Unemployment, Labour Market Institutions and Shocks*

Luca Nunziata†

April 24, 2003

Abstract

This paper aims to investigate the determinants of OECD unemployment from 1960 to 1995 with a special focus on labour market institutions. We want to know if the evolution of OECD unemployment can be accounted for by changes in labour market institutions, and by the interactions of institutions and macroeconomic shocks. Our findings suggest that labour market institutions have a direct significant impact on unemployment in a fashion that is broadly consistent with their impact on real labour costs. Broad movements in unemployment across the OECD can be explained by shifts in labour market institutions, although this explanation relies on high levels of endogenous persistence. We also identify a significant role for institutions through their interaction with adverse macroeconomic shocks, although the estimates do not appear extremely robust in this case. In contrast, the direct effect of institutions still holds when we include the possibility of interactions between shocks and institutions.

*I wish to thank Steve Nickell, John Muellbauer, Andrew Glyn, Jan VanOurs and Claudio Lucifora for comments and very helpful discussions. Thanks also to Olivier Blanchard, Justin Wolfers, Giuseppe Nicoletti, Stefano Scarpetta and Michèle Belot for making available their data. The usual disclaimer applies.

†London Business School, Regent's Park, London NW1 4SA, UK and Nuffield College, Oxford OX1 1NF, UK. Email for correspondence: luca.nunziata@nuffield.ox.ac.uk .

1 Introduction

The multi-country empirical literature on unemployment and labour market institutions experienced a recent boost when new data on time varying institutional indicators were made available by the OECD and other researchers. Following the taxonomy proposed by Blanchard and Wolfers (2000), we can classify the analysis explaining OECD unemployment into three broad categories: the ones that focus on the role of adverse macroeconomic scenarios, the ones that focus on the role of institutions and the ones that focus on the interaction between institutions and macroeconomic conditions. In this paper we concentrate on the second and the third categories, since in our belief the third encompasses the first. Indeed, as noted before in the literature, trying to explain OECD unemployment through focusing solely on the role of adverse macroeconomic shocks is problematic. The differences in the shocks across countries are not sufficient to explain the variation in OECD unemployment.

The first works that investigate the role played by institutions date from around the early 1990s and rely on simple cross sectional regressions. Nickell (1997) proposes a refutation of the widespread picture of a flexible North American labour market versus a rigid European one, and of the explanation of the diversities in the unemployment performances of the two continents based on this assumption. The main argument of this influential paper is that European markets are characterized by an enormous variation in unemployment rates, and the countries with the highest unemployment rates are not necessarily the rigid ones. The empirical results are consistent across different models, and suggest that high unemployment is associated with generous unemployment benefits, high unionization associated with low bargaining coordination and high taxes. On the contrary, labour market rigidities that do *not* raise unemployment significantly include strict employment protection or labour standards regulations, high benefits associated with pressure on the unemployed to take jobs[1] and high unionization levels accompanied by high levels of bargaining coordination.

Elmeskov et al. (1998) propose an empirical analysis of the effects of labour market institutions on OECD structural unemployment, extending previous work by Scarpetta[2]. Their

[1] This is enforced through reducing the duration of benefits or influencing the ability (or willingness) of the unemployed to take jobs.

[2] See Scarpetta (1996).

results are in line with the findings of Nickell (1997), although they identify a positive significant coefficient on employment protection regulations and provide evidence in support of significant interaction effects between institutions. The claim of the paper is that some European countries[3] have been successful in reducing unemployment in recent years thanks to their labour market reforms, particularly oriented towards the insiders. Some of the change in regulations that might have reduced unemployment are stricter unemployment benefits provision (both through tightened eligibility conditions and reduced replacement rates) and looser fixed term contracts regulations.

Belot and Van Ours (2000, 2001) insist on the potential relevance of complementarities between institutions and propose a static fixed effect multi-country unemployment model that includes institutions and a set of interactions among institutions as explanatory variables. The results of their model suggest that in some countries institutions have a direct effect on unemployment while in others the interaction effects are more important. The tax rate and the replacement rate are found to be the most important factors in determining unemployment, and in general the impact of labour market reforms is affected by the institutional factors that determine the bargaining position of the worker.

Blanchard and Wolfers (2000)[4] concentrate on the combined role played by institutions and macroeconomic conditions. They identify a set of macroeconomic variables that could have played a role in the explanation of European unemployment. These are the decline in total factor productivity growth, the real interest rate and the adverse shifts in labour demand.

The authors argue that although the effect of these shocks is not supposed to persist in the long run, their interaction could explain part of the European unemployment time series in recent decades. Broadly speaking, a decline in TFP, accompanied by slow wage adjustment to the new equilibrium, could have pushed up unemployment in the 1970s. Then, the real interest rate increases in the 1980s could have negatively affected capital accumulation, maintaining high levels of unemployment in that period. Finally, an adverse shift in labour demand may be responsible for the high unemployment levels of the 1990s.

The main idea in the paper is that these trended variables may explain the general increase

[3] These are Australia, Denmark, Ireland, The Netherlands, New Zealand and United-Kingdom.
[4] Two papers with a similar approach are Fitoussi et al. (2000) and Bertola et al. (2001).

in unemployment in Europe, while the cross sectional variation across countries can be imputed to their different institutions. In order to test this assumption they estimate an unemployment equation where the impact of the institutions is interacted with the vector of macroeconomic shocks. They first treat the shocks as unobservable but common to all countries, interacting the time dummies with a vector of time invariant institutions[5] and then they substitute the time dummies with the country specific series of TFP growth, real interest rate and labour demand shift.

The estimation of the simple time dummies specification yields significant effects, with the expected signs, for all institutions excluding union coverage. Moreover, the time effects, for average levels of the institutional indicators, account for a 7.3% rise in unemployment from the 1960s to the 1990s. The impact of the shocks on unemployment is mediated by labour market institutions. This implies that, for example, a 1 percent increase in unemployment for average levels of institutions, becomes 0.58 when employment protection is at a minimum and 1.42 when employment protection is at a maximum. When substituting the time invariant employment protection and unemployment benefit variables with analogous time varying indicators, the results are similar, although the estimated effect is weaker.

Overall, the approach based on both macroeconomic shocks and institutions looks appealing, since it relies on a simple mechanism that accounts for both the evolution of unemployment and its variation across countries. However, much of the success of this kind of explanation for European unemployment relies on the identification of sensible macroeconomic variables to be interacted with institutions.

In what follows we first produce an empirical test of the ability of institutions to explain the time pattern of unemployment in OECD countries. Subsequently, we compare the approach based on institutions alone with the one where institutions are interacted with shocks, and investigate which one performs better.

Section 2.1 presents our main econometric analysis, including a set of dynamic simulations that examine the explanatory power of our model. Section 3 extends the analysis in order to test the role played by the interaction of institutions and macroeconomic shocks. Finally,

[5] These are the indicators in Nickell (1997).

section 4 contains some concluding remarks[6].

2 The Explanatory Power of Labour Market Institutions

2.1 The Model

We follow the theoretical framework depicted in Nickell (1998), estimating an unemployment model where the explanatory variables are represented by all factors influencing the equilibrium level of unemployment and the shocks that cause unemployment to deviate from the equilibrium. The general unemployment equation has the form:

$$U_{it} = \beta_0 + \beta_1 U_{it-1} + \boldsymbol{\gamma}' \bar{\mathbf{z}}_{w,it} + \boldsymbol{\lambda}' \mathbf{h}_{it} + \boldsymbol{\vartheta}' \mathbf{s}_{it} + \phi_i t_i + \mu_i + \lambda_t + \varepsilon_{it} \tag{1}$$

where U_{it} is the unemployment rate in percentage points, $\bar{\mathbf{z}}_{w,it}$ is a vector of labour market institutions, $\mathbf{h}_{it}$ is a vector of interactions among institutions, $\mathbf{s}_{it}$ is a vector of controls for macroeconomic shocks, t_i is a country specific time trend, μ_i is a fixed country effect, λ_t is a year dummy and ε_{it} is the stochastic residual.

More specifically, the vector of labour market institutions includes the following elements:

$$\boldsymbol{\gamma}' \bar{\mathbf{z}}_{w,it} = \gamma_1 EP_{it} + \gamma_2 BRR_{it} + \gamma_3 BD_{it} + \gamma_4 \Delta UD_{it} + \gamma_5 CO_{it} + \gamma_6 TW_{it} \tag{2}$$

where EP_{it} is employment protection, BRR_{it} is the unemployment benefit replacement rate, BD_{it} is the unemployment benefit duration, UD_{it} is net union density, CO_{it} is bargaining coordination, and TW_{it} is the tax wedge, i.e. direct + indirect +labour tax rate.

The vector of institutional interactions in the benchmark model has the following form:

$$\boldsymbol{\lambda}' \mathbf{h}_{it} = \lambda_1 BRRBD_{it} + \lambda_2 UDCO_{it} + \lambda_3 TWCO_{it} \tag{3}$$

[6] A simpler analysis of some of the baseline models discussed in the paper can be found in Nickell et al. (2002).

where the notation is self-explanatory. Each element is expressed as an interaction between deviations from world averages. In this way the coefficient of each institution in levels can be read as the coefficient of the "average" country, i.e. the country characterized by the average level of that specific institutional indicator, since for this average country, the interaction terms are zero.

The vector of controls for macroeconomic shocks contains the following elements:

$$\boldsymbol{\vartheta}'\mathbf{s}_{it} = \theta_1 LDS_{it} + \theta_2 TFPS_{it} + \theta_3 D2MS_{it} + \theta_4 RIRL_{it} + \theta_5 TTS_{it} \tag{4}$$

where LDS_{it} is a labour demand shock, $TFPS_{it}$ is a total factor productivity shock, $D2MS_{it}$ is a money supply shock, $RIRL_{it}$ is the long term real interest rate, and TTS_{it} is a terms of trade shock[7]. These are all mean reverting, except for the real interest rate.

The institutional indicators and the macroeconomic variables are provided by assembling the works of different researchers and institutions. All the data definitions and sources are contained in the appendix to Nunziata (2001).

In what follows we use a semi-pooled specification for (1), correcting for heteroskedasticity and serial correlation of the disturbances. We first present a set of specification and diagnostic tests that justify our choice[8] and then we illustrate the estimation results and the dynamic simulations of the benchmark model.

2.2 Specification and Diagnostic Tests

If parameter heterogeneity is ignored in a fixed effects multi-country dynamic setting like ours, the pooled estimator is inconsistent even when $T \to \infty$, as shown by Pesaran and Smith (1995). As noted by Baltagi (1995), a pooled model can yield more efficient estimates at the expenses of bias. McElroy (1977) suggests three tests based on weaker mean square errors

[7] The definition of each shock is as follows: (i) LDS is measured by the residuals of 20 national labour demand equations; (ii) $TFPS$ is measured by the deviations from the total factor productivity trend; (iii) $D2MS$ is equal to the acceleration of the money supply; (iv) TTS is $\left(\frac{imports}{GDP}\right)\Delta \log\left(\frac{P_{import}}{P_{GDP}}\right)$ where P_{import} is the imports deflator and P_{GDP} is the GDP deflator at factor cost. See also Nunziata (2001) for data definitions and sources.

[8] A detailed account of each test can be found in a longer version of this paper, Nunziata (2002).

(MSE) criteria that do not test the falsity of the poolability hypothesis, but allow a choice between the constrained and unconstrained estimator on a pragmatic basis, i.e. on the basis of the trade-off between bias and efficiency, under the general assumption of $\boldsymbol{\varepsilon} \backsim \mathbf{N}(\mathbf{0}, \boldsymbol{\Omega})$.

According to the tests, the pooled model is preferable to the unconstrained model under the first and second Weak MSE criteria. In other words, the pooled model yields more efficient estimates than the individual country regressions.

In order to balance the efficiency gains obtained using a pooled empirical approach with the need to avoid the bias produced by an homogeneity assumption, we set up a *semi-pooled* specification for the model, introducing a set of interactions among institutions. In this way we allow some institutional coefficients to vary across countries and over time, and we are also able to control for the institutional complementarity effects suggested by the theory. The institutional coefficients are free to vary across countries and over time, according to the restrictions imposed by the homogeneous coefficients of each interaction.

Our dynamic model includes fixed effects in order to control for country specific effects. This is a potential source of bias, as suggested by Nickell (1981), although the bias becomes less important as T grows. Indeed, Judson and Owen (1999) suggest that the fixed effects estimator performs as well as or better than many alternatives when $T = 30$, i.e. with a T dimension similar to ours.

If the residuals are not homoskedastic, the estimates will still be consistent but inefficient. We performed a groupwise likelihood ratio heteroskedasticity test performed on the residuals of the baseline model estimated by OLS. The null hypothesis of homoskedasticity across groups is rejected.

Using a Baltagi and Li (1995) serial correlation test the null hypothesis of no serial correlation in the disturbances is rejected.

Given the results of the heteroskedasticity and autocorrelation tests, the feasible GLS estimator in this paper is constructed assuming country groupwise heteroskedasticity, and an AR(1) structure in the disturbances, ε_{it}. Since we model contemporaneous cross country correlations through the inclusion of time dummies, the variance covariance matrix $\hat{\Omega}$ is characterized by $N \times 2$ parameters only. This implies that our model is immune of the potential

bias affecting feasible GLS time-series cross-sectional models, described by Beck and Katz (1995)[9].

Given the large T dimension of our model, we check its cointegration properties by means of a simple Fisher-Maddala-Wu test[10] that combines the results of N individual country unit roots tests of any kind, each with P-value P_i , in the statistic $-2\sum \log P_i$, shown to be χ^2 distributed with $2N$ degrees of freedom[11].The null hypothesis of no cointegration is rejected using both the Dickey Fuller and the Phillips Perron version of the test.

2.3 The Estimation Results

Tables 1, 2 and 3 present the estimation output from a set of alternative specifications of the unemployment model of equation (1). These are:

1. the baseline model;
2. a static model;
3. a static model with no macroeconomic shocks;
4. a model including changes in the tax wedge, ΔTW;
5. a model including Oswald's Home Ownership variable[12] (Portugal excluded) which represents the proportion of owner occupier households and is a proxy for labour mobility;
6. a model including an indicator of fixed term contracts and temporary work agencies regulations (Portugal excluded);
7. a model excluding Portugal for a comparison with the previous model;

[9] See the argument contained in Nunziata (2001).

[10] See Maddala and Wu (1996) and Fisher (1932).

[11] The test relies on the assumption of no cross country correlation and whenever this assumption is not met Maddala and Wu suggest bootstrapping to define the critical values. In our model we control for cross country correlation by means of time dummies, and therefore we assume we are free to use the exact distribution of the test for inference.

[12] See Oswald (1996).

8. a model excluding Portugal and Spain in order to check for the impact of the non democratic regimes in these countries in the 1970s and the transition to democracy afterwards;

9. a model including coordination types dummies;

10. a model using an alternative measure of bargaining coordination;

11. a model estimated on a subsample from 1970;

12. a model estimated on a subsample from 1970, using unemployment in logs;

13. a model including a test of the hump shaped effect of taxation on unemployment, dividing the countries into three groups according to their degree of bargaining coordination[13];

14. a model including a second test of the hump shaped effect of taxation on unemployment, dividing the countries into three groups according to their degree of bargaining centralization;

15. a model including union density in levels;

16. a model where macroeconomic shocks are substituted with the change in inflation;

17. the baseline model estimated by OLS;

18. the baseline model using 5 years averaged data;

19. the baseline model using 5 years averaged data, including union density in levels;

20. the baseline model using 5 years averaged data, including union density in levels and Oswald's Home Ownership variable.

All models are estimated by fixed effects GLS, with the correction for heteroskedasticity and serial correlation commented on above, except for Model 17 which is estimated by OLS.

Model 1 is the benchmark specification. It is characterized by a significant effect for most labour market institutions, except employment protection. Although the cointegration tests

[13]See Alesina and Perotti (1997) and Daveri and Tabellini (2000) for some empirical evidence on this.

	(1) UR	(2) UR	(3) UR	(4) UR	(5) UR	(6) UR	(7) UR
$UR(-1)$	**0.863**			**0.864**	**0.866**	**0.869**	**0.868**
	[48.49]			[49.08]	[47.61]	[47.97]	[47.69]
EP	**0.146**	**0.679**	**0.041**	**0.151**	**0.151**	**0.167**	**0.220**
	[0.91]	[1.90]	[0.12]	[0.95]	[0.89]	[1.02]	[1.34]
BRR	**2.208**	**4.339**	**4.356**	**2.212**	**2.195**	**2.619**	**2.267**
	[5.44]	[5.04]	[5.16]	[5.43]	[5.24]	[6.26]	[5.46]
BD	**0.473**	**1.732**	**1.563**	**0.433**	**0.401**	**0.521**	**0.428**
	[2.49]	[4.01]	[3.55]	[2.22]	[2.06]	[2.67]	[2.22]
$BRRBD$	**3.752**	**14.872**	**16.657**	**3.890**	**3.072**	**3.641**	**3.216**
	[3.97]	[8.36]	[9.43]	[4.10]	[3.16]	[3.79]	[3.34]
$UDCO$	**-6.983**	**-13.325**	**-6.990**	**-6.838**	**-7.482**	**-7.679**	**-7.458**
	[6.12]	[6.14]	[3.33]	[5.99]	[6.48]	[6.68]	[6.46]
$TWCO$	**-3.456**	**-13.562**	**-11.889**	**-3.439**	**-3.625**	**-3.044**	**-3.693**
	[3.29]	[6.57]	[5.83]	[3.25]	[3.38]	[2.93]	[3.47]
ΔUD	**6.989**	**-0.856**	**-1.677**	**6.810**	**5.973**	**7.031**	**6.173**
	[3.17]	[0.19]	[0.39]	[3.09]	[2.57]	[3.04]	[2.65]
CO	**-1.007**	**0.869**	**1.947**	**-1.019**	**-0.898**	**-0.913**	**-1.004**
	[3.54]	[1.37]	[3.15]	[3.56]	[3.01]	[3.24]	[3.52]
TW	**1.511**	**3.490**	**2.121**	**1.570**	**1.585**	**2.267**	**1.680**
	[1.72]	[1.94]	[1.19]	[1.70]	[1.77]	[2.56]	[1.89]
LDS	**-23.580**	**-28.888**		**-24.023**	**-24.854**	**-23.780**	**-24.138**
	[10.36]	[6.11]		[10.50]	[10.58]	[10.43]	[10.41]
$TFPS$	**-17.872**	**-11.553**		**-17.739**	**-17.522**	**-16.788**	**-17.404**
	[14.14]	[4.24]		[13.88]	[13.34]	[13.28]	[13.35]
$\Delta^2 MS$	**0.228**	**1.875**		**0.179**	**0.238**	**0.272**	**0.247**
	[0.93]	[2.82]		[0.73]	[0.96]	[1.12]	[1.00]
$RIRL$	**1.812**	**11.745**		**1.818**	**2.544**	**2.238**	**2.562**
	[1.56]	[5.12]		[1.55]	[2.14]	[1.93]	[2.17]
TTS	**5.823**	**14.682**		**5.824**	**5.000**	**4.637**	**4.930**
	[3.26]	[3.94]		[3.21]	[2.75]	[2.58]	[2.71]
ΔTW				**-1.568**			
				[0.98]			
HO					**3.017**		
					[1.21]		
FTC						**0.422**	
						[3.79]	
TWA						**-0.121**	
						[0.96]	
Country dummies	√	√	√	√	√	√	√
Time dummies	√	√	√	√	√	√	√
Obs	600	600	646	598	579	579	579
Countries	20	20	20	20	19	19	19
$av.T$	30.0	30.0	32.3	29.9	30.5	30.5	30.5
Pval Cf=0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pval f.e.=0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average $\mid \rho_i \mid$	0.68	1.05	0.92	0.71	0.60	0.60	0.60
RMSE	0.58	1.21	1.25	0.58	0.58	0.58	0.58

t-ratios in brackets.

Table 1: OECD Unemployment Models: 1960-1995

	(8) UR	(9) UR	(10) UR	(11) UR	(12) UR	(13) UR	(14) UR
$UR(-1)$	**0.869**	**0.863**	**0.887**	**0.850**	**0.784**	**0.881**	**0.871**
	[45.56]	[48.33]	[49.74]	[41.56]	[32.58]	[50.34]	[48.91]
EP	**0.253**	**0.066**	**-0.506**	**-0.112**	**-0.153**	**-0.095**	**-0.092**
	[1.53]	[0.41]	[3.35]	[0.43]	[1.88]	[0.61]	[0.59]
BRR	**2.237**	**2.553**	**1.728**	**2.231**	**0.193**	**2.175**	**2.400**
	[5.36]	[6.21]	[4.15]	[4.09]	[1.60]	[5.23]	[5.69]
BD	**0.430**	**0.449**	**0.201**	**0.820**	**0.223**	**0.459**	**0.475**
	[2.29]	[2.29]	[1.00]	[3.84]	[3.38]	[2.35]	[2.43]
$BRRBD$	**3.206**	**4.404**	**4.222**	**3.443**	**0.419**	**3.830**	**4.399**
	[3.35]	[4.57]	[4.22]	[2.89]	[1.38]	[3.99]	[4.51]
$UDCO$	**-7.597**	**-6.254**	**0.912**	**-8.136**	**-0.169**	**-6.370**	**-6.800**
	[6.53]	[5.59]	[1.66]	[5.11]	[0.48]	[5.94]	[6.17]
$TWCO$	**-3.619**	**-2.922**	**-2.375**	**-0.871**	**-0.391**		
	[3.40]	[2.75]	[3.97]	[0.70]	[1.46]		
ΔUD	**6.699**	**7.198**	**7.039**	**8.840**	**2.007**	**7.144**	**6.334**
	[2.88]	[3.35]	[3.24]	[3.57]	[3.42]	[3.17]	[2.83]
CO	**-1.002**	**-1.007**	**-0.132**	**-1.178**	**-0.121**	**-1.139**	**-0.934**
	[3.48]	[3.43]	[1.22]	[3.22]	[1.64]	[3.85]	[2.98]
TW	**1.773**	**1.610**	**-1.063**	**0.717**	**0.042**		
	[1.97]	[1.80]	[1.29]	[0.67]	[0.18]		
LDS	**-22.308**	**-23.681**	**-20.800**	**-24.163**	**-3.474**	**-23.714**	**-23.658**
	[9.65]	[10.38]	[8.74]	[9.38]	[5.53]	[10.16]	[10.20]
$TFPS$	**-16.980**	**-18.550**	**-19.524**	**-17.009**	**-3.644**	**-18.018**	**-18.956**
	[13.21]	[14.85]	[14.70]	[12.95]	[11.22]	[13.99]	[14.75]
$\Delta^2 MS$	**0.265**	**0.280**	**0.374**	**0.172**	**0.187**	**0.193**	**0.197**
	[1.09]	[1.18]	[1.32]	[0.65]	[2.59]	[0.74]	[0.78]
$RIRL$	**2.923**	**1.642**	**0.744**	**-0.965**	**-0.094**	**1.868**	**1.440**
	[2.46]	[1.42]	[0.62]	[0.76]	[0.32]	[1.59]	[1.22]
TTS	**4.275**	**6.201**	**5.572**	**7.179**	**0.543**	**5.170**	**5.075**
	[2.34]	[3.42]	[2.92]	[3.68]	[1.43]	[2.86]	[2.83]
$TW{\cdot}Gunc$						**1.351**	**1.926**
						[1.31]	[1.78]
$TW{\cdot}Gint$						**1.449**	**1.328**
						[1.63]	[1.50]
$TW{\cdot}Gcoo$						**1.064**	**0.174**
						[1.27]	[0.20]
$CO1$		**-0.483**					
		[3.10]					
$CO2$		**-0.453**					
		[3.25]					
$CO3$		**0.159**					
		[0.593]					
$CO4$		**-0.276**					
		[2.54]					
$CO6$		**-0.174**					
		[1.54]					
Country dummies	√	√	√	√	√	√	√
Time dummies	√	√	√	√	√	√	√
Obs	549	600	600	491	485	600	600
Countries	18	20	20	20	20	20	20
av.T	30.5	30.0	30.0	24.5	24.2	30.0	30.0
Pval Cf=0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pval f.e.=0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average $\mid \rho_i \mid$	0.55	0.69	0.75	0.60	0.70	0.69	0.69
RMSE	0.55	0.56	0.58	0.53	0.61	0.58	0.58

t-ratios in brackets.

Table 2: OECD Unemployment Models: 1960-1995 (continued)

	(15) UR	(16) UR	(17) UR	(18) UR	(19) UR	(20) UR
$UR(-1)$	**0.859**	**0.876**	**0.867**			
	[47.16]	[41.81]	[42.27]			
EP	**0.257**	**-0.053**	**-0.254**	**0.935**	**0.966**	**0.955**
	[1.47]	[0.34]	[0.95]	[2.45]	[2.54]	[2.08]
BRR	**2.457**	**1.977**	**2.783**	**3.123**	**3.068**	**3.846**
	[6.05]	[4.87]	[5.17]	[2.59]	[2.85]	[3.40]
BD	**0.560**	**0.006**	**0.335**	**2.496**	**2.794**	**3.228**
	[2.84]	[0.04]	[1.07]	[3.65]	[3.99]	[4.42]
$BRRBD$	**4.067**	**3.952**	**4.316**	**5.731**	**5.841**	**7.607**
	[4.31]	[4.16]	[3.36]	[2.57]	[2.72]	[3.35]
$UDCO$	**-7.224**	**-3.679**	**-4.472**	**-15.655**	**-14.925**	**-14.527**
	[6.01]	[3.15]	[2.87]	[5.57]	[5.22]	[4.79]
$TWCO$	**-3.620**	**-1.748**	**-1.836**	**-15.788**	**-16.132**	**-17.160**
	[3.40]	[1.61]	[1.27]	[4.92]	[5.53]	[5.79]
ΔUD		**7.138**	**4.247**	**1.028**		
		[3.16]	[1.64]	[0.10]		
CO	**-0.947**	**-0.492**	**-0.958**	**0.212**	**0.210**	**0.126**
	[3.38]	[1.60]	[2.98]	[0.29]	[0.31]	[0.18]
TW	**1.488**	**1.839**	**2.224**	**1.491**	**1.839**	**1.272**
	[1.70]	[2.00]	[1.93]	[0.66]	[0.85]	[0.57]
LDS	**-25.903**		**-22.847**	**-86.342**	**-85.754**	**-84.199**
	[11.18]		[8.80]	[8.37]	[8.51]	[7.45]
$TFPS$	**-18.257**		**-20.422**	**-26.515**	**-32.340**	**-33.949**
	[14.24]		[12.41]	[3.05]	[3.27]	[2.77]
$\Delta^2 MS$	**0.385**		**0.456**	**12.731**	**12.762**	**14.586**
	[1.48]		[1.72]	[2.38]	[2.62]	[2.48]
$RIRL$	**1.505**		**0.713**	**27.528**	**29.244**	**31.334**
	[1.28]		[0.52]	[4.82]	[5.62]	[5.22]
TTS	**5.927**		**5.782**	**79.703**	**78.062**	**73.510**
	[3.32]		[2.87]	[10.75]	[10.59]	[9.23]
UD	**-0.224**				**2.581**	**2.049**
	[0.24]				[1.38]	[1.04]
HO						**-1.517**
						[0.29]
$\Delta^2 p$		**-0.170**				
		[4.10]				
Country dummies	√	√	√	√	√	√
Time dummies	√	√	√	√	√	√
Obs	600	636	600	127	127	123
Countries	20	20	20	20	20	19
av.T	30.0	31.8	30.0	30.0	30.0	30.0
Pval Cf=0	0.00	0.00	0.00	0.00	0.00	0.00
Pval f.e.=0	0.00	0.00	0.00	0.00	0.00	0.00
Average $\mid \rho_i \mid$	0.70	0.68	0.57			
RMSE	0.58	0.58	0.69	0.56	0.62	0.62

t-ratios in brackets.

Table 3: OECD Unemployment Models: 1960-1995 (continued)

Time dummies								
1966	0.07	(0.3)	**1976**	0.69	(0.6)	**1986**	0.62	(0.3)
1967	0.02	(0.1)	**1977**	0.61	(0.5)	**1987**	0.79	(0.4)
1968	0.11	(0.3)	**1978**	0.72	(0.5)	**1988**	0.56	(0.3)
1969	-0.06	(0.1)	**1979**	0.59	(0.4)	**1989**	0.53	(0.2)
1970	0.11	(0.2)	**1980**	0.55	(0.4)	**1990**	0.98	(0.4)
1971	0.37	(0.6)	**1981**	1.14	(0.7)	**1991**	1.33	(0.5)
1972	0.5	(0.7)	**1982**	1.41	(0.8)	**1992**	1.62	(0.6)
1973	0.28	(0.3)	**1983**	1.21	(0.7)	**1993**	1.55	(0.6)
1974	0.08	(0.1)	**1984**	0.69	(0.4)	**1994**	1.14	(0.4)
1975	0.92	(0.9)	**1985**	0.52	(0.3)	**1995**	0.58	(0.2)

t-ratios in brackets.

Table 4: Time dummies from model (1)

Time Trends					
Australia	-0.054	(0.5)	**Japan**	-0.059	(0.6)
Austria	-0.059	(0.6)	**Netherlands**	-0.045	(0.5)
Belgium	-0.022	(0.2)	**Norway**	-0.067	(0.7)
Canada	-0.072	(0.8)	**New Zealand**	0.003	(0.0)
Denmark	-0.078	(0.8)	**Portugal**	-0.107	(1.1)
Finland	0.017	(0.2)	**Spain**	0.042	(0.4)
France	-0.019	(0.2)	**Sweden**	-0.078	(0.8)
Germany	-0.006	(0.1)	**Switzerland**	-0.041	(0.4)
Ireland	0.022	(0.2)	**UK**	-0.007	(0.1)
Italy	-0.015	(0.2)	**US**	-0.026	(0.3)

t-ratios in brackets.

Table 5: Time trends from model (1)

indicate that our model can explain the long run properties of unemployment, the estimated lagged dependent variable coefficient is quite high. This could mean that unemployment is highly persistent and/or that our model is not capturing the complexity of the data generating process. Indeed, in contrast to the analysis summarized in section 2, our shock variables are mean reverting, implying that institutions have to play a major role in the explanation of the evolution of OECD unemployment.

As regards the explanatory power of the model, we can see from Tables 4 and 5 that neither the time dummies nor the country specific time trends are significant, and their contribution to the fit of our equation is marginal. The ability of the model to explain the time pattern of the unemployment rate in each OECD country is investigated by means of a set of dynamic simulations contained at the end of this section.

Looking at the impact of each institutional indicator, benefit replacement rates and benefit durations have a significant positive effect on unemployment, and their impact is reinforced by their interaction.

Taxation has a positive impact on unemployment, which is moderated if wage bargaining coordination is high. The overall effect of taxation is, however, not as large as the one estimated by Daveri and Tabellini, with a 10 percent increase in the tax wedge inducing only a 1 percent increase in unemployment for average levels of coordination.

The impact of union density is not significant in levels[14], but we find a significant effect for its difference, consistent with the labour cost model. The role of coordination in wage bargaining appears to be one of moderating the impact of union density and taxation, as shown by the interaction terms with these indicators. The effect is also negative in levels.

As regards the macroeconomic shocks, we find a significant negative effect for the labour demand shock and the total productivity shock. The acceleration of the money supply is not significant, while both the real interest rate and the terms of trade shock are significant with positive sign, as expected.

Columns 2 and 3 present the static version of the baseline model, respectively with and without the macroeconomic shocks. Most of the results in column 1 can also be observed in

[14]This is consistent with previous results by Elmeskov et al. (1998).

column 2, except that there is now a significant positive effect for employment protection, but no effect from the change in union density, and coordination in levels. Column 3 indicates, instead, that once we omit the controls for macro shocks, the model produces inconsistent results, especially regarding the tax wedge and the coordination indicators. This result suggests that the macro controls are needed in order to obtain a clean estimate of the long run relationship between unemployment and institutions.

In column 4 we check for a rate of change effect in the tax wedge, which is not found significant. Column 5 indicates a positive although weak impact of home ownership[15]. Column 6 shows that strict fixed term contract regulations have a positive impact on unemployment, while temporary agency regulations are not significant. This result is consistent with the empirical findings of Nunziata and Staffolani (2003) on a sample of ten European countries.

The last two models are estimated excluding Portugal because no data are available on these indicators for that country. We check, therefore, the effect of omitting Portugal in column 7, and of omitting both Portugal and Spain in column 8. This is also to ensure that the inclusion of two countries characterized by non democratic regimes up to the mid 1970s does not affect our estimates. The main results are very stable, and all our findings are confirmed if not reinforced.

Model 9 includes a set of coordination dummies proposed by Traxler and Kittel[16] that describe the type of coordination which is prevalent in each country at any time. These are:

$CO1$=inter-associational coordination, i.e. coordination by the major confederations of employers and labour;

$CO2$=intra-associational coordination, i.e. within the major confederations of employers and labour;

$CO3$=pattern setting coordination, i.e. actions by a dominant sector establishing a pattern for other sectors;

$CO4$=state imposed coordination;

[15] As we will see below, the high interpolation of this institutional indicator does not seem to be enough to account for this explanatory weakness.

[16] See Traxler (1996) and Traxler and Kittel (2000). We include five of the six categorical variables originally set by these authors, excluding CO5, non-coordination, in order to avoid multicollinearity.

$CO6$=state sponsored coordination, i.e. with the state joining the bargaining process as an additional party.

The coordination types that have a significant and negative effect on unemployment are inter-associational, intra-associational and state imposed coordination.

In model 10 we check the robustness of the coordination effect using an alternative indicator provided by Nickell et al. (2002) that accounts for short term variation in coordination. The effect, in levels, of coordination, as well as the effect of the interaction with union density, disappear. However, the interaction with the tax wedge is robust to the change in the indicator, remaining negative and significant.

Model 11 is the baseline equation estimated from 1970 onwards. After dropping almost 20 percent of the observations, most of the institutional effects are confirmed, although the tax wedge effect is not significant both in levels and interacted with coordination. If we estimate the model over the same period but using unemployment in logs[17], as in column 12, the effect of institutions appears to be moderately weaker.

Columns 13 and 14 present a test of the Alesina and Perotti and Daveri and Tabellini hypothesis[18] of a hump shaped effect of taxation on unemployment. In the first case we divide the observations into three groups according to the degree of wage bargaining coordination. Each group is defined, respectively, as uncoordinated, intermediate and highly coordinated. We then construct a dummy for each group and interact it with the tax wedge indicator. The numerical criteria defining each group are the same as in the wage equation[19]. The tax wedge effect is only vaguely hump shaped in model 13, with a 10% level significant positive effect on intermediate countries only. If we substitute our coordination measure with a centralization indicator, as in column 14, we find instead a positive significant impact in countries with decentralized bargaining only. In addition, the tax effect is weaker the higher is centralization.

Model 15 contains the union density indicator in levels, which is found to be insignificant. Model 16 substitutes the macroeconomic shock controls with an inflation change variable

[17] Using logs of unemployment from 1970 onwards is not problematic (as it is in the full sample case) since some countries are characterized by unemployment rates close to zero in the early 1960s only.

[18] See Alesina and Perotti (1997) and Daveri and Tabellini (2000).

[19] *Gunc* is the dummy for the group of uncoordinated countries, characterized by a coordination level $CO < 1.5$. *Gint* is the indicator for the intermediate countries, with $1.5 \leq CO \leq 2$, and *Gcoo* is the indicator for highly coordinated countries with $CO > 2$.

in order to replicate the results of previous models, such as Nickell (1997). The variable's coefficient is negative and significant and the institutional coefficients are robust to this change, apart from that on the benefit durations indicator, which becomes insignificant.

The OLS estimation of the baseline model, i.e. without taking into account the problems of heteroskedasticity and serial correlation, is presented in column 17. The estimates of columns 1 and 17 are very similar, apart from the lack of significance of the benefit duration indicator.

Another robustness check is presented in the last three columns of Table 3. These models are estimated using five years averaged data, reducing the number of observations from 600 to 127. The 5 years averaged version of the baseline model, presented in column 18, confirms most of our previous results, apart from the lack of significance of the tax wedge in levels and the rate of change in union density. Model 19 includes union density in levels which has a weak positive effect. The home ownership variable effect is estimated in model 20. Although the 5 years averaging reduces the degree of interpolation in the home ownership indicator, the coefficient is still not statistically significant.

Summarizing the results above, our models are able to produce a quite satisfactory explanation of the unemployment patterns in OECD countries. The empirical results are largely consistent with the findings of a similar analysis of OECD labour costs presented in Nunziata (2001). It is possible that with better institutional indicators on unions and with information on the enforcement of the unemployment benefits we would be able to produce better results that do not have to rely on such a high level of endogenous persistence to fit the data.

The next section contains a set of dynamic simulations of the baseline model in order to assess how much of the unemployment evolution in each country can be explained by institutions.

2.4 Dynamic Simulations

The model simulations generate an unemployment series for each country through a recursive procedure that substitutes the lagged dependent variable with the previous year's predicted value obtained from the baseline model[20]. Figure 1 displays actual unemployment and the

[20] This is the same procedure employed in Nunziata (2001).

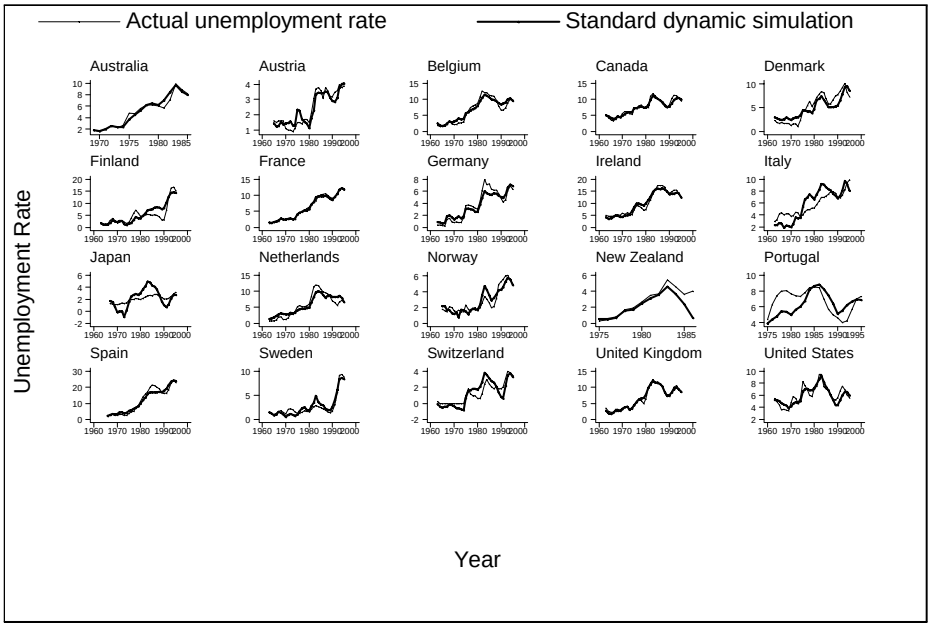

Figure 1: The unemployment model fit: actual and simulated unemployment

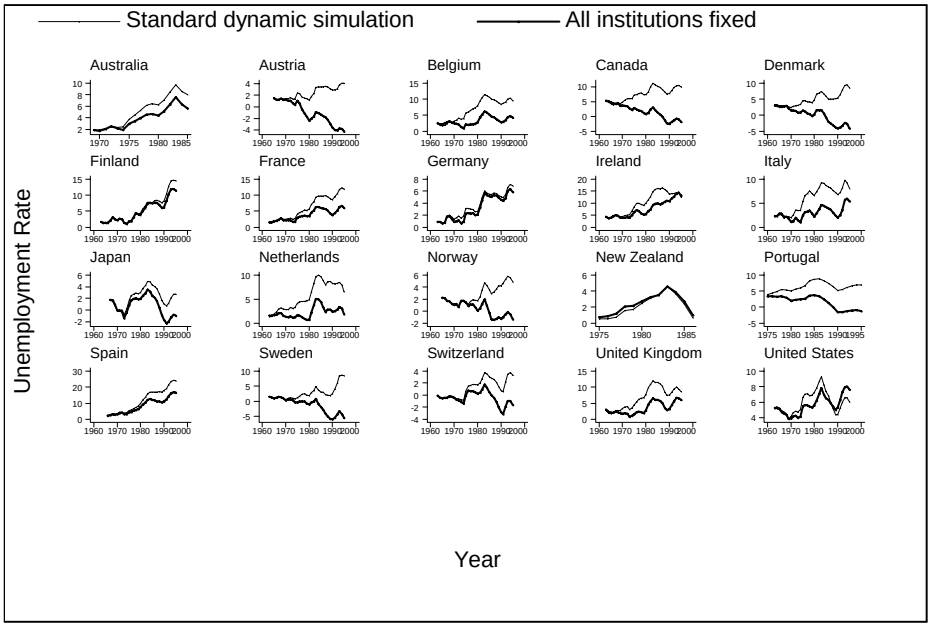

Figure 2: Dynamic simulations keeping all isntitutions fixed at average 1960s values

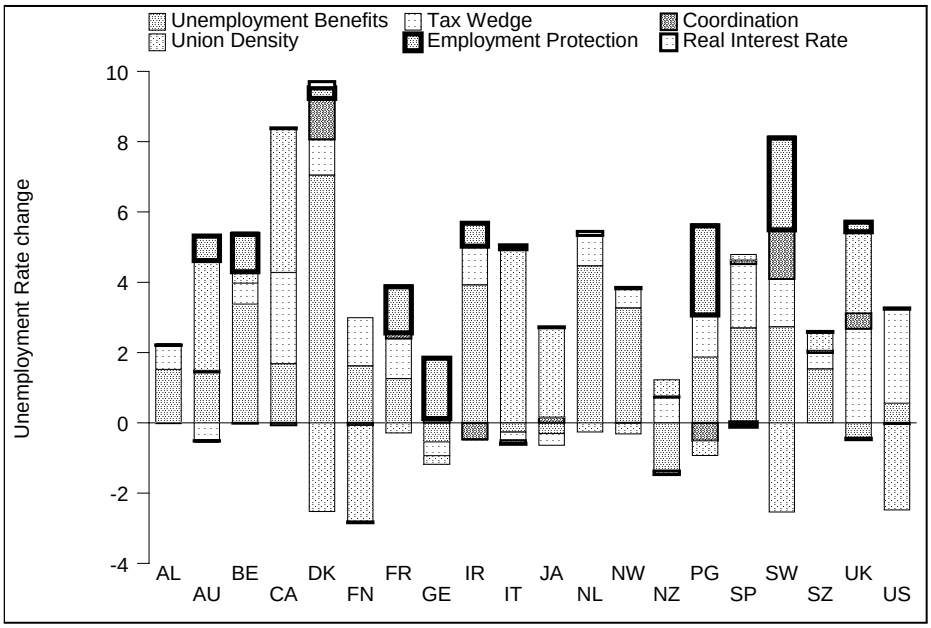

Figure 3: Dynamic simulations with regressors fixed at 1960s average values: changes in unemployment in the 1980s imputed to specific institutional dimensions

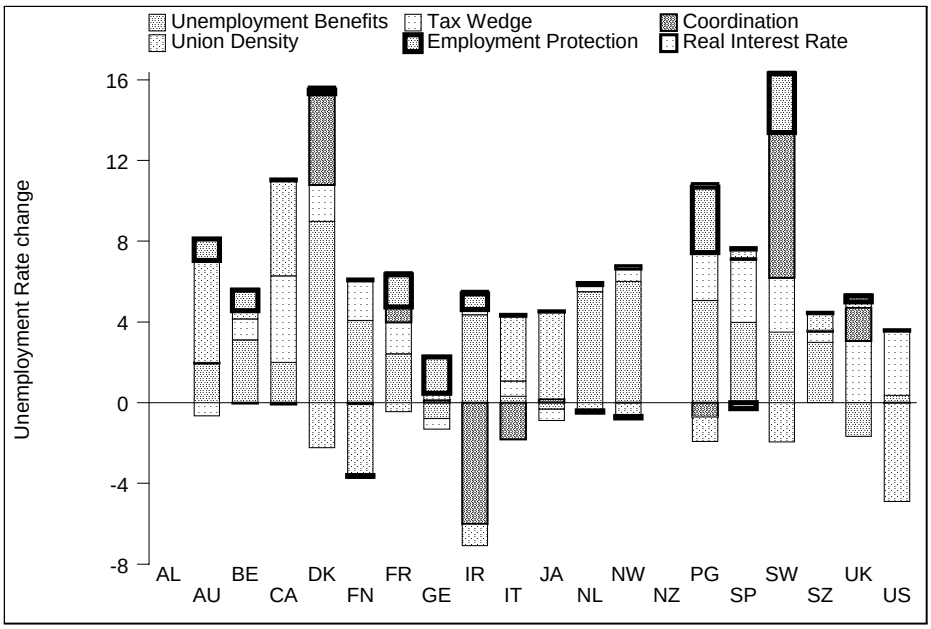

Figure 4: Dynamic simulations with regressors fixed at 1960s average values: changes in unemployment in the 1990s imputed to specific institutional dimensions

simulated series for each country, showing a good overall fit for each country, apart from Portugal and, to a lesser extent, Japan.

A summary account of the dynamic simulations is contained in Figures 3 and 4, where the impact of each institution is assessed in a comparative way. We constrain each regressor at its average 1960s value and the impact of each institutional dimension is stacked on each country bar. In this way we calculate the variation in unemployment that can be attributed to the evolution of specific regressors over the estimation period.

Overall, the institutions seem to explain a significant part of the change in unemployment since the 1960s in Australia, Belgium, Denmark, Finland, France, Italy, Netherlands, Norway, Spain, Switzerland and the UK. They probably explain too much in Austria, Portugal and Sweden, while they are unsuccessful in explaining unemployment in Germany, New Zealand and the US. The last case is not a surprise given the mainly cyclical nature of US unemployment.

Looking at the simulation figures we notice that the labour market institutions can explain around 55 percent of the 6.8 percent increase in the average European unemployment rate from the 1960s to the 1990s[21]. The model's explanatory power is therefore very good, especially considering the fact that the early 1990s were characterized by a deep recession in most European countries. If we exclude Germany from this calculation, a country for which our model is not able to say much, we explain 63 percent of the rise in unemployment in the rest of Europe.

The combination of benefits and taxes are responsible for two-thirds of that part of the long-term rise in European unemployment that our institutions explain.

3 Institutions and Shocks: a General Framework

In the previous section we proposed a model whose explanation of the evolution of unemployment in OECD countries is based on the direct effect of institutions, controlling for a set of mean reverting macroeconomic shocks. What we have not examined is the hypothesis that

[21] Note that we consider European OECD countries only, therefore excluding Greece and Eastern Europe.

the role of institutions is mainly one affecting the impact of the shocks, as suggested by some authors. In this section we aim to discriminate between these two hypotheses, i.e. we want to understand if institutions affect unemployment directly or through their interaction with the shocks.

The first question we need to answer is how best to describe the macroeconomic shocks. The easiest way is to rely on time effects, i.e. to treat the shocks as unobservable but common across countries[22]. This approach has the advantage of its generality but the disadvantage of relying on the hypothesis of identical shocks in all countries in each year. The latter assumption is far from ideal, especially when we want to disentangle how much of the effect of a shock to a country is actually shaped by its specific institutional framework.

A first best solution would be to include a vector of relevant observable macroeconomic shocks. Blanchard and Wolfers suggest using the decline in total factor productivity growth, the real interest rate and the adverse shifts in labour demand. However, these variables are characterized by marked trends and they do not seem the best choice if we are interested in modelling the degree of turbulence which each country is subject to, and seeing how labour market institutions interact with it.

In what follows we simply model the shocks as unobservable in order to avoid making specific assumptions about the variables relevant to each country. Keeping in mind the limitations of this approach, we also try a different specification using the observable mean reverting shocks included as controls in the previous section's model.

The framework we propose is a generalization of equation (1), i.e. of the benchmark model of Table 1. In its most general form it allows an additional term that includes the interaction between the unobservable shocks represented by the time effects and the vector of labour market institutions. In addition, we allow the lagged dependent variable coefficient, which captures the degree of unemployment persistence, to depend on a set of relevant institutions. In other words, we also check if the labour market institutional framework affects the speed at which unemployment converges towards its equilibrium level.

[22] This is what Blanchard and Wolfers propose in the first part of their paper.

In analytical terms, the model in equation (1) is generalized as follows:

$$U_{it} = \beta_0 + \boldsymbol{\beta}_{1t} U_{it-1} + \boldsymbol{\gamma}_1' \bar{\mathbf{z}}_{1w,it} + \boldsymbol{\lambda}' \mathbf{h}_{it} + \boldsymbol{\vartheta}' \mathbf{s}_{it} + \phi_i t_i + \mu_i + \lambda_t \left(1 + \boldsymbol{\gamma}_2' \bar{\mathbf{z}}^d_{2w,it}\right) + \varepsilon_{it} \qquad (5)$$

where $\boldsymbol{\beta}_{1t} = \left(\alpha_0 + \boldsymbol{\gamma}_3' \bar{\mathbf{z}}^d_{3w,it}\right)$, and the superscript d stands for deviation from the world average.

Equation (5) suggests that institutions may have three distinct roles in explaining OECD unemployment:

1. they may directly affect unemployment as in model (1) through the vectors $\boldsymbol{\gamma}_1' \bar{\mathbf{z}}_{1w,it}$ and $\boldsymbol{\lambda}' \mathbf{h}_{it}$;

2. they may shape the impact of the shocks through the interaction with the time effects $\lambda_t \left(1 + \boldsymbol{\gamma}_2' \bar{\mathbf{z}}^d_{2w,it}\right)$;

3. they may affect unemployment persistence through the lagged dependent variable coefficient $\boldsymbol{\beta}_{1t} = \left(\alpha_0 + \boldsymbol{\gamma}_3' \bar{\mathbf{z}}^d_{3w,it}\right)$.

Note that the two vectors of interacted institutions $\bar{\mathbf{z}}^d_{2w,it}$ and $\bar{\mathbf{z}}^d_{3w,it}$ are expressed as deviations from the world average so that we may interpret the coefficients on the institutions in levels as the coefficients of the average country.

The results of our estimations are presented in Tables 6, 7 and 8. They include, in addition to the general model of equation (5), a range of alternative specifications in order to check the robustness of our findings[23].

We first try to replicate Blanchard and Wolfers' results estimating an analogous model, i.e. regressing unemployment on a constant, the country dummies and the time effects interacted with institutions:

$$U_{it} = \beta_0 + \mu_i + \lambda_t \left(1 + \boldsymbol{\gamma}_2' \bar{\mathbf{z}}_{2w,it}\right) + \varepsilon_{it} \quad . \qquad (6)$$

[23] In order to avoid confusion with the previous section, we denote each model in this section with a letter instead of a number.

Their sample of countries and the time period is the same as ours, although they use 5 years averaged data instead of annual data. Model a is the replica of their model on our (averaged) data. Our specification differ from theirs because we end up having 127 observations instead of 159[24], and because our institutional indicators are all time varying[25]. In column b we estimate the same model on annual data. Both models include union density in delta form since we do not find a significant effect for the level.

Our results in column a are broadly in line with the findings of Blanchard and Wolfers. Each institution enters significantly with the expected sign with the exception of union density, which is not significant, and the tax wedge which has a negative coefficient. The fit of the equation is also comparable, with an $\bar{R}^2$ equal to 0.811 instead of 0.863. These results are confirmed when we use annual data as in column b, with the addition of a significant effect of union density in delta form and a slightly worse fit. The time effects are significant in each model and they account, respectively, for a 4.35% and a 6.86% rise in unemployment for average values of all institutional indicators[26]. This is less than the 7.3% estimated by Blanchard and Wolfers.

This simple specification offers a good description of the data. The task now is to assess whether what matters more in explaining OECD unemployment is the direct role of institutional changes, or the role of the interactions between institutions and shocks. Columns c to n in the tables present a set of alternative specifications of equation (5) in order to discriminate between these two hypotheses. Following Blanchard and Wolfers we first present a simpler version of the model interacting both the LDV and the time effects with a set of time invariant institutional indicators[27]. We then proceed to use the time varying indicators.

Model c is estimated using time invariant indicators in the interactions. Among the interacted institutions only, the benefit indicators are significant with expected sign, and most of the results of section 3 are confirmed. In addition, the time effects are not significant. If

[24] The reason for the limited sample is twofold: we have 7 observations per country while Blanchard and Wolfers have 8, and our panel is unbalanced. Some of the regressors are not available for some years, in some of the countries.

[25] Blanchard and Wolfers present a version of their model including time varying indicators for the benefit replacement rates and employment protection only.

[26] The impact of the time effects is calculated as estimated time effect in 1995 minus estimated time effect in the first available year.

[27] These are calculated as country averages of each indicator over the sample.

we reduce the model, and interact the lagged dependent variable with employment protection only, as in column d, we also find that the latter is significant with the expected positive sign. In other words, stricter employment protection increases unemployment persistence.

The characterization of the interactions between institutions and shocks adopted in columns c and d is the same as Blanchard and Wolfers', i.e. $\lambda_t \left(1 + \boldsymbol{\gamma}_2' \bar{\mathbf{z}}_{2w,it}^d\right)$. This specification implicitly assumes that each shock is shaped by institutions in the same fashion at any time. Models e and f relax this assumption, allowing the effect of each time dummy to depend differently on the interacted institutions in each year. In analytical terms, we use a more general specification such as $\left(\lambda_{1t} + \lambda_{2t} \boldsymbol{\gamma}_2' \bar{\mathbf{z}}_{2w,it}^d\right)$ that accounts for a partition of the effect of each shock into two bits, one interacted with institutions and one not. Every year, a different fraction of the shock will impact unemployment through its interaction with institutions. In this way we control for the possibility that the interactions may have a different degree of importance when a country faces shocks of different nature.

The estimation results of columns e and f provide a further, even more impressive, confirmation of the direct effect of institutions analysed in section 3. As regards the interactions, most institutions are not significant, with the exception of employment protection which has a negative coefficient[28]. Again, however, the time effects are not significant, and in model f stricter employment protection reduces the adjustment speed of unemployment.

Blanchard and Wolfers typically obtain weaker results when interacting the shocks with time varying institutions. This is not necessarily true in our case. Models g and h use time varying institutional indicators in the interactions. They include, respectively, the simple and the more general characterization of the interactions depicted above.

Model g is the only specification where the interacted institutions seem to play a more important role than the institutions in levels. The tax wedge and the interaction between coordination and union density are the only variables that show up in levels rather than as interactions. The time effects are significant, and they account for a 6.53% rise in unemployment at average values of all institutions. The significant impact of employment protection on unemployment persistence is confirmed.

[28] These results are confirmed when we drop the controls for the mean reverting macro shocks $\boldsymbol{\vartheta}' \mathbf{s}_{it}$.

When we adopt the more general specification for the interactions, as in column h, these results are partially reversed. The institutions in levels are now significant with expected sign, with the only exception being a weak effect from coordination[29]. In addition, we find several significant interacted effects and again a significant impact of employment protection on unemployment persistence. The time effects account for a 4.81% rise in unemployment at average institutional levels. In contrast to the previous results, the coefficient on interacted union density is negative.

The specifications in columns i and l are the same as the ones in columns g and h, but without including the lagged dependent variable. In these columns, both institutions in levels and interacted are significant with expected sign, except for coordination in levels and the interacted tax wedge in column i. In addition, the time effects can explain a rise in unemployment equal, respectively, to 2.17% and 8.23%. Employment protection is now significant in levels in column l.

Finally, models m and n provide an attempt to substitute the interactions with time effects with a set of observable shocks. The variables we use are the ones contained in the vector $\mathbf{s}_{it}$, i.e. a labour demand shock, a total factor productivity shock, a money supply shock, the long term interest rate, and a terms of trade shock[30]. Each variable in the new vector $\bar{\mathbf{s}}_{it}$ is constructed in order to be an adverse shock[31]. The main difference compared to variables used by Blanchard and Wolfers is the fact that our shocks are mean reverting.

As with the time effects, we provide two alternative specifications for the interactions between institutions and shocks. Model m contains a simple interaction of the form $\boldsymbol{\vartheta}'\mathbf{s}_{it}\boldsymbol{\gamma}_2'\bar{\mathbf{z}}_{2w,it}$ as in Blanchard and Wolfers, while model n contains a more general specification of the form $(\boldsymbol{\vartheta}_1'\mathbf{s}_{it} + \boldsymbol{\vartheta}_2'\mathbf{s}_{it}\boldsymbol{\gamma}_2'\bar{\mathbf{z}}_{2w,it})$. Both models contain non-interacted time dummies as controls. These do not yield significant coefficients.

The estimation results show a significant effect of expected sign for interacted coordination and benefit replacement rates, and this is common to both models. As regards the institutions in levels, the tax wedge and the benefit replacement rates are significant in both specifications,

[29] Note that employment protection was also insignificant in Table 1.

[30] See the definition of each shock on page 6.

[31] This means that $\boldsymbol{\vartheta}'\bar{\mathbf{s}}_{it} = \theta_1 LDS^*_{it} + \theta_2 TFPSH^*_{it} + \theta_3 D2MS_{it} + \theta_4 RIRL_{it} + \theta_5 TTS_{it}$, with $LDS^*_{it} = -LDS_{it}$ and $TFPSH^*_{it} = -TFPSH_{it}$.

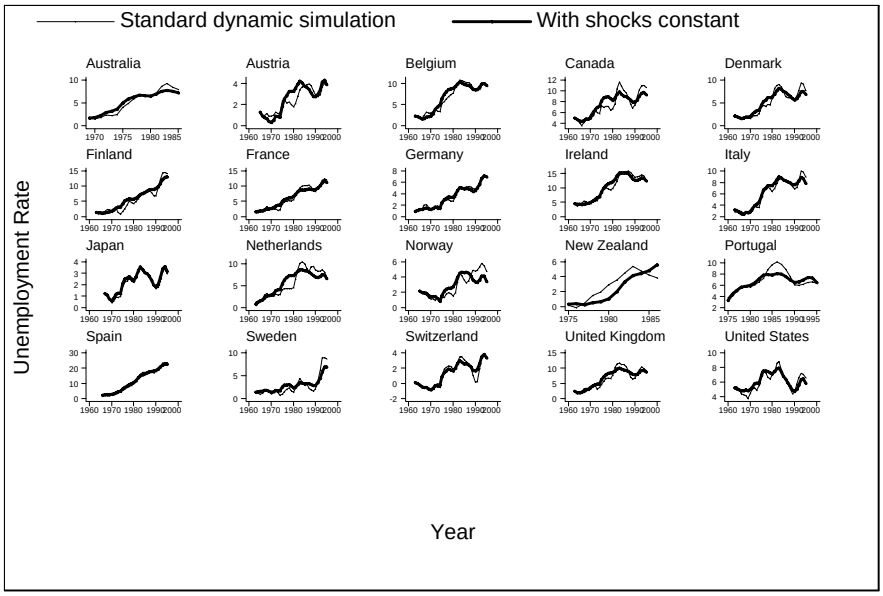

Figure 5: Dynamic simulations of model (m) keeping the shocks constant at average values

while employment protection is significant in column m only, with a negative sign. Looking at the institutions interacted with the lagged dependent variable, our previous findings about employment protection are confirmed in both models, together with a similar effect for union density. The dynamic simulations of model m in Figure 5 show that the interacted shocks explain part of the dynamics in unemployment in New Zealand and Portugal in the 1980s, and to a lesser extent in the late 1970s and early 1980s in Austria, Canada and the Netherlands, and in the early 1990s in Norway. The other countries are only marginally affected.

On the basis of the results above we cannot rule out a significant role for institutions through their interactions with adverse shocks. On the other hand, it seems that most of the implications of the previous section still hold when we include the possibility of interactions between shocks and institutions.

4 Concluding Remarks

This paper discusses the relationship between labour market institutions and equilibrium unemployment in OECD countries. We first produce an empirical test of the ability of institutions to explain the time pattern of OECD unemployment. Subsequently, we compare our

	(a)		(b)		(c)		(d)	
shock int.	$\lambda_t\left(1+\boldsymbol{\gamma}_2'\bar{\mathbf{z}}^d_{2w,it}\right)$		$\lambda_t\left(1+\boldsymbol{\gamma}_2'\bar{\mathbf{z}}^d_{2w,it}\right)$		$\lambda_t\left(1+\boldsymbol{\gamma}_2'\bar{\mathbf{z}}^d_{2w,i}\right)$		$\lambda_t\left(1+\boldsymbol{\gamma}_2'\bar{\mathbf{z}}^d_{2w,i}\right)$	
α_0					**0.844**	[35.18]	**0.846**	[38.07]
$\boxed{\boldsymbol{\gamma}_1'\bar{\mathbf{z}}_{1w}}$								
EP					**-0.330**	[1.27]	**-0.363**	[1.42]
ΔUD					**3.994**	[1.55]	**4.155**	[1.61]
BRR					**1.890**	[3.34]	**1.875**	[3.35]
BD					**0.452**	[1.41]	**0.341**	[1.09]
CO					**-0.647**	[2.08]	**-0.701**	[2.27]
TW					**1.494**	[1.31]	**1.490**	[1.33]
$BRRBD$					**2.663**	[1.90]	**2.565**	[1.91]
$UDCO$					**-5.800**	[3.52]	**-5.499**	[3.42]
$TWCO$					**-1.354**	[0.94]	**-1.485**	[1.04]
$\boxed{\boldsymbol{\gamma}_2'\bar{\mathbf{z}}^d_{2w}}$								
EP	**0.358**	[2.12]	**0.430**	[5.92]	**0.066**	[0.42]	**0.223**	[1.45]
UD					**0.071**	[0.14]	**0.123**	[0.24]
ΔUD	**-0.331**	[0.78]	**6.032**	[2.79]				
BRR	**1.668**	[3.52]	**1.308**	[6.82]	**2.260**	[3.92]	**2.375**	[4.03]
BD	**0.951**	[3.47]	**0.984**	[8.61]	**1.139**	[4.21]	**1.171**	[4.27]
CO	**-0.354**	[2.41]	**-0.381**	[6.43]	**-0.217**	[1.52]	**-0.255**	[1.80]
TW	**-1.254**	[1.71]	**-1.688**	[5.96]	**-1.061**	[1.40]	**-0.991**	[1.31]
$\boxed{\boldsymbol{\gamma}_3'\bar{\mathbf{z}}^d_{3w}}$								
EP					**0.047**	[1.19]	**0.0676**	[2.33]
UD					**0.049**	[0.36]		
CO					**0.079**	[1.51]		
TW					**-0.075**	[0.35]		
$\Delta^2 MS$					**0.426**	[1.66]	**0.449**	[1.75]
$RIRL$					**2.616**	[2.08]	**2.582**	[2.07]
TTS					**3.911**	[2.10]	**3.224**	[1.72]
LDS					**-21.668**	[8.43]	**-22.080**	[8.60]
$TFPS$					**-21.007**	[13.01]	**-21.546**	[13.56]
time effects	4.35%		6.86%					
significant?	yes		yes		no		no	
time trends					$\surd$		$\surd$	
significant?					no		no	
μ_i	$\surd$		$\surd$		$\surd$		$\surd$	
Obs	127		646		600		600	
$RMSE$	1.46		1.81		0.53		0.53	
$\bar{R}^2$	0.811		0.784		0.980		0.980	

Time Effects: estimated effect in 1995 - estimated effect in 1966, for average levels of institutional indicators. t-ratios in brackets.

Table 6: OECD Unemployment: the role of institutions and shocks

shock int.	(e) $(\lambda_{1t}+\lambda_{2t}\boldsymbol{\gamma}_2'\bar{\mathbf{z}}^d_{2w,i})$		(f) $(\lambda_{1t}+\lambda_{2t}\boldsymbol{\gamma}_2'\bar{\mathbf{z}}^d_{2w,i})$		(g) $\lambda_t(1+\boldsymbol{\gamma}_2'\bar{\mathbf{z}}^d_{2w,it})$		(h) $(\lambda_{1t}+\lambda_{2t}\boldsymbol{\gamma}_2'\bar{\mathbf{z}}^d_{2w,it})$	
α_0	**0.874**	[5.52]	**0.869**	[41.24]	**0.827**	[32.88]	**0.842**	[34.19]
$\boldsymbol{\gamma}_1'\bar{\mathbf{z}}_{1w}$								
EP	**-0.125**	[0.48]	**-0.230**	[0.89]	**-0.452**	[1.61]	**-0.377**	[1.13]
UD	**4.446**	[1.73]	**4.344**	[1.70]	**-3.221**	[0.66]	**4.456**	[1.76]
BRR	**3.051**	[5.85]	**3.114**	[6.02]	**-0.085**	[0.09]	**2.577**	[3.53]
BD	**0.534**	[1.67]	**0.506**	[1.63]	**-0.083**	[0.19]	**0.660**	[1.86]
CO	**-1.200**	[3.68]	**-1.145**	[3.54]	**-0.911**	[1.23]	**-0.956**	[1.36]
TW	**3.508**	[2.96]	**3.282**	[2.81]	**3.599**	[2.30]	**2.578**	[1.73]
$BRRBD$	**4.065**	[3.02]	**4.616**	[3.64]	**2.313**	[1.61]	**3.755**	[2.77]
$UDCO$	**-6.489**	[4.13]	**-6.141**	[3.97]	**-3.702**	[2.05]	**-5.899**	[3.59]
$TWCO$	**-2.402**	[1.60]	**-2.684**	[1.81]	**-0.609**	[0.40]	**-1.483**	[0.96]
$\boldsymbol{\gamma}_2'\bar{\mathbf{z}}^d_{2w}$								
EP	**-0.685**	[1.72]	**-0.732**	[1.74]	**-0.096**	[0.66]	**0.538**	[1.95]
UD	**0.463**	[1.10]	**0.303**	[0.78]			**-0.750**	[1.79]
ΔUD					**8.054**	[1.65]		
BRR	**-1.401**	[1.61]	**-1.637**	[1.65]	**1.952**	[4.05]	**0.840**	[1.82]
BD	**-0.213**	[1.03]	**-0.206**	[0.96]	**0.836**	[3.21]	**0.320**	[1.63]
CO	**0.186**	[1.35]	**0.192**	[1.33]	**-0.233**	[1.62]	**-0.194**	[1.68]
TW	**-0.174**	[0.38]	**-0.207**	[0.42]	**-0.590**	[0.92]	**-0.441**	[1.06]
$\boldsymbol{\gamma}_3'\bar{\mathbf{z}}^d_{3w}$								
EP	**0.064**	[1.40]	**0.076**	[2.06]	**0.070**	[2.11]	**0.074**	[1.87]
UD	**-0.022**	[0.16]			**0.121**	[1.44]	**0.125**	[1.36]
CO	**0.033**	[0.66]			**0.018**	[0.38]	**-0.015**	[0.31]
TW	**0.306**	[1.43]			**-0.061**	[0.39]	**0.205**	[1.21]
$\Delta^2 MS$	**0.425**	[1.67]	**0.432**	[1.70]	**0.427**	[1.66]	**0.517**	[2.03]
$RIRL$	**3.148**	[2.24]	**2.719**	[1.96]	**1.941**	[1.50]	**3.236**	[2.28]
TTS	**2.987**	[1.48]	**3.143**	[1.56]	**3.563**	[1.96]	**2.363**	[1.17]
LDS	**-20.367**	[7.98]	**-20.307**	[7.98]	**-21.066**	[8.23]	**-20.716**	[8.05]
$TFPS$	**-20.718**	[12.68]	**-20.976**	[13.11]	**-20.258**	[12.40]	**-19.695**	[11.88]
time effects significant?	0.79% only λ_{2t}'s		0.61% only λ_{2t}'s		6.53% yes		4.81% few λ_{2t}'s	
time trends	$\surd$		$\surd$		$\surd$		$\surd$	
significant?	no		no		DK,JA NW,PG		no	
μ_i	$\surd$		$\surd$		$\surd$		$\surd$	
Obs	600		600		600		600	
$RMSE$	0.50		0.50		0.53		0.50	
$\bar{R}^2$	0.981		0.981		0.980		0.981	

Time Effects: estimated effect in 1995 - estimated effect in 1966, for average levels of institutional indicators. t-ratios in brackets.

Table 7: OECD Unemployment: the role of institutions and shocks (continued)

shock int.	(i) $\lambda_t\left(1+\boldsymbol{\gamma}_2'\bar{\mathbf{z}}_{2w,it}^d\right)$		(l) $\left(\lambda_{1t}+\lambda_{2t}\boldsymbol{\gamma}_2'\bar{\mathbf{z}}_{2w,it}^d\right)$		(m) $\boldsymbol{\vartheta}'\mathbf{s}_{it}\boldsymbol{\gamma}_2'\bar{\mathbf{z}}_{2w,it}^d$		(n) $\left(\boldsymbol{\vartheta}_1'\mathbf{s}_{it}+\boldsymbol{\vartheta}_2'\mathbf{s}_{it}\boldsymbol{\gamma}_2'\bar{\mathbf{z}}_{2w,it}^d\right)$	
α_0					**0.835**	[35.49]	**0.839**	[35.66]
$\boldsymbol{\gamma}_1'\bar{\mathbf{z}}_{1w}$								
EP	**0.131**	[0.25]	**2.054**	[3.77]	**-0.487**	[1.81]	**-0.415**	[1.53]
UD	**4.832**	[0.82]	**0.566**	[0.11]	**3.396**	[1.35]	**3.403**	[1.35]
BR	**3.073**	[1.91]	**3.968**	[3.52]	**2.587**	[4.73]	**2.387**	[4.27]
BD	**1.681**	[2.12]	**3.794**	[4.32]	**0.292**	[0.89]	**0.334**	[1.02]
CO	**1.602**	[2.15]	**-1.671**	[2.27]	**-0.795**	[1.18]	**-0.927**	[1.37]
TW	**5.259**	[1.69]	**0.286**	[0.10]	**2.397**	[1.68]	**3.041**	[2.13]
$BRRBD$	**14.586**	[5.39]	**15.446**	[6.14]	**4.178**	[3.09]	**4.033**	[2.95]
$UDCO$	**-7.696**	[2.37]	**0.227**	[0.07]	**-3.327**	[2.03]	**-3.936**	[2.39]
$TWCO$	**-14.696**	[5.10]	**-9.302**	[3.07]	**-2.424**	[1.67]	**-2.532**	[1.75]
$\boldsymbol{\gamma}_2'\bar{\mathbf{z}}_{2w}^d$								
EP	**0.363**	[2.82]	**0.294**	[1.86]	**-0.283**	[2.37]	**-0.198**	[1.92]
UD			**-2.689**	[3.84]	**0.172**	[0.49]	**0.194**	[0.66]
ΔUD	**2.936**	[0.78]						
BRR	**1.888**	[4.88]	**0.767**	[1.72]	**1.145**	[3.23]	**0.948**	[3.14]
BD	**1.415**	[5.74]	**2.755**	[6.43]	**0.137**	[0.67]	**-0.051**	[0.30]
CO	**-0.668**	[5.01]	**-0.656**	[4.32]	**-0.447**	[3.73]	**-0.335**	[3.22]
TW	**-3.636**	[6.28]	#	#	**1.516**	[3.05]	**1.834**	[4.01]
$\boldsymbol{\gamma}_3'\bar{\mathbf{z}}_{3w}^d$								
EP					**0.069**	[2.20]	**0.074**	[2.31]
UD					**0.173**	[2.15]	**0.179**	[2.22]
CO					**0.016**	[0.34]	**0.028**	[0.59]
TW					**-0.096**	[0.62]	**-0.146**	[0.91]
$\boldsymbol{\vartheta}_1'\mathbf{s}_{it}$								
$\Delta^2 MS$	**0.663**	[1.31]	**0.772**	[1.56]			**0.666**	[2.31]
$RIRL$	**6.683**	[2.59]	**4.411**	[1.69]			**1.948**	[1.38]
TTS	**10.307**	[2.92]	**8.490**	[2.25]			**3.988**	[1.97]
LDS	**-14.702**	[2.78]	**-13.903**	[2.76]			**-21.2668**	[8.39]
$TFPS$	**-14.709**	[4.55]	**-15.346**	[5.00]			**-20.873**	[12.16]
$\boldsymbol{\vartheta}_2'\mathbf{s}_{it}$								
$\Delta^2 MS$					**0.276**	[1.32]	**-1.231**	[1.78]
$RIRL$					**2.365**	[1.81]	**6.761**	[2.19]
TTS					**4.151**	[2.53]	**9.150**	[2.05]
$(-LDS)$					**21.228**	[8.89]	**17.254**	[2.20]
$(-TFPS)$					**21.637**	[12.71]	#	#
time effects	2.17%		8.23%					
significant?	yes		only λ_{2t}'s					
time trends	$\surd$		$\surd$		$\surd$		$\surd$	
significant?	yes		SP,SW		no		no	
$RMSE$	1.09		0.96		0.53		0.52	
$\bar{R}^2$	0.921		0.932		0.981		0.981	

All models have 600 obs and include country dummies. Time Effects: estimated effect in 1995 - estimated effect in 1966, for average levels of institutional indicators. t-ratios in brackets. #: the coefficient could not be properly estimated due to lack of convergence.

Table 8: OECD Unemployment: the role of institutions and shocks (continued)

analysis with a broader model where we allow a set of interactions between institutions and macroeconomic shocks, investigating which one performs better.

Our analysis is based on a sample of 20 OECD countries observed for the period 1960-1995. Our estimation method is semi-pooled fixed effect GLS, accounting for heteroskedasticity and serial correlation. We include time dummies in order to control for contemporaneous correlations, and we present a set of specification tests in order to justify the choice of estimator.

The main findings of the paper are the following:

1. Labour market institutions have a direct significant impact on unemployment in a fashion that is broadly consistent with their impact on real labour costs in Nunziata (2001).

2. The benefit variables have a significant positive effect, reinforced by their interactions.

3. The tax wedge has a positive effect which is lowered by high levels of coordination. The hump shaped hypothesis, however, is not confirmed.

4. The increase in union density has a positive effect that is offset by high levels of coordination.

5. Coordination in wage bargaining has a direct negative effect, and a negative effect through the interactions with taxation and union density.

6. Employment protection plays a significant role in increasing unemployment persistence.

7. Stricter fixed term contract regulations have a significant positive impact on unemployment. The regulations of temporary work agencies are not significant.

8. Oswald's home ownership variable does not appear significant.

9. The effects of controls for the labour demand shock, the terms of trade shock and the TFP shock are consistently significant, and have expected sign.

10. The significant effects of institutions are robust to different specifications, including the static version of the model, the one estimated from the 1970s and the one using 5 years averaged data.

11. Broad movements in unemployment across the OECD can be explained by shifts in labour market institutions. To be more precise, changes in labour market institutions explain around 55 per cent of the rise in European unemployment from the 1960s to the first half of the 1990s, much of the remainder being due to the deep recession observed during the latter period.

12. We do not rule out a significant role for institutions through their interactions with adverse shocks. On the other hand, the direct effect of institutions still holds when we include the possibility of interactions between shocks and institutions.

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