country group by excluding one country at a time. The results from this variation in the country group allow us to conclude that for both the long period (1985-2011) and the shorter period (2001-2013) neither the size of the coefficients of the explanatory variables nor their statistical significance are markedly affected by including or excluding single countries.[11]

5.4 Statistical significance versus economic relevance

It might be misleading to only look at statistical significance, since significance does not always imply that the relevant variables have an impact that can be seen to be economically relevant (e.g. McCloskey and Ziliak, 1996). Hence, to highlight the economic impact of labour market institutions and macroeconomic variables on unemployment, we standardise the variables in our baseline models. We do so by rescaling the estimates, i.e. we divide the parameters by two standard deviations (Gelman, 2008). This standardisation facilitates an assessment regarding which variables have the most relevant association with the dependent variable (unemployment),

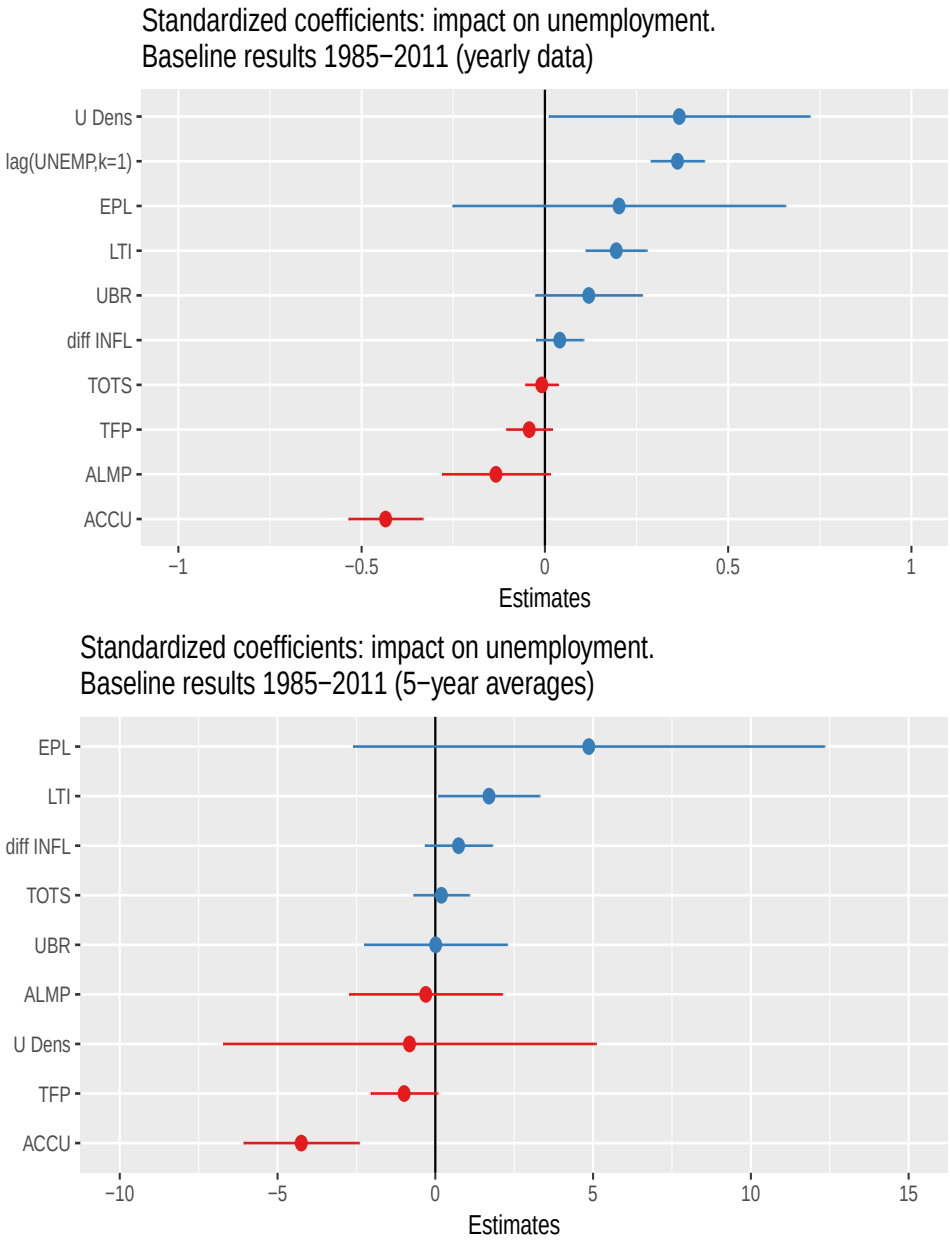
[10] Detailed regressions results on interaction terms are not reported due to space constraints, but they are available upon request

[11] Due to lack of space, results from variations in the country group are not reported here, but they are available upon request.

as the resulting coefficients are then directly comparable.

Figure 1 consists of two forest plots, which show the standardised coefficients for the baseline results over the time period 1985–2011. In the upper panel, we depict the standardised results based on the annual fixed effects model (see column (2) in Table 3), and the lower panel reports the results based on the fixed effects model with 5-year averages (see column (3) in Table 3). The bars that accompany the point estimates represent standard errors as a measure of the uncertainty around the estimates. Two main points can be learned from Figure 1. First, the economic impact of labour market institutions on unemployment is quite small after performing the standardisation. Indeed, none of the labour market variable has uncertainty band that does not touch the vertical zero line. Second, the largest economic impact on unemployment is clearly found for the macroeconomic control variables, with LTI having a positive impact (an increase in real long-term interest rates pushes unemployment upwards) and ACCU having a negative impact (an increase in capital accumulation is associated with lower unemployment). Hence, the standardisation of the baseline regression estimates confirms our previous findings that labour market institutions largely underperform in explaining unemployment, while the macroeconomic controls are highly relevant.

Figure 1: Standardised regression results: Economic impact of control variables on unemployment



Notes. Upper panel: standardised results based on the annual fixed effects model in equation (2) of Table 3. Lower panel: standardised results based on the fixed effects model with 5-year averages in equation (3) of Table 3). Estimates were rescaled by dividing them by two standard deviations (Gelman, 2008). The error bars (of two standard deviations) indicate the uncertainty around the point estimate.

UNEMP, unemployment rate; diff INFL, change in inflation rate; ACCU, capital accumulation; LTI, long-term interest rate; EPL, employment protection legislation; ALMP, active labour market policies; UDens, trade union density; UBR, gross unemployment benefit replacement rate; TFP, total factor productivity growth; TOTS, terms of trade shock.

6 Conclusions

Over the last 25 years, a large number of influential studies has suggested that increased unemployment in OECD countries is mainly a problem of rigid labour market institutions, i.e. excessive employment protection, minimum wages, dysfunctional centralised wage bargaining procedures etc. (e.g. OECD, 1994; Siebert, 1997; International Monetary Fund, 2003; Belot and van Ours, 2004; Nickell et al, 2005; Bassanini and Duval, 2006; Gianella et al, 2008; Orlandi, 2012). In this paper, we have revisited the evidence. We use a data set for the time period 1985–2013: by going beyond the existing literature in terms of looking at a comprehensive set of alternative hypotheses for explaining unemployment, by using a longer time period than most studies, by considering a larger OECD country group than most previous papers, and by providing a substantial set of robustness checks, the econometric results presented in this paper suggest that the research question whether standard measures of 'rigid' labour market institutions in OECD countries are indeed robustly related with higher ('structural') unemployment rates can be answered with a clear 'no'. Indeed, the econometric results discussed so far suggest that the view that institutions are at the heart of unemployment problems is *not* backed by robust panel-econometric evidence; in this regard, our study echoes earlier critical studies (e.g. Baccaro and Rei, 2007; Howell et al, 2007; Stockhammer and Klär, 2011; Vergeer and Kleinknecht, 2012; Stockhammer et al, 2014; Heimberger et al, 2017; Constancio, 2018). We find that labour market institutions do have an impact on unemployment, but it is comparatively smaller than the impact of macroeconomic variables: capital accumulation maintains its significant impact even when we also control for real long-term interest rates.

The most important implication of these findings is that to understand the development of unemployment in OECD countries, researchers and policy-makers should look at capital accumulation. The results presented in this paper point to the empirical fact that increases in ('structural') unemployment cannot simply be attributed to increased institutional labour market rigidities. The aggregate macroeconometric evidence does *not* support the policy recommendation according to which the deregulation of labour markets will cure unemployment. However, as higher capital accumulation is robustly linked to lower unemployment, the implication is that stimulating capital accumulation should rank high on the priority list of macroeconomic policy-makers who want to bring down unemployment.

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